SRPEDD

SOUTHEASTERN REGIONAL PLANNING AND ECONOMIC DEVELOPMENT DISTRICT

TEN MILE RIVER DRAINAGE BASIN

208

AREAWIDE WASTEWATER MANAGEMENT PLAN

SUMMARY AND ENVIRONMENTAL IMPACT STATEMENT

DRAFT

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DRAFT ENVIRONMENTAL IMPACT ASSESSMENT

on the

PROPOSED 208 WATER QUALITY MANAGEMENT PLAN

for the

SOUTHEASTERN REGIONAL PLANNING AND ECONOMIC DEVELOPMENT DISTRICT

TEN MILE RIVER DRAINAGE BASIN

August 1977

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AREAWIDE WASTEWATER MANAGEMENT PLAN
FOR
SOUTHEASTERN MASSACHUSETTS

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PREFACE

Since 1970, the thirty municipalities included in this document have expended nearly $100 million of public money to construct and operate municipal sewage treatment facilities. Private individuals and industries have probably spent at least as much for individual water quality solutions. If for no reason other than the significant amounts of money spent, and continuing to be spent, this report is important.

There are other reasons as well. The region has recently experienced a dramatic warning of significant chemical pollution, in the form of polychlorinated biphenyls (PCB's), which represent a direct threat to the valuable bluefish and bass resources. This problem arose because of a deficiency in general knowledge, but ignorance of this nature cannot be afforded again.

The possible economic loss of sport and commercial fisheries is only one of the reasons to pay attention to the choices presented in this report. Human health is also at stake. The water borne diseases of typhoid and dysentery of the nineteenth century have been forgotten because they have been eliminated by the money spent for sewage systems and other public health measures. However, we are now finding that new toxic materials are appearing in water bodies and new efforts must be made to protect our health against the new threat which they pose. Heavy metals and unfamiliar but widespread materials are building up in the environment and it is time to take a measure of the dangers and devise means to avoid them in the future.

If money, fish and health are not enough motivation signs of a real water shortage are just beginning to be felt in the region. Legal rights have been allocated for more water than exists in the primary lakes. A few cities may have to limit economic growth for lack of future water supplies. The wastewater plan which follows deals in detail with water supply issues.

However severe these problems, there are encouraging and positive aspects to this report. Economic growth and employment in the region is closely tied to environmental health. The jobs created by the environmental industries, the swimmable and fishable goals which ensure attractive working areas, and the water support system for active industries all contribute to the general well-being of the region. The regional economic development policy is to attract new industries and to maintain a healthy climate for those already in the region. The implementation of the programs recommended in this report will make a substantial contribution to this overall goal.

The opportunities which are based on clean water are so important to all Americans that the water quality program has been mandated by Congress to apply nationwide, which means that no one region is placed at a competitive disadvantage from water quality efforts. It means, however, that regional goals must be accomplished efficiently and with concern for the full range of issues that are sensitive to the needs of the local population. Much of the money for water treatment will come from outside the region through the federal program. Nonetheless, many local dollars will be spent in operating and maintaining facilities and many programs will require intelligent local regulation rather than money. The following plan suggests how to proceed in order to spend money well and to avoid excessive costs by the intelligent choide of alternatives. The following pages are designed to help make those choices.

CHAPTER ONE

PLANNING FOR AREAWIDE WASTEWATER MANAGEMENT

SUMMARY

"It is the national goal that wherever attainable an interim goal of water quality which provides for the protection and propogation of fish, shellfish and wildlife and provides for recreation in and on the water be achieved by July 1, 1983." Public Law 92-500

With the passage of the Federal Water Pollution Control Act Amendments of 1972 (PL 92-500), Congress set forth a number of ambitious goals and policies for cleaning up and preserving the Nation's water. Within the broad framework of the clean water goals that were established, Congress developed a number of mandates that recognized the complexity of water pollution problems, and set up an elaborate process for addressing these discrete but interrelated problems. Several unique responsibilities were reserved for Section 208, the "Areawide Waste Treatment Management" portion of the law. They include:

- Recognition that pollution did not respect political boundaries and jurisdictions, and must be addressed on an "areawide" level;
- Addressing non-point sources of pollution as well as point sources, and evaluating their combined impact on water quality;
- Developing a continuing planning process for the purpose of preventing problems rather than correcting them; and
- Assignment of responsibilities to appropriate management entities for the numerous tasks that would be required.

This plan addresses these four issues as part of a comprehensive plan to achieve the goals for clean water set by Congress.

The organization of the Plan is shown below:

- -- Chapter One: Planning for Areawide Wastewater Management;
- -- Chapter Two: Structural Approaches to the Achievement of Water Quality;
- -- Chapter Three: Regulatory Approaches to the Achievement of Water Quality;
- -- Chapter Four: Basin and Local Water Quality Strategies; and
- -- Chapter Five: Managing Areawide Water Quality.

The interaction of the Plan with other programs being conducted under different sections of PL 92-500 is also explained in Chapter One. The other programs include: State basin plans under Section 303 (e); specific facilities plans for sewage treatment works under Section 201; and the National Pollutant Discharge Elimination System (NPDES) permit program under Section 402.

A complete description of the Southeastern Regional Planning and Economic Development District (SRPEDD) is provided in Chapter One of the full plan. SRPEDD was originally organized as a regional planning agency in 1956, following the passage of state legislation. The agency is governed by a Commission of sixty-six members, which includes chief elected officials or their designees from the thirty member communities, planning board members from the thirty communities, and six representatives of low-income and minority groups elected at-large. The agency derives its funding from a 15¢ per capita assessment and matching federal and state funds.

The role of public participation as a learning process between those conducting the study and local officials, interest groups and the general public is discussed. An review and analysis of the public participation process emcompassing the two-year study period is provided along with an explanation of committee structures, the "208" mailing list, and special activities and information publications, and media contacts.

Activities which became a spin off of the "208" effort and contributed to the achievement of water quality goals are listed in Chapter One. These included:

- -- a joint project for industrial wastes pretreatment and recovery of precious metals by three silver platers in the Taunton area;

- -- a pilot septage composting project by the Towns of Rehoboth, Seekonk and Swansea.
- -- a manual for homeowners on septic tank maintenance;
- -- a handbook on wastewater disposal options;
- -- a provision in the facilities study for the Fall River Wastewater Treatment Plant for the acceptance of septage from surrounding municipalities; and
- -- an application for the locating and planning of sites for hazardous residuals wastes disposal in the area.

Chapter One also includes a description of the "208" planning area, outlining its boundaries; provides a history of the region since the time of the Indians; describes the climate and the physical characteristics of the land such as topography, soil types and inland water bodies; and explains the usage of land in the region. Finally, socio-economic factors in the region such as population, income, and education, and the labor force are also discussed.

STRUCTURAL APPROACHES TO THE ACHIEVEMENT OF WATER QUALITY

I. INTRODUCTION

Chapter Two outlines a wide variety of means, methods, technologies, types of structures and/or treatment processes which can be built to collect and treat all four kinds of municipal wastewaters:

- Sanitary sewerages from homes, schools, business and industries
- Commercial wastewater from laundries, restaurants, etc.
- Industrial water used in manufacturing processes,
- Storm drainage and street runoff.

The various types of structures can be grouped into categories according to the primary purpose to be served:

- Ways to treat domestic sewerage on-site
- Ways to collect stormwater and sanitary waste and/or separate the collection of these two different types of wastes
- Ways to treat the wastes that have been collected before the wastes are discharged
- Ways to discharge the wastes to water or land
- Ways to prevent the generation of pollutants in scattered places
- Ways to dispose of by-products which result from some of the treatment processes outlined above.

Chapter Two contains information on:

- water conservation,
- information on the cost of each of the types of structures outlined above, and
- ways to raise money to pay for these facilities.

II. WATER CONSERVATION

Water conservation provides communities with the most effective way to reduce the amount of wastewaters generated and hence the costs of treatment and disposal. Recommendations for water conservation apply to every community in the region.

There are two ways recommended for communities to reduce the amount of water used in households:

1. Encourage residents to modify water use habits by turning off water that is not being used, reducing the amount of water used in baths, showers, dish-washers and washing machines and promptly repairing leaks within the water system. Brochures mailed with water bills, and a revision of the fee schedule where water use is metered are two measures communities can employ.

2. Legislate the installation of water saving devices in new housing, and encourage the conversion of regular plumbing fixtures in existing houses to low-flow devices. The most common water saving devices are water saving toilets, which use three and a half gallons (or less) of water per flush, compared to five to seven gallons for conventional toilets; low-flow shower heads, which average about a fifty (50) percent savings in water used; and faucet aerators. All these devices are commercially available, with water saving toilets costing the same as conventional ones (approximately $130 installed), shower heads cost $20 and faucet aerators cost $5 each.

Cost Savings: Sewered Areas

Example:

A much simplified comparison of the costs of a treatment plant, with and without conservation, yields a rough estimate of the savings to a city's residents which can be achieved. This example assumes all residences (not just new ones) have installed new devices to conserve water, that a fifty (50) percent per person savings is achieved, that our city has 30,000 people, and 3.2 people per household. Savings from smaller pipes, pumping station, etc. are not included.

	Conventional Use	Conservation Use
Water Use	80 gpd per person	40 gpd per person
Total Residential Flow	2.4 mgd	1.2 mgd
Industrial Flow, 20% of conventional total	.6 mgd	.6 mgd
Total Plant Capacity	3.0 mgd	1.8 mgd
Capital Costs of Plant	$6.1 million	$4.4 million
Annual Operation and Maintenance	$170,000	$150,000
One-time per Household Saving on Capital Construction Costs, Adjusted to Reflect 90% for Federal & State Grants to Pay for Plant		$ 10.50
Annual per Household Savings on Operation & Maintenance		$ 16.50

These costs do not include savings on water heating, and possible savings on the development of local water supplies.

For those who cannot convert their systems to low-flow fixtures, the "brick in the toilet" and modifying wasteful water use habits can still help to reduce total flow.

Non-Sewered Areas

Water conservation can help homeowners with septic tanks as well, by extending the life of the leaching system. Costs for new septic tanks and sewer systems are discussed below, so that readers can compare the effort needed to promote water conservation versus the costs to either replace failing systems or install sewer systems. Chapter Three, in a discussion of the need for local programs to maintain existing septic tanks explains in more detail why water conservation lengthens the life of these on-site systems.

Industrial Water Conservation and Reuse

Chapter Five recommends a continuing effort to make industries aware of water reuse opportunities and techniques. In-plant process changes or flow modification can result in cost savings to industries, as well as reduce the need for sewage treatment plant capacity.

III. ON-SITE SEWAGE DISPOSAL OPTIONS

There are, besides the well-used and well-known septic tank, six or seven other kinds of systems that can be installed on individual lots. The following chart outlines the characteristics of each type of system, the installation costs and the annual charges for pumping and disposal of septage.

Of these systems, the local Board of Health may approve, in writing, the use of a humus toilet, a privy, or chemical toilet, as well as the septic system. All other systems require the written approval of the Department of Environmental Quality Engineering before these may be used.

TABLE I

	Characteristics	Installation	Annual
Outhouse	Simple located outside house environmentally sound requires greywater system	$300	$ 20
Septic Systems	Requires proper soils can contaminate groundwater with nitrates Must be maintained with regular pumping to be reliable Works best when water use is not excessive	$1,000-2,000	$ 20
Aerobic Treatment units	Has mechanical components can contaminate groundwater with nitrates Requires mechanical maintenance	$2,00-3,000	$200

TABLE I (cont.)

	Characteristics	Installation	Annual
Compost or Humus Toilets	Larger units more reliable mechanically maintained environment prone to upsets		
	Large bins make installation sometimes difficult		
	Reduce total household water comsumption by approximately 40%		
	Eliminate groundwater pollution.		
	Requires greywater system	small: $600-$1,200	$ 75
		large: $1,500-$2,500	0
Incinerator Toilets	Requires installation of vent stack		
	Complex mechanism must be adjusted if not used over extended period of time		
	Uses no water: water use reduced by 40%		
	Eliminates groundwater pollution problems		
	Exhaust vapors not appropriate for dense area (air pollution)		
	Requires greywater system	$ 6,000	$400
Evapotranspiration System	Eliminates groundwater pollution		
	Requires large land area of bed		
	Insufficient data to estimate reliability	$6,000	$ 20

TABLE I (cont.)

	Characteristics	Installation	Annual
Holding Tank systems	Requires greywater system Requires pumping		
	Frequency of pumping determined by amount of water used: (little water, infrequent pumping)		
	Eliminates groundwater pollution		
	Separation of toilet and greywater drains can be expensive		
	New drain & vent stack must be installed	$2,000	$250
Greywater System	Little groundwater pollutants		
	Requires proper soils	$800-1,200	$ 5

IV. COMMUNITY SEWER SYSTEMS: THE PIPE

Community sewer systems consist of a system of collection pipes, together with manholes, pump stations and interceptor sewers, all designed to transport the wastewater or storm water flow to a point of treatment or discharge. Sewers can contain 1) sanitary and industrial and commercial wastewater sewerage; 2) storm waters consisting of excess rainwater from streets, parking lots and other drained areas; or can contain both types of wastewaters mixed together (combined).

Combined sewer systems are found in older cities in the District. Side-street collector piping typically is connected to both house drains and storm water catch basins at street sides. The collectors, in turn, empty into surface waters (these points of discharge are known as outfalls) or into a treatment facility. At the major junctions of the collector system and interceptor, there are provisions for overflows to either accommodate storage of excess flows or by-pass the remainder of the system altogether.

It should be understood that combined sewer systems are designed to overflow. For example, the existing New Bedford interceptor can accommodate less than 10 percent of the peak stormwater runoff flow collected by the city's combined sewerage during a two-year storm typical for the area. The excess, or up to 80 million gallons of combined sewage, will overflow during a storm event of this intensity to the Acushnet River and New Bedford Harbor through devices intentionally designed for this purpose.

Street runoff is comprised largely of suspended and settleable solids similar to sand and silt. Entrained with this material is organic matter, algal nutrients, coliform bacteria, heavy metals and pesticides. Stormwater discharges generally have bacterial contamination concentrations 2 to 5 orders of magnitude higher than those considered safe for water contact activities. Urban runoff rates may vary from 5 to 10 times the dry weather flows during an average storm of 0.10 in/he (0.25 cm/hr) rainfall. It is evident that separated sewers reduce annual discharged BOD but increases suspended solids, which in this case flow directly to receiving waters and are not involved with any part of the sanitary sewage treatment system.

The need for overflow control and/or upgrading of the old combined sewers is paramount if receiving water quality is to be improved and subsequently maintained, particularly in the older urban areas.

Alternative Solutions

A great variety of combined sewer remedial schemes are available. Each combined sewer problem may have a particularly appropriate solution or set of solutions depending on certain site specific factors.

For purposes of discussion, it may be helpful to group alternative methods for reducing pollution from combined sewers into five general classifications, as follows:

a. Complete Storm and Sanitary Sewer Separation

b. Partial Storm and Sanitary Sewer Separation

c. Detention and Storage of Overflows

d. Pumping of Overflows

e. Separate Treatment of Overflows

--Complete Separation

There are three potential approaches in this general classification:

1. Construct new sanitary sewers and use the existing combined sewers as storm drains.

2. Construct new storm drains and use the existing combined sewers as sanitary sewers.

3. Construct new sanitary sewers and storm drains and abandon the existing combined sewer.

By providing a two-pipe system in place of the single combined line, separation of stormwater from sewage wastes theoretically occurs. Discharges from the sewer line are largely independent of storm frequency or intensity, except for groundwater infiltration, and the sewage collector-interceptor network does not become surcharged with flows exceeding design capacity.

Separation of storm and sewer lines, however, does not completely solve the combined sewer overflow pollution problem. Watershed storm runoff can be highly contaminated in urban areas. While bacterial components of the combined storm system discharges are reduced by elimination of sewage, the suspended solids loadings usually remain virtually unchanged. On this basis, since separated storm sewers usually discharge directly to receiving waters or drainage basins, some form of end-of-pipe treatment is still necessary to protect these waters from contamination.

Direct costs for complete separation are proportional to difficulty of installation. In downtown urban areas, for example, where other street located utilities are of concern, building roof drains are present or extensive trench sheeting is needed to avoid sidewalk or building disturbance, installation is very costly regardless of the separation method used. Indirect costs to the community in terms of business interruption, traffic control, construction activity and nuisance must be added to the direct costs of construction for comprehensive consideration. Cost figures are found in Figures A through H.

Partial <u>Separation</u>

Five alternative methods may be associated with this general classification of combined sewer overflow control and/or treatment.

1. Construct separate storm drains only in critical drainage areas.

2. Enlarge existing interceptor for greater capacity and to relieve constructions or "bottlenecks."

3. Construct sanitary sewers only in high stormwater flow areas where consistent overflows occur in the combined system.

4. Construct pressure sewers in certain areas to prohibit external stormwater entry and infiltration.

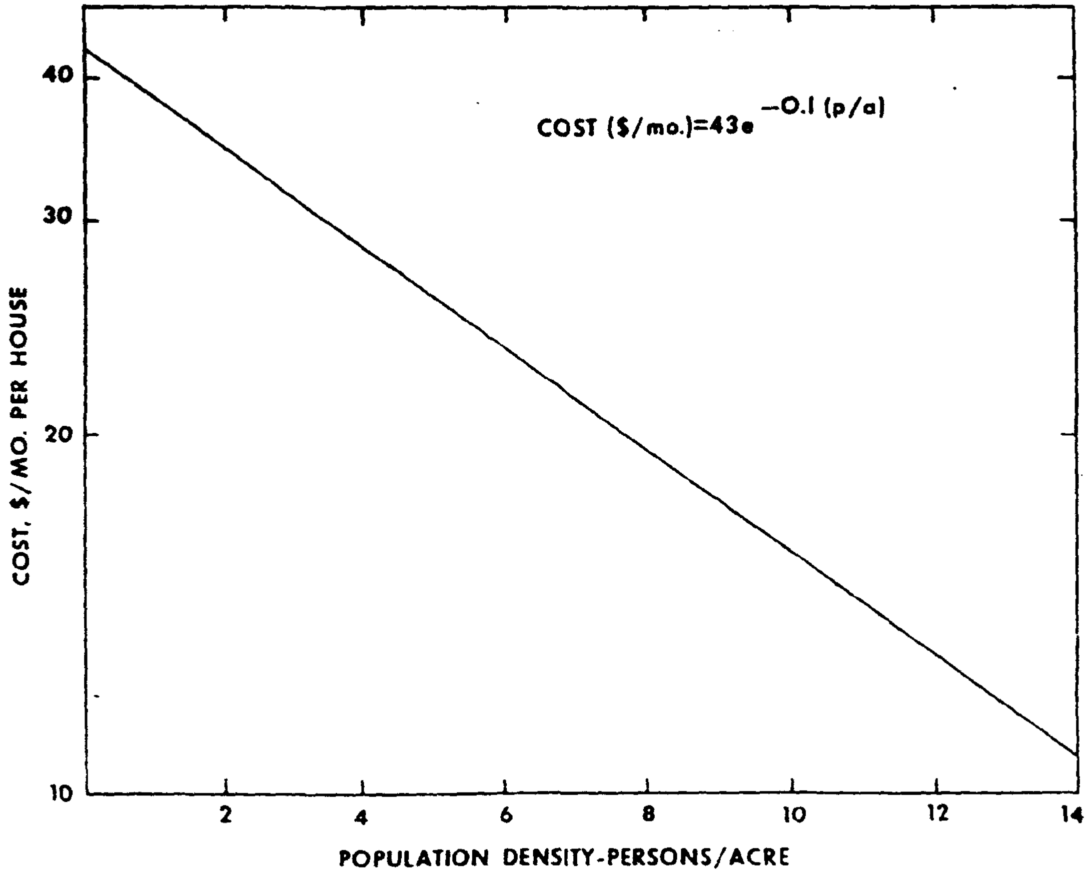

FIGURE 1. MONTHLY COST OF GRAVITY SEWERS

Status of Pressure Sewer Technology, James F. Kreissl, 1977
Paper presented at EPA Technology Transfer Design Seminar for
Small Flows

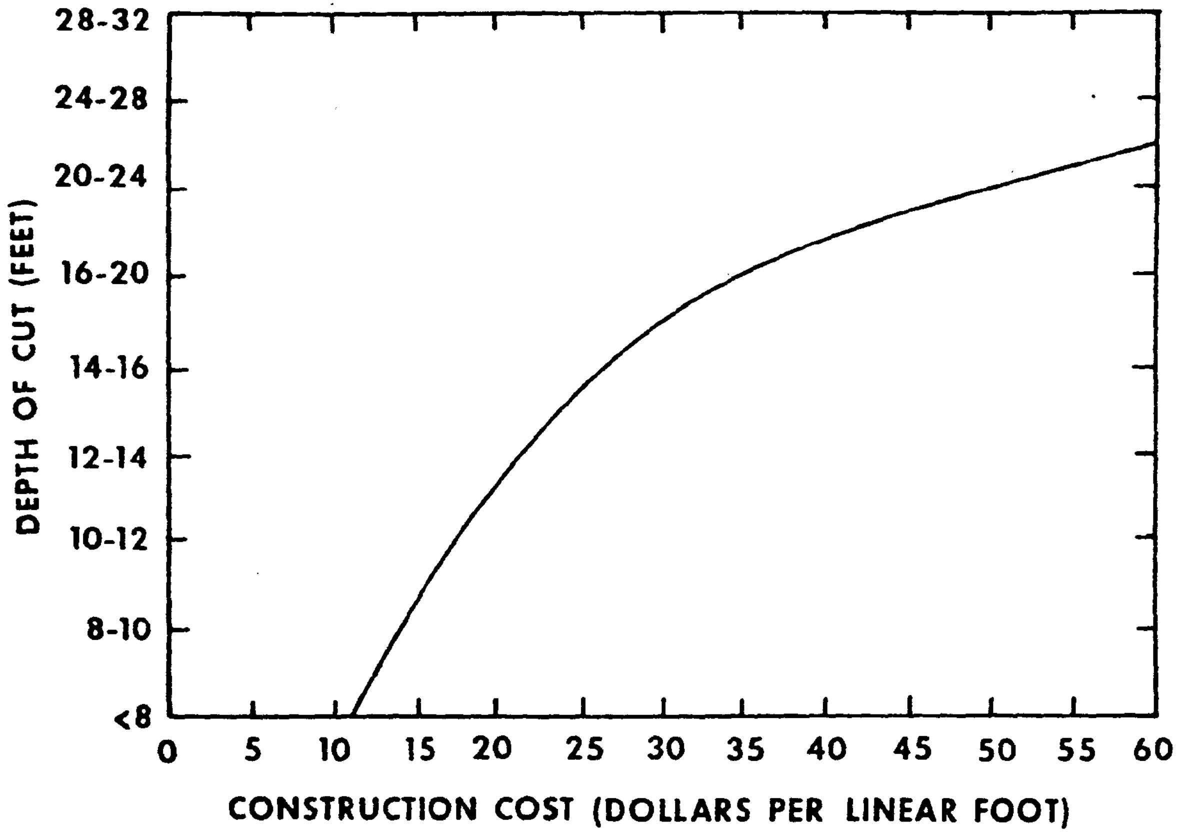

FIGURE 2. COST OF SEWER CONSTRUCTION

Status of Pressure Sewer Technology, James F. Kreissl, 1977
Paper presented at EPA Technology Design Seminar for Small Flows

5. Introduce polymers to increase interceptor flow capacity.

The thrust of partial separation is to selectively "fix" the combined sewer system to reduce the pollution potential from overflows. This requires detailed engineering analysis of the condition of the collectors, interceptors and the overflow regulators.

Gravity Collection Systems

Gravity collection systems are by far the most common and as the name implies, the pipes are constructed on a slight slope so the sewage will flow by gravity. When pipes become too deep in the ground for economical construction, or where topography prevents gravity flow, pump stations must be installed to lift the flow to a point where gravity flow can commence again. Force mains may also become necessary where sewage must be pumped against gravity.

The cost of conventional sewerage is extremely high for most small communities, often in excess of $10,000 per home, with the collection system representing more than 80% of the system capital cost in rural areas. Figures 1 and 2 indicate the average costs of gravity sewer construction.

Low Pressure & Vacuum Collection Systems

Pressure and vacuum sewers may have considerably lower capital costs when compared to gravity sewers since they both employ small diameter plastic pipe buried just below the frost penetration depth. Site conditions such as hilly terrain, rock or high groundwater may also favor the installation of pressure or vacuum sewers. In addition, since both systems operate with tight pipes, infiltration of groundwater is eliminated. These characteristics of the pressure and vacuum systems present specific economic and environmental advantages where favorable conditions for installation exist.

Low pressure sewage collection systems consist of a series of individual pumps which deliver the sewage under pressure to small diameter collection pipes. The basis of the system is the individual grinder-pump located in each building served by the system. These pumps grind and eject the sewage into the collection system. Since the flow in the collection pipes is under pressure, pipe sizes can be small (2 to 4 inches in diameter) and are not restricted by topography as the gravity collector is. Generally, low pressure collection pipes are laid just below the frost line.

Although power costs for operating a low pressure pumped system are generally higher than for gravity sewers, the simplicity of the low pressure system (i.e. with its ease of construction and convenience of repair) can compensate for the increase in operating costs.

The low pressure sewage collection system is a relatively new option for sewage collection, having been developed in the late 1960's, and to date, no low pressure systems have been constructed in Massachusetts.

Another collection technology, particularly for smaller communities with difficult terrain or soil conditions, is vacuum sewers. This system requires a central vacuum source continuously maintaining 15 to 25 inches of mercury vacuum on the collection system of small diameter plastic pipes. In addition to the central vacuum facility, specially designed plumbing fixtures and control valves are required in each structure served by the system. Various systems also include separate piping for both black water and gray water, in line collection tanks, gravity-vacuum interface values and other specialized construction or equipment requirements.

V. COMMUNITY TREATMENT METHODS

The municipal sewage collection system delivers the wastewater to a central downstream point where it is treated to remove or neutralize pollutants. This section summarizes a variety of treatment processes.

Biological Treatment

Presently, biological processes in which bacteria degrade organic water are most common.

Stabilization ponds copy the stream process in a confined body with detention times generally over 60 days. Here natural biological processes occur with a wide range of plant and animal interaction providing treatment. The technology is low, energy consumption low and the space requirements are large.

Waste stabilization ponds can be either:

a. Aerobic: This is a very shallow pond 2-3 feet deep. The shallowness allows complete mixing by wind agitation and strong sunlight is able to penetrate a much larger depth. The shallow conditions require a much larger surface area as compared to the deeper aerobic-anaerobic pond.

b. Aeorbic-Anaerobic: These ponds are generally 4-5 feet deep and contain two or three zones of biological activity. Wind agitation and photosynthetic activity (which decomposes matter) creates an aerobic surface zone one to two feet deep. The lack of agitation and sunlight and the settling of solids at the bottom of the pond creates an anaerobic zone. Between these zones is an intermediate zone which is frequently dispersed with the top or bottom layer. Both zones digest sewage and sludge, but in different ways.

Oxidation ditches provide a more optimum environment for organisms to consume the wasteload and therefore shorten the time and volume necessary to achieve treatment. However, in order to increase the efficiency of the processes the wastewater must be artificially aerated and excess solids removed by additional settling. This increases operation and maintenance costs but reduces land area requirements.

Activated sludge treatment plants further increase natural process efficiencies by carefully controlling the food to organism ratios and amount of air provided for biological oxidation. This requires more manpower, high technology levels including laboratory analyses for process control, increases waste solids production and energy consumption but significantly reduces detention times to hours instead of days with a resulting reduction in space requirements.

Figure 1 below provides a comparison of cost factors for three of the alternative biological processes. The reader should bear these factors in mind as he reads the overview discussion below. Clearly, the low technology natural processes have limited application because of their space requirements but may be a very cost effective solution for isolated areas of the more rural communities.

Fig. 1

COMPARISON OF ALTERNATE BIOLOGICAL TREATMENT METHODS

	Ponds		Ox. Ditch		Act Sludge	
CAPITAL COSTS	1/2 MGD	2 MGD	1/2 MGD	2 MGD	1/2 MGD	2 MGD
LAND	$ 138,000 (1)	$ 540,000 (2)	$ 18,000 (3)	$ 60,000 (4)	6,000 (5)	12,000 (6)
CONSTRUCTION	1,200,000	$4,400,000	1,200,000	3,300,000	3,200,000	4,000,000
O & M COSTS						
OPERATORS	1	3	1	3	2	5
POWER	4,800 (7)	16,200 (7)	12,000	22,000	26,500	43,500
CHEMICALS	1,900	7,800	2,500	12,000	9,500	31,500
% EQUIP.	LO	LO	MOD.	MOD	HIGH	HIGH

(1.) 46 ac. ALL LAND COSTS ASSUMED $3000/AC.
(2.) 180 ac.
(3.) 6 ac.
(4.) 20 ac.
(5.) 2 ac.
(6.) 4 ac
(7) ASSUMES THAT FLOW WILL BE LIFTED THROUGH PROCESS AT SOME POINT - IF GRAVITY FLOW ACHIEVED POWER COSTS ALMOST NEGLIGIBLE SAME ASSUMPTION APPLIED TO OTHER PROCESSES

Lagoons are the man-made counterparts of the natural ponds. These consist of large earthen basins, usually lined with plastic or other impermeable material to prevent leakage and subsequent contamination of groundwater.

Raw sewage flows into the lagoon system where treatment occurs as the flow passes through the series of ponds. Treatment is similar to the biological purification achieved in natural pond systems. Due to the large volume of the ponds and the long detention times (60-120 days), lagoons provide a stable treatment environment, relatively immune to upsets due to the quantity and concentration of the effluent wastes. In addition, little or no mechanical equipment or power is required for operation.

Effluent quality from lagoons is consistently good. Normally, the effluent is passed through sand filters before disinfection and discharge.

Packaged treatment plants are complete wastewater treatment systems manufactured off site and installed with a minimum of additional on site construction. These plants fill the gap between small on-lot systems and the large custom built municipal systems. Several packaged plants exist in the District, servicing schools, commercial developments and recreational facilities.

A packaged plant is a valuable alternative for areas isolated from municipal systems or where a large system is economically infeasible. The treatment process is usually biological, although physical-chemical processes are also adaptable to packaged plants.

Normal unit sizes are 50,000 gpd to 250,000 gpd, although large capacities can be obtained by adding additional units. Packaged plants, if installed in modules, are adaptable to seasonal flow fluctuations; i.e., a minimum number of units can be operated in the low flow seasons with additional units activated during peak periods.

The Department of Environmental Quality Engineering requires extensive redesign of packaged plants to meet Massachusetts standards, greatly increasing the cost of packaged plants. In addition the state will approve packaged plants only if they are owned and maintained by an organization which can be held responsible for operation and maintenance, although in general, state policy prefers connection to municipal or regional sewage treatment plants rather than allowing scattered packaged plants located at problem areas.

Custom Built Biological Treatment Plants

Description

Similar to the treatment processes of the previous three alternatives, custom built biological treatment plants treat only BOD, suspended solids and bacteria and are primarily capable of handling domestic waste. These plants cannot treat metals or chemicals without additional treatment steps. The treatment plants are individually designed and built in place. Capacity can range from .5 MGD on up.

Different levels of treatment available include:

- Primary Treatment is a mechanical process which involves the removal of large particles, the settling of smaller particles, grit removal and oil and grease removal. In addition, the chemical processes of pH control and chlorination are usually included. (Chlorine is added to kill or inactivate pathogens.) Federal law (PL 92-500) makes primary treatment alone unacceptable after 1977 so it is normally followed by biological or physical/chemical secondary treatment processes. Primary treatment has BOD and suspended solids removal capabilities of 30 to 40 percent.

- Secondary Treatment generally consists of adding a biological process after primary treatment to further remove organic pollutants. The usual biological processes include trickling filter, aeration tanks or other variations of the activated sludge process. Other less common secondary processes may include physical and/or chemical removal of pollutants. Physical-chemical processes, however, are usually applicable only where industrial wastes constitute a large percentage of the total flow. Secondary Treatment has BOD and suspended solids removal capabilities of 85 to 95 percent.

- Advanced Treatment often called "tertiary" treatment, is used where the removal of specific pollutants such as nitrate and phosphate is required or where exceptionally high quality effluent is required for the protection of the water body into which the effluent is discharged. Nitrient removal, i.e. removal of nitrates and phosphates, is a common form of advanced treatment which protects downstream surface receiving waters from excessive algae growth. The Attleboro treatment plants will have the capability of advanced treatment.

Treatment of the sludges, which are moved as underflow from the process, generally includes a digestion step, which biologically reduces the volatile organic portion of the sludge. A thickening step frequently follows to concentrate the amount of solids in the sludge prior to dewatering. Dewatering is generally accomplished mechanically by centrifuge or vacuum filter and reduces the sludge to a solid state for landfilling or incineration. For additional information see Section G of Chapter Three.

Physical-Chemical Treatment Plants

Physical-chemical treatment systems remove pollutants by chemical clarification in conjunction with physical processes. The process generally includes:

- Preliminary Treatment
- Chemical Clarification
- Filtration
- Carbon Adsorption
- Disinfection

Chemical clarification proves the major portion of pollution removal. Raw wastewater first received preliminary treatment of coarse screening and grit removal, followed by treatment with a coagulant (such as lime, iron or aluminum salts, polyelectrolytes or a combination of these). Following chemical addition, the wastewater is then allowed to precipitate and settle. The resulting sludge must then be removed and properly disposed of. Filtration of the effluent is necessary to remove additional solids to prevent clogging of subsequent processes.

The role of carbon adsorption is to remove soluble organics from the wastewater. The carbon contacting system generally uses granular carbon and the wastewater may either flow downward or upward through the carbon media. Periodic backwashing of the downflow bed must be proved because suspended solids will accumulate in the bed.

Physical chemical treatment processes may be used alone but are most effective when used in conjunction with biological treatment. Generally physical chemical processes are used as a polishing or advanced phase following secondary biological treatment. Where high concentrations of industrial pollutants prevent the use of biological treatment, physical chemical treatment has distinct advantages. Operating and maintenance costs of physical-chemical treatment plants tend to be higher than for biological plants of the same capacity, so that to date physical-chemical treatment has not been widely used for municipal sewage treatment. As more attention is directed to industrial pollutants which either cannot be removed by biological treatment or inhibit the biological treatment process, physical-chemical treatment either alone or in conjunction with biological treatment may become more common.

Combined Sewer Overflow Treatment

Since there is the possibility that undesirable overflows will occur during storm events, or even during dry weather caused by a blocked or damaged overflow regulators, end-of-pipe solutions to the problem are available for combined sewers. Alternative treatment methods may be grouped into three general classifications, as follows:

- Storage and Detention of Overflows
- Pumping of Overflows
- Separate Treatment of Overflows

Alternative methods for each of these classifications will be described in following sections. Comparative information will be provided for conceptual understanding including reference to cost. Each alternative approach is essentially governed by site specific factors. Therefore, precise design detail and associated cost estimates cannot be given except in general terms.

Storage and Detention of Overflows

This general classification includes four basic methods for confining combined sewer storm overflows in established storage facilities for later introduction to either surface or groundwater, or re-introduction to the sewer system. They are listed as follows:

1. Temporary ponding of overflows in open surface areas.

2. Storage in an aerated detention basin for later pumping back into the interceptor after subsidence of storm event.

3. Passive standby storage in tanks, deep wells or tunnels underground for later pumping to receiving waters or interceptor sewer.

4. Storage or detention in oversized upstream collector sewers for later discharge to interceptor sewer.

Pumping of Overflows

Three alternatives are appropriate to this general classification for end-of-pipe treatment.

1. Upstream storage, with pumping programmed to wastewater treatment plant flow capacity.

2. High rate pumping to downstream storage prior to treatment.

3. Upstream high rate pumping directly to an outfall located offshore.

The alternatives suggested under this class are generally energy intensive, must be reliable, require programming to respond to varying flow conditions associated with runoff during a storm event and are costly to build and maintain.

Separate Treatment of Overflows

End-of-pipe treatment of not only combined sewer overflows, but also separate storm sewer discharges has received, in recent years, increasing technical emphasis. As a result there are a number of options available to each community for assessment in relation to need and financial capability. While some of the options grouped in this classification have some of the structural elements contained in methods included in the prior classifications, they usually add treatment steps to render their effluent discharges less harmful to the environment.

The following listing includes major alternative options or methods for end-of-pipe treatment of combined sewer overflows.

1. Dissolved air-flotation of solids and chlorination of discharge.

2. Micro-straining of solids combined with chlorination or ozone treatment of discharge.

3. Stabilization ponding or sedimentation combined with chlorination of discharge.

4. Crazed resin filtration and disinfection with chlorination.

5. Rapid-flow filtration by means of conventional sand filters or special media beds and chlorination of discharge.

6. Fine screening by rotary vibration and disinfection by chlorine.

7. Simple detention and chlorination of discharge.

8. Simple flow concentration of solids and discharge with or without chlorine.

VI. COMMUNITY EFFLUENT DISPOSAL

Two basic alternatives are available for effluent disposal:

- discharge to water; and
- discharge on or below the surface of the ground.

Discharge to Surface Waters

Of the various effluent discharge options available to municipal sewage treatment facilities, discharge to surface waters is by far the most common. Discharge is both simple and inexpensive, the treated effluent being discharged directly from an outfall pipe generally below the surface of the receiving waters. The quality of the effluent is established by permit issued under the provisions of the National Pollution Discharge Elimination System (NPDES) of PL 92-500. This will require the municipality to control, through the sewer ordinance, those pollutants which the biological treatment process cannot remove. At present, however, sewer ordinances are not adequate to protect the treatment process or the receiving waters from pollutants nor has EPA issued the federal guidelines for the degree of industrial pretreatment required prior to discharge to a municipal sewer system.

Land Disposal of Treated Effluent

Description - Land disposal of treated effluent may be divided into two categories:

- rapid infiltration where the effluent is rapidly infiltrated into the soil through specially prepared sand filter beds; and
- land spreading or spray irrigation where effluent is distributed on the surface of a vegetated area and percolates slowly into the soil.

Rapid infiltration requires suitable soils, generally thick strata of highly permeable sands and gravel, in order to percolate the effluent and avoid surface ponding. A moderate amount of land area is required for the actual sand bed infiltration surfaces. Effluent disposal is rapid and efficient and requires only periodic maintenance of the surface of the sand beds (five-year intervals with good quality secondary effluent).

Monitoring, however, is designed to control only the efficiency of the treatment process and accordingly addresses only those pollutants which the biological process is capable of removing. Other pollutants are not monitored, thus the possibility of passing quantities of toxic and hazardous substances to the ground disposal system and eventually the groundwater exists.

Land spreading and spray irrigation refers to the disposal of treated effluent on the surface of the ground, where living vegetation can utilize and remove many of the pollutants before they are carried down to the groundwater. This option is generally more expensive than either discharge to surface waters or rapid infiltration due to the far greater land area requirements, effluent storage requirements and the mechanical equipment required to distribute the effluent. For the degree of wastewater renovation it provides, it is often the most cost-effective process. Final effluent reaching the groundwater has been shown to be equal or better than that provided by an advanced wastewater treatment plant. Secondary treatment with land application of effluent often costs less than half that of comparable treatment by a conventional advanced wastewater treatment plant. Additionally, a crop is usually harvested, which helps offset the costs of the land spreading disposal option.

VII. NON-POINT SOURCE CONTROLS

Like point source alternatives, non-point source structural measures fall into these categories:

- Rerouting and/or Collection
- Holding and Retention
- Treatment

Structural controls are defined as those activities which, when implemented directly, affect the amount or quality of a non-point discharge and/or also directly affect the impact of that discharge on the receiving environment.

The following table outlines these mechanisms. As these mechanisms follow very closely the ones outlined above for point sources, they are not discussed here.

Saltwater Intrusion Prevention

Major structural control measures which can be employed include control of pumping patterns, artificial recharge and extraction barriers. There are no general costs on these methods and they must be evaluated on a case-by-case basis. Artificial recharge can include infiltration from surface spreading or wells. Because much of the region takes its drinking water from aquifers, the prevention of saltwater intrusion is important but the potential for contamination by recharge must be considered also.

VIII. SLUDGE AND RESIDUALS

Sludge treatment and disposal are integral and interdependent parts of the sewage treatment process. Sludge is one of the two major end products of the treatment process and must be carefully considered in treatment facilities planning to satisfy water quality goals.

The processing or treatment of sludge and its final disposition are separate operation in most instances. The disposal method depends on whether the end product can be used as a fertilizer, for example, or whether it is an inert material suitable for landfilling.

The following figures and tables summarize options for sludge treatment and/or disposal, the costs associated with different alternatives, a summary evaluation of their environmental effects, and a chart which outlines the considerations involved in making decisions about which alternative a community should choose.

Sludge handling and disposal is a major part of the sewage treatment process. The unit process concerned with sludge comprises 25 to 40 percent of the total capital equipment cost of most wastewater treatment facilities. Much of the normal treatment plant operation and maintenance is typically directed to sludge disposal activity.

Septage

Disposal of raw, unprocessed, liquid sewage ("night soil") is a problem which is serious in the planning area. This material, in a strict sense, is not a sludge since it has received little or no treatment except minimal anaerobic digestion in septic tanks or cesspools under less than optimum conditions. Alternatives for this material are directed to dewatering and reduction of bacteriological strength so that utilization or disposal can be achieved without risk to the environment or danger to public health.

One alternative is introduction into sewage treatment plant headworks for processing to provide adequate treatment of the liquid content and further reduction of bacterial strength by normal treatment plant sludge processing procedures. Several treatment facilities in the SRPEDD area have capacity to handle septage with modification to their operating procedures.

Three communities in the SRPEDD region are demonstrating a septage treatment solution based upon a composting system. Due to the high moisture content of typical septage wastes, the selection and costs of absorbent materials are critical to successful operation. A properly operated composting system, however, will not present odor problems, contaminate groundwater or have other negative environmental impacts. Capability to operate in cold weather at a reasonable cost and the production of a salable fertilizer product are additional benefits derived from the system.

With proper management the application to land of septage as a fertilizer supplement or soil conditioner should avoid environmental and public health related problems.

Sanitary landfill disposal should be considered only for digested or otherwise stabilized sludges. Disposal of liquid or unstabilized sludges is not advisable without detailed technical analysis and thorough environmental assessment. It is apparent that the existence of established sludge handling unit processes (see Figure 1) in the SRPEDD area has confined the foregoing description and consideration of sludge disposal methods and options to conform to the first major alternative approach described under major planning and management pathways. On this basis then, any recommended sludge utilization and disposal program for the region will have to accept the generated sludge as it is produced by area wastewater treatment facilities unless some of the sludge treatment processes are bypassed or changed. Candidate sludge characteristics vary from sewage treatment plant to treatment plant, such as an ash from New Bedford to a heat treated dried material from the new Taunton facility. Therefore, there appears to be limited opportunity for aggragation of sludges from several treatment plants to achieve economies of scale in composting, for example.

TABLE 1

GENERAL STRUCTURAL NONPOINT CONTROLS
INVOLVING REROUTING, COLLECTION AND RETENTION

Measure	Mechanism and Result
Channels/Pipes	Collection, rerouting, interim storage, dilution and mixing.
Underdrains	Collection, rerouting, infiltration prevention
Dams/Dikes	Impoundment, sedimentation, mixing flow routing
Sewer Separation	Pollutant isolation
Inline Storage	Flow equalization and discharge management
Offline Storage	Flow equalization and treatment
Sedimentation Basins	Flow equalization and settling of pollutants
Sand and Gravel Storm Sewer Filters	Filtering of particulate pollutants such as asbestos, rubber, automobile emission particles
Infiltration Berms	Control and filter runoff leaving roadways
Lagoons and Ponds	Biological (aerobic and/or anaerobic) and physical (sedimentation)
Physical Treatment	Screening, sedimentation, filtration, swirl concentrators, flotation principally aerobic
Biological Treatment	Trickling filters, etc.
Disinfection/Aeration	Chlorination bubbled or surface agitated air addition
Chemical Addition	Coagulation and/or precipitation
Land Application	Spray irrigation
Receiving Water Treatment	In situ aeration or chemical addition generally for acute condition
Saltwater Intrusion Prevention	Injection wells

TABLE 2

SUMMARY OF STORAGE COSTS*

Location	Type	Capacity, mil. gal.	Cost $/gal.
Oak Lawn, Ill.	Surface detention	53.7	0.03
Seattle, Wash.	In-line	32.0	0.23
Chippewa Falls, Wis.	Open, lined basin	2.8	0.26
Jamaica Bay, N. Y.	Covered basin	10.0	2.12
	Basin plus sewer	23.0	0.92
Milwaukee, Wis.	Buried basin	4.0	0.50
Akron, Ohio	Buried-void space	0.7	0.62
Boston, Mass.	Buried, short detention	1.3	4.74**
Chicago, Ill.	Open quarry	2,736.0	0.21
	Tunnels and appurtenances	2,834.0	0.27

* ENR = 2000
** Includes influent pumping station, chlorination facilities, and outfall.

FIGURE 1
ENUMERATION OF SLUDGE TREATMENT PROCESSES AND THEIR FUNCTIONS

Unit Processes*	Alternative Methods	Functions
Thickening (Blending)	Gravity Flotation Centrifuge	- Water Removal - Volume Reduction - Post Process Efficiencies - Blending
Stabilization (Reduction)	Composting Aerobic Digestion Anaerobic Digestion Lime Treatment Chlorine Treatment Heat Treatment	- Pathogen Destruction - Volume & Weight Reduction - Odor Control - Putrescibility Control - Gas Production
Conditioning (Stabilization)	Chemical Addition Elutriation Heat Treatment	- Improve Dewatering or Thickening Rate - Improve Solids Capture - Improve Compactability - Stabilization
Dewatering	Filter Press Drying Beds Centrifuge Rotary Vacuum Filter Horizontal Filter Cylindrical Screen Lagoons	- Water Removal - Volume & Weight Reduction - Change to Damp Cake - Reduces Fuel Requirements for Incineration/Drying
Heat Drying	Flash Dryer Multiple Hearth Tray Dryer Spray Dryer	- Water Removal - Sterilization - Utilization
Reduction (Stabilization)	Incineration Wet Air Oxidation Pyrolysis	- Destruction of Solids - Water Removal - Conversion - Sterilization
Final Disposal	Application	- Utilization(Cropland) - Utilization(Energy) - Utilization(Land Reclamation) - Disposal(Landfill) - Disposal(Ocean)

* EPA Technology Transfer,
"Process Design Manual for Sludge Treatment and Disposal." October 1974.
EPA 625/1-74-006.

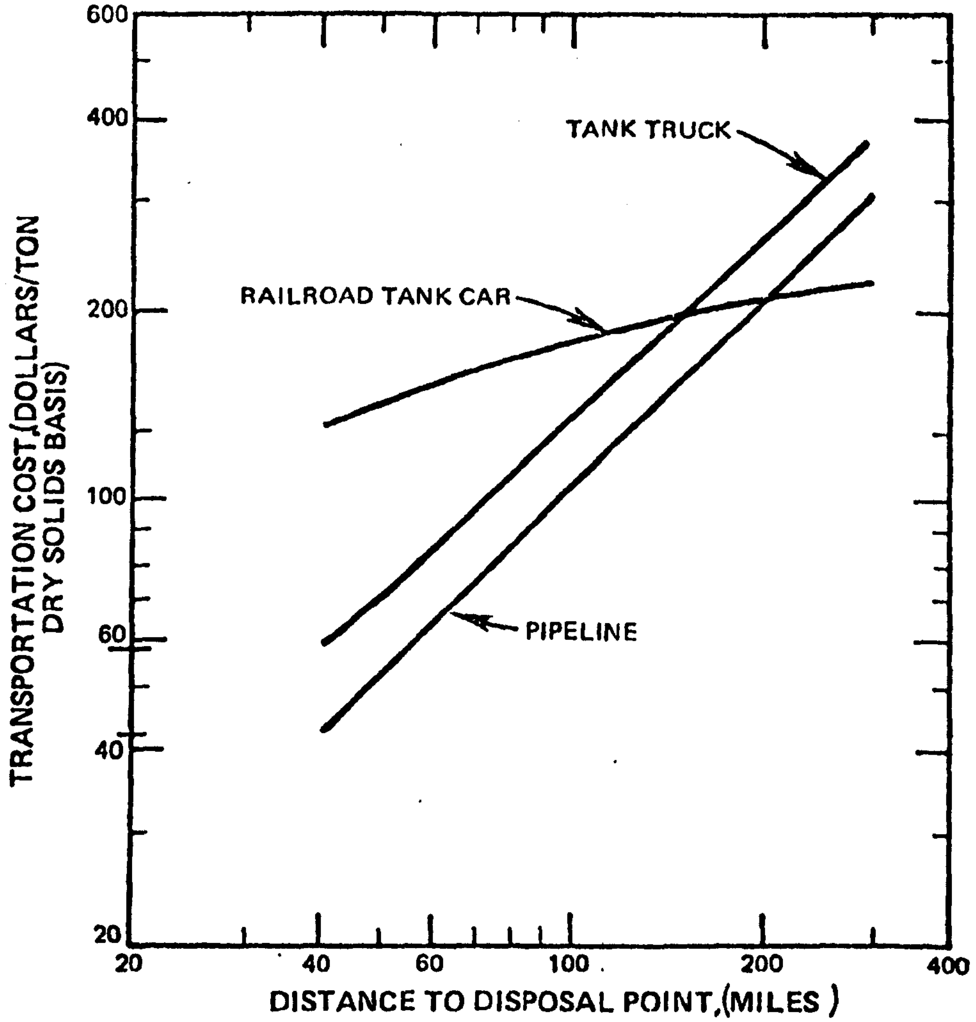

FIGURE 2

RELATIVE TRANSPORTATION COST FOR LIQUID ORGANIC SLUDGES-1974*

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* Ewing, B.B., and Dick, R.I., "Disposal of Sludge on Land." Water Quality Improvement by Physical and Chemical Processes. University of Texas Press, Austin. EPA Technology Transfer, Process Design Manual For Sludge Treatment And Disposal, October 1974

ESTIMATED TYPICAL COSTS OF SLUDGE DISPOSAL PROCESSES PER DRY TON, 1974

Methods	Cost Per Dry Ton*
Dewatering:	
Vacuum filter	$31.00
Centrifuge	26.00
Sand beds	30.00
Land Transport (5% solids):	
Tank truck	3.00/mile
Railroad	0.25/mile
Pipeline	1.55/mile
Land Transport (30% solids):	
Dump truck	0.65/mile
Railroad	0.25/mile
Ocean Transport (5% solids):	
Barge	0.20/mile
Outfall	0.60/mile
Ocean Transport (30% solids): Barge	0.03/mile
Storage:	
Stockpile (30% solids)	2.30
Lagoon (5% solids)	14.00
Disposal (5% solids):	
Ocean disposal	-
Landfill	3.00
Land spreading	20.00
Disposal (30% solids):	
Ocean disposal	-
Landfill	3.00
Land spreading	10.00

Miscellaneous Disposal Methods:
Incineration (total cost including dewatering) $50 to $85
Composting (total cost including dewatering) Estimated $8.00 to $14.00.

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* Derr. D.A., et.al. "Economic considerations for planning sewage sludge disposal systems." In A. Freiberger, ed. Pretreatment and Ultimate Disposal of Wastewater Solids; Proceedings; Research Symposium, Rutgers University, State University of New Jersey, May 21-22, 1974. (New York) U.S. Environmental Protection Agency, Region II.

TABLE 2
SUMMARY GROSS COST COMPARISON OF SLUDGE DISPOSAL ALTERNATIVES

Applicable Cost Element*	Land Application	Land Reclamation	Energy Generation (Incineration)	Composting	Controlled Landfills
	$ per Dry Ton, 95% Solids*				
DEWATERING (Treated Sludge)	30	30	30	30	30
LAND TRANSPORT	(25 miles av.)	(25 miles av.)		(5 miles av.)	(10 miles av.)
5% Solids (Treated Sludge)	75 (tank truck)	NA	NA	NA	30 (tank truck)
30% Solids (Treated Sludge)	18 (dump truck)	18 (dump truck)		3 (dump truck)	7 (dump truck)
STORAGE					
5% Solids (Lagoon Treated Sludge)	14	NA	NA	NA	14
30% Solids (Stockpile Treated Sludge)	3	3		3	3
DISPOSAL					
5% Solids (Treated Sludge)	20	NA	NA	NA	3
30% Solids (Treated Sludge)	10	10	55	35	3
APPROXIMATE TOTAL COST, $/Dry Ton, for					
5% Solids (Treated Sludge)	140/ton	NA	NA	NA	77/ton
30% Solids (Treated Sludge)	60/ton	60/ton	85/ton	70/ton	43/ton
	$ per Wet Ton, 20% Solids				
EQUIVALENT WET TON TOTAL COST, $/Wet Ton					
5% Solids (Treated Sludge)	35/ton	NA	NA	NA	18/ton
30% Solids (Treated Sludge)	15/ton	15/ton	20/ton	17/ton	10/ton

* Ref: Derr, D.A. et al 1974 basis for dollar values (see page 13).

TABLE 1

ENVIRONMENTAL EVALUATION OF SLUDGE DISPOSAL ALTERNATIVES

Factors	Land Application	Land Reclamation	Energy Generation (Incineration)	Composting	Landfills
WATER QUALITY	Potential nutrient pathogen or metals contamination of groundwater	Possible nutrient pathogen or metals contamination of surface and groundwater	Little change in Water Quality affects	Possible nutrient or metals contamination of surface or groundwater by-product	Potential leachate contamination of groundwater
AIR QUALITY	Produces slight increase in odors and truck emissions	Produces slight increase in odors and truck emissions	Produces slight increase in odors and particulates	Produces slight increase in odors and truck emissions	Produces slight increase in odors and truck emissions
LAND QUALITY	Increases soil productivity	Increases soil productivity & enhances use options	No change in land quality	Increases soil productivity by product use	Limits soild productivity and land use options
FLORA & FAUNA	Disrupts local ecology during application operations	Restores local ecology to prior or improved status	Has minor impact on ecology	Disrupts local ecology at work site	Several affects local ecology by altering site topography
AESTHETICS QUALITY	Degrades in local area when freshly applied	Improves land appearance in local area after application & stabilization	Little change	Degrades in local area with unsightly open work site	Working face activity degrades in local area

TABLE 1
(continued)

ENVIRONMENTAL EVALUATION OF SLUDGE DISPOSAL ALTERNATIVES

Factors	Land Application	Land Reclamation	Energy Generation (Incineration)	Composting	Landfills
PUBLIC HEALTH	Increases potential of harm to public health by action upon the food chain if used on crops	Increased potential of harm to public health from ground-water contamination	Little change in public health involvement	Increases potential of harm to public health by action upon the food chain if used on crops	Possible change in public health in-volvement from ground water contamination
COMMUNITY IMPACT	Little change in social elements	May involve dis-placement of resi-dents or alter prior land use	Increases odor or noise levels near operations site	May involve dis-placement of resi-dents near work site	No change in social elements
RESOURCE	Promotes benefi-cial use of sludge, reducing use of natural resources	Promotes benefi-cial use of sludge, reducing use of natural resources	Increases primary resource usage & reduces secondary resource produc-tion	Promotes benefi-cial use of sludge, reducing use of natural resources	Maintains present level of energy & resource use

TABLE 3

SUMMARY EVALUATION OF SLUDGE DISPOSAL ALTERNATIVES

Sludge Disposal Alternative	Study Area Constraints: Technical	Environmental	Socioeconomic	Institutional	Where Applicable
LAND APPLICATION	Compatibility and capability of soil to properly absorb	Toxic trace elements if present & low nitrogen fertilizer value	Acceptability limited generally to forage crops & transport costs to site or to restricted publicly owned land	Requires strict operation and monitoring	Town
LAND RECLAMATION	Usually high application rates required for restoration of land areas	Risk of groundwater or runoff pollution	Transport costs may limit use	Requires strict operation & monitoring. Also complex institutional arrangements may be needed	limited in SRPEDD
ENERGY GENERATION (Incineration)	Relatively low heat value either as gas or in dried state as fuel. Needed for supplementary primary fuel	Some air quality degradation possible with incineration	Supplementary fuel needed for combustion of dried sludge	None if energy is not marketed, otherwise may be complex	City
COMPOSTING	Requires bulking agent on 3 to 1 volume basis	Toxic trace elements	Limited market for all of product	Requires monitoring of product.	Town or City
LANDFILLS	Requires careful siting and preparation	Risk of groundwater pollution	Requires rural location and restricts future land use options	State regulations require separation from other solid waste disposal facilities	Town

IX. COSTS

1. Introduction

In an attempt to provide a useful tool for planning wastewater management alternatives, a series of figures have been prepared which permit the assessment of budget capital costs and operation and maintenance costs for various treatment and collection components. The figures provide a guide for estimating wastewater flows for various land use types and areas. In order to price various alternatives, all one needs to do is to know the zoning category and the area to be planned.

All costs are based upon Engineering News Record construction cost index of 2600 estimated for June, 1977. Costs are based upon updating previous 201 studies for communities in the region, and estimates and bid prices for similar municipal construction in southern New England. While the capital costs are generally reflective of actual bid prices they cannot be used to set budgets for individual design situations. Nor are the component sizing figures sufficiently precise to permit individual designs.

THESE CHARTS ARE PRESENTED AS A PLANNING GUIDE FOR PUBLIC OFFICIALS IN ORDER THAT THEY MAY INVESTIGATE ALTERNATIVES IN A SIMPLIFIED BUT REALISTIC FASHION. THEY ARE NOT APPROPRIATE FOR USE IN DESIGNING SPECIFIC FACILITIES.

2. Capital Costs

The capital costs include all facilities installed in-place in existing ways and include such costs as: engineering design, supplying all necessary materials, tools and labor, shoring trenches, minor dewatering, normal traffic control, protection of existing infrastructure, replacing pavement and contingencies, they exclude any legal, land taking, or extraordinary soil condition costs.

Assumptions for cost comparisons will be given below.

The following is a hypothetic case illustrating the use of the charts.

Example Case Study

Town A has 200 acres of homes located on a lake which is used by City B as a source of water supply. The homes are all on small lots 6000-8000 square feet. All of the homes have on-site sewage disposal systems (OSDS) many of which have seasonal high groundwater problems.

The various alternatives which are being considered are:

(a) Extend an interceptor sewer up from City B and sewer the entire area connecting it to the new interceptor and the conventional biological treatment plant in City B.

(b) Sewer the entire area connecting it to a central pumping station which will lift it to a stabilization pond which is sufficiently distant from the lake to eliminate the threat of pollution.

Step 1

Divide 1 Ac = 43,560 sq. ft. by 8000 sq. ft. lot to determine the appropriate land use curve for wastewater generation estimating.

$$\frac{43,560}{8,000} = 5.4 \qquad \text{use 5 du*/ac}$$

Step 2

Enter into Figure A at 200 acres and project line to 5 du/ac curve - read treatment system flow = 0.30 mgd
collection system flow = 1.20 mgd

Note: That treatment systems capacities may be rated at average flows while collection systems must be able to carry peak flow.

*du = dwelling units

Step 3

Under Alternative A select interceptor size for peak flow of 1.2 mgd from Figure B. Required Pipe = 12".

Note: The interceptor would not be sized for only the problem area but in reality would be designed to carry all of the area tributary to it in Town A. However, for first cost comparisons only the minimum size to eliminate the problem wasteflow will be considered.

Step 4

a. Determine the cost per foot of the interceptor sewer from Figure C.

Use a cost of $60/ft. Note: A judgement can be made regarding the appropriate range of costs to use from soils and topographic maps of personal knowledge of the area.

b. From municipal maps a length can be determined from the problem area to City B's closest adequate sewer. Assume this scales 6,000 feet, the interceptor cost would be 6,000 x $60 or $360,000.

c. Since the collection system can be assumed to be the same under both alternatives, it is not necessary to compute its capital cost. If the collection system were not the same, it could be assumed to be all 8" sewer (min. recommended sewer size) and the total length could be scaled from the municipal map.

Step 5

a. Determine pumping station cost from Figure D by using peak flow of 1.2 mgd.

Capital Cost = $190,000

b. From Figure E select force main size (pressure pipe discharging from a pumping station).

Required pipe = 8"

c. From Figure F determine cost per foot of the force main. Use a cost of $41/feet.

d. From municipal maps determine a treatment location outside of the aquifer recharge area of the lake. Assume this scales 1,500 feet, the force main cost would be 1,500 x $41 or $62,000 (round all costs off to nearest $1,000).

Step 6

a. Assume under Alternative A that City B has a present conventional secondary treatment plant of 3 mgd which is slightly overloaded. As part of the new sewerage extension they would double the size of the plant to allow for their needs and increased flow of Town A. By entering Figure G at 3.0 mgd and using the conventional "ACTIVATED SLUDGE" curve a capital cost of $6,200,000 can be determined. However, the portion of that cost which is attributable to the problem area of Town A can be related to the ratio of flows as follows:

$$\frac{\text{Average flow from problem area}}{\text{Average flow capacity of plant expansion}} = \frac{0.3}{3.0} = 0.10$$

Therefore the proportional cost =

0.1 x $6,200,000 = $620,000

b. UNDER Alternative B. The stabilization pond would be sized for the project flow of 0.3 mgd. Its cost can be picked off the appropriate curve on Figure G.
Capital Cost = $800,000

Note: Figure 6-1 is an enlargement of the lower end of Figure 6. This was prepared to provide greater estimating detail over the primary applicable flow range for pre-engineering modular activated sludge plants, so-called "package" plants.

In estimating the costs of these smaller plants, current Massachusetts Department of Environmental Quality Engineering guidelines for components were used. The costs include the modular plant, with flow equalization, diffused-air aeration, followed by filtration, disinfection and a leaching system for ground discharge. Sludge treatment includes aerobic digestion and bed dewatering and landfill disposal. Cost include appurtenant structures, fencing and site preparation.

Step 7

Summation of estimated costs.

Alternative A

Interceptor Sewer	$260,000
Portion of Treatment Plant	620,000
	$980,000

X. FISCAL ALTERNATIVES FOR WATER QUALITY MANAGEMENT

The purpose of this section is to outline the financial requirements imposed on local governments by PL 92-500, and to list alternative mechanisms by which communities can meet these requirements. Capital costs are treated separately from operation and maintenance costs.

1. Requirements of PL 92-500

a. Requirements for local share of capital costs

Local governments which receive EPA grants for the construction of sewer treatment plants must raise 100% of the non-eligible costs and 10% of the capital costs of such plants. 75% of eligible costs can be paid for with a federal grant, 15% with a state grant. Cities and towns may borrow within the debt limit for up to 30 years (Ch. 44 S·7 (1)), or outside the debt limit for up to 30 years, with the approval of the Emergency Finance Board (Ch. 44 S 9 (1-5)) for this purpose.

Municipalities must appropriate the local share of the total project funds (see CFR 30.935-1) before their application for a grant is filed. The local authorization is to make specific mention that funds are to be used together with state and federal funds and should also authorize the town or city to apply for the state and federal grants.

b. Requirements for operation and maintenance costs

Section 204(b) of PL 92-500 states that revenues for operation and maintenance must be levied through user charges, defined in 40CFR 35.905-26 as "a charge levied on users of a treatment works for the cost of operation and maintenance of such works......" These charges apply to industrial as well as to commercial or residential users.

c. Requirements for Industrial Cost Recovery

If a treatment plant handles waste flows from (an) industrial source(s), provisions must be made to charge to these industrial users the amount of the initial construction costs which can be attributed to providing such treatment.

2. Fiscal Alternatives

a. Ways to raise local share of capital costs

Communities have 3 types of bonds they may issue: (1) full faith and credit bonds (or general obligation bonds, which are backed by the taxing power of the jurisdiction; (2) revenue bonds, which are backed by user charges or other revenues generated by the use of specific project; (3) special tax bonds which depend on a special levy assessed solely for the purpose of retiring a specific bond issue. The capital costs can thus be paid for through property taxes, user charges or betterment (special) taxes.

For local communities, the most crucial variable in floating a bond, the interest rate, will be determined by the rating assigned to each bond issue by the rating services (Standard and Poors, and Moody's Investors Service, Inc.). For revenue bonds, soundness of revenue projections is only one aspect of the evaluation of the project. Other factors influencing the rate paid, for either type of bonds are the community debt structure, with borrowing inside the debt limit encouraging lower rates. Other factors include financial management practices, financial history, etc.

The responsibility for timely financial planning is that of the chief elected officials.

b. Paying for Operation and Maintenance

One reason Congress included the provision for user charges was the fear that municipalities would slight the costs of annual operation in the annual budgetary process. The user charge provisions are designed to provide separate revenues for the treatment facility which will adequately cover the annual operating costs.

Local governments, however, should carefully scrutinize these costs, and demand that consultants show them alternatives with minimum operating costs. Experience has shown that annual operation and maintenance costs far exceed the initial estimates presented at the time of construction.

Note: This should not imply that minimum operating costs will be the sole determinant of which alternative is finally selected, and approved by the Division of Water Pollution Control and EPA, as the recommended alternative must be both cost-effective and environmentally acceptable. Cost-effectiveness includes the capital as well as operating costs.

c. Calculations of User Charges

For municipalities which will treat domestic wastes only, the simplest basis for calculating user charges is flow, which can be easily computed and billed in areas with metered water. The costs of maintenance would be apportioned on the basis of average annual water use.

Where water is not metered, the costs of metering water use must be balanced against the additional revenue and general equity to be obtained by metering.

For systems under construction, it is easier to include meters in the hook-up phase than it is to install them in pre-existing systems. If a decision is made not to meter, then user charges must be based on generalized assumptions as to per household use.

Water rates, like all utility rates, are controlled by the Department of Public Utilities and are based on user classification systems. Heavy users usually pay smaller per unit fees and the fee structure encourages water consumption. Thus, user charges based on water flows should reflect water consumed and not the water rates paid.

User charges for industrial users are found in the Appendix to Subtask 5.3. User charges for septage can be based on the increased costs of flow management, weight as a percentage of the total weight of suspended solids handled per time unit, and BOD as a percentage of total BOD per time unit.

For communities which have both sewered and unsewered areas, the management authority might be broadened so that fees can be collected from both sewered and unsewered households. User charges would be calculated for unsewered households. The local government or management authority would assume responsibility for purchasing trucks or for contracting with private companies or individuals, and for routine inspections and pumping of septic tanks. The operating and maintenance costs for both sewered and unsewered areas could then be pooled, and divided evenly among households. This would be most equitable for those plants which treat septage as well as domestic sewage.

If such a "unified" system is adopted, provisions should be made to insure that individual systems are properly used and maintained.* Boards of Health should adopt regulations to reflect proper maintenance procedures, with penalties and fines specified for improper use.

Another technique for unifying the management of both sewage treatment plants and on-site systems would be a program of reimbursement to homeowners for pumping septic tanks. Bills are submitted directly to the town for payment.

The annual costs for disposal of residuals from the treatment plants should be included.

d. <u>Alternatives to User Charges</u>

Although the law requires operation and maintenance to be paid for from user charges, Congress is considering amending this to provide more flexible local financing. For new systems with few initial users, the per user cost can be exorbitant. If such an amendment passes, cities and towns will be able to include operation and maintenance costs in calculations of annual revenue to be raised through the property tax.

*SRPEDD has published a booklet entitled "Septic Systems: How They Work and How to Keep Them Working" which local Boards of Health may distribute to homeowners.

e. Financing Excess Capacity

Plants are built to last twenty-five years, and have the capacity to handle new users as they come on line. Many plants have excess capacity that will probably not be used until well into the life of the plant. Communities should carefully evaluate the implications of excess capacity, especially as it affects the annual costs of operation and maintenance.

If the costs of excess capacity are borne by present users, they are paying for the future growth capacity of that municipal service, a public good that is shared by all members of the community. There is good reason, then, that excess capacity, both in terms of capital expenditures and as such excess capacity may increase early operation and maintenance costs, should be financed through the community-wide property tax.

f. Operational Implications

Bookkeeping practices, and budget format should be developed or revised at the same time that various cost sharing or billing systems are established, and those involved in the day to day operations of the plant should be consulted to make sure that operational costs can be proportionately allocated.

The sewer ordinance which communities must adopt must contain enforcement procedures, especially to insure that industrial users are meeting their prescribed pretreatment standards. Any local monitoring program should also be coordinated with the assessment of user charges.

g. Intermunicipal Financing

Shared facilities can be financed one of three ways: intermunicipal contracts; the formation of Water Pollution Abatement Districts; or by special means authorized by special legislation passed by the General Court.

1. Cities and towns may act jointly under a contractural agreement entered into under Chapter 40, S.4 and 4.a, under which one community plans, constructs and operates a treatment facility and agrees to provide service for a certain volume of flow from

another community in return for annual payments. The contract format allows flexible terms dealing with volumes of sewerage treated, reimbursement for specified capital costs, length of contract period, renewal of contracts and arbitration in the case of disputes. Detailed examination of existing intermunicipal contracts is found in Subtask 7.2.

2. Water Pollution Abatement Districts are legal corporate bodies with authority to issue bonds and charge member communities and towns annual debt retirement and operating and maintenance costs. General obligation bonds can be issued upon the majority vote of the District Commission, composed of two members from each city and town appointed by the selectmen or city council. (For communities with over 20,000 and under 50,000 population, one additional member is appointed; for those with populations over 50,000 two additional members are appointed.)

   Formulas and methods for appointment must be approved by the Division of Water Pollution Control, and cannot be altered without the approval of the Division. Amounts to be raised from each city or town are not submitted to cities and towns for annual votes at either the city council meeting or town meeting, but are certified to the assessors of each city and town and must be included in the amount of local revenues to be raised annually.

   Indebtedness incurred by Districts shall not be included in computing the limit of indebtedness of any city or town, any portion of which is included in the district. Water Pollution Abatement Districts can only be dissolved by an act of the legislature.

3. Special Legislation: Any group of cities and towns can jointly petition the legislature to create a special water quality management district. The powers and duties, form of representation, methods of establishment and dissolution, methods of revenue raising and cost apportionment can be specified in accordance with the requirements of the possible member communities.

h. Districts Consisting of a part or parts of a City or Town

Federal 201 grants may only be used to fund facilities for wastes from sections of a city or town if these facilities are owned or operated by a public authority. Funds to retire special assessment bonds may be levied by betterment taxes, with operation and maintenance funded through user charges.

Chapter Three - Summary

REGULATORY APPROACHES TO THE ACHIEVEMENT OF WATER QUALITY

DRAFT

I. INTRODUCTION

This chapter presents a variety of regulations which are necessary to achieve the goal of water suitable for fishing and swimming. The set of regulations discussed in this chapter can be used to:

1. prevent, in some cases, the need for the expensive structural solutions found in Chapter Two;

2. to supplement the control of point sources of pollution with the equally important control of non-point sources; and

3. to ease implementation, in some cases, of structural solutions.

The first section of this report addresses each of the major types of non-point pollution which PL 92-500 requires be controlled. Non-point sources of pollution are dispersed, and can be set back at any distance from a body of surface water or groundwater.

The second section outlines both traditional and more innovative land-use management techniques which can be used to further local water quality policies.

The third section outlines, briefly, a set of recommendations which pertain to point sources.

Each recommendation is outlined in the text, but specific wording for legislative changes, regulations, by-laws or ordinances is found in the technical appendices.

Development of Recommendations: Public Participation

As described in Chapter One, the planning process joined by SRPEDD placed great emphasis on public participation. Some of the issues addressed in this chapter were selected by various publics as important, and the recommendations have been fully informed by public discussion. Other issues have not seized the public imagination, and recommendations concerning them were developed without the benefit of extensive public input.

II. ANALYSIS BY NON-POINT SOURCES

The following section outlines recommendations for controlling non-point sources.

A. AGRICULTURAL POLLUTION

As different types of agriculture produce different types of pollutants, SRPEDD has broken down this section by agricultural sector. Each set of practices recommended for the four sectors were developed with the help of advisory committees of growers. The four agricultural sectors most prevalent in the SRPEDD region are:

- cranberry growing
- livestock and dairy farming
- forestry
- fruit and vegetable growing

1. Cranberry Cultivation

Cranberry cultivation utilizes pesticides and fertilizers in the immediate vicinity of surface waters and directly 0-2 feet above the water table. The problem is to confine pesticides and fertilizers to the bogs. This is a challenging problem as the streams and groundwaters associated with cranberry bogs are draining to streams and aquifers respectively towards the ocean. Small amounts of pesticides do leave the bogs with the streams and groundwaters in the flow down basin.

Research has shown that pesticides in cranberries chelate or otherwise adhere to clay and organic detritus present on the bogs and in the ditches which drain them.

Pesticides are a mixed blessing. They are one of the factors that have raised yields per acre to their present level, but they have also:

--caused fish, crab, and seagull kills (caused by chlorinated hydrocarbon-type pesticides no longer used and to a lesser extent by present organophosphate-type pesticides)

--caused (in part at least) present problems with pests like Sparganothis, cranberry girdler, and red mites. (Resulting from buildup resistance and killing of natural predators.)

--introduced trace amounts (below drinking water standards) of pesticides into groundwater aquifers tapped by both private and public wells.

Regulatory Responses

Because the practices which are needed to reduce the hazards outlined above call for very fine-grained, everyday sorts of activities, a formal regulatory program is not feasible.

The use of good practices requires on-the-spot day-to-day judgement, and could not be easily specified, monitored, or enforced. The Cranberry Experiment Station plays a crucial role in informing cranberry growers that best management practices are often in the best interests of the growers. These practices are outlined below.

a. Slow release of flood water to prevent erosion and sedimentation and the excess scouring of ditches and canals.

b. Aerial spraying of pesticides only when the wind speed is less than 7 mph, preferably at dusk when wind dies down, when wildlife activity is at a minimum, and so that breakdown of pesticide compounds can occur throughout the night before wildlife returns to the bogs.

c. Use of biodegradable pesticides rather than persistent ones.

d. Reliance on sanding and flooding to control pests whenever possible.

e. Design of sprinkler systems, which convey agricultural chemicals so that part-circle heads are used near ponds, reservoirs, roads, avoiding sprinkling in non-bog areas.

f. Application of pesticides only after the infestation level is serious enough to warrant treatment. The Appendix of Chapter Three contains a pest control chart to help growers determine this level of infestation.

g. The use of approximately no more than 25 lbs per acre per year of major fertilizing nutrients.

The Cranberry Experiment Station will investigate complaints, make analyses within its capability to determine causes of environmental mischief, and if necessary revise its concept of best management practices and communicate promptly with the Growers Advisory Committee. Violations of Best Management Practices which cause problems can also bring regulatory and enforcement action from: The State Pesticide Control Board, the Division of Water Pollution Control, and local boards of health.

2. Livestock and Dairy Farming

As the Dairy Growers Advisory Committee has not completed its work on best management practices as of this press date, it will be included later in the Final Plan.

3. Forestry

If forest land is harvested to the extent that ground cover is removed, soil can erode into nearby streams. The problem is thus one of clear-cutting rather than logging, and there are no known problems in the SRPEDD district.

Regulatory Responses

State law calls for the preparation of a forest cutting plan by a professional forester if the landowner is to benefit from forest land exemption from property taxes. Such a plan provides for the layout of roads, stream crossings, revegetation and erosion control.

If unsupervised cutting becomes prevalent, and the demand for firewood increases significantly, the following recommendations would apply:

- Regulations should be extended to cover changes in land use, not just logging, so that harm from land clearing can be mitigated.

- Copies of forest plans should be filed with the local Boards of Health and Conservation Commissions to bolster project monitoring.

4. Fruit and Vegetable Growing

The two general water quality problems attributable to this sector are:

-groundwater pollution due to leaching of excess nitrogen fertilizer; and

-surface water pollution due to runoff of soil, pesticides and fertilizers.

These are comparatively minor problems in the district, with localized impact.

Best Management Practices

a. Soils should be tested to determine the amount of nutrients to be supplies, and the application rate should be in accordance with the specifications prepared by the County Extension Service.

b. Cover crops should be established on all land to retain nutrients and prevent erosion.

c. Pesticides should only be used when cultural or biological pest control methods (interplanting, natural predators etc.) fail.

d. Pesticides should only be used in response to an observed infestation (not as a preventative) and only in amounts specified by Agricultural Extension Service.

e. The least persistent pesticide which will deal with a particular infestation should be used.

f. All appropriate cultural practices designed to reduce soil loss (contour plowing, cover crops etc.) should be followed.

g. Irrigation should be limited so as not to produce surface runoff from the site.

h. Structural measures (sedimentation basins) may be required in some areas, particularly those with steep slopes.

i. A buffer strip of undistrubed vegetation (minimum width 20 feet) should separate all crop areas from surface water bodies.

j. Especially stringent erosion controls are needed on orchards and other lands where mercury, arsenic and other persistent pesticides applied in the past have built up in the soil.

B. EROSION AND SEDIMENTATION

Statement of the Problem

The Natural Erosion Process

Soil erosion takes place when rain falls or water from any source, such as snowmelt, runs downhill on bare soil and moves soil particles. Soil particles are first loosened by the impact of falling rain or by scouring action and then moved along with the water. Finally, the soil particles are deposited at some location downstream. This transported soil is called sediment.

The removal of fairly thin uniform layers of soil from the land surface by water is called sheet erosion. When the runoff water moves fast enough, it scours out small channels in the soil and rill erosion results. As the channels become larger than approximately 6 inches deep, gully erosion takes place.*

Conditions for Erosion

Some erosion will always occur through natural processes, and this is referred to as natural or background erosion. Under certain conditions, however, erosion is more rapid and severe. Conditions which lead to severe erosion are both natural and man-made, and include the following:

--heavy rainfall
--steeply sloping soil (over 15%)
--lack of vegetative cover
--easily erodable soils (droughty soils
    such as sand or finely grained soils
    such as muck)
--loss of soil structure
--channelized drainage

*U.S.D.A. Soil Conservation Service, Guidelines for Soil and Water Conservation in Urbanizing Areas of Mass., p.3.

Results of Erosion

The result of erosion is that suspended solids become mixed with water in rivers and ponds.

In rapidly moving water, soil particles become mixed with water, creating a highly turbid condition which can interfere with the normal growth of fish and plants, by reducing both the oxygen and the sunlight available. In slow-moving waters, behind dams, for instance, or in ponds, the suspended solids fall to the bottom, creating sedimentation. Excessive sedimentation can produce stagnant lakes and ponds.

The top soil also supports vegetation, which serves to remove pollutants. When the top soil is removed, this vegetative "filter" is also removed. Pollutants in runoff do not get taken up by plants as they travel over the surface of the land; instead they are more directly discharged into surface waters.

Where herbicides, pesticides have been applied to increase agricultural productivity or where chemicals are stored in the open, the eroding material can become contaminated, resulting in contaminated solids or sediments.

Erosion Producing Activities

The activities which produce erosion over and above natural erosion are those which destroy vegetative oover, remove the top soil, or create severe cuts in the earth. Some of these activities include:

--highway construction
--residential, commercial, industrial construction
--mining of sand and gravel
--mining of coal
--open storage of salt for road maintenance
--agricultural and silvicultural cultivation on sloping land

This section will discuss all of the activities listed above, with the exception of agriculture, which has been discussed in the preceeding section.

1. Erosion from Highway Construction and the Installation of Utility Lines

Highway construction activities are major earth-disturbing operations which can cause considerable erosion unless controls are used. Erosion can also result from the installation of utility lines.

Regulatory Responses

The Massachusetts Environmental Policy Act (MEPA), Chapter 30, Sections 61 and 62, requires any state agency undertaking an action which may result in significant damage to the environment to prepare an Environmental Impact Statement (EIS) containing a description of the project, an assessment of the impacts of the project, alternatives to the project and specification of measures to be used to mitigate environmental damage. The MEPA legislation applies not only to state highways, but also to utility transmission lines, as the Department of Public Utilities must approve land taking and the installation of transmission lines.

As there are efforts underway to revise the MEPA legislation, SRPEDD will make no recommendations in regard to MEPA in this report.*

A road built to interstate design specifications has a large impact on the environment because among other reasons, interstate highways are designed to carry traffic at 70 miles per hour. Grade and radius restrictions for a 70 mile per hour highway requires greater cutting and filling of the landscape than would be necessary for highways designed for 50-55 mph travel.

If the federal funds were made available for roads designed for 50 to 55 mile an hour travel speed rather than 70 miles per hour, energy conservation would be encouraged and erosion from highway construction would be reduced.

*Meeting with Bill Hicks, March, 1977. The problems mentioned were (1) inadequate means to screen out projects with significant or insignificant harmful environmental consequences; (2) delays; and (3) staffing of public agencies charged with preparation of Environmental Impact Statements. Further information about proposed changes in MEPA may be obtained from Mr. Hicks, at the Executive Office of Environmental Affairs, Saltonstall Building, Boston, Mass. (617)-727-5830.

2. Erosion from Residential, Industrial and Commercial Construction

Construction activity has the potential to produce significant soil erosion unless methods are used to prevent soil loss.

Regulatory Responses

There is very little "law" in Massachusetts relating to erosion and sedimentation directly. Local regulations, however, can be used to minimize erosion by introducing a requirement that local construction must meet a set of criteria for erosion control. These criteria can be introduced into local zoning by-laws, as a general use regulation, subdivision control rules and regulations, cluster development provisions in the zoning by-law, and planned unit development requirements.

Zoning can also prohibit or restrict building on steep slopes. Soil maps prepared by the Soil Conservation Service are available for most SRPEDD communities, and these show steep slopes as well as soil types.

If erosion control plans are required for building permits for various types of projects - subdivisions, planned unit development, or cluster development - communities may arrange with the Soil Conservation Service to have a technical review of such plans.

To aid in enforcement of any such plans, communities may wish to make the provisions of such plans public, so that local officials, while they cannot monitor each project, can at least respond to complaints from a well-informed and interested public.

3. Erosion from the Mining of Sand and Gravel

Statement of the Problem

While the description of the erosion process found above holds true for sand and gravel pits, mining operations may have special features. In washing operations, for instance, the water used may have especially heavy sediment loads which, if not recycled or left to settle for a while in sediment basins, will result in rapid siltation of nearby water courses. Often, sand and gravel pits lie over large aquifers which contain valuable underground water for present or future water supplies. Removal of the overlying sand and gravel removes a natural purifying filter. Excavations if not limited to four feet above the watertable, can, therefore, result in pollutants entering the groundwater.

Regulatory Responses to Erosion Problem from Sand and Gravel Pits

In the absence of a state law specifically dealing with inland sand and gravel mining*, local communities may regulate such operations by either:

--a general by-law enacted under Chapter 40; or
--provisions in the zoning ordinance/by-law in accordance with Chapter 40A**.

Samples of by-laws based on each kind of authority are found in the full text, technical appendix of Chapter Three.

Again, it is recommended that local authorities make the provisions of gravel pit operating permits available to the public to aid in the enforcement of the permit conditions.

4. Erosion from Coal Mining

While coal mining is not a current activity, explorations to determine the amount, depth and type of coal suspected to lie in the northwest part of the SRPEDD region have been started.*** With the likely emphasis on increased use of coal in the future, erosion from strip-mining, as well as acid-mine drainage, could become serious problems in the future.

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*Under Chapter 21, S.54, the Division of Mineral Resources in the Office of Environmental Affairs has authority to license and/or lease the excavation of minerals in coastal or navigable waters. No such state authority exists for inland excavation.

**Alexander D. Dawson, Esq., "Earth Removal and Environmental Protection", Environmental Affairs Quarterly, Vol. III, #1, February 1974, pp. 166-187.

***Weston Observatory, Interim Report of The Pennsylvania Coal Bearing Strata of the Narragansett Basin, NSF/RANN Document 76-0337, December, 1976, Grant #AER76-02147.

Regulatory Responses

Several bills have been filed in the Legislature to give the Commonwealth the authority to control the mining of coal. One bill gives licensing power to the Commissioner of the Department of Environmental Quality Engineering, while another bill sets general standards, but leaves their specification and enforcement up to local officials*.

Cities and towns in the Ten Mile River basin, perhaps acting through the Ten Mile, Mt. Hope and western part of the Taunton Basin Advisory Group, should examine this legislation and determine whether or not they wish to have a role in the future regulation of coal mining.

5. Erosion and Sedimentation from Storage of Road Salt

The incidence of wells with a high sodium content is increasing. Of the approximately 130 wells tested in the SRPEDD region, approximately 30 had sodium counts of over 20 ppm, the standard set by the Commonwealth for drinking water.** How much of this salt leaching into groundwater comes from the application onto roads and how much comes from salt stored out in the open varies from case to case. At least two known cases of well contamination from the open storage of road salt have been documented in Lakeville, off Route 140, and in Plainville, below Route 495.

Regulatory Responses

Although the state Legislature could pass legislation requiring that the State DPW and local highway departments store salt in enclosed areas which have impermeable floors, SRPEDD recommends, instead, that local communities review both their salting practices and their salt storage facilities.

As the proposed measures take advantage of local knowledge and existing facilities, they should provide a flexible scheme for developing and implementing "best management practices."

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*Bills filed inre Coal Mining are: S.302 and H.5515.

**Department of Environmental Quality Engineering, Report of Routing Chemical and Physical Analyses of Public Water Supplies in Massachusetts, 1975, Publication #8818-2nd printing, 85-100-9-76-CR.

Local City councils and Boards of Selectmen should ask their local highway departments for a written report concerning salt storage and application procedures. These reports will then be reviewed at a basin advisory meeting to determine if groups of communities could share salt storage facilities and coordinate the protection of water supplies from local salt application to roads.

6. Costs of Regulation and Ways to Raise Money

In the cases of private construction and sand and gravel mining operations, the costs of implementing requirements imposed by regulation are borne by the private sector.

If these regulations are drafted such that they do not contribute to delay in obtaining approvals, the extra costs imposed on the private sector can be minimized, and will mostly consist of engineering fees*.

Use of associate members to aid in initial review might relieve some of the additional time burden for local elected officials.

Although the Soil Conservation Service is willing to review projects, the SCS could not provide speedy and detailed reviews without additional technical personnel.

The SCS should therefore prepare a budget based on the expanded need for review of plans for subdivisions, industrial and commercial projects.

EPA should support this budget request, as should the Commonwealth's Office of Environmental Affairs.

In negotiating with SCS, communities can determine a per-case review cost, with these costs being included in an annual contract. This, then can become the basis of fees charged to applicants.

7. The Costs of Impacts of Non-Regulation

Erosion and sedimentation do not seem to be particularly urgent problems when regarded from a local point of view. As one's vantage point, however, includes a larger and larger area, the problem becomes more recognizable and more important.

*Richardson, Dan K. The Cost of Environmental Protection, 1976, Rutgers University.

The costs of failing to regulate erosion include the following:

1. Increased sedimentation in storm drains, causing clogging and/or increased maintenance costs:

2. Dredging of harbors;

3. Reduced productivity of turbid waters - a ffecting freshwater fishing;

4. Contamination of shellfish beds and estuarine ecology systems;

5. Loss of agriculturally productive soils; and

6. Political costs.

Most of these "costs" or negative impacts do not get directly paid for by the local municipality which chooses not to regulate erosion and sedimentation. The dredging of harbors, for instance, is usually paid for out of federal dollars rather than local tax dollars. Likewise, it is downstream or ocean fishermen who suffer most directly when productive estuarine areas become contaminated, although consumers may end up paying more for fish.

In the case of sand and gravel mining, however, the costs are local and direct. Valuable local water resources can be lost.

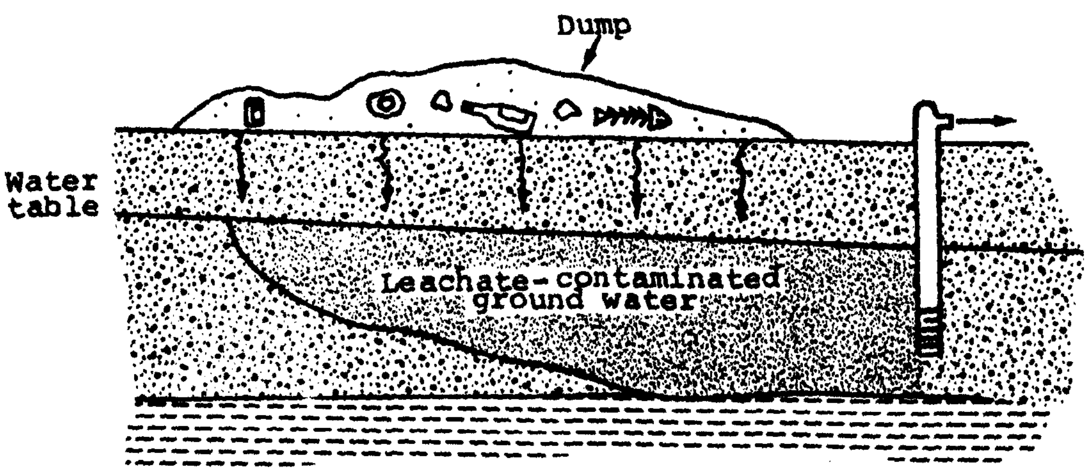
A final cost for a local government may be political, the loss of control over yet another aspect of land use decisions. Several states have statewide erosion laws, among other reasons because it is difficult for local governments to accept the need for erosion and sediment control.*

*See, for example, North Carolina's law on erosion and sediment control. Other states with erosion and sediment control statutes are Maryland, Virginia, Iowa, Montana, Pennsylvania and Ohio.

C. SANITARY LANDFILLS

Leachate as rainwater infiltrating through trash in a dump or sanitary landfill, accumulates a wide variety of chemical and biological substances. The resulting fluid, or leachate, may be highly mineralized and grossly polluted, "a repulsive orange ooze" as one observer describes it. As the leachate moves down through the soil, some of the pollutants are removed or degraded. The leachate may eventually reach the water table, where it flows in the direction of the regional groundwater gradient, possibly toward a well (Figure 1).

FIGURE 1



The potency and degree of pollution in leachate is related to:

- -the size and age of the dump,
- -the type of material in the dump,
- -features of the surrounding areas through which the leachate flows,
- -the length of flow before the water again appears at the surface, and
- -the climate.

Sanitary landfills generally are constructed by placing wastes in excavations and covering the material with soil daily--thus the term "sanitary" to indicate that garbage and other materials are not left exposed to produce odor, smoke, vermin, and insect problems. Even though a landfill is covered, however, leachate may be generated by the infiltration of precipitation and surface runoff.

Toxic Wastes

Generally it has been the practice to dispose of toxic wastes (pesticides, industrial by-products and residues, brines, acids, and other chemical compounts) in a common landfill. The only protection against the obvious hazard to health has been due to either dilution--that is, the volume of toxic products has been low enough as compared to non-toxic products to prevent any widespread pollution of the groundwater*, or to remote locations.

Landfills in SRPEDD's District receive industrial residuals, many of which are toxic. Although there are regulations and statutes requiring disposal of hazardous wastes only in areas specially designed for this purpose, and that any person who handles or disposes of hazardous wastes be licensed by the Division of Water Pollution Control, there are no such areas in the Commonwealth, and within the SRPEDD area, only one firm has a license to dispose of hazardous materials. The method used by this license, thermal oxidation, is not applicable to the total range or waste materials requiring disposal. The case of the polychlorinated bi-phenals in New Bedford's landfill is a now-famous example of the threats posed by hazardous materials, in this instance, to groundwater used by the Town of Dartmouth.

*EPA, A Manual of Laws, Regulations and Institutions for Control of Groundwater Pollution, June, 1976. Document #EPA-440/9-76-006, p. I-70-77, and p. IV-8.

Regulatory Responses

Regulatory responses can be grouped according to their general purposes. The first group of responses is aimed at reducing the amount of waste that is generated. A second group concerns recovering energy and/or materials from wastes, so that they may be reused. A third set of responses aims at better regulation and control of hazardous wastes, and the fourth set concerns better regulation and enforcement of sanitary landfills.

Demand Reduction

Any measure which would reduce the amount of wastes to be disposed in the landfill can reduce the "demand" for landfilling. Demand reduction measures can either reduce the amounts of wastes generated at their sources, or they can sort out and remove certain materials prior to the entry of these materials into a waste disposal area.

One approach consists of developing fiscal incentives to reduce the amount of unnecessary wastes generated by households. The revenues raised by a tax on unnecessary or excess packaging could be returned to the cities and towns on a per capita basis for the design, construction and operation of sanitary landfills.

A second approach is recycling. The Bottle Bill, for instance, would remove some beverage containers from the waste stream and recycle them. Opposition to the Massachusetts bill filed in this legislative session came not only from container manufacturers, but also from local store owners, who disliked the extra handling and storage that returnable bottles would impose on them. One solution to this objection is to have vocational high schools operate a reclamation center, where bottles can be returned by the retailer, sorted at the center and sold to the wholesale distributor. A reclamation center in Burlington, Vermont, currently operating at a profit, is described in the Appendix to Chapter Three.

Industrial recycling is discussed in Task 5, Industrial Pollution, and a joint project to recover precious metals in Taunton has been funded by an EPA demonstration grant.

Resource Recovery

Resource Recovery for municipalities allows a wide variety of materials to enter the waste stream and relies on various technologies to shred the materials and then separate out small pieces of metals, glass, etc., by a series of magnetic plates, air flotation devices, and the like. The resource recovered from waste can also be energy; large quantities of wastes are burned and used to generate steam. Resource recovery operations require that a guaranteed quantity of waste is supplied to the facility and that there be a reliable, fairly stable market for the resource recovered, and hence requires a substantial amount of economic and legal work for both planning and implementation. In some areas, resource recovery efforts conflict with demand reduction efforts because economic resource recovery projects require large waste streams while demand reduction seeks to reduce the quantity of wastes generated.

The Resource Conservation and Recovery Act, PL-94-500, seeks to promote both techniques, and requires states to prepare comprehensive management plans for solid wastes.

Hazardous Waste

With the closing of an Attleboro disposal site, the disposal of hazardous wastes has become a major problem for local industries. There is no legal disposal site for hazardous wastes anywhere in the Commonwealth of Massachusetts.

Hazardous wastes include radioactive wastes, toxic materials, pathogens and explosives, and are legally defined in Massachusetts as "special wastes." These wastes are either transported out of State, or to landfills which are not designed to insulate these materials or to treat the leachate they produce. It is essential that top priority be given to the development of a disposal site for these hazardous wastes.

Regulation of Sanitary Landfills, Enforcement Provisions

The regulations governing sanitary landfills currently in effect were adopted in April, 1971, and are not in conformance with the current powers, duties and structure at the Office of Environmental Affairs. The regulations should be rewritten not only for that purpose, but also to better reflect State and local policies concerning ground and surface water pollution, the Clean Water Act, PL 90-500, Safe Drinking Water Act, PL 93-523, and the Resource Recovery Act.

The substance of specific Regulatory recommendations cover:

1. Monitoring

   Require that permanent groundwater observation wells be installed down gradient from all landfills. Wells should be located so as to intercept any leachate leaving the site. Samples should be taken and analyzed every 4 months. The results of these tests should be published in a paper of general local circulation along with EPA primary drinking water standards.

2. Corrective Action

   The operations plan should include a description of remedial measures that are to be implemented to deal with any groundwater contamination revealed through the monitoring program.

3. Volume Reduction

   Leachate generation is largely the result of the decay of organic matter. This decay produces an acidic, oxygen deficient environment favorable to the movement of metals and other contaminants.

   - Separate garbage. Use as livestock feed, compost and apply to agricultural land, or bury separately.

   - Separate paper, glass and metals. Pay if necessary to keep these materials out of the landfill. Recovery presently feasible for paper, increasingly for glass and metal. Consistent with State and Federal policy.

   - Prohibit dumping of leaves, brush, grass clippings and other non-putriadable vegetable matter.

4. Operator Training and Certification

   All landfills should be under daily supervision by a person who has successfully completed a course of training given by DEQE in landfill operation and management. The training course should cover: state regulations, operating techniques (how to reduce litter, direct traffic, estimate volumes, control dust, cell construction etc.), the basic biology, chemistry and hydrology of landfills, emergency procedures (fire, accidential discharge of hazardous material etc.), how to follow an operations plan, monitoring and notification requirements, manpower and equipment requirements, and fill requirements.

D. ON SITE SUB-SURFACE DISPOSAL

Introduction

Septic systems are popularly viewed as being only a short term means of sewage disposal.

Once his system has been installed, a homeowner simply crosses his fingers and waits for the inevitable breakdown and overflow of sewage into his yard.

Although this scenario may have been appropriate for old cesspools, it need not apply to the well-designed septic systems installed today. Over the years, the design of subsurface disposal systems has been refined, and the reliability and performance of such systems has generally improved. It is now generally believed that the biggest improvements to be made in septic system performance have to do not with engineering but rather with proper maintenance of the system. This point is stated very clearly in the purpose section of Title 5 of the Massachusetts Environmental Code.

The basic objective of septic system maintenance is to prolong the system's useful life by protecting the leaching system from clogging. This is done by pumping out the accumulated sludge and scum from the septic tank before they begin to overflow into the leaching area. By pumping out the septage regularly, the treatment capability of the system is also enhanced.

In addition to the greater degree of surface and groundwater quality protection that a maintenance program can provide, significant financial benefits can also be realized. In the past, the shortcomings of subsurface disposal systems have been the primary reasons given for installing municipal sewerage systems. If septic systems are made more reliable through regular maintenance, the cost of installing sewers to "correct" failures can be nearly eliminated. In addition, the cost to the unsewered homeowner of periodically repairing his system can be greatly reduced if failures are prevented by proper maintenance.

Why Pump?

Regular septic tank pumping provides four major benefits which result in a lower cost to the homeowner for sewage disposal and improved surface can groundwater quality. First, pumping removes the sludge and scum which would otherwise overflow into leaching areas causing the soil to clog and the system to overflow. The septic tank acts as a storage reservoir for sludge and scum. As long as this material is removed before it overflows, the soil in the leaching area will not become clogged with organic matter. Thus the useful life of a septic system can be greatly increased through regular maintenance.

Secondly, the septage that accumulates in a septic tank is, essentially, very concentrated sewage. It has very high level of bacteria, oxygen demanding materials, and nutrients. By removing this material periodically through regular maintenance, the homeowner is removing large amounts of pollutants that would otherwise be discharged into the groundwater. If the tank is pumped once every three years as is commonly recommended, as much as 20% of the oxygen demanding material, and 5% of the nutrients produced by a typical home can be removed. Regular septic system maintenance can result in a slight improvement in the quality of local groundwater.

The third reason for pumping regularly concerns detention time. Septic systems provide an area where materials which might clog the soil of the leaching area can be removed. Heavier particles settle out of the sewage forming a layer of sludge, while lighter material floats to the surface forming a scum layer. Bacteria within the tank act to liquify the solid organic material. As the amounts of sludge and scum in the tank increase, the room for settling of sewage decreases, and sewage flows through the tank more quickly. This means that the sewage has undergone less bacterial decomposition, and has had less time for sludge and scum materials to be separated. Because the periodic removal of septage will increase the detention time of the sewage within the septic tank, regular maintenance can be expected to result in improved treatment of the water.

Finally, pumping provides an opportunity to inspect the hardware of a septic system. Once the manhole is opened to allow pumping of the septage, the condition of the inlet and outlet tee's can also be checked. In addition, any undetected discharges into the system such as leaky faucets or toilets can be identified by observing the flow through the inlet. Such mechanical defects can lead to clogging or flooding of the leaching area.

In summary, regular septic system maintenance, which includes periodic pumping of the septic tank, can be expected to: significantly increase the system's life by removing soil clogging materials, remove contaminants that would otherwise pollute the groundwater, increase the detention time (and thus the treatment efficiency of the septic tank), and provide an opportunity for inspecting the treatment system hardware.

Pump or Inspect

Every septic system is different. It operates in different soil conditions, and handles sewage from different numbers of people and different types of water using appliances. As a result, the rate of accumulation of sludge and scum within each septic tank is different. While some septic systems may require pumping every couple of years, other systems which are oversized or seldom used may not need pumping for ten years. This gives rise to the question: should septic systems be pumped out on a regular schedule, or should they be merely inspected to see if pumping is necessary? While a simple inspection of a septic tank might seem much simpler than pumping out the septage, in practice, the two operations are quite similar. To inspect a septic system, the following four steps are involved: First, the home in question is located; second, the location of the septic tank within the yard is determined; third, the access manhole to the septic tank is unburied (if necessary) and removed; and fourth, the thickness of the sludge and scum layers is measured. Pumping of the system would differ only in step four in that rather than measuring the level of sludge in the septic tank, the tank would actually be pumped.

Based on an "average" sewage flow from a "typical" home, it is generally agreed that septic tank pumping should occur every three years. On the other hand, if inspections are relied on for septic systems maintenance they must be made annually. Thus, while annual inspections will require pumping of only those septic system that specifically require pumping, they will also result in more disruption for the homeowner, more record keeping for the community, and most likely, a greater cost to the homeowner. Annual septic system inspection with pumping only when needed is expected to cost about $30 per home per year, while simply pumping every third year is expected to cost about $20 per year.

The technique used to measure whether or not pumping is needed involves judgement on the part of the inspector. For this reason, inspections should be performed by someone other than a septic tank pumper to avoid any obvious conflict of interest. Thus a septic system maintenance program that relies on annual inspectors of each septic tank would involve two separate groups, inspectors and pumpers. On the other hand, if the maintenance program consists simply of having every septic tank pumped at the recommended interval of once every three years the whole program can be carried out by septic tank pumpers.

Who Performs the Maintenance

The actual pumping out of septic tanks could be handled in any of the three following ways. First, the local community could provide the personnel and equipment required to perform regular maintenance as a municipal service. Second, pumping could be done by a private operator under contract to the community. And third, pumping could be done by a private operator hired by the specific homeowner being served.

A Town-owned septic tank pumping operation could likely provide comparatively low-cost service due to the economies of scale involved in a Townwide maintenance program. However, the establishment of such a system would also effectively force out of business any private septic tank pumping companies presently in existence.

The second option, that of having the pumping done by a private pumping company under contract to the local community, would not require the hiring of additional town employees, and would not take work away from private operators. Through competitive bidding, the cost of providing the needed maintence would be kept down.

The third option, that of having each homeowner be responsible for hiring a septic tank pumper, puts the responsibility for maintenance on the homeowner. The local community would be responsible for record keeping such as sending out reminders to residents when it is time to pump, and checking to see that the work gets done. This type of maintenance system would allow each homeowner the opportunity to "shop around" for the least expensive service.

Start-Up Costs

In order for a septic system maintenance program to run smoothly, certain preparations must be made. In particular, a program of public education must be developed, a schedule of when systems in various parts of Town need to be pumped must be prepared, and the location of each septic tank must be marked. These are basically one-time costs that must be paid when a maintenance program first begins.

The success of any type of septic system maintenance program will depend heavily on popular acceptance and support of the program by local residents. Because the idea of required maintenance is new in this area, a program of public education is called for to help local homeowners understand the need for preventive maintenance. Mailing of information material to each household as well as coverage in local newspapers should provide residents with the information they need.

A significant portion of the cost of pumping out a septic tank is associated with the time needed to "set up" at each house. This includes the time required to located the access manhole. In cases where the access manhole is clearly marked, this is not problem. If the manhole cover is buried, however, locating the septic tank can be a time-consuming process. To minimize this problem, it is recommended that a house-to-house survey be undertaken prior to the first round of pumping to mark the location of each septic tank or cesspool. Locations could be permanently marked by affixing a metal tag to the foundation wall indicating the distance to the septic tank from the nearest corners of the foundation. Once the location is marked, a septic tank can be pumped quickly and with no need for the homeowner to be home at the time. In the course of trying to locate septic tanks, it is quite likely that some direct discharges of sewage to storm drains or surface waters will be discovered. In these instances, the homeowners would be faced with the expense of installing a complete septic system.

The cost of locating amd marking septic tanks would be expected to vary from one community to another depending upon the age of the homes, the accuracy of plans filed with the board of health and the degree of cooperation of homeowners. This work could be included in the first round of pumping, or it could be done separately. Depending on the difficulty of locating the septic tank, the cost of this work is estimated to be $10-20 per house.

Costs

The cost of pumping out a septic tank has three basic components: the pumper fee, the disposal fee and administrative costs. An average cost of $60 on the following breakdown: pumpers fee --$25, disposal fee--$30, administrative cost--$5. The pumpers fee covers the cost of labor, equipment, profit and overhead for the company that does the pumping. The disposal fee covers the cost of amortizing and operating a septage treatment facility. Recent estimates on treatment costs have ranged from about $20 to $30 per 1,000 gallons depending upon the size and design of the treatment facility. The administrative cost includes expenses to the local community for reviewing contractor bids, overseeing contracts, and providing public information.

By spending $60 every three years to have his septic system pumped, a homeowner can expect to increase the useful life of his system and thus reduce his expenditures for repairs. If a new septic system with a life expectancy of 30 years in installed and added to a 30 year mortgage at 8 3/4% interest, and the system is pumped out only once every 10 years, the average cost of this system is about $150 per year. This is typical of systems presently in use. If the lifespan of such a system was doubled by having the tank pumped every 3 years, the average cost over the life of the system would drop to about $90 per year, a savings of about $60 per year. While the exact effect of maintenance on system life is uncertain, the savings to the homeowner that regular maintenance can provide are significant.

Regulations

As discussed above, there are various ways in which a septic system maintenance program could be operated. Below is recommended a program which includes pumping of septic tanks every 3 years by a private pumper under contract to the local community. This type of program involves the smallest amount of administrative work for the Town, and the least inconvenience for local residents.

Under the authority of Sections 31 and 27 of Chapter 111 of the General Laws, and in conformance with the provisions of Regulation 2.19 of Title 5 of the Massachusetts Environmental Code, the Board of Health can adopt such a program. Specific wording for local regulations if found in Chapter Three.

E. URBAN RUNOFF

Extent of the Problem

Numerous storm sewer and combined sewer discharges have had a considerable impact on water quality especially in the Ten Mile and Taunton River Basins. There are at least thirty storm discharges in North Attleborough and fifty-one in Attleboro. According to 1973 summer sampling data collected by the Division of Water Pollution Control, runoff discharges have increased coliform bacteria, BOD, ammonia nitrogen, nitrate nitrogen and phosphorous levels in the Ten Mile. In the Taunton Basin, combined sewer overflows are a greater problem than storm sewers, but storm runoff will become more of a problem as treatment plants are upgraded and combined overflows are eliminated. Presently, Taunton has five combined overflows and twenty-seven known storm outfalls while Fall River has nineteen combined and numerous (but untabulated) storm sewer discharges. The most apparent effect is a marked rise in coliform levels in the Mill River and also the Taunton River as it passes Taunton and Fall River.

The most pressing runoff problem in New Bedford is also with combined sewers. Here there are about twenty-five combined overflows or by passes. The prohibition of shellfish taking in Clarks Cove (except Quahogs) is at least partially attributed to the pollution from this source. In addition to combined overflows, there are a minimum of thirty one storm water discharges to Clarks Cove, New Bedford Outer Harbor and the Acushnet River. Plymouth also has had portions of its shellfish beds closed, and part of the reason is combined sewer overflows. Only one overflow remains, but numerous catch basins and roof down spouts are still connected to the sanitary system. As a result, overflows still occur to Plymouth Harbor during rainstorms.

In addition to the community by community problems mentioned above, there are other runoff problems associated with parking lots and highways which are more or less common to all communities in the 208 project area. Some of the toxic materials which have been found in the runoff from parking lots include:

-- Lead
-- Cadmium
-- PCB's
-- Copper
-- Zinc

-- Oil and Grease
-- Chromium
-- Nickel
-- Mercury
-- Inorganic Acids
-- Vanadium
-- Selenium

Specific pollutants from highway salting and de-icing efforts have included:

-- Sodium Chlorides
-- Calcium Chlorides
-- Ferric Ferrocyanide
-- Sodium Ferrocyanide
-- Sodium hexametaphosphate
-- Zinc
-- Cadmium
-- Chromates (hexavalent and trivalent chromium)

Possible Regulatory Responses

In the 208 study area, very few communities have regulations which are geared toward the control of urban runoff. A few communities have by-laws which include wording to the effect that dirt and rubbish is prohibited from public streets or that storm discharge from new developments cannot exceed that which occurred prior to development. Others require that roof runoff be diverted from public ways. By and large, existing regulations are limited and not designed to control urban runoff. It is reasonably clear that many cities and towns in the district could adopt measures to reduce the impact of urban runoff. Some of these regulations could be aimed at existing problems while others could address runoff from new development.

While most communities with severe runoff problems may have to provide some type of structural treatment at the point of discharge, it is possible that less intense measures could be adopted to control runoff at the source prior to the runoff episode. For example, some of these measures might include:

--More effective housekeeping in the form of an anti-litter program or a street sweeping program designed to pick up more of the fine grained material and to coincide with local storm patterns where possible.

-- Regular catch basin cleaning to prevent the build up and flushing of pollutants during the early part of the storm.

-- Improved snow removal practice to avoid the disposal of snow to surface water and areas which drain to water supplies or aquifer recharge sites.

-- Regulation of the use and application of pesticides, herbicides and fertilizers by public agencies. Also, provide educational material to residents on the proper application of fertilizers and on alternative fertilizers with lower nutrient content.

-- Require the disconnection of downspouts from sanitary sewers.

-- Institute an economic disincentive program whereby a levy would be placed on an activity or substance which would eventually become a component of urban runoff. For example, a tax might be placed on certain fertilizers with high nutrient content or on pet owners who live within urban areas. The purpose of the tax would be to cover the environmental cost caused by the runoff of nutrients or animal wastes to surface waters.

Other measures could be designed to reduce runoff problems before development occurs.

-- Establish a performance permit program whereby a developer would be required to incorporate in the design provisions to maintain runoff at a predevelopment rate.

-- Update the city or town master plan to identify critical environmental areas such as excessively steep slopes, poor soils, wetlands, future water supply areas and prime aquifers.

-- Establish a land aquisition program to purchase critical environmental sites.

-- Establish a capital incentive program whereby municipal investments would be made with an eye toward guiding growth away from critical areas and particularly surface water bodies.

Other measures could be applied to address particular problems from large shopping center parking lots and road salt runoff.

-- Establish a program for the monitoring of storm drains from large parking lots which drain directly to surface waters.

-- Require a wetlands permit and order of conditions for all storm drains discharging to wetlands.

-- Carefully manage the application of road salt in order to adjust the quanfity and frequency of application to the traffic volume, temperature and driving conditions.

-- Prohibit the use of road salt additives such as chromates and cyanides.

-- Establish salt tolerant vegetative buffer zones.

F. HYDROLOGIC MODIFICATIONS

Hydrologic modifications are changes in the distribution of circulation of water. Sewering is one such modification, because it drains away water used in dispersed locations and discharges that water at one point usually downstream in a river or bay. The water budget is the basic tool needed to determine if there is a recharge problem for a given aquifer. The water budget compares the amount of water going into an aquifer with the amount of water which leaves the aquifer. Activities which can affect the water balance are:

- --the position of wellfields
- --the extent of surface paving
- --alteration of wetlands
- --the location and type of effluent discharge from a sewage treatment plant (spray irrigation versus a discharge into a surface body)
- --impoundments
- --interbasin water transfers.

<u>Regulatory Responses to Preserve Quality of Groundwater</u>

The control of subsurface discharge provides the most effective way to minimize hydrologic modifications and assure the quality of groundwater for all uses. Most of the proposed measures listed briefly below have been discussed in previous sections:

a. Low-flow plumbing fixtures to encourage water conservation and increase contact time of waste with biologic soil filter in leaching system.

b. Prohibition on garbage grinders in areas which rely on subsurface disposal.

c. Septic tank maintenance program.

d. Monitoring of groundwater (individual wells) where the lot size is 1/2 acre with on-site water and sewage disposal.

e. Fail-safe tanks with monitors for subsurface storage of hazardous materials.

Regulatory Responses to Preserve Quantity of Groundwater

Developed and/or sewered areas can also take the following steps to limit hydrological modifications:

a. minimize impervious surfaces through parking and loading regulations

b. divert storm runoff to groundwater recharge basins

c. roof drains directed to dry wells

d. use of spray irrigation for disposal of secondary effluent in preference over surface discharge where conditions permit

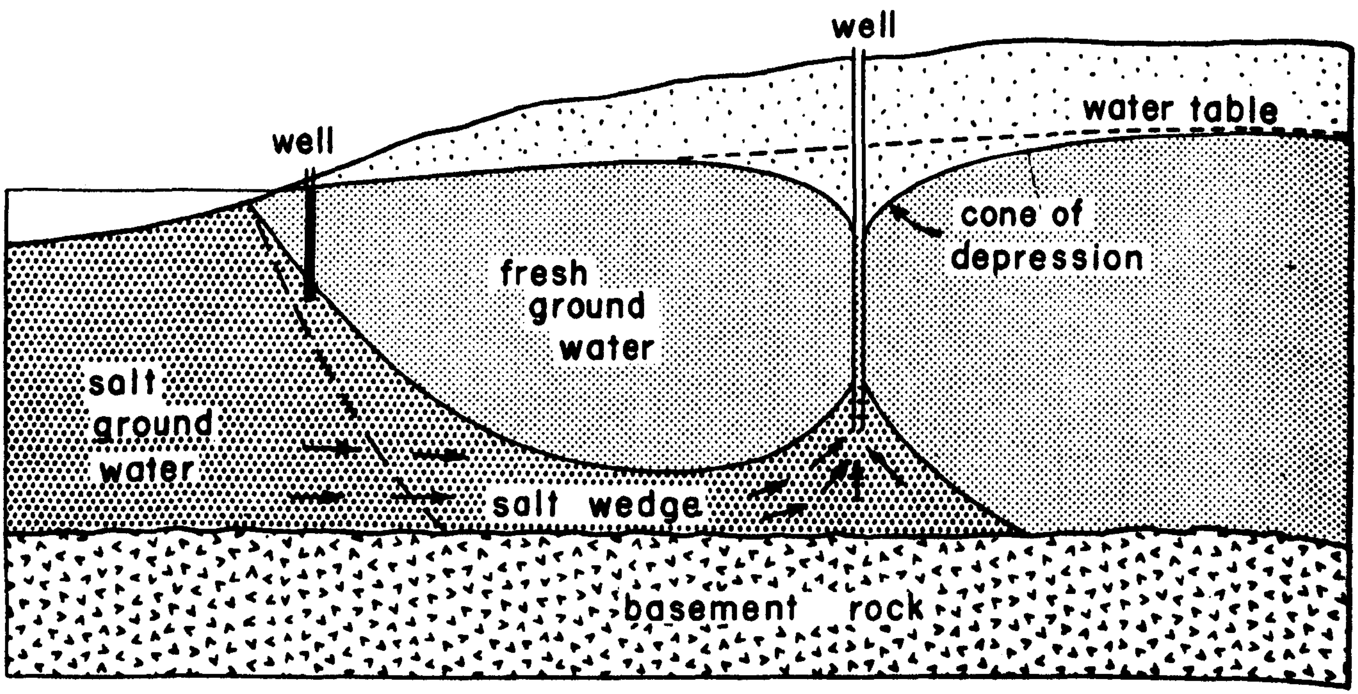
e. control the spread of sewered areas by insuring groundwater quality protection measures for the unsewered areas.

These steps will act to maintain normal levels of groundwater recharge as opposed to increased surface water runoff and decreased groundwater recharge. Such measures will maximize the safe yield of groundwater supplies and assure quality.

G. SALTWATER INTRUSION

Statement of the Problem

Freshwater aquifers along the coast and river estuaries have a fresh water-saltwater interface. Overpumping of wells in these aquifers will induce movement of the fresh water-saltwater interface towards the wells. Because of density differences, the heavier saltwater forms a wedge between the fresh water body and the basement surface, as shown in Figure 1.



A salt-water wedge beneath the fresh-water zone, contaminating a large supply well and a small well near the shore.

Figure 1

In southeastern Massachusetts, saltwater intrusion is occurring in two coastal summer communities (individual cases are discussed in Chapter Four) where medium capacity supply wells are withdrawing sufficient groundwater that the fresh-water-saltwater boundary is being drawn towards the wells. As the summer progresses, water use increases and natural ground-water discharges decrease. The result is increasing salt levels which give the water a brackish taste.

Regulatory Responses

The most obvious response to the over-pumping of groundwater which is responsible for saltwater intrusion is to devise a fair system for limiting groundwater pumping. At the state level there is no statute in Massachusetts providing for allocation of rights to groundwater among private claimants. There is thus no statutory authority for limiting groundwater withdrawals, even in cases of saltwater intrusion.

At the local level, however, boards of health may take some actions which may result in reduced pumping. The installation of low-flow water fixtures as described in Chapter Two can reduce plumbing water consumption. Local boards can also require permits for individual wells, and could refuse the permit if existing quality analysis show saltwater intrusion to be a problem.

H. MARINE POLLUTION

Untreated discharges of sewage into harbors and bays from recreational vessels, and the metals which are scraped off from anti-fouling bottom paints from boats are two sources of pollution in harbors.

Marion Harbor was the subject of a special study, which concluded that as new EPA regulations come into effect, the problem of untreated discharges from boats will become less severe.

The report recommended, however, that harbors be continually monitored for the toxic materials which result from boat bottom washing, and that the effluent from boatyards be held in detention basins prior to discharge to a bay or harbor.

III. Analysis By Land Use Management Technique

Environmental Zoning Districts

There are four types of environmentally-based zoning districts which can be locally mapped and incorporated into the local zoning ordinance or by-law. These are: wetlands districts, flood plain districts, buffer zones, and well-field protection districts. Chapter Three discusses how each of these districts can be mapped, and contains, in its appendices, sample by-laws which list the permitted uses for each type of district.

Performance Zoning

Performance zoning can be used in conjunction with traditional or Euclidian zoning in order to specify at what level certain environmental functions must continue to operate. Instead of listing permitted or non-permitted uses by district, performance zoning stipulates that any land use must not, for instance, increase runoff by a certain amount over and above the natural runoff rate. Chapter Three, together with its appendices, spells out how performance standards may be developed and implemented.

Lakeshore Management

Problems of water quality degradation and eutrophication in lakes demand a coordinated "package" of measures for solution. In the absence of a concentrated state program to help localities and regions identify the extent of lake problems, local groups can undertake several steps on their own as follows:

--a secci disk test
--surveys of rooted plant growth
--bottom dissolved oxygen tests
--dye tests
--sanitary surveys

Once identified, problems can be solved by strict adherence to a septic tank maintenance program, water conservation, buffer strip zoning and additional setback requirements for housing construction, local adoption of use regulations specifying hours for certain types of uses, speeds for boats, special loading areas, parking regulations, etc.

The Watershed Management Councils will have an important role to play in lakeshed management, as currently there is no jurisdiction which can effectively deal with intermunicipal lake management issues.

Local Use of State And Federal Legislation

The following lists several pieces of state or federal legislation which local communities can use to aid in the preservation or restoration of local water quality.

The state has the authority to map inland wetlands under Chapter 130, S.40A. Were the state to carry out its mapping program, these maps could be made available to local communities for use in local wetland zoning districting.

The Scenic Rivers provides a mechanism whereby the state can negotiate orders of conditions on the use of land 300 yards back from the edge of a scenic river. Chapter Three contains a list of potential scenic rivers which the state should investigate in the initial stages of implementing this state legislation.

A conservation restriction (easement) is basically a recorded agreement by an owner to retain land or water areas predominantly in their natural, scenic or open condition, or in agricultural, farming or forest use. The owner gives up the right to develop, and the land is taxed at a lower rate in compensation.

Forest Lands Property Tax Exemption (MGLA Chapter 61)

Forest land which (1) is not used for purposed incompatible with forest production, (2) has a value not in excess of $400 per acre, and (3) exists in parcels of not less than 10 contiguous acres, may be listed by assessors as classified forest land. Classified forest land may be exempt from property taxation but is subject to a products tax.

Farmland Assessment (MGLA Chapter 61A, et. seq.)

Lands qualifying under this statute are taxed at their current agricultural and horticultural use rather than at their potential development value. Use of this tax incentive encourages maintenance of agricultural land thereby limiting development in unsewered areas, preserving open areas, and maintaining the natural character of rural communities. Such land can be developed but the developer must pay back the tax differential.

Taxation of Land Under Permanent Restriction (MGLA Chapter 59, Section 11)

Real estate which has been permanently restricted under the Scenic Rivers Act, Coastal or Inland Wetlands Protective Orders, or the Conservation and Preservation Restriction Act is required to be assessed as a separate parcel of real estate.

Land Acquisition, with the use of state and federal Bureau of Outdoor Recreation and Self-Help funds is another opportunity for local governments. Eligibility for these funds requires that localities submit a recreation-conservation plan to the state Department of Environmental Management. Guidelines are found in the Appendices to Chapter Three.

The Coastal Zone Management Program

For the past two years, the Office of Coastal Zone Management has been developing a coastal zone management program in accordance with PL 93-586. Several Coastal Zone Advisory Groups in the SRPEDD region have been involved in developing the recommendations in this plan, which has been submitted to federal officials for their approval. Most recommendations are aimed at creating a "network" of policies, regulations, and referrals pertaining to state level agencies. Local land use decisions will be subject to various incentive programs exercised by state agencies, and technical assistance will be made available to cities and towns through regionalized offices (Lakeville in this region). The focus of the Coastal Zone Program has been state agencies, while SRPEDD's program has stressed local decisions. There are, however, a few issues which are common to both programs. As the Coastal Zone program moves to arbitrate conflicts among land users on the local level, local officials will need to continue examining their land use policies in the light of both programs.

The policies of Coastal Zone Management and 208 reinforce or affect each other in regard to the following matters:

1. The placement of septic tanks in the Coastal Zone. CZM is proposing amendments to the State Environmental Code which would require more stringent controls for the placement of septic tanks in the Coastal Zone.

2. CZM will encourage the use of Public Access Funds for acquisition of beach areas.

3. CZM will monitor the location of sewage treatment plant discharges, and will encourage that water quality standards for ocean discharges remain at the same levels as those for effluent limited rivers and streams.

4. CZM will encourage the Pesticide Control Board to seek alternatives to the use of harmful pesticides in maintaining utility transmission lines and other public rights of way.

5. CZM will seek to discourage development within the one-hundred (100) year flood zone.

IV. REGULATIONS PERTAINING TO POINT SOURCES

The following summarizes the recommendations in Chapter Three for regulations to ease the implementation of some of the structural solutions to water quality problems found in Chapter Two and Four.

Sewer Ordinances

The most important local regulations concerning discharges to municipal sewers are found in the local sewer ordinance which each community must adopt as a condition of accepting a 201 facilities grant. SRPEDD has developed a model format for a local ordinance, with options under various provisions so that applicable regulations can be used for each community.

Effluent Limitations

Chapter Three recommends that the limits contained in the NPDES permits for industries and municipalities should apply to a consistent set of constituents. Currently, industrial permits limit discharges of chemicals and metals, but often have no limits on nutrients, BOD, COD, or flow. Municipal permits limit BOD, COD, flow and some nutrients, but not chemicals or metals.

Residuals Disposals

NPDES permits should contain stipulations and conditions for the disposal of all residuals as well as for discharges to surface waters.

Sampling

SRPEDD recommends that the Division of Water Pollution Control increase the number of samples taken per station, the number of stations, the frequency of sampling, and the duration of sampling programs.

Operation of Plants

Communities should be prepared to pay higher salaries than many of them now offer in order to attract qualified treatment plant operators.

User Charges

User charges should be designed to encourage water conservation.

Joint Treatment

Where the possibility for joint treatment of industrial waste exists, EPA should allow variances in the compliance schedules of NPDES permits. Industrial Development Revenue Bonds should be made available for joint financing of pollution control equipment for industries.

Priority-Setting for 201 Funds

The setting of priorities for construction grants for wastewater treatment plants should be a regional function based on criteria developed through a public participation program, and should reflect local needs and priorities.

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CHAPTER FOUR

BASIN & LOCAL WATER QUALITY STRATEGIES

I. INTRODUCTION

A. TRADE-OFFS AND THE PROCESS OF CHOICE

There are many different methods to achieve water quality goals, whether at the level of the state, the region or a city and town. Different methods may be used to produce clean water, depending upon long-term and short-term costs, reliability, secondary impact, political acceptability and even governmental philosophy. This chapter presents the various choices, in the form of alternative plans for each municipality and thus for the region, since each plan can help meet the goal of clean water in the region. Each alternative is evaluated on the basis of an environmental assessment, a policy review, and upon cost. The various local alternatives must then be evaluated as to their collective impact on receiving* water quality. Assuming that each alternative locally results in the desired level of clean water, then the choice among alternatives must be made on the basis of these four criteria.

The importance assigned to the differenct factors will depend upon the perception of the problem. This process of choice becomes a consideration of trade-offs, a decision on what can be given up and what will be gained by means of the different alternatives for each locality and a combination of local solutions on a basin scale. Selection of favored local systems should be made on the basis of information presented in this report, as well as on the reader's first-hand knowledge of the problem. Basin solutions should come from an aggregation of local choices. In light of the way local options are structured, the optimum basin water quality should result from the selected local solutions.

It is the collective wisdom of the decision-makers, officials and citizens alike, that will result in a workable and acceptable plan to achieve clean water.

1. Environmental Assessment

Environmental assessment includes analysis and evaluation of the natural resource, social, and economic impacts of the various alternatives. The following questions should be considered in making an evaluation:

--Will the plan meet water quality goals for surface and groundwater?

*Receiving water - Bodies of water into which pollutants are discharged.

--What is the impact on:

-Hydrology (surface and goundwater flow and quantity)?

-Biology (rare and endangered species)?

-Air Quality, including noise pollution?

-Land Uses (growth, critical areas)?

-Resources (energy, land)?

--How does the plan affect:

-Population?

-Economic Activity (jobs, income)?

-Public Health?

-Aesthetics (recreation, historical)

-Equity (is any group affected more than others)?

These broad questions allow analysis of each alternative from the environmental, social, and economic point of view. Adverse answers to any one of these questions should not disqualify an alternative from consideration, but should be viewed in the context of trade-offs. An environmental assessment chart is included with each local section to facilitate the comparison of alternatives.

2. Policy Review

This factor addresses the acceptance of proposed solutions by voters, local officials, and state and federal regulatory agencies. In some cases, proposed alternatives are contrary to accepted practices and are discouraged or not permitted by regulatory and funding agencies. Technically reliable solutions used successfully in other states have been presented as alternatives to suggest changes in regulations as an option. No option has been ruled out, even though not currently approved, because the plan recommendations address a twenty-year time period, and regulations are subject to review and may be changed.

Political feasibility must also assess the acceptance of an alternative by local officials and citizens. Strong local resistance may override the best possible technical plan. The goal of clean water cannot be served by technically "good" plans that voters refuse to implement.

3. Cost

A tangible factor in the evaluation alternatives is the cost associated with the particular option. Dollar figures are presented for each alternative that follows along with a cost-effectiveness analysis for each city and town in the summary. Cost-effectiveness adds the dimension of whether or not an alternative "minimizes total costs to society over time to reliably meet given goals and objectives."* The least cost alternative and the most cost-effective alternative are not necessarily the same.

Other aspects of cost should be considered also, including the following:

a. Types of cost

--Capital cost - This refers to initial construction costs of any project, including bonding and debt retirement over the life of a bond. Capital costs are generally presented as a single initial expense, and are often calculated out over the life of the bond as well.

--Operation and Maintenance (O&M) Costs - These are costs associated with personnel, energy, chemicals and routine maintenance of a facility. O&M costs are generally presented as annual costs.

*Guidelines for Areawide Waste Treatment Management Planning, EPA, August, 1975

--Administrative Costs - These include finances necessary for planning, inspections, record keeping, permit issuance and compliance, and other items not normally associated with day-to-day operations of a facility. For the most part, cost associated with non-structural solutions are administrative costs.

b. Cost Burden

The question of who pays is as important as how much is paid. The different wastewater options presented in this plan vary considerably along these lines. In some cases, the cost burden falls on the individual homeowners, such as septic system rehabilitation and maintenance for individual homes. Options for public expenditures vary according to whether the local, state or federal levels will pay and in what percentage. The cost of construction of a sewage treatment plant, for example, is now covered at a level of 75 percent by the federal government, 15 percent by Massachusetts, and 10 percent locally. The operation and maintenance of that plant, however, is paid for 100 percent by the local property tax and user charges.

4. <u>Receiving Water Quality Impact</u>

Receiving water quality impact can be assessed on a basin scale by utilizing, where available, the existing Division of Water Pollution Control and SRPEDD basin water quality models. These models can be used to estimate the possible surface water quality which will result from implementation of all of the individual local alternatives. Selected groundwater quality impacts can also be estimated. Based on the methods described earlier for structuring local alternatives, the basin evaluation should not produce results which violate or require changes in the town by town alternative selection process. This water quality evaluation should rather show the cumulative impact of implementation of structural and non-structural alternatives.

The criteria of cost effectiveness, environmental impact, policy review, and receiving water quality impact are suggested as four factors upon which to base a decision on choosing alternatives. None of the four should be considered without the others, and the choices will be selected by making trade-offs among these criteria. The alternatives will be presented with the information necessary to pose key questions. They should be asked, and the answers should determine your choice.

B. DESIGN AND POLICY ASSUMPTIONS

The options presented for each of the thirty communities are based upon a number of assumptions, generally relating to adequate design, construction and maintenance of facilities, protection of environmentally sensitive areas, etc., which are stated below. As indicated previously, comparison of various alternatives cannot be made unless the basic assumptions controlling the options are standardized.

1. Septic System Location, Design and Construction

It has been assumed that new septic systems or renovations to existing septic systems will be in accordance with Title V of the Environmental Code (formerly Article XI), particularly with regard to proper soil conditions and adequate depth to the groundwater table. In addition to proper placement of an adequately designed leaching system, construction methods must be controlled in order to prevent practices detrimental to the future functioning of the system. Vigorous enforcement of Title V by local officials will help insure effective septic disposal systems. Some of the requirements for septic systems include:

--The bottom of a leaching area must be a minimum of four feet above the seasonal high water table.*

--Leaching areas must be at least 100 feet from all private wells.

--Leaching areas must be at least 50 feet from water bodies.

--The minimum septic tank size is 1,000 gallons.

--A plan of the system must be on file with the local Board of Health.

2. Septic System Maintenance

In order to function properly over an extended period of time (50 years or more), septic systems must receive periodic maintenance. The most effective and convenient procedure is pumping the septic tank periodically (at least every three years is recommended) in order to prevent accumulated sludge and scum from entering and fouling the leaching system. To accomplish this, it is recommended that municipalities develop a maintenance procedure to cover all septic tanks within the community. A recommended procedure is contained in Chapter Three. Only after a systematic maintenance procedure has been implemented can septic systems be considered as a sewage disposal option consistent with the goals of water quality.

*Seasonal high water table - That season of the year during which the groundwater comes closest to the surface.

3. Relation Between Septic System Density and Groundwater Contamination

Although septic systems can provide efficient disposal for domestic sewage, they do not provide total purification of the waste. The most significant contaminant which passes through the septic system to the groundwater is nitrate/nitrogen (in this report referred to as nitrate).

The nitrate in the septic system effluent becomes diluted by clean rainwater percolating down from the yard surrounding the system. Thus, an acre of land with two septic systems on it would be expected to have twice as high a level of nitrate as a similar piece of land with only one septic system. By estimating the amount of nitrate being discharged by a "typical" septic system, and the amount of natural recharge from precipitation on a lot of a given size, it is possible to estimate the expected nitrate level in the groundwater. The plume (direction of flow) of effluent on the surface of the water table is assumed to be anaerobic (without oxygen) and therefore the nitrate is not attenuated by exchange with clay minerals in the aquifer. Ultimately, at a variable distance down gradient of septic systems, the effluent plume disperses horizontally and becomes aerobic (containing oxygen), and at this point nitrate is attenuated to a degree by exchange with clay materials. The results of a calculation of this type are listed in the table below. It must be emphasized that the figures are generalized. Every septic system, household and soil condition is unique. Furthermore it must be stressed that these figures cannot realistically be applied to a single house lot or group of homes, but the assumptions included in these calculations make the results applicable to the groundwater beneath and immediately down gradient of larger developments.

The limit for nitrate in drinking water established by the Environmental Protection Agency (EPA) is 10 parts per million (PPM). If the density of home septic systems is kept below 180 units per hundred acres, this limit should be met. Although 10 ppm nitrate is considered acceptable in drinking water, this same level in surface water would be considered unacceptable because of the weed and algae growth that it would stimulate. For this reason lower densities of septic systems should be considered for areas in which groundwater flows directly to nearby bodies of surface water.

Number of Septic Systems per 100 Acres	Gross Lot Size Acres	Gross Lot Size Square Feet	Estimated Nitrate From Septic System
400	¼	10,890	17.0 ppm
200	½	21,780	10.8 ppm
179	.56	24,200	10.0* ppm
133	3/4	32,670	7.9 ppm
100	1	53,560	6.3 ppm
67	1½	65,340	4.4 ppm
50	2	87,120	3.4 ppm
14	7.2	314,600	1.0 ppm

*EPA drinking water standards limit the level of nitrate to 10 ppm.

It is generally recommended that communities with large areas on septic systems which exceed the density of 179 units per 100 acres should have their groundwater monitored for nitrate concentration.

4. Water Conservation

Since a reduction in water use is an effective method of water pollution control (see Chapter Two), water conservation could have a significant impact on water quality for each alternative. Reduction in flows greatly benefits overloaded municipal treatment plants in their ability to handle effluent, and septic systems are less likely to fail if the flow is cut down and does not force solids into the leaching area. As discussed in Chapter Two, water conservation includes modifying water use habits, installing water saving devices and appliances, and providing for water reuse.

The following alternatives are based upon the assumption that water conservation will be practiced to the extent that there will be no significant increase in per capita consumption. Wastewater generation is assumed to remain constant at 80 gallons per capita per day through 1995. This rate of wastewater generation is considerably lower than traditional engineering values, which frequently use as a rule of thumb an increase of one gallon per capita per year. The traditional method results in many designs of treatment plants based upon a flow of 100-125 gallons per person (excluding industrial flow) for the design year. On the other hand, strict conservation measures that can be instituted (and have been during drought conditions) can cut the 80 gallons per capita per day by more than half.

While water conservation is a desirable option, this plan assumes a stationary level of consumption due to increasing costs of supplying and treating water and wastewater; a greater awareness by individuals of the need and value of conservation; the possibility of future shortfalls; and finally a belief that it will be difficult for the average household to consume any more water, given the number of washing machines, dishwashers and other water consuming devices already in the home.

In some cases, where specific conditions warrant, the installation of water saving devices has been recommended as part of that particular option. Water reuse, at present, is only applicable to industrial situations and has been so noted where it is appropriate.

5. Protection of Environmentally Sensitive Areas

Environmentally sensitive areas, including wetlands, aquifers, and aquifer recharge areas are given high priority for protection as part of the local options. Alternatives not only address wastewater management but consider the secondary impacts and varied development patterns resulting from different options. In all cases, options were developed that allow for maximum protection of environmentally sensitive areas from further degradation.

C. PUBLIC PARTICIPATION

The local alternatives presented in this chapter represent a significant degree of public participation. Selection from among the alternatives will be accomplished through a process relying primarily upon public reaction and official sign-off. Each of the municipal sub-plans is divided into four sections:

A. Introduction and Base Data - An overview of the city or town, stressing past growth and projected future growth based upon local desires and future trends.

B. Water Resource Information - Description of water supply, groundwater quality, stream conditions and sewage treatment facilities.

C. Local Water Quality Issues - Coverage of specific water quality problems within a community, physical constraints and non-point sources.

D. Alternative Solutions - Proposals for addressing previously identified problems, including environmental assessment, policy review, and cost.

Virtually every public meeting, every local contact, letter and phone call has contributed to this Chapter. Familiarity with each community and its problems has been accomplished by means of direct contact with local residents and officials. Some specific techniques utilized for local input are described below:

--Subarea meetings - An initial round of meetings in each of the four subareas was organized. Citizens were provided with maps of their communities and asked to identify recently developed areas, project growth areas, point and non-point sources of pollution and other pertinent information. At subsequent meetings, maps were handed out to local officials and citizens with a request that additional non-point sources, and particularly areas with septic system failure, be identified and mailed to SRPEDD.

--Community liaison - As part of the statewide effort to develop local growth policy statements under Chapter 807 of Massachusetts General Laws, SRPEDD staff members worked with broadly representative Local Growth Policy Committees on an ongoing basis. In many cases, the results were beneficial in helping the 208 plan identify local problems and solutions.

--Questionnaires - To assist in development of local alternatives, questionnaires with questions pertaining to growth and related local issues were mailed to seven boards and committees in each municipality.

--Contracts - At the beginning of the 208 planning process, contracts were executed with nine cities and towns for officials to provide input directly to the study.

--Committees - Various groups met on numerous occasions to review reports and provide input to the basin and local alternatives. They included: the Industrial Task Force, an open-ended group of industrialists, Chambers of Commerce and Industrial Development Commissions; the Executive Committee, consisting of subarea Chairmen and Mayor's representatives; and the Advisory Committee (ACQUA) also met to provide direct input.

--Local Meetings - Numerous meetings were held in individual communities with citizens groups, watershed associations, local officials, Leagues of Women Voters, Citizen Advisory Committees, etc., in addition to regular meetings mentioned above.

All of the public input described above was in addition to more formal contacts with all local health agents, shellfish officers, water superintendants, sewage treatment plant operators, city and town planners, as well as many Boards of Selectmen, Boards of Health, Planning Boards, Conservation Commissions, etc.

All of the relevant public input over the past two years is represented in the local alternatives. In many cases, specific options were developed at the request of local officials and/or residents.

At the present stage, the process is only partially complete. The process of selecting from among the alternatives will be carried out over the next few months to insure that the final recommendations are in fact acceptable to those who must work toward their implementation and live with them.

D. BASIN OVERVIEW

Sections of this chapter of the plan cover resources and problems which cross local boundaries and address problems for a river basin and/or the whole region. The subjects covered are, for the most part, assemblings of local or municipal water quality considerations; however, the analysis also uses basin and regional criteria, measures and perspectives.

There are many specific wastewater, water quality and general resource decisions which have larger than local implications. Some examples of these include:

- Residual Waste Management
- Non-point Source Assessment and Control
- Multi-community Wastewater Treatment
- Treatment Plant Priority Setting
- Groundwater/Aquifer Protection and Use Control
- Wasteload Allocation
- Stream Classification

Although the scale of the investigation at a basin level is different from local problems, the basic resources and opportunities are not different. Thus, the same data base was used and the local and basin analyses were conducted simultaneously and mutually. This sharing enriched and simplified both analyses without artifically biasing or limiting the outcome of the 208 process to either a local or a regional plan. In each of the areas addressed in this chapter an attempt has been made to utilize existing pre-208 information and use or contrast it with what has been developed as a result of the 208 process. This chapter also relies heavily on information developed in town-by-town analyses and on data prepared by the Division of Water Pollution Control for the 303(e) basin plans.

II. GENERAL WATER QUALITY PROBLEM DESCRIPTIONS

There are a multitude of traditional and successful water quality analysis techniques and past wastewater planning and management has emphasized only a few. The 208 process has expanded on those currently in use and has developed and demonstrated others.

Because we cannot easily or rapidly predict what will happen in a surface or groundwater in the future when various structural or nonstructural actions are taken, we have come to rely on mathematical models and the computer. A surface or groundwater mathematical model is a set of equations which describe how a river or aquifer is affected by changes in, for example, temperature, flow or pollution. Since it is only a model, it is not always accurate. It can, however, be used to "predict" current conditions and these predictions can be compared with what is actually happening. Thus, the mathematical model can be calibrated or adjusted to generally simulate or reflect the river. This calibrated tool can then be used to predict how water quality will be affected if various changes in land use, wastewater treatment, water use, flow, etc. occur. While the model is not a perfect predictor, it can produce reasonably accurate results and is the most economical tool now available to predict the quality of a river or an aquifer in the future. A mathematical model can be used by solving the equations by hand or by using a computer. The equations are complicated and numerous and thus a computer is used to facilitate the calculation process.

There are two general kinds of mathematical models used in water quality assessment. The first kind is called "steady state" and is the type employed by WPC in their 303(e) basin studies. The second kind is called a "dynamic model." A steady state condition is one in which variables such as flow, temperature, individual pollutant discharges, etc. are assumed to be constant over time. This condition is not often encountered in a river. While steady state conditions are not often found in a river, there are certain times when flow, pollution loads and temperature do not vary significantly, and thus the model can be reasonably accurate. This is particularly true for low flow or drought conditions. The dynamic models allow variables to change over time. This makes the equations even more complicated than for the steady state models and the calculations also take much more time. Presently all of the water quality models used in the SRPEDD 208 region are steady state.

Water quality is a measure of the health of the resource and as such there are numerous conditions which must be quantified. Temperature, acidity or alkalinity (pH), dissolved oxygen or DO concentration, sediment, metals, toxic materials, phosphorous and nitrogen (nutrients), organic material (biochemical oxygen demand or BOD), bacteria or coliform (MPN), aquatic plants and animals such as algae and fish and other specific quality pollutants or components of the water are measured. Differing types and levels of pollutants, such as effluents from a sewage treatment plant (a point source), will raise the temperature, decrease the DO, increase BOD and coliform, etc. Thus by measuring above and below point source discharges, the impact on the receiving water can be measured. Another measure of pollution is to sample the discharge and measure these components in the discharge. If a discharge is going to groundwater or if many discharges to a stream or lake (surface waters) are located close to each other, it may be difficult to estimate the impact by measuring the receiving water. Nonpoint sources have no one point or time of discharge. Storm runoff from agricultural lands, residential runoff, forest lands infiltration and septic tank discharges or overflow will contain different pollutants and will occur as a result of rainfall, irrigation, accidents, poor operation, etc. The point of entry into a surface or groundwater may not be easily defined and any one septic tank, farm, residential area may not be as important as the sum of all land use and nonpoint discharges in a stretch of river which is used for fishing or boating or over a part of an aquifer which is used as a drinking water supply.

Using water quality data, information from river basin computer models, background data on water uses, capabilities of treatment processes, etc., permits are issued by WPC to direct point source discharges. The permits stipulate the flows, type of pollutants permissible and expected quality levels for each discharge. Where receiving water quality is not acceptable, arrangements for upgrading the discharge are established and a compliance schedule is set. On the basis of the above activities, each surface water body is divided into stretches or segments. Each segment is classified based upon data collected on quality, discharges and uses. The existing classification scheme covers both fresh and salt waters. General classifications are "A" for those waters used as water supply, "B" for waters of sufficient quality for bathing and fishing, and "C" for waters suitable for recreational boating and habitat for certain species. Salt water standards are designated as SA, SB and SC. Surface water stretches or segments of a river are also classified as antidegradation (AD), effluent limited (EL), or water quality limited (WQ). An antidegradation classification is applied to all parts of a river above the most upstream municipal treatment plant discharge. Effluent limited segments are those where water quality standards will be met if all waste discharges receive best practical treatment (essentially secondary treatment or, for industrial discharges, its equivalent). Water quality segments are those where higher degrees of treatment are required to meet the water quality standards. This classification is also assigned to segments where a problem which cannot be solved by conventional means, such as urban runoff, causes violations of water quality standards.

The time selected as the most critical for surface water pollution is the 7-day drought which occurs once in ten years. At this extremely low flow, the expected quality of known point source discharges and the upstream water quiality conditions are used to calculate the quality of the river below point source discharges. This is done by computer if a river basin mathematical model has been developed. Aquifers or groundwaters have two general classifications. One designation is for actual/potential sources of drinking water. For this use discharges to the aquifer must meet the same quality standards as actual drinking water. If groundwaters are not in the water supply category, the quality of discharges is judged on a case-by-case basis. However, the quality of any discharge to any groundwater in the state must be high.

By combining actual measurement techniques with special studies of polluting activities such as boating, septic tanks, cranberry growing, etc.; and by adding predictive methods and public and professional visual inputs, such as reports of or statistics on fish kill or the extent of weed growth, the data necessary for management of water quality can be provided.

The state, SRPEDD and their consultants, local communities, public and private organizations, and individuals have contributed information on water quality and pollution discharges using one or more of the above approaches. The information presented in the basin or the town-by-town analyses is a combination of these inputs; details can be found in the task reports produced during the course of the study. The information has been presented and analyzed at both the local and basin level.

III REGIONAL SLUDGE AND SEPTAGE MANAGEMENT

Community Alternatives

Previous sections of this chapter and other chapters in this report contain data on individual sources of residual waste generation, methods for residual waste treatment and transport, alternatives for residual waste disposal and/or utilization. Areawide considerations relative to disposal options, criteria for disposal site selection as well as evaluation of alternatives in terms of area characteristics are also addressed. Reference has been made also to the fact that the study area wastewater treatment facilities are either constructed or in the process of design and construction. This largely stabilizes the quantity of sludge generation and conditioning. A critical areawide need is for immediate solutions to the sludge utilization or disposal problem and the need for longer term solutions is secondary. Therefore, Table 3 provides a summary of the estimated present and future sludge and septage quantities generated in the study area. Also shown are the disposal methods currently being used and potentially appropriate for each community. This table defines the extent of the solids generation as septage and as sewage treatment plant sludge by town. Tables 1 and 2 are a summary of the same data by treatment plant. These tables show the amounts of septage which has been assigned to each treatment plant and the estimated amount of sludge to be produced at each plant. Prior to the 208 study there were no areawide estimates of either of these quantities and there was also no system recording or collecting this type of data. Thus it was necessary to develop the information in these tables from various sources including 201 plans, treatment plant records, treatment plant operator memory and/or estimates, septage hauler estimates, per capita generation rules of thumb and national data. In order to compile estimates of both septage and sludge quantities a consistent set of assumptions was applied across the region and where data on actual amounts of septage or sludge were available these were compared with the estimates. Adjustments were made in the assumptions if estimates were significantly different than actual amounts now being generated. The estimates are based on population data from the 208 study for contributing communities, a sewage flow of 100 gallons per capita day which makes provision for industrial flows, and 0.25 pounds of suspended solids per capita daily. They are average figures which may vary widely if flows or solids loadings are markedly different. However, the estimates generally are comparable with the existing data which was available.

A review of the tables will indicate that the sludge disposal options achieving optimum ranking for the study area have been used as appropriate; namely, landfill and incineration. This does not foreclose the other land application alternatives, but utilizes disposal methods that can be implemented sooner than later, or that are already in operation. As a component of the ongoing planning in the region efforts should be instituted to seek land disposal alternatives to replace incineration. Consideration should be given to using the sludge wherever possible.

Septage is shown primarily as delivered to nearby treatment plants. While landfilling is an alternative option, it requires special precautions requiring capital expenditure which may preclude this method in the near term. Treatment plants in the study area should be required to accept septage for treatment if they are not already doing so. This is particularly applicable for the new plants in Fall River, Taunton, Middleborough, the Attleboros and Mansfield. For some of these plants additional septage holding and handling facilities must be considered. Table 2 shows the septage loadings for study area treatment plants. These loadings are taken from Table and are for quantities in cubic feet per day, which are 90 percent wet. A rough estimate of the gallonage can be derived by multiplying the cubic foot by 7.5. Where communities are not shown in Table 2, their septage disposal option is primarily directed to land application via the composting process. This option may be feasible later in the 20-year planning period for other rural areas presently shown on Tables 1 and 2 as discharging septage to treatment plants. This may be particularly applicable to Westport, for example. Both the landfill and composting alternatives for septage disposal depend largely upon the amount of financial assistance available and needed by the respective towns to implement these options.

The amounts of septage in cubic feet or in gallons assigned to any treatment plant are relatively small and there should be no hydraulic problems in accepting these quantities. In every case there must be holding facilities to allow slow discharge of the septage to the influent. This type of operation will prevent upsets and other problems associated with shock loads of high strength organic material (BOD). As was stated earlier, at the present and for the next several years disposal of septage at treatment plants will generally be the most acceptable method from economic, environmental and water quality considerations. Individual towns and groups of towns, however, should investigate the acceptability of land disposal alternatives, particularly composting or land spreading, as mid-and long-term solutions. In both of these processes the nutrient, fertilizer and soil building components of the septage can be utilized. The gradual elimination of reliance on the treatment plants as the prime disposal option for septage will also free capacity for future population growth.

The estimated production of sludge by treatment plants is summarized in Table 1 . The Sludge quantity data were derived using 208 contributing population estimates, per capita sludge estimates where specific 201 data were not available. The selection of final disposal processes was also based principally on 201 data. Other estimating assumptions are similar to those used for septage. In that not all the 201 treatment plant plans have been finalized, certain additional sewering and connection assumptions had to be made. In general these assumptions will not influence the total amount but only the location where the sludge will be generated. For example, the regional Mansfield plant was assumed with Foxborough and Norton contributing and the Taunton plant was assumed to serve Raynham and parts of Dighton. The estimates could not all be made at the same solids concentration due to the peculiarities of the solids handling processes at each plant. There are also specific anomalies in sludge generation which are not easily identified in the table such as the Marion estimates. The treatment at Marion involves ponds, and until a pond becomes inoperative due to solids accumulation no sludge is withdrawn for final disposal. Also while the sludge accumulates in the ponds, it undergoes anaerobic decomposition and the amounts to be disposed of from the plant will likely be significantly smaller than are now estimated. However, until actual withdrawals are made no accurate estimates of amounts can be made. It is estimated that approximately 3000 cubic feet of sludge per day were generated in the region in 1975. This amount will more than double by 1995 if the population and sewering estimates are accurate. As an indication of the size of sludge disposal problem for 1975, if all of the sludge was collected at one place and spread one foot deep it would cover approximately 60 acres. Thus, between now and 1995 our sludge generation problem could be solved if we could find approximately 2000 acres of land upon which sludge could be safely and economically applied. The final disposal solutions presented in Table 1 should only be considered as interim and as with septage every effort should be made to find ultimate composting or land spreading opportunities.

TABLE 1

SUMMARY OF ESTIMATED SLUDGE GENERATION
AT TREATMENT PLANTS IN THE REGION

	1975 cu ft/day*	1980	1985	1990	1995	FINAL DISPOSAL
Attleboro	202	338	382	493	542	Landfill & Incineration in 1980
Dartmouth	118	220	228	233	236	Landfill or Land Application
Fairhaven (Mattapoisett)	177	207	297	272	295	Landfill or Land Application
Fall River (Tiverton) (Westport) (Freetown)	1115	1006	1064	1091	1101	Landfill & Incineration in 1980
Mansfield (Foxborough) (Norton)	55	62	257	278	287	Landfill on Site
Marion** (estimated)	53	57	135	142	148	Inpond Storage & Ultimately Landfill
Middleborough	118	120	132	168	170	Landfill
New Bedford (Acushnet)	410	1795	1846	1847	1864	Incineration
North Attleborough (Plainville)	121	138	180	195	212	Landfill & Attleboro Incinerator in 1985
Plymouth	356	118	137	308	315	Landfill
Somerset (Swansea)	218	351	600	610	613	Landfill
Taunton (Raynham) (Dighton)	113	579	634	693	718	Landfill
Wareham	59	99	132	149	201	Landfill

* Most sludge quantities are at 20% solids.

** The sludge amounts estimated for Marion are based on a per capita factor and the final amount to be disposed of by landfill will be much smaller.

TABLE 2

SEPTAGE VOLUMES ALLOCATED TO AREA TREATMENT PLANTS
(Cubic Feet/Day)

City or Town		1975	1980	1985	1990	1995	Contributing Communities
Attleboro		257	209	195	130	105	
		-	100	109	114	119	Rehoboth*
		-	158	141	118	123	Seekonk*
	TOTAL	257	467	445	362	347	
Dartmouth	TOTAL	-	158	170	179	182	
Fairhaven		86	104	102	87	79	
		-	59	66	62	62	Mattapoisett
		-	31	35	38	42	Rochester
	TOTAL	86	194	203	187	183	
Fall River		60	54	53	46	54	
		162	170	118	126	134	Tiverton
		-	182	178	159	163	Westport
		-	211	146	155	160	Swansea*
		-	37	42	48	51	Freetown
	TOTAL	222	654	537	534	622	
Mansfield		93	127	88	89	93	
		-	199	145	162	177	Foxborough
		-	158	102	112	117	Norton
	TOTAL	93	484	335	363	387	
Marion**		-	-	-	-	-	
Middleborough		99	120	125	110	113	
		-	61	70	80	88	Carver
		-	73	69	75	74	Lakeville
	TOTAL	99	254	264	265	275	
New Bedford		60	94	92	92	93	
		-	37	43	48	52	Freetown
	TOTAL	60	131	135	140	145	

* Rehoboth, Seekonk and Swansea are studying the feasibility of land application (composting) techniques for septage. Their appearance in this table represents a contingency allocation.

**Marion septage has been allocated to the Wareham plant in that the type of treatment at Wareham is better able to handle septage.

TABLE 2
(continued)

SEPTAGE VOLUMES ALLOCATED TO AREA TREATMENT PLANTS
(Cubic Feet/Day)

City or Town		1975	1980	1985	1990	1995	Contributing Communities
North Attleborough		105	139	138	111	103	
		-	80	55	55	60	Plainville
	TOTAL	105	219	193	166	163	
Plymouth	TOTAL	204	286	293	144	145	Plymouth
Somerset		100	55	-	-	-	
Taunton		192	178	291	160	157	
		-	70	46	43	46	Dighton
		-	106	123	131	144	Raynham
		-	30	32	34	36	Berkley
	TOTAL	192	384	492	368	383	
Wareham		141	156	151	153	129	
		-	33	13	14	15	Marion
	TOTAL	141	189	164	167	144	

IV. INDUSTRIAL RECOMMENDATIONS

A. Major Recommendations

There are three major recommendations to enhance the region's efforts to clean up and/or prevent industrial pollution.

1. Industrial Pretreatment - Industries discharging their wastes into municipal plants must meet federal pretreatment standards, yet EPA has not issued the final pretreatment standards. The pretreatment issue affects the design of municipal treatment plants, as the capacity and treatment process selected will to some degree depend on what the pretreatment standards are. The pretreatment standards will also be important to industry; the costs of meeting pretreatment standards may lead to process changes, changes in the amount of water discharged, and certainly will amount to significant expenditure on the part of those industries affected.

   Regionally designed pretreatment programs are based on bringing together industrialists and enforcement agencies which can result in shared collection, treatment and recovery facilities, which significantly reduce costs for both industries and municipalities.

   The current study to determine the feasibility of building a joint pretreatment plant for three Taunton silver companies can serve as a model for implementing the recommendations found in the local alternatives for several cities and for the recommendations by industry which follow.

2. Hazardous wastes - There are currently no safe places in Massachusetts for disposing of toxic wastes. While this problem may not be visible at present, we can predict with a fair degree of certainty that unless action is taken, the environment will accumulate an increasing amount of toxic materials to the point where collection and treatment becomes impossible. The history of PCB's (Polychlorinated bi-phenyls) shows us clearly a progression of wider and more important effects that can stem from lack of attention to the disposal of toxic materials. The toxics move from a few sources to a specific area in the river, then necessitate the closing of a harbor for shellfishing, then to the contamination of finfish in an entire bay area.

While we have overcome the nineteenth century of bacterial disease, the twentieth century problems of chemically caused diseases require priority attention. If we are to avoid a contaminated future, we will need to resolve the toxic waste problem today.

Regional facilities and systems for handling, recovering, and disposing of toxic wastes provide an important option for beginning to solve this problem. If planned around existing or new industrial parks, such facilities can lower the costs of doing business in the area and promote industrial growth.

3. Water Conservation/Reuse - The cost of water to both the public and private sector, and the cost of disposal for both sectors now make water conservation and/or reuse an attractive economic proposition. Yet many industrialists are not aware of this, and many plants are designed for a capacity which does not take account of the conservation effects which user charges will most likely create. Industries' good record in energy conservation due to the increasing cost of energy is an indicator of what will happen as water and sewer costs rise.

   Communications efforts are needed to inform both industries and municipalities that technology exists to dramatically reduce water consumption and thus for the overall costs of water use and disposal. In some cases, neighboring utilities and industries can jointly plan for water and energy re-use, again saving costs.

B. Identification of Specific Problems and Alternative Solution by Industry

The major recommendations outlined above can be applied to the three major wet-processing (or water using) industries in the region. These include Food and Kindred Products (SIC No. 20), Textile Mill Products (SIC No. 22) and the Metal-Related Industries (SIC Nos. 33, 34, 35, 36 and 39). Each has a unique wastewater discharge with specific characteristics but they all share the common problem of high flow rate.

1. The Food and Kindred Products Industry includes many different types of companies but the one of major interest is fish processing and particularly the companies in New Bedford. Here the major problem is the in-plant separation of high solids loadings. In particular, there is an opportunity for recovery of this material which will be encouraged by sewer surcharge but can also be augmented by a market study for its use as animal feed. In addition, the potato processors of Fall River can contribute their high solids content as well. A regional approach identifying sources and markets would assist in lowering the percentage of these materials going unnecessarily to sewerage.

2. The Textile Industry similarly must look to in-plant process changes to reduce water use, possibly through solvent substitution as well as recovery options for processing chemicals. Larger plants requiring equalization and neutralization may find it feasible to increase the detention time in order to accomplish some BOD reduction. Dyes and other organic chemicals must be evaluated for their level of biodegradability as a way of decreasing total BOD loadings. All of these considerations will become more important when the cities and towns announce the cost recovery and user charge programs which are structured by flow rate, BOD and TSS loadings.

3. The Metal-Related Industries focus on a variety of problems, not the least of which is a lack of information on federal regulations. As a group of companies they are facing high water use, but with some recycling opportunities, as well as treatment of toxic metals and other chemicals. With the various cities and towns in the region proposing different sewer ordinances with different pretreatment regulations, there is a great need for community/industry information and coordination. Similarly, the issue of hazardous waste disposal is greatest for these industries as the toxic materials come out of the wastewater streams in the form of sludges.

TEN MILE RIVER DRAINAGE BASIN

PLAINVILLE

NORTH ATTLEBOROUGH

ATTLEBORO

SEEKONK

REHOBOTH

V. TEN MILE RIVER BASIN

A. Basin Overview

The Ten Mile River runs almost north to south, and except for its mouth which is in Rhode Island, it is within the study area. Figure 1 shows the river and salient basin features. Principal tributaries to the Ten Mile include Coles Brook, Speedway Brook, the Bungay and the Seven Mile; and the Ten Mile Basin also includes the Palmer and Runnins Rivers.

There are no permanent flow gauges in the Ten Mile River Basin and thus no records of average stream discharge are available. Maximum, minimum and average flow figures from gauges in adjacent drainage basins with similar topographic and rainfall characteristics have been used to estimate flows. When expressed in terms of discharge per square mile, the average flows from these gauges are fairly similar. Applying these figures to the Massachusetts portion of the Ten Mile Basin (48.9 square miles) indicates an average flow of about 80 cubic feet per second at the state line.

The existing Basin Plan (Part C) prepared in 1975 by WPC and the current 208 study have identified a number of water quality and wastewater management issues. The basin plan now stipulates that within the 208 region, the goal for the Ten Mile is Class B or above thus meeting the 1983 swimmable-fishable criteria everywhere except in the stretch from the Attleboro-North Attleborough boundary to the state line. In this stretch it is classified "C." Class C waters are suitable for recreational boating and secondary water contact recreation and for certain agricultural and industrial uses. Such waters are a suitable habitat for wildlife and fish indigenous to the region.

Major streams in the Ten Mile Basin classified as antidegradation include the Ten Mile above Plainville Center, the Seven Mile River, the Bungay River, Scotts Brook and Coles Brook.

The new treatment plants at Attleboro and North Attleborough when constructed will provide better than secondary treatment, and their discharges will be limited to 5 mg/l of BOD, 1 mg/l of total phosphorous (PO_4-P), and between 1 and 1.5 mg/l of ammonia nitrogen (NH_3-N). Unless the BOD discharge requirements are lowered, during drought flows the stream cannot be expected to reach the dissolved oxygen level

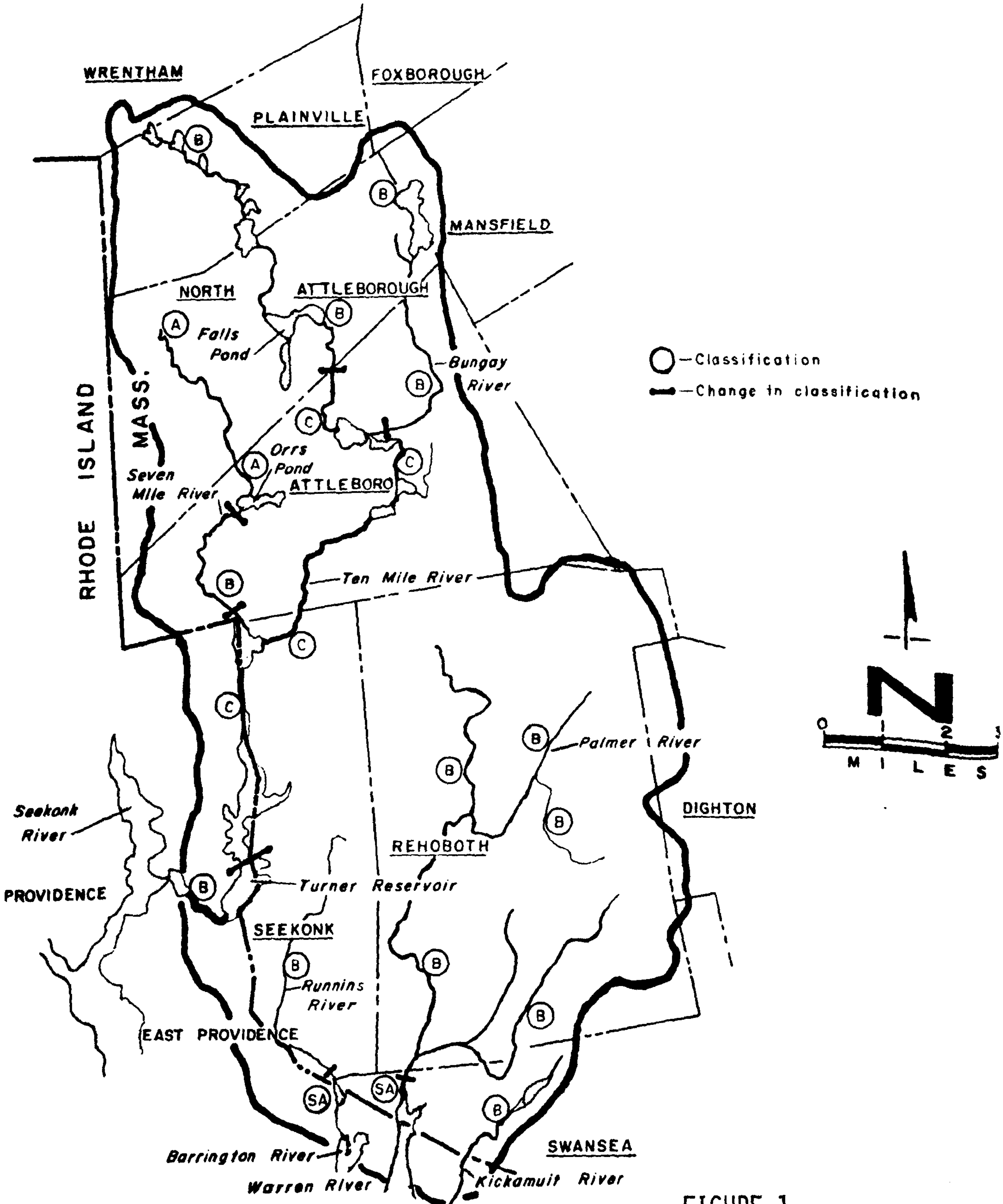


FIGURE 1

CLASSIFICATION MA

TEN MILE RIVER BASIN

stipulated (6.3 mg/l) for a "B" classification. Analysis was performed for a number of possible point and non-point discharge quality conditions using the mathematical river basin models. The drought flows used for this analysis were:

WPC	1997	23.6 cfs*
SRPEDD	1980	14.7 cfs
SRPEDD	1995	19.5 cfs

The differences in flows are caused solely by the difference in estimated treatment plant flow. The SRPEDD estimates assume a lower population contributing to the Attleboro and North Attleborough treatment plants than those in the WPC Ten Mile Basin Plan estimate. An overall analysis using the WPC flow estimates shows that as much as 2.8 miles of the river could be below the 1977 standards for DO if the plants discharge 10 mg/l of BOD, and 11.5 miles could be below the 1983 standards under the same assumption.

For an assumed 1 mg/l of BOD in the disbursed (non-point) flow entering the river during a drought, the amount of BOD contributed by these non-point sources would be approximately one percent of the total point source contribution. The total flow contributions from disbursed sources along the river is approximately 1.9 cfs or eight percent of the total estimated WPC 1997 river flow at mile 0.0. Thus, if the disbursed flow estimates used in the program are accurate, the BOD loads are reasonable, and the principal contribution of disbursed sources is BOD, then disbursed or non-point sources do not significantly affect river water quality in either the upper or the lower Ten Mile <u>during drought conditions</u>. The above three assumptions are probably reasonably accurate for drought conditions; however, during most of the time flows in the river will be substantially higher than the estimated drought flow. Data from this analysis suggests that at drought flow conditions, whether 23.6 or 19.6 cfs, the quality of the river will not meet the DO requirements; also, the discharges from the treatment plant are shown to make up a large portion of the total flow and total BOD load. Under any of the three drought flows, the North Attleborough discharge will be approximately 83 percent of the river flow at the discharge point at mile 15.3. The Attleboro discharge will be approximately 60 percent of the river flow at its discharge point (mile point 7.7) and at mile 0.0 the two plants will have contributed 84 percent of the total river flow.

*cubic feet per second

If the SRPEDD flow estimates are accurate and the treatment plants meet the 4 mg/l of BOD discharge permit limitation during a seven-day ten-year drought, there could be over seven miles of river with DO concentrations below the applicable standard. If and when a drought occurs of less than 23 cfs, dissolved oxygen conditions in the river can be expected to be less than 6.3 mg/l over large distances for extended periods of time. The previous data also indicates that there will be stretches with DOs below 5.0 mg/l. Under either of these two flow conditions, the river would not meet "B" classification and thus would not meet the swimmable-fishable requirements of EPA.

In addition to BOD-DO problems, the amount of nutrients discharged by point and non-point sources have created algae blooms in some of the ponds of the river. In the Ten Mile Basin Plan, nitrogen and phosphorous discharge limitations are placed on the two treatment plant discharges. The non-point source analyses conducted as a part of this 208 process have projected that non-point source discharges of these nutrients could be substantially greater than the point source discharges.

B. Other Major Ten Mile Basin River Systems

In addition to the mainstem of the Ten Mile, the major river systems include the Bungay River, Speedway Brook, the Seven Mile River, Coles Brook, the Runnins River and the Palmer River. The Bungay River, Speedway Brook and Coles Brook each comprise one segment of the Ten Mile. The Seven Mile River is divided into two segments due to the change in classification. Very little data is available on the Runnins and Palmer Rivers and these are discussed in the town-by-town descriptions. Additional information on each major surface water and current quality problems is also presented in the local alternatives discussion.

C. Non-Point Sources

Within the Ten Mile Basin, non-point source inventories have been prepared on a town-by-town and basin level. Additionally, a basin summary of the amount of land in the major uses which contribute to non-point source pollution is included in Appendix IV-C of Chapter IV. This summary is further augmented by discussions of existing and potential non-point source pollution is included in Appendix IV-C of Chapter IV. This summary is further augmented by discussions of existing and potential non-point pollution problems in the town-by-town descriptions.

The above described non-point inventories were used as input to the non-point source discharge model. This model will simulate the runoff and groundwater recharge for various weather conditions and levels of land-use activities. In the Ten Mile, two types of weather conditions were assumed: normal dry weather (end of summer) and normal wet weather (end of winter). For these two conditions, using the current (1975) and projected (1995) land-use inventories,pollutant discharge estimates were made for the Ten Mile basin. The date show the amount of polluting materials (BOD, solids, phosphorous, etc.) which are discharged to the groundwater and surface waters during the chosen dry and wet weather conditions. Using this data and the point source summaries presented earlier, it is possible to compare the amount of material both sources contribute. This type of comparison is not the only or the best way to decide on the significance of sources; however, as one type of comparison and at present the only type which can be made at this level of detail it can be used to identify some interesting and important information.

Load Allocations and Summary

Based solely on the drought flow BOD and DO analysis described above, changes should be made in either the point source discharge permits and waste load allocations or to the receiving water classifications in the Ten Mile River. Additional consideration should be given to changing treatment plant design and operation requirements. It is likely that Class B DO levels cannot be met even after the new Attleboro and North Attleborough plants are operating. Thus, either the plants must be upgraded, the river classifications downgraded or other pollutants and flow conditions must be adopted as criteria for judging the swimmability and fishability of the river.

The Ten Mile River should not be degraded further. However, treatment levels, discharge permit stipulations, load allocations and non-point source controls should be established with much less reliance than is now the case on low flow-steady state-DO/BOD modeling. The impact of point and non-point source discharges to the Ten Mile can also be measured using dry (annual average and not drought) and wet weather flow and water quality modeling to estimate river conditions. Additionally, conservative substances such as metals, refractory organics, coliform, etc., should be included in the mathematical model so that future river water quality conditions can be estimated. Without this expanded capability the waste load allocation, permit issuing and discharge and water quality monitoring programs of the state and other governments will not be sufficient to accurately define appropriate point load allocations.

LOCAL STRATEGIES - PLAINVILLE

A. INTRODUCTION AND BASE DATA

Plainville is a small, established, industrial Town which has been influenced by its proximity to the manufacturing centers of Attleboro and North Attleborough.

Historically, land development in the community has been restricted to those areas serviced by the public water system. Urban development, particularly residential, is prevalent in the area surrounding the Town center and north along Route 1A. Industrial and commercial uses are also located in this area.

For the most part, Plainville follows a relatively open residential development policy. The existing zoning by-law establishes three types of residential districts: two districts for single-family homes and a two-family residential district. Apartment developments are granted through a special permit process. Density requirements range from 15,000 to 44,000 square foot lots.

Plainville has a small industrial base composed mostly of jewelry and metal firms. Historically, the manufacturing sector of the Town's economy has remained relatively stable, accounting for 65-75 percent of the total employment. As mentioned, most of the existing manufacturing concerns are located along Route 1A. Some additional industrial development is also located off Route 152, particularly around Turnpike Lake.

Plainville's existing commercial activity is located within the Town center, along Route 1 and at Wilkins Four Corners on Taunton Street. Most communities situated along Route 1 took advantage of the once heavily travelled highway and zoned adjacent lands for commercial development. Plainville similarly zoned both sides of Route 1 for roadside commercial development, and some businesses did locate along the road. This trend, however, was reversed with the construction of Route I-95. Route 1 no longer receives the major traffic flows, and Plainville has been relatively unsuccessful at attracting new businesses to the highway location.

Since 1955, Plainville has more than doubled in population size. While this is an impressive figure, the absolute numbers involved are still rather small. On a yearly basis the growth rate has progressed at slightly more than 6 percent per year.

TABLE 1

HISTORIC AND EXISTING DATA

a. Population

1955	1960	1965	1970	1975	Historical % Change
2,557	3,810	4,252	4,953	5,825	127.8

b. Land Use

Acres	1951	1975	Historical % Change
Residential	381	1,024	168.8
Commercial	21	36	71.4
Industrial	12	122	916.7

Of all the land development that took place in Plainville between 1951 and 1975, residential growth was by far the most impressive. Six hundred forty-three acres were consumed by housing construction, and a significant amount of this growth took place on the fringes of the older Town center. Additional development also took place to the east of Route 152 particularly in the vicinity of Lake Mirimichi.

Commercial acreage increases, on the other hand, were minimal. What did occur came in the form of strip growth along Route 1 and a small shopping center development on Route 152. The industrial sector has added a healthy increment to its base since 1951. The 110-acre increase is particularly impressive since the Town lacks a public sewer system, has a limited water distribution system and did not have particularly good highway access before the construction of I-495 and I-95.

Projections for the next twenty years are for a significant slowdown in the rate of population growth. The increase from 1975 to 1995 is expected to amount to about 36.5 percent or about 2,025 people compared to 127.8 percent or 3,268 people from 1955 to 1975.

TABLE 2

1995 PROJECTIONS

a. Population

(1) Community

1975	1980	1985	1990	1995	Projected % Change
5,825	6,650	7,200	7,550	7,950	36.5

(2) Sub-Community Distribution (see Figure 1)

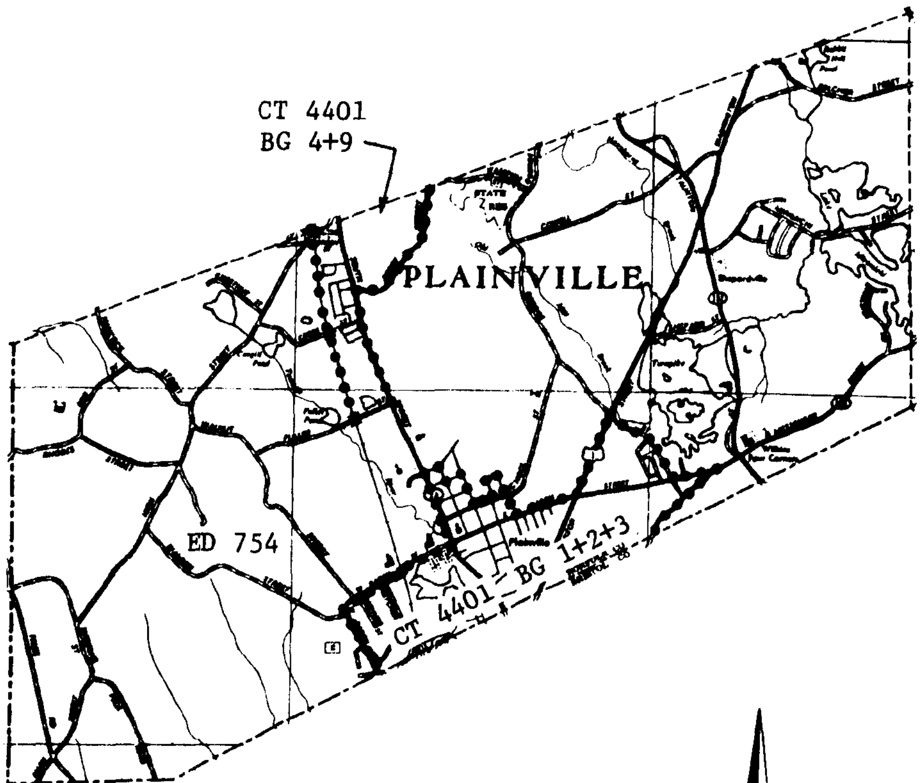
Census Area	1970	1995	% Change
ED 754	2,078	4,265	105.2
CT 4401 BG 1-3	2,199	2,721	23.7
CT 4401 BG 4, 9	676	964	42.6
TOTAL	4,953	7,950	

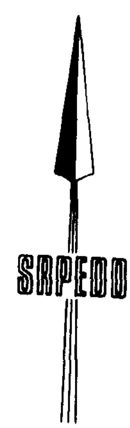
b. Land Use

Acres	1975	1995	% Change
Total Residential	1,024	1,775	73.0
Commercial	36	60	66.7
Industrial Acres	122	136.5	11.9

Aside from the compact growth in the southern portion of Town along Route 1A, Plainville is characterized by its large tracts of vacant land. In the future, residential development will most likely scatter throughout the Town, but probably do so primarily to the east of Route 1A. Reasons for this are good highway access, availability of services and comparatively good soils.

In the commercial and industrial sectors, the growth pattern is expected to reverse with commercial development picking up somewhat and industrial growth slowing down significantly.





LEGEND

●●●●● CENSUS AREA BOUNDARIES

SCALE

½ 0 1 2 MILES

FIGURE 1

CENSUS AREA BOUNDARIES
TOWN OF
PLAINVILLE

Most of the commercial activity projected for Plainville should take advantage of the I-495 interchange. A good sized portion of land has been zoned as a location for shopping center development. This is a highly visible spot compared to other parts of Town, and it holds some potential as Plainville and surrounding towns continue to become more urbanized.

Plainville, like many communities, desires industrial development to expand the economic base of the community. The lack of a public sewer system, the limited public water distribution system and the anti-degradation status of the Ten Mile River which passes through Plainville are factors that in combination may hold down industrial development. While the Town is working towards adding sewers in the older developed sections on Route 1A, the most promising industrial area is the land in the northeast corner of Town just off the I-495 interchange. While locationally this site is attractive, it does not have the infrastructure to make it prime industrial land. These elements plus the intensive competition in the State and region for industry will serve to keep economic growth to a minimum in Plainville. What does occur, however, is likely to take advantage of the transportation node just off I-495.

B. WATER RESOURCE INFORMATION

The Town of Plainville is drained by the Wading River in the east and the Ten Mile River in the central part of Town. The western part of Town drains to Diamond Hill Reservoir in the Abbot Run drainage basin with a small area drained by the Seven Mile River.

Stratified glacial drift deposits form important aquifers in the Wading River drainage area and under the Ten Mile River (see Figure 2).

1. Water Supply

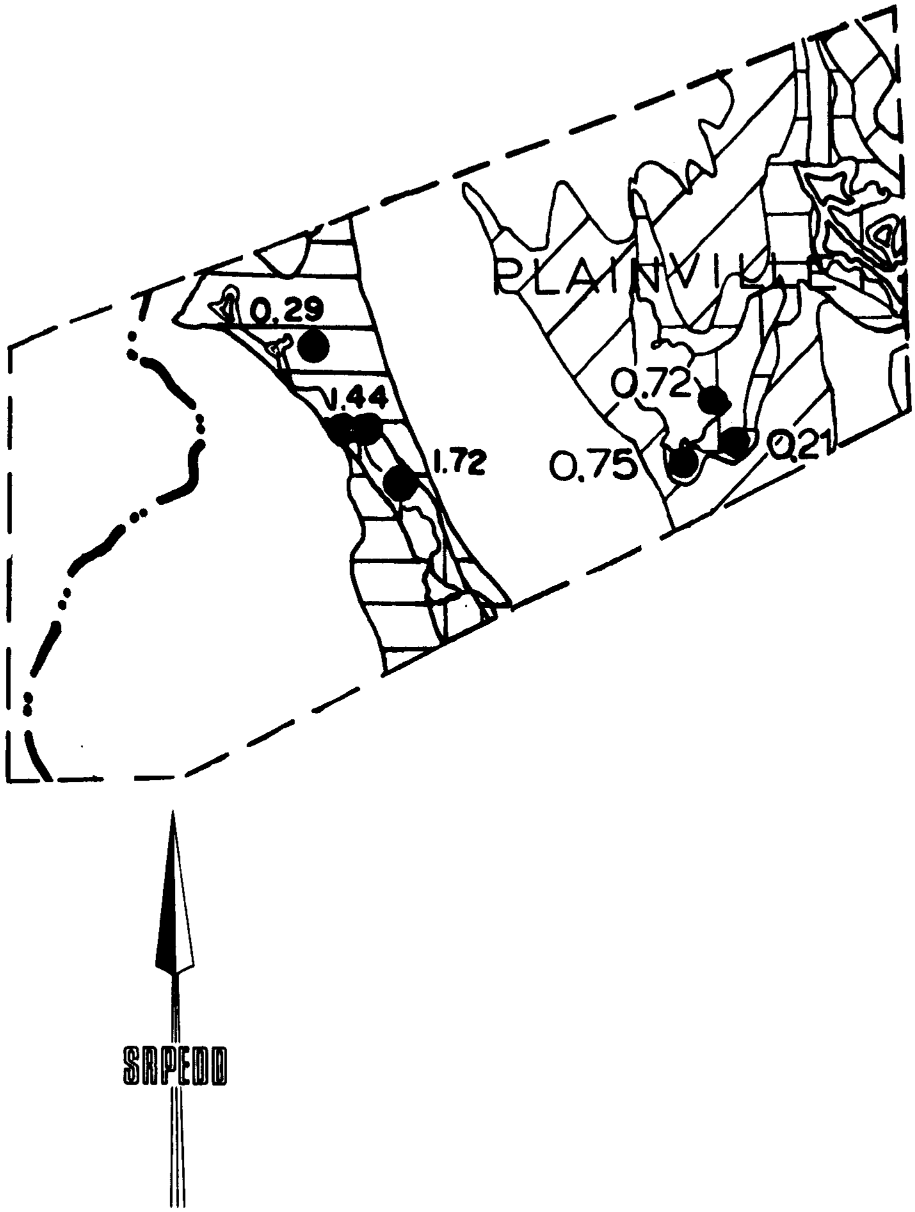
The Plainville Water Department has two gravel packed wells by Turnpike Lake in the Wading River drainage basin. They have a total capacity of 1.5 mgd and are normally pumped at 1.1 mgd. An additional well with a capacity of 1.1 mgd is located by the Ten Mile River. It has a normal pumpage rate of .73 mgd.

The Water Department has two proposed well sites. One is located in the Ten Mile aquifer near High and Cross Streets and the other is situated in the Wading River drainage basin by Old Mill Brook and George Street.

The Ten Mile River and the Turnpike Lake aquifers are mapped by the USGS on Hydrologic Atlas HA-300 which also gives the approximate safe yield of two aquifers. The Turnpike Lake aquifer is shown more clearly on USGS Hydrologic Atlas HA-640.

The Town of North Attleborough has four wells in Plainville in the Ten Mile River aquifer with a normal pumpage rate of 2.75.

The withdrawal from the Ten Mile River aquifer by both towns averages 4.45 mgd plus an additional .6 mgd (minimum) drawdown by industries. The total drawdown is 5.1 mgd, well above the 2.0 mgd maximum safe yield estimated by the USGS in 1968. As a result, North Attleboro's wells have experienced pumping problems. The deeper Plainville well has not experienced problems.



LEGEND

	YIELD POTENTIAL	RECHARGE POTENTIAL	CONTAMINATION POTENTIAL	RELATIVE RUN-OFF RATE	ACQUIFER COMPOSITION
	HIGH >300 GPM	LOW-HIGH	HIGH	MODERATE-LOW	STRATIFIED
**	MODERATE <300 GPM	HIGH-MODERATE	HIGH	LOW-MODERATE	GLACIAL DEPOSITS
	MODERATE-LOW <100 GPM	HIGH-LOW	HIGH-LOW	HIGH-LOW	
	LOW <25 GPM	LOW	LOW*	HIGH	BED ROCK & OR TILL

* HIGH WHERE BEDROCK IS AT LAND SURFACE

● 0.5 MUNICIPAL-AND INDUSTRIAL SUPPLY WELL. NUMBER IS YIELD, MILLION GALLONS PER DAY

STUDY-AREA AND DRAINAGE BOUNDARY

** HORIZONTAL LINE ORIENTATION: PARALLEL WITH TOWN NAME

SCALE

FIGURE 2

GROUNDWATER RESOURCES TOWN OF PLAINVILLE

C. LOCAL WATER QUALITY ISSUES

1. Areas with Wastewater Disposal Problems (Figure 3)

The major problem area is the downtown section. This is the oldest and most densely developed portion of Plainville. This high density condition, the advanced age of the systems and hardpan soil conditions have combined to create a long history of septic system failures.

2. Constraints on Future Development

Although a soil survey has not been undertaken in Plainville, two particular areas have been identified for their notable soil problems. The western third of Town is an area of hardpan and ledge. A second location is a zone from Lake Mirimichi south where, again, the presence of ledge has created problems.

Two aquifer systems run through Plainville, and both are tapped as a source of water supply (see Figure 2). One of the aquifers runs the length of the Town along the Ten Mile River. The other encompasses a general area from the Old Mill Brook east and from Lowell Street south. This aquifer has less promise than the Ten Mile system. However, there are some potentially high yield portions which run along a stream from Rabbit Hill Pond to Lake Mirimichi and then to Turnpike Lake. Several wells already exist on the south side of Turnpike Lake.

While wetlands are not particularly extensive in Plainville, there are a few notable concentrations to the east of George Street. In this section both the Old Mill Brook and Hawthorne Brook drainage basins have sizeable wetland areas. In the north, a wetland of good proportions is found along the brook connecting Lake Mirimichi and Turnpike Lake. Other wetlands are quite small and scattered.

3. Known Non-Point Problems (Figure 3)

--Cowell Street Landfill

Although closed, this old landfill site creates a problem because of poor drainage. Leachate from this site drains into Hawthorne Brook and eventually Turnpike Lake.

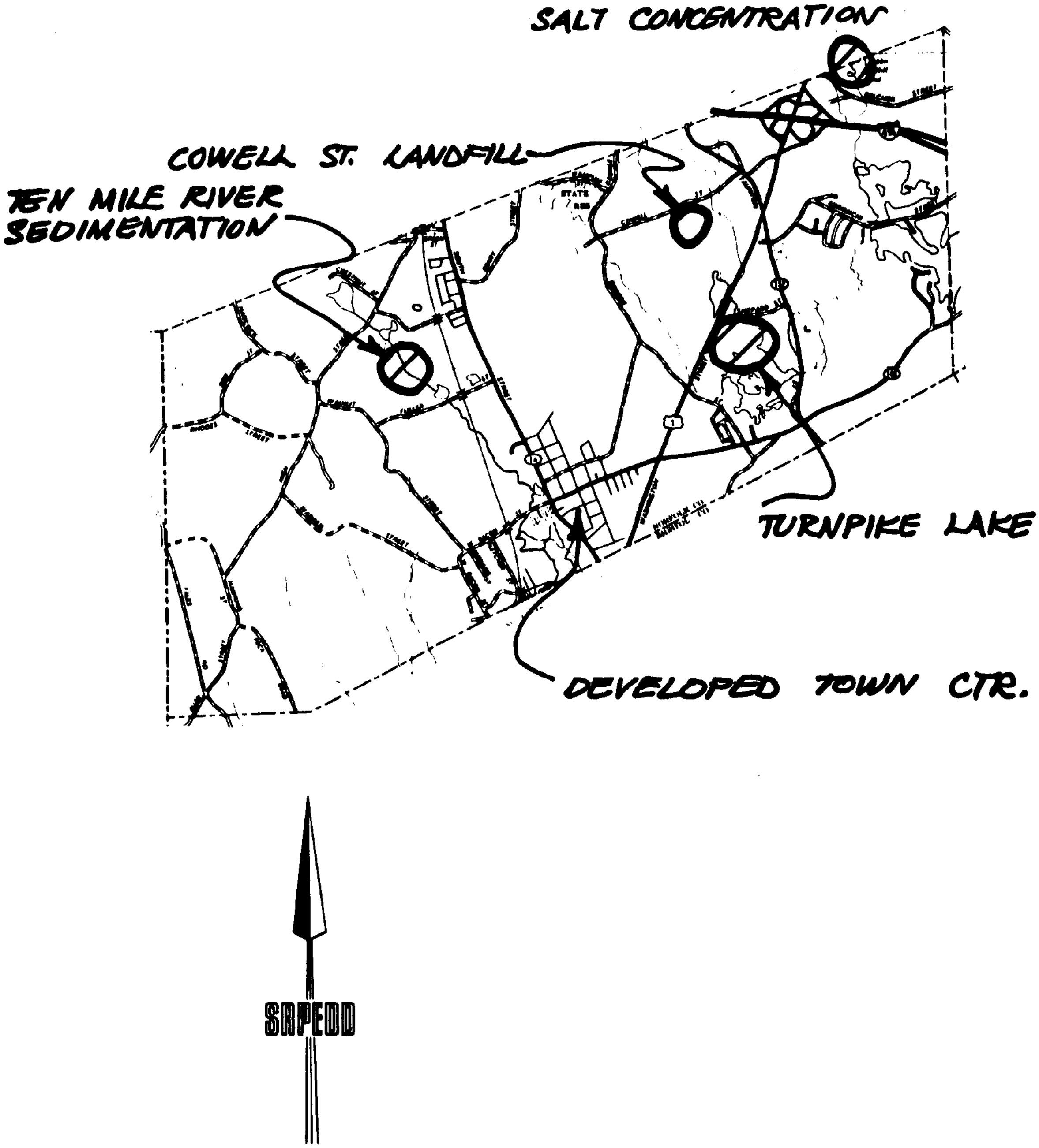


FIGURE 3
LOCAL WATER QUALITY ISSUES
TOWN OF
PLAINVILLE

--Salt Contamination

At one time the Department of Public Works maintained an open salt storage pile off the I-495 interchange. The salt is now stored in salt sheds, but past practices have been responsible for today's problems. One well site with a yield of about 1500 gpm has been left unusable due to salt contamination from this particular storage pile.

--Turnpike Lake Eutrophication

Large amounts of nutrients feeding into the Lake have left it in an advanced eutrophic state and as a result unsuitable for any recreational use. One source of pollution is a shopping center parking lot, which drains into the lake.

--Ten Mile River Sedimentation

Several extractive industries maintain dump sites for their waste products along the Ten Mile. Most of the material dumped at these locations have a sand or gravel base, and apparently the combination of the location of the dumps and the type of waste material have caused sedimentation problems in the Ten Mile River.

D. ALTERNATE SOLUTIONS

Although a small town (11.5 square miles), much of the development is concentrated along Route 1A and, as a result, a considerable amount of land remains vacant and potentially developable. The two features of concentrated development and available open land (approximately 6000 acres), plus the presence of soil limitations and important aquifers provide a background within which alternative solutions can be offered. The range of possible alternatives includes sewers, protective by-laws and innovative on-site disposal practices.

1. Sewers (see Figure 4)

1a. Limited Sewer Option

At the present time, Plainville is preparing a 201 facilities plan which would provide for the installation of sewers in the densely built south central portion of Town. The projected service zone would encompass an area roughly defined by Route 1 up to the East Bacon Street intersection in the east, Route 1A to about St. Martha's Church in the north, and West Bacon Street to approximately Fletcher Street at the western boundary. Flow is estimated to be in the range of .50 to 1.00 MGD.

The collected waste would be sent by way of a newly built interceptor to the North Attleborough treatment plant. The Plainville collection system is being planned in conjunction with plans for the new North Attleborough treatment plant, and its future depends on construction of this facility.

--Environmental Assessment

This option will provide a solution to the problem of failing septic tanks in Plainville's center. This should help the quality of the Ten Mile River as well as the ponds through which the river flows. The program will also help the Ten Mile aquifer which as previously mentioned, has demonstrated somewhat elevated nitrate levels.

The construction of sewers under this plan will probably have little secondary land use impacts, since the area is already built up.

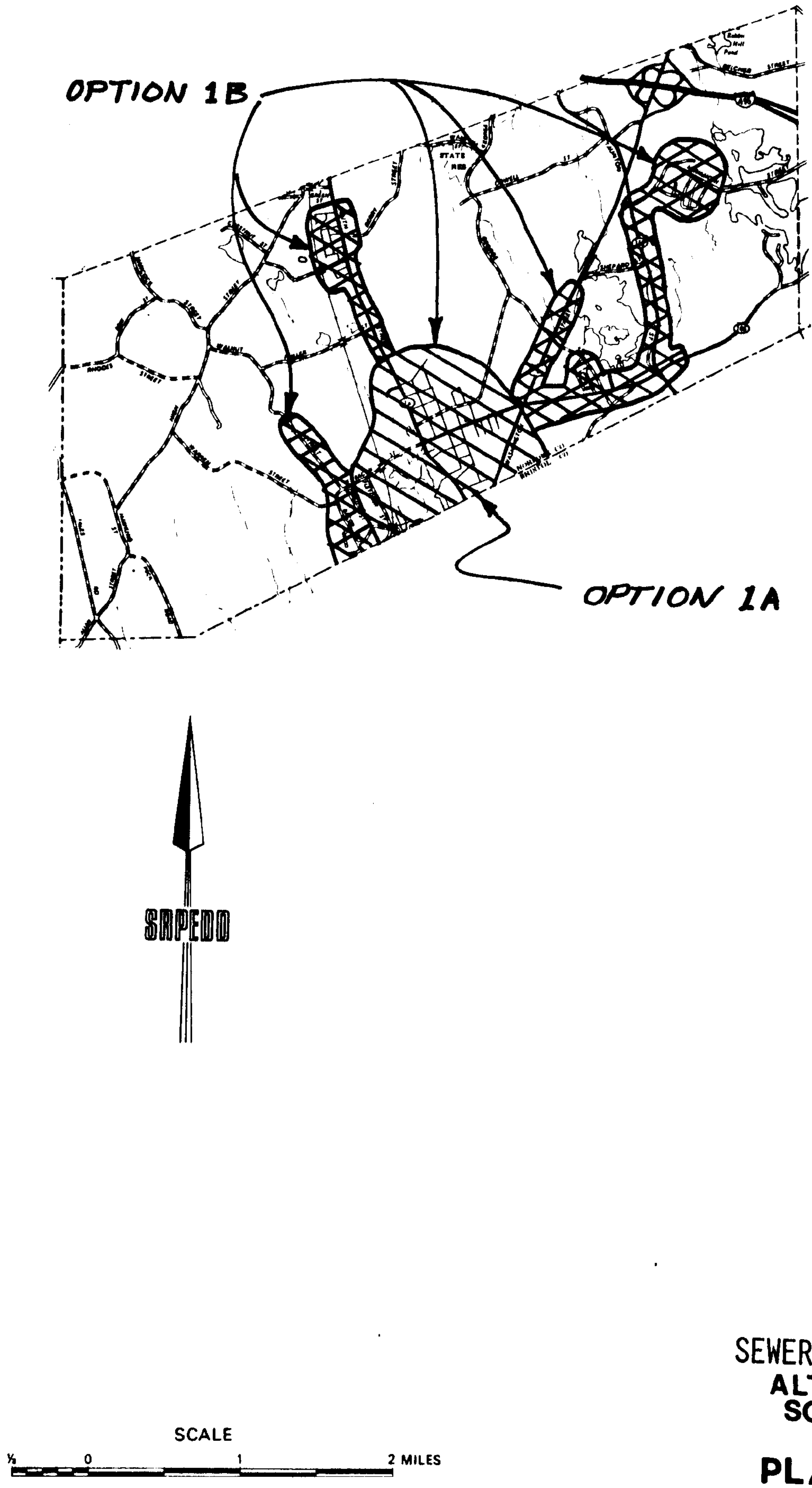


FIGURE 4
SEWER SERVICE AREA
ALTERNATIVE SOLUTIONS
TOWN OF
PLAINVILLE

--Policy Review

The plan is currently in progress and has the support of local and state officials.

--Costs

Laterals and collectors	-	$1,500,000
Pump station and force main	-	82,000
Interceptors	-	1,911,000
TOTAL	-	$3,493,000

House Connections - $600/unit

1b. Expanded Sewer Options

The expanded option would include all that is planned in option 1a plus: all of West Bacon Street and part of Walnut Street to the west of the Town center, all of Route 1A in the north; and Route 1 to Shepard Street; Messenger Street to Wilkens Four Corners; Route 152 up to and including that part of Mirimichi Street west of the lake. The additional flow would be about .20 MGD, and the total flow would be in the area of .70 to 1.20 MGD. It should be noted here that other non-structural non-sewer options exist and they are described further on.

--Environmental Assessment

The expanded option would afford a much larger area and it would take care of almost all development in the Plainville portion of the Ten Mile River basin. In addition, it would protect the Wading River aquifer as well as Turnpike Lake and Lake Mirimichi.

The likelihood, of secondary implications is much greater under option 1b. The extension of sewers through many sparsely developed portions of Town could stimulate much growth along the sewer lines thereby causing a new threat from runoff type pollution.

--Policy Review

The area encompassed under this option is much larger than the limited sewer option, and, therefore, the costs would be much greater. While Plainville is working toward sewering the Town center, it is questionable whether voters will agree to a more intensive sewer program.

--Costs

Since the land area is much larger, the cost for 1b is nearly double 1a. Furthermore, this option is much more energy intensive since five pump stations are required instead of one in 1a.

Total Cost 1a -		$3,493,000
Additional costs:		
Laterals and Collectors	-$1,457,500	
Pump Stations and Force Mains	- 724,000	
		$2,181,500
Total Costs 1a and 1b -		$5,674,500

House Connections - $600/unit.

2. Land Use Measures

Even under 1a or 1b, a large part of Plainville will remain unsewered. Given the Town's total reliance on groundwater for its supply, it is imperative that some steps be taken to provide additional protection for this valuable resource.

In order to protect its groundwater system, the Town would have to first assess which portion of the aquifer or well field was most important to its water supply needs, and then accurately map the location of the aquifer zone. Once complete, Plainville could then institute one of the following measures. (Chapter Three also includes a section on land use management techniques which apply here.)

2a. Aquifer or Well Field Protection

-Restrictive (or Protective), By-Law

Under this technique, the Town could predefine certain uses, which because of their hazardous nature, would be prohibited from locating on the aquifer or within a certain distance of a well field. Examples of hazardous uses include: landfills, fuel storage, chemical production or storage, and salt storage.

Plainville currently has extensive land zoned for industry in both the Ten Mile and Bungay River aquifers. This option would be a useful means of protecting aquifers or portions of an aquifer if a set of potentially hazardous activities is comprehensively identified prior to any development.

-Performance System

The operation of a performance system would require that permits be issued before a particular use could locate in a defined aquifer zone. The permit would be issued subject to an assessment of what impact the proposed use would have on the aquifer. Based on information submitted, the proposed development would either be allowed, allowed with modifications, or rejected.

--Environmental Assessment

Both of the above methods are useful ways of protecting the quality of an aquifer system. While each one differs in terms of flexibility and ease of administration, the success of all three would depend on how carefully the Town located the aquifer system and then how carefully it enforced the provisions of the by-law.

--Policy Review

Aquifer protection by-laws are somewhat uncommon throughout the State primarily because of a lack of understanding of the interrelationship between land use and groundwater quality. Before such protective measures could be implemented in Plainville, an awareness of the importance of this particular resource would have to exist among the Townspeople in order that the measure could pass a Town meeting vote.

2b. Lot Size Requirements

There are several zoning districts in the Ten Mile basin which require 15,000 square feet lots. As mentioned earlier, the Ten Mile aquifer has slightly elevated nitrate levels, and this probably can be attributed to the numerous on-site systems which exist on small lots. To avoid further damage, the Town could enlarge lot size requirements in the Ten Mile basin. SRPEDD calculations suggest that three-½ quarter acre lots would be adequate.

--Environmental Assessment

Enlarging lot size requirements would reduce the pressure on the aquifer simply by reducing the total pollution load that would ultimately be possible. Larger lots would not eliminate the threat, but some reduction of that threat would be possible.

--Policy Review

A zoning change would have to pass a Town meeting vote. Opposition could be raised by prospective developers who would like to maximize the number of units they could place on a parcel of land.

3. On-Site Alternatives

In spite of Plainville's sewering plans, much of the Town will rely on individual units for the disposal of wastewater. Since soil limitations are widespread and aquifer areas are extensive, a program which addressed the installation, operation, maintenance and type of individual treatment could be helpful in protecting the Town's water resources. Possible features which could either be adopted separately or as a comprehensive package include the following:

-Regular Inspection and Maintenance

In order to prolong the useful life of septic systems and discover existing or potential problems, Plainville could establish a systematic program whereby each on-site system would be pumped and inspected on a scheduled basis (see Chapter Three for discussion).

The cost of this operation could be borne entirely by the homeowner or the Town could assume that portion of the cost attributed to the inspection process. Where malfunctioning units are discovered, the Town could react according to the factors which attributed to the failure. For example, if the problem is due to improper installation or a physical breakdown in the system (i.e. broken pipe, etc.), the owner could be required to repair or replace the existing septic system. If on the other hand, failure is the result of unfavorable soil conditions, a high water table or surface wetness, then the Town could require some alternative facility such as a no discharge humus toilet or a low-flow toilet (see Chapter Two for discussion). Further, water conserving devices might be required for certain locations in order to reduce wastewater flows to the ground.

-Installation

For new construction, a strict installation policy could be followed in order to avoid problems that might arise due to improper location or installation. The State Environmental Code requires percolation tests and deep hole tests for each lot. The Town might supplement State requirements by:

--establishing more stringent criteria for percolation rates or groundwater elevations; or

--calling for a soil analysis in order to locate historical high water marks, which might be different from the observed water table.

The above steps would be useful particularly in certain areas of Town where potential problems are more likely. The western section of Plainville, for example, is suspect because of hardpan and ledge conditionswhile the Route 1 and Route 152 area is sensitive because of the Bungay aquifer. By observing a stringent installation policy, problems could be avoided before they developed. Either the location, type or system or amount of waste discharged could be altered according to particular site features. This might be accomplished by requiring:

--no discharge toilets (see Chapter Two);

--low-flow toilets (see Chapter Two); and

--water conserving devices to reduce grey water flow (see Chapter Two).

--Environmental Assessment

The option as outlined above builds in some flexibility, thus allowing for an assessment of localized conditions and problems. If closely followed, the measures in option 3 would help to identify existing problems, prevent problems from prematurely developing and tailor disposal methods to areas which appear to be of marginal suitability.

--Policy Review

The success of this option depends primarily on how vigorously Plainville and more specifically the Board of Health pursues the necessary details of such a program and how steadfast it is in following through on the information that is gathered. Public sentiment could have a deflating effect on such a program if a uniform feeling develops that the requirements create too much of an imposition.

One noteworthy element is that the costs involved would for the most part fall on the individual homeowner. It would in effect amount to a payment for the right to discharge wastewater and it would be geared somewhat to the sensitivity of the land with respect to water quality.

--Cost

The cost of an inspection and maintenance program would amount to approximately $60 per pumping. It is recommended that pumping take place once every three years. The total cost for the no discharge set up would also have to include the price of a grey water system. (See Chapter Three for a discussion of the above elements.)

System	Installation Cost	Annual Operation & Maintenance Cost
Compost Toilet	$600-$2500	$0-75
Incinerator Toilet	$600	$400
Grey Water System	$800-$1200	$5

4. Ten Mile Sedimentation Control

As mentioned, it has been reported that erosion from dump sites has created sedimentation problems in the Ten Mile. A precise corrective measure cannot be offered here as an alternative without detailed knowledge of the site's characteristics. However, there a number of procedures that can be useful both on a temporary and permanent basis. Some temporary measures include fairly simple techniques such as straw bales placed in drainage ways or grassed channels. Permanent solutions are generally more structurally intensive, and the appropriate scale will depend on the size of the problem. Possibilities include dams, sedimentation ponds, and diversions. In some cases, proper land grading could also serve as an adequate long-term solution.

--Environmental Assessment

If severe enough, sedimentation can create major problems with the flow regime and ultimately the ecological structure of a stream. A properly designed erosion and sedimentation control program could provide an adequate solution to the sedimentation problems on the portion of the Ten Mile which flows through Plainville. However, unlike other pollution constituents which remain suspended, eroded material which has settled out will be removed only after a much longer period of time if at all. In addition, if the deposited material is scoured out by the force of the stream flow, chances are that it will only be deposited again somewhere further downstream. Overall, then, efforts made to control erosion will be more helpful in preventing future problems and probably less useful in solving existing in-stream difficulties. (See discussion of erosion and sedimentation in Chapter Two.)

--Policy Review

This is a difficult question to assess. The Town has an earth removal by-law, and conceivably it could use this measure to require a program of erosion control. It is unclear, however, how aware Plainville is of the problem, and whether the Town views some type of control mechanism as necessary.

--Cost

Cost for check dams, sedimentation ponds and diversions would depend on the scale of the project. Cost for the establishment of grassed channels might vary as follows:

Sod - $\$1/\text{yard}^2$
Seeding (without topsoil) - $\$.08/\text{yard}^2$
Seed, Fertilizer - $\$.50/\text{yard}^2$
and jute mesh

5. Turnpike Lake Eutrophication

A portion of the Turnpike Lake eutrophication problem may be attributed to runoff from an adjacent shopping center parking lot. Although it comprises only part of the problem, some action could be taken to divert parking lot runoff away from the lake. There are several means of accomplishing this goal, and all involve infiltrating the runoff to the ground.

Runoff Spreader

Instead of piping the runoff to the lake, runoff could be dispersed at non-erosive velocities over undisturbed areas for infiltration to the ground. Primary requirements are sufficient amounts of land and permeable soil.

Recharge Basin

Recharge basins are simply pits designed to receive runoff from a storm and retain it for infiltration to the ground water. Most also have sediment traps to prevent sediment in the runoff from reducing the capacity of the basin.

Seepage Pits or Dry Wells

These facilities are designed to accept and retain runoff for recharge to the ground. Pits are usually filled with gravel. A commercial parking area would need several pits or wells, and they would have to be designed to handle runoff from a large storm (a one- in ten-year storm).

--Environmental Assessment

The measures outlined above would reduce or eliminate (depending on the design) the amount of runoff pollution entering Turnpike Lake. The effectiveness in reducing the eutrophication process, however, is difficult to determine since it is not known what other sources are contributing to the problem. The natural contribution of nutrients from the lake's drainage basin and the contribution of leachate from the old landfill located to the northwest of Turnpike Lake may very well be more significant than runoff from the shopping center.

--Policy Review

Since the shopping area has been in existence for several years, it would indeed be a difficult job to persuade the owners to voluntarily install the facilities suggested under this alternative.

--Cost

Costs would depend on the type of facility selected, the number installed and the design. Unit costs are not available to provide an approximate idea of total cost involved.

6. Cowell Street Landfill

Although the landfill has been abandoned, poor surface drainage has apparently created a situation where rainfall collects over the site and either runs off to the surface water or passes down through the site and leaches vertically or horizontally to the groundwater. A monitoring system established around the landfill could determine the impact of landfill leachate on water quality.

If the monitoring results indicate a pollution problem, the landfill could be capped with an impervious cover and graded and then vegetated. According to Massachusetts regulations for sanitary landfills, the cover should be at least two feet thick and sloped at a grade of at least 2 percent. This measure would allow rainfall to drain from the site without collecting contaminants from the material buried in the landfill. (See Chapter Three for a broader discussion of landfill operations.)

--Environmental Assessment

Capping the landfill will prevent additional surface flow and leachate from reaching Hawthorne Brook and ultimately Turnpike Lake. It is difficult to assess the extent of improvement in the lake since other sources also contribute to the problems of Turnpike Lake.

--Policy Review

State regulations for the disposal of sanitary waste and operation of landfills require that a landfill be capped and graded upon termination of the site. Theoretically, at least, the State could enforce the regulations in this instance.

--Cost

Cost of the cover material would amount to approximately \$5/cubic yard in place. This figure might vary depending on the distance the material is hauled. Other costs would include spreading and compacting the material as well as establishing a vegetative cover.

SUMMARY

Plainville's situation is such that several options, both structural and non-structural are possible. High density development in the Town center coupled with rising nitrate levels in well water suggests that sewers may be warranted. Important aquifer zones and large area of undeveloped land indicate that land use protective measures and alternative disposal methods are necessary to preserve the quality of the Ten Mile and Bungay aquifers.

Plans for sewering downtown Plainville are in progress, and the total cost will be in the area of \$3.5 million. If sewers are expanded beyond the core downtown area, additional protection would be afforded aquifer resources, but the cost would be extremely high (approximately 40 percent greater). The Town can adequately protect its water resources without the extensive sewering outlined in 1b. However, the alternative protective measures outlined in 2 and 3 must be along with 1a.

Other problems in Plainville, including sedimentation of the Ten Mile River, landfill leachate and lake eutrophication are more site specific, and individualized methods will have to be adopted to address these problems. Costs for sedimentation control and runoff control to Turnpike Lake will vary according to the structural intensity of the solution. For example, control of sedimentation by use of grassed channels will be considerably less than a sedimentation basin. Cost for capping the landfill will involve primarily the cost of the cover material which is estimated at about \$5 per cubic yard. Costs for the control of parking lot runoff vary according to the site and the design selected. No figures are available for the options cited in the text.

The Town should undertake a monitoring program at the landfill site to determine to what extent leachate is a problem. If the results show that landfill leachate has a water quality impact, it should then be capped.

Sedimentation control should also be adopted on the Ten Mile River, but a detailed site evaluation must be accomplished to select the proper control technique. The same procedure is recommended for the runoff condition to Turnpike Lake.

TABLE 3

ENVIRONMENTAL ASSESSMENT

	OPTIONS							
	1a	1b	2a	2b	3	4	5	6
SURFACE WATER QUALITY IMPROVEMENT	+2	+2	+1		+1	+2	+1	+1
GROUNDWATER QUALITY IMPROVEMENT	+2	+2	+2	+1	+2			+1
EXTENT CONSTRUCTION DISRUPTION	-2	-3				-1	-1	
ENERGY DEMANDS	-1	-3			-1			
CHEMICAL DEMAND	-1	-2			-1			
LAND AREA REQUIRED			-1	-1		-1	-1	
DRINKING WATER PURITY	+2	+2	+2	+1	+2			+1
ENDANGERED SPECIES								
COMMERCIAL FISHERIES								
AIR QUALITY	-1	-2						
NOISE POLLUTION	-1	-2						
SOIL EROSION				+1		+3		
FRAGILE AREAS		+1	+2			+1	+1	
PUBLIC HEALTH	+2	+2	+1		+1			+1
USE OF RECREATIONAL AREAS		+1					+1	+1

+ = Beneficial Impact
- = Adverse Impact
Blank = No Discernible Change/Not Applicable

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

	1a	1b	2a	2b	3	4	5	6
GROWTH IN RESIDENTIAL LAND USE		+2	-1	-1				
GROWTH IN COMMERCIAL LAND USE		+1	-1					
GROWTH IN INDUSTRIAL LAND USE	+1	+1	-1					
INCREASED RUNOFF FROM DEVELOPMENT		+1	-1					
DISLOCATION OF INDUSTRY OR FIRMS								

+ = Yes
- = No
Blank = No Change

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

LOCAL STRATEGIES - NORTH ATTLEBOROUGH

A. INTRODUCTION AND BASE DATA

The Town of North Attleborough is situated in the northwest section of the study area with the State of Rhode Island forming its westernmost boundary. Other bordering communities include Plainville to the north, Mansfield to the east, and Attleboro to the south.

Historically, the community has maintained the character of a moderately-sized industrial town. Much of this activity has been and continues to be centered around jewelry and silverware manufacturing. Up until a short time ago, most of North Attleborough's industrial activity could be found very close to the Town's center. However, recently new industrial growth has taken place in the eastern portion of the Town in proximity of I-95. Additions here have come from the metals industry, as well as warehousing.

Although a good protion of the manufacturing employment is provided by the jewelry industry, several other manufacturing concerns provide some diversity to the industrial base. These include: paperboard containers and boxes, plaster products, nonferrous rolling and drawing, metal services, miscellaneous machinery, and opthalmic goods.

Like most older communities, North Attleborough has a recognizable downtown center which contains industrial and commercial uses. Additionally, a commercial concentration exists in the Attleboro Falls portion of the Town. Recently, however, strip development has occurred along Route 1 and a shopping center was developed in the late 1960's at the I-95 interchange.

Residential pattern in North Attleborough is characterized by a fairly concentrated ring around the Central Business District and the Attleboro Falls area. Considerable development also is evident along Route 152. Much of the existing housing is high density since a good deal of the zoning calls for minimum lot sizes of 10,000 or 15,000 square feet. Significantly, about 40 percent of the housing stock is of the multi-family variety.

Over the last twenty years, North Attleborough has demonstrated a fairly rapid rate of growth. Since 1955, population increased by nearly 7,000 people, or slightly more than 50 percent. A diverse and stable economy composed of the jewelry and several other industries plus ample amounts of developable land are some of the factors which provided incentive for the Towns's population growth.

TABLE I

HISTORIC AND EXISTING DATA

a. population

1955	1960	1965	1970	1975	Historical % Change
13,069	14,777	15,682	18,623	19,120	46.3

b. land use

Acres	1951	1975	Historical % Change
Residential	1,532	2,509	63.8
Commercial	127	246	93.7
Industrial	62	186	200

Along with the population growth, land use changes have also been significant. Nearly 1,000 acres of residential development has taken place since 1951. Much of this growth has occurred to the east and southeast of the downtown area. Commercial and industrial land also increased rapidly during this period. Commercial acreage nearly doubled with additions being made along Route 1, the I-95 interchange, and also to some extent in Attleboro Falls and in the northern edge of Kelley Boulevard. Industrial gains were particularly impressive with exactly three times the amount of industrial land in use in 1975 compared to 1951. Much of this expansion has occurred around Kelley Boulevard in the north end of Town and also at the interchange fo I-95.

Projections for North Attleborough point to a less rapid increase in population over the next twenty years, compared to the growth which occurred between 1955 and 1975.

TABLE 2

1995 PROJECTIONS

a. population

1975	1980	1985	1990	1995	Historical % Change
19,120	21,400	22,350	23,050	23,700	24.0

Census Area	1970	1995	% Change
ED 415	2,281	3,851	68.8
ED 416	1,540	2,280	48.0
ED 417	1,085	1,382	27.4
Rmdr			
CT 6302	3,899	5,461	40
CT 6301	9,860	10,726	8.8
TOTAL	18,665	23,700	

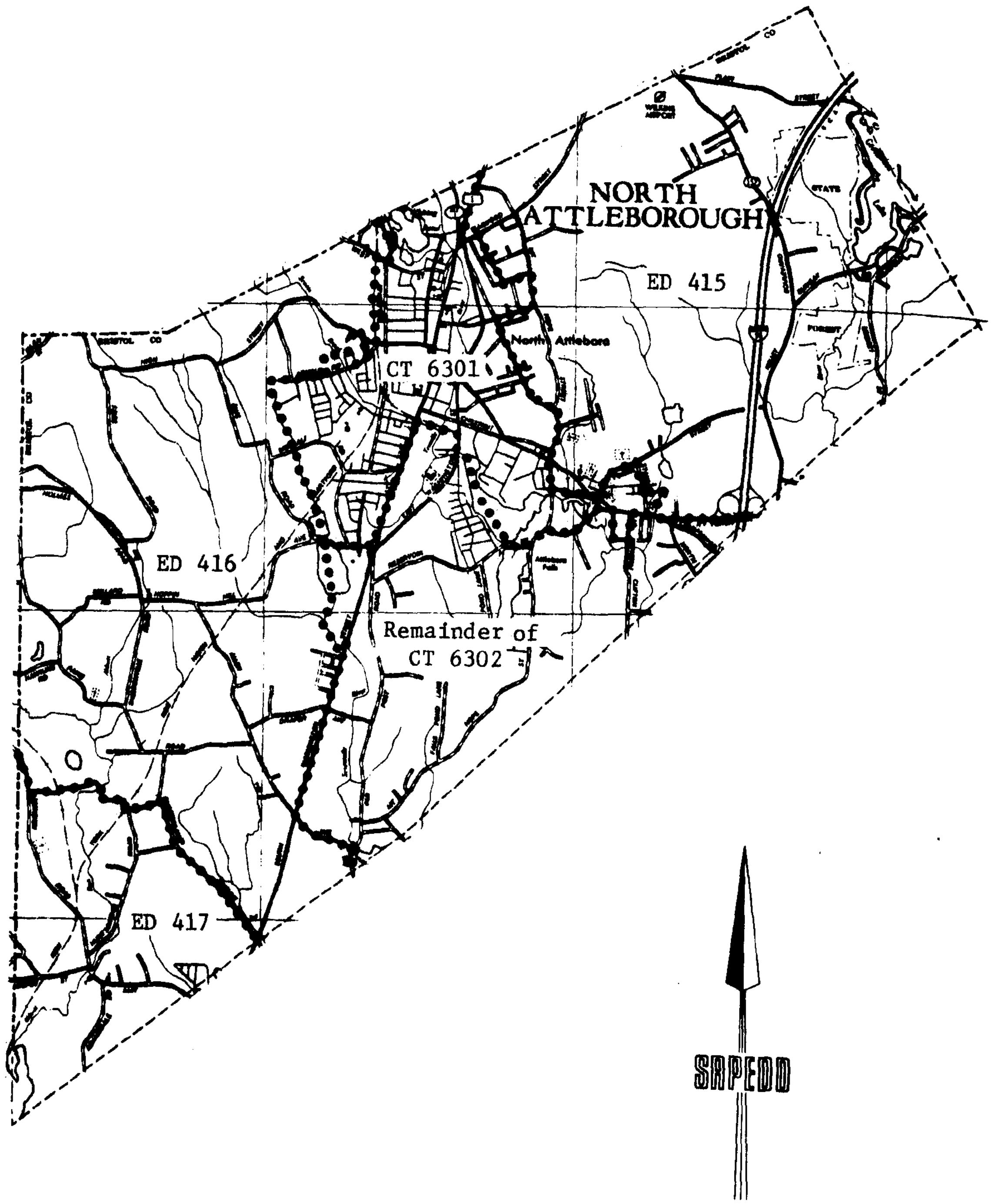
b. land use

Acres	1975	1995	% Change
Total Residential	2,509	3,060	22
Commercial	246	289	17.5
Industrial	186	220	18.3

Following a slowdown in population growth, expected land consumption for residential development is projected to be approximately half that which occurred between 1951 and 1975. The outlook is for slightly more than 500 acres of land to be shifted into residential usage over the next twenty years. Most of this should be on relatively small lots since zoning for much of the Town calls for a minimum lot size of 15,000 square feet. There is a 30,000 square foot requirement in the northwest quarter of town, but little growth is expected in this section. The bulk of the residential development is expected to take place primarily in the eastern portion of North Attleborough. (See Figure 1)

Commercial and industrial growth is viewed as undergoing a similar slowdown. In the commercial sector, the anticipation is for a moderate amount of growth around I-295 and Route 1 interchange and also north along Route 1 into the southern end of East Washington Street. This seems fairly plausible since most of the zoned commercial land exists in this area, and a high volume of potential shoppers regularly travel through this zone. Additional commercial growth has been projected nearby the I-95 interchange and also along Kelley Boulevard. However, such growth will take place only as more land is zoned for this purpose since existing areas are nearing capacity.

For industry, the overall projection looks to be one of continued moderate growth around the major highway route of I-95. This area is well suited for industrial development from the standpoint of transportation services since the I-295 and I-95 interchange provides a convenient transportation node. In addition, extensive amounts of land have already been zoned for industrial use in this area.



LEGEND

●●●●● CENSUS AREA BOUNDARIES

SCALE

½ 0 1 2 MILES

FIGURE 1

CENSUS AREA BOUNDARIES
TOWN OF
NORTH ATTLEBOROUGH

B. WATER QUALITY INFORMATION

The central portion of North Attleborough is situated in the Ten Mile River drainage basin. The eastern third of Town is in the Bungay River Basin while the western part of Town is drained by both the Seven Mile River and Abbott Run at the extreme edge of Town.

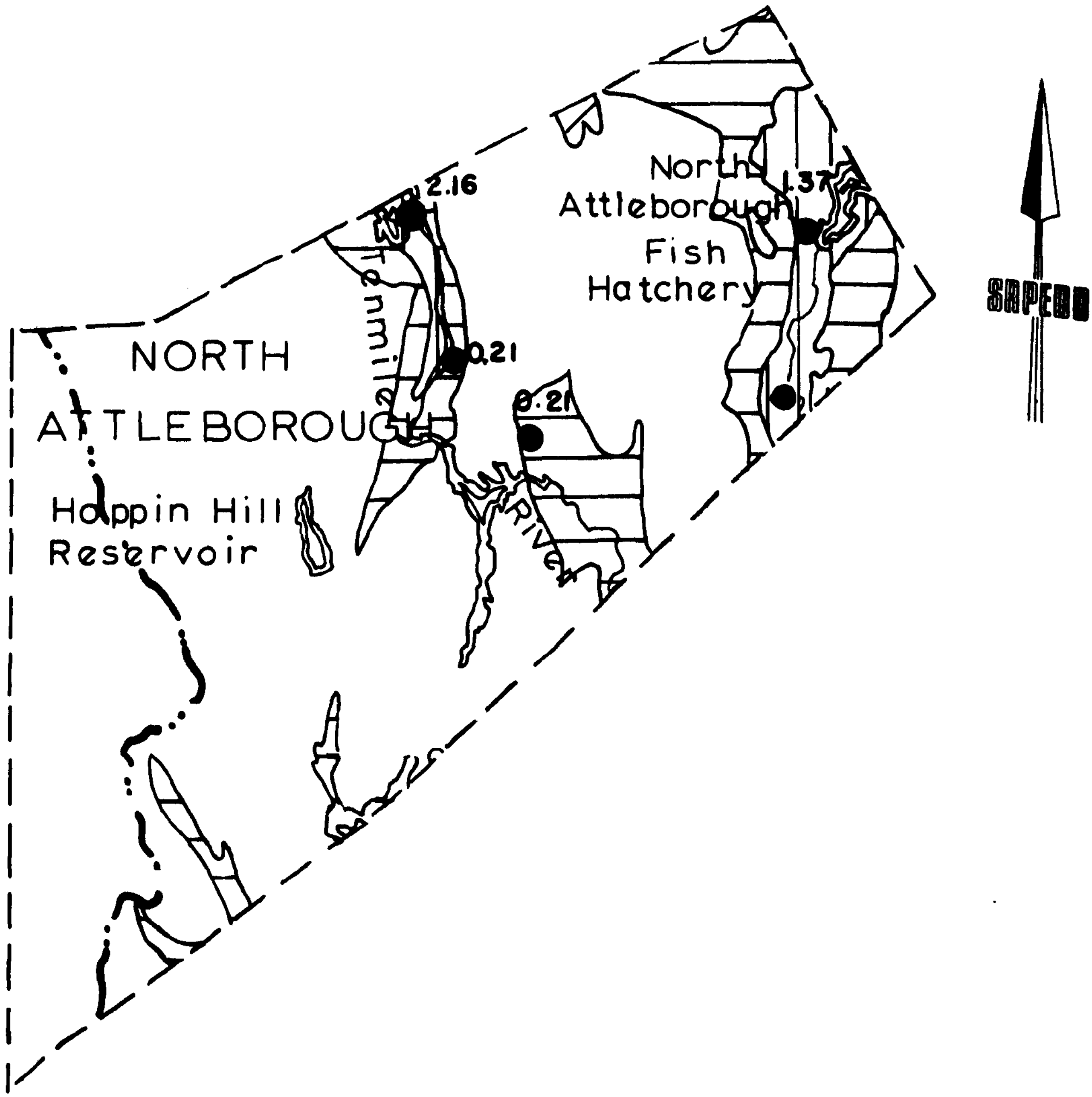
Portions of the Ten Mile, Seven Mile and Bungay River basins are composed of glacial deposits which form important aquifer systems. These aquifers are recharged in places by the streams which run across them. The North Attleborough aquifers are mapped by the U.S.G.S. on Hydrologic Atlas #300. (See Figure 2)

1. Water Supply

The Town of North Attleborough has four wells in Plainville in the Ten Mile River aquifer with a total normal pumpage of approximately 2.7 MGD. The Whiting Street well (1.0 MGD) in North Attleborough is also in the Ten Mile River aquifer. The withdrawal from the Ten Mile River aquifer by both towns averages 4.45 MGD while industries pull a minumum of 0.6 MGD for a total of 5.1 MGD. This is well above the 2.0 MGD minimum safe yield estimated by the U.S.G.S. in 1968. As a result, North Attleborough's wells have experienced pumping problems due to draw down. The deeper Plainville well has not as yet experienced problems.

The Kelly Boulevard well in the Bungay River aquifer is normally pumped at .72 MGD. An additional well (.72 MGD) is proposed in the same aquifer area to meet future needs. North Attleborough shares the Bungay aquifer with Mansfield (3.2 MGD), the North Attleborough National Fish Hatchery (1.5 MGD), and Attleboro (1.45 MGD). Total average withdrawal from the Bungay aquifer (#3 on U.S.G.S. Hydrologic Atlas HA-300) is 6.87 MGD which is above the 5.6 MGD minimum safe yield estimated by the U.S.G.S. in 1968. In the future, periods of less than average precipitation and the combined withdrawals from the Bungay aquifer will help to lower the levels of the river and Bungay Lake.

Both aquifers the city taps are developed near capacity. A well site has been bought in the Abbott Run basin and the city may get up to 1.0 MGD of additional future supply.



LEGEND

	YIELD POTENTIAL	RECHARGE POTENTIAL	CONTAMINATION POTENTIAL	RELATIVE RUN-OFF RATE	ACQUIFER COMPOSITION
(vertical lines)	HIGH ≥300 GPM	LOW-HIGH	HIGH	MODERATE-LOW	STRATIFIED GLACIAL DEPOSITS
** (horizontal lines)	MODERATE <200 GPM	HIGH-MODERATE	HIGH	LOW-MODERATE	
(blank)	LOW <25 GPM	LOW	LOW*	HIGH	BED ROCK & OR TILL

* HIGH WHERE BEDROCK IS AT LAND SURFACE

●0.5 MUNICIPAL-AND INDUSTRIAL SUPPLY WELL. NUMBER IS YIELD, MILLION GALLONS PER DAY

STUDY-AREA AND DRAINAGE BOUNDARY

** HORIZONTAL LINE ORIENTATION: PARALLEL WITH TOWN NAME

SCALE

½ 0 1 2 MILES

FIGURE 2

GROUNDWATER RESOURCES

TOWN OF

NORTH ATTLEBOROUGH

North Attleborough, along with Plainville and Attleboro have tapped the known supplies of water, and new supplies (other than interbasin transfers) will be difficult to locate. These communities could find that reducing per capita water consumption (25 percent with 2.5 gallon toilets, and low flow fixtures) could be the cheapest and most efficient way to sustain an adequate supply. Further information or the possibilities for water conservation can be found in Chapter Two.

2. Groundwater Quality

The North Attleborough Water Department does not use treatment other than caustic soda to adjust the pH of the acidic groundwater.

The sodium concentration in the finished water is above the recommended 20 ppm. The two primary sources of sodium are highway salting, which subsequently leaches to the groundwater, and water treatment chemicals. The State is presently reducing its salt application rates and the town may want to consider doing the same. Calcium oxide and other base chemicals could be used in place of caustic soda to achieve the desired pH adjustment without the undesirable increase in sodium.

The Ten Mile River aquifer in Plainville and North Attleborough shows slightly elevated nitrate levels (1.8-2.5 ppm) which reflect the density of unsewered development in the drainage basin. Any substantial future development in the Plainville or North Attleborough portions of the Ten Mile River basin (above the outlet of Whiting pond) should consider the no discharge or sewer options (See Section D) to insure the quality of the Ten Mile River aquifer.

Elevated nitrate levels (3.3 ppm) have been reported from Kings Grant Estate Company's well which is located in the Abbott Run drainage basin above the proposed North Attleborough well site. The sources of this nitrate may require identification and control to insure the quality of the groundwater.

3. Stream Conditions

In addition to the Ten Mile River, the Ten Mile Basin in North Attleborough also includes the Seven Mile River and the Bungay River. The Seven Mile River has been assigned a classification goal of A, and because of the absence of point sources it is also an anti-degradation segment. However, sampling results show that the stream falls far short of its A classification goal. High values for coliform bacteria, BOD, solids and nutrients prohibit the stream from meeting its designated classification. Agricultural runoff is probably the prime source of these pollutants while leachate from septic systems may also be contributing to the problem.

The Bungay River has a B classification for future use although under existing pollution loads the stream only meets the criteria of a C river. Problems which have been found include high total coliform levels, very low dissolved oxygen concentrations, higher than normal solids as well as elevated color readings. There are two primary reasons for this condition. First, the Bungay is a sluggish stream which moves through some swamp land areas. Passage through the swamp acts to deplete dissolved oxygen levels due to the demand extended by decaying vegetation and possibly because of the diurnal variation of algal photosynthesis activity. Secondly, the operation of the National Fish Hatchery on the Bungay provides a significant discharge to the stream. This discharge contributes significantly to the pollution problems mentioned above.

The portion of the Ten Mile River which passes through North Attleborough has been assigned a B classification as a water quality goal. However, a complex set of circumstances including urban runoff, impoundments on the river and discharges from numerous industries combine to leave the river in poor condition. Because of the complexity of the situation, even if the best practicable treatment is applied to the point sources the stretch of the Ten Mile in North Attleborough will not be able to meet a B condition. As a result, this stretch has been declared a water quality limited segment and additional measures such as treatment of storm runoff will be necessary before the river meets the B goal assigned by the State. It is important to stress here that the use of conventional treatment methods alone will not enable the Ten Mile as it passes through the City to achieve the 1972 Water Pollution Control Act goal of fishable and swimmable by 1983.

More specifically, some of the problems which exist in the North Attleborough portion of the Ten Mile are as follows. As the river exits from Whiting Pond, high coliform levels have been noted. Likely sources of this pollution include urban runoff and sewage discharged along with industrial waste. Further downstream, between Whiting Pond and Falls Pond, a number of other parameters complicate the pollution situation. In addition to high coliform levels, nutrient and heavy metals are also a problem. Industrial discharges from metal plating activities have combined to create unacceptable concentrations of phosphorous as well as copper and nickle in the stream. Very high concentrations of these two metals as well as cadmuim, chromium, zinc, mercury, and arsenic have also been discovered in the bottom sediment.

As the river enters Falls Pond, algal activity increases considerably and heavy metal concentrations in the sediment remain high. The long time practice of industrial discharge to the river is the primary source for these pollution problems. From Falls Pond south to the city line, the river is subject to additional industrial discharges plus occasional overflows from the sewage pumping station at Freeman Street. These sources result in elevated concentrations of BOD, coliform, ammonia nitrogen and nitrate nitrogen.

4. Sewage Treatment Plant

The North Attleborough sewage treatment plant is located near Clifton Street, about 2 miles west of Route 95, along the east shore of the Ten Mile River. The present secondary sewage treatment plant consists of a distribution chamber, a primary clarifier, a trickling filter, a secondary clarifier and a chlorination system. Sewage flows from the distribution chamber to the primary clarifier. The primary effluent goes to the trickling filter and then to the secondary clarifier and the chlorine chamber prior to discharge to the Ten Mile River. The North Attleborough sewage is a mixture of domestic and industrial waste, and runoff. Presently, 8,000 residents are served by the sewer system which represents 50% of the total population. The area served is about 2.3 square miles. The existing structure does not comply with the standard requirements of a secondary plant. Capacity related to hydraulic and organic loading is often exceeded.

Designed to handle 1.4 MGD, the plant is presently running at 2.4 MGD. In addition, the non-controlled mixing of septage with the primary effluent increases the organic load of the sewage and sometimes causes inefficiency of the trickling filter operation. Since the plant lacks flexibility, adjustment of the detention time in the primary and secondary clarifier becomes dependent on the hydraulic load.

North Attleborough is well aware of the inadequacy of its treatment plant, and for many years they have been attempting to get a new one built. Currently the Town is in the design phase for building a new plant.

C. LOCAL WATER QUALITY ISSUES

1. Areas With Wastewater Disposal Problems (See Figure 3)

a. King's Grant Estate

This is a relatively new and fairly extensive subdivision which has experienced significant septic system problems. Apparently the problem stems from the soil conditions which consist of sand and gravel plus layers of clay which prevent adequate percolation.

b. Autumn Road

The problem in this area is poor surface drainage which has caused the flooding of septic systems and their subsequent failure.

c. Ellis Road

There is not much development along this road, but what exists is plagued by poor soil conditions.

d. Bayberry Road

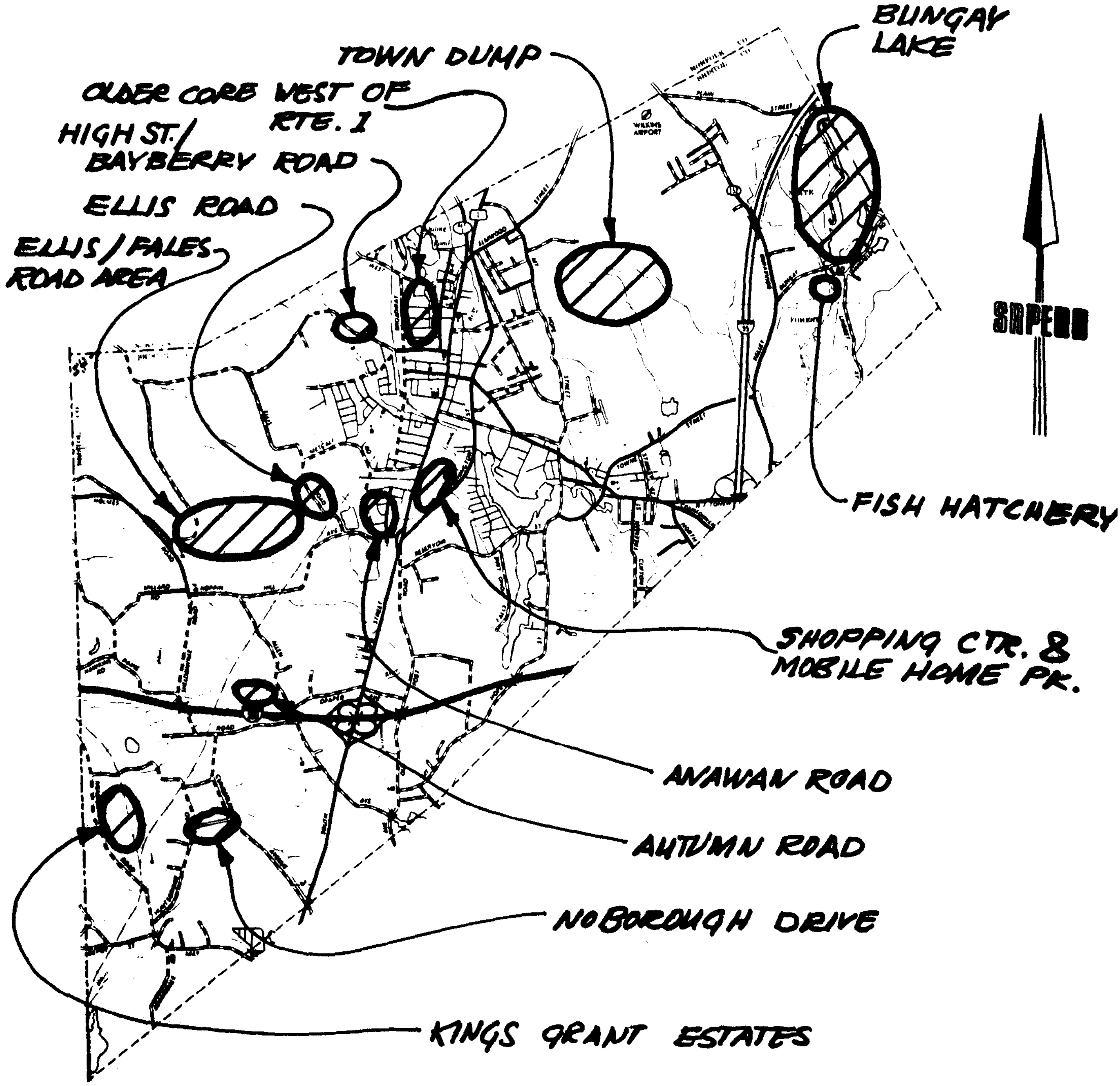
Poor soils and inadequate surface drainage during the spring have created on-site problems for dwelling along this road.

e. West of Route 1 - Older Core Area

Many lots in this older section of Town remain unsewered and cesspools are the most common means of sewage disposal. Many failures have occured in this section, and the failed units have subsequently tied into the sewer system.

f. Shopping Center and Mobile Home Park off Route 1

A storm drain from Route 1 cuts between the shopping center and the mobile home park and then into the Ten Mile River. Storm runoff from the parking area is a pollution problem, but more importantly, raw sewage from the mobile home park has resulted in storm drain flows with very high coliform counts.



SCALE

½ 0 1 2 MILES

FIGURE 3

LOCAL WATER QUALITY ISSUES

TOWN OF

NORTH ATTLEBOROUGH

g. Anawan Road

In this area septic tank failures have occurred in the past.

h. Noborough Drive

Poor surface drainage and some septic tank failures have been noted in this area.

i. Bungay Lake

There is a significant amount of seasonal and year round homes on this lake. Some signs of eutrophication have been noted during the summer months.

2. Constraints on Future Development

Soil limitations for the on-site disposal of sewage are present throughout large portions of the Town. The soil survey undertaken by the Soil Conservation Service indicates that approximately 65% of the land is plagued by development related problems of moderate to severe intensity. Reference to soil maps shows that only the eastern and western most edges of Town as well as stretches in the central section from the southern part of Attleboro Falls and then north along either side of Smith Street are relatively free of soil constraints.

As mentioned earlier, there are a number of important aquifers in the North Attleboro area which the Town currently taps for its water supply needs. The largest one essentially encompasses all the territory to the east of I-95 and Route 152 and extends into Attleboro and Mansfield. Another important aquifer exists along the Ten Mile River roughly through the center of downtown North Attleborough.

Other aquifers in the Town are located along Cumberland Avenue and also along the Ten Mile in the Attleboro Falls section. Although these are smaller groundwater systems, they do tie into much larger systems in Attleboro. It should be noted that North Attleborough's treatment plant sits directly above the aquifer in Attleboro Falls. This represents a potential if not an existing water quality problem.

According to the U.S. Geological Survey maps, there are very few areas of concentrated wetlands in the Town. What wetlands exist are small and are widely scattered.

3. Known Non-Point Sources Problems (Figure 3)

a. Ellis Road and Fales Road

The section between Fales Road and Ellis Road as outlined on the map is an area of poor soils, and is a portion of Town that should remain undeveloped. At the present time, Cumberland Farms and other smaller farms in this particular drainage area of the Seven Mile watershed constitute a source of pollution. The threat from these farms has been lessened to some extent, since manure is now collected and shipped to Rhode Island.

b. Town dump

The Town dump, which has been in use for some 40 years, occupies an extensive area to the east of Mount Hope Street. Underlying the site is a considerable amount of ledge and bedrock and, as a result, leachate from the site flows into Rattlesnake Brook and eventually reaches the Ten Mile River.

c. Storm Drains

Although not specifically identifiable because of their large number, storm drains, which are most prominent from Reservoir Street north, are a known source of pollution. Although significant, it is difficult to determine the importance of this source compared to industrial point sources along the river.

d. Industrial Discharges

Several fishkills along the Ten Mile River have been observed over recent years. It is suggested that concentrated industrial discharges have been the cause of these fishkills.

e. National Fish Hatchery

The process of raising fish results in a large input of organic matter into the Bungay River. This input negatively effects the dissolved oxygen content of the river downstream from the hatchery.

D. ALTERNATIVE SOLUTIONS

In offering alternatives for North Attleborough, several features must first be observed. For one, the Town is currently in the Step II design phase for a new 4.61 MGD treatment plant. The plant would include capacity to handle wastewater from Plainville. Secondly, most of the older, high density areas are already sewered and there are no immediate plans to extend sewer service to other parts of the Town. An exception would be the interceptor from Plainville to the new treatment plant and the hookup of numerous households which have been prohibited from doing so during the sewer moratorium. Thirdly, because North Attleborough has grown in a rather tightly knit spatial pattern much land remains undeveloped today. This is true particularly in the Seven Mile River Basin and in the Bungay River Basin as well. Because of the relatively undeveloped condition of the basins and also the presence of an important aquifer in the Bungay Basin, future land use decisions will play an important part in determining how well surface and groundwater conditions will be preserved.

In sum, the above suggests that land use controls as well as individual on-lot treatment systems could play important roles in preserving the Town's water quality. While sewer additions may be made, a very large portion of the Town will still remain unsewered. Within this framework the following options are put forward.

1. Sewage Treatment Plant

As mentioned, North Attleborough is well along in the process of expanding and improving its treatment plant. One of the features which the Division of Water Pollution Control has required in the design of the new plant is a component that would provide for nitrification and the removal of phosphorous. Even with the resultant high quality effluent from the new advanced treatment plant, it is uncertain whether the water quality below the plant will improve sufficiently to meet the Federal goal of fishable and swimmable waters (Class B).

SRPEDD modelled the Ten Mile River for biochemical oxygen demand (BOD) and dissolved oxygen (DO), and the results of this effort are at the beginning of the Ten Mile River Basin section of Chapter Four. In summary, the model showed that during periods of critical summer low flow conditions the dissolved oxygen content in significant portions of the river would fall short of class B water quality criteria.

One of the primary justifications for WPC's decision to have North Attleborough upgrade its treatment plant to an advanced system is the eutrophication along the Ten Mile. Advanced treatment will eliminate a significant amount of the nitrogen and phosphorous from the treatment plant effluent. Since nitrogen and phosphorous are the key ingredients in the production of algae, removal of these elements at the North Attleborough plant will improve the condition of the downstream ponds. However, to what extent advanced treatment will eliminate the algae problem is uncertain. For one, the capability of the model to reliably demonstrate the instream effects of a reduction in the treatment plant nutrient load is questionable. First, the model loses accuracy in ponds or large impoundments since it was not designed to handle these water bodies. Second, since the model was designed to simulate DO and BOD, attempts to model nutrients must be viewed with caution. Further, treatment plant effluent is not the only source of nutrients. Urban runoff and industrial discharges also contribute significant amounts to the Ten Mile. Finally, by reducing the amount of nitrogen and phosphorous in the treatment plant waste load, most of the beneficial effect will occur in Central Pond and Turner Reservoir. It is not clear what will happen in Dodgeville or Hebronville Pond. The remaining nutrient load from the treatment plus contributions from industries and runoff may be enough to allow the eutrophication process to continue in these ponds.

Whiting Pond and Falls Pond will remain unchanged since they are above the treatment plant.

Given the situation outlined above where the benefits of going to advanced treatment are somewhat in doubt, North Attleborough could proceed in the manner outlined below.

1a. Operate the advanced portion of the treatment on a seasonal basis only. That is, phosphorous removal and nitrification would be carried on for the months during which algae growth normally takes place and shut down during the cold weather months. A reasonable operation period might be mid-April to mid-October.

--<u>Environmental Assessment</u>

Operation of the advanced system during warm weather months would eliminate a significant portion of the nutrient load entering the Ten Mile below the treatment plant. Depending on the amount entering the river from other sources, algae growth should diminish in the ponds located downstream. During cold weather, algae production is cut down tremendously or ceases altogether. Stream conditions should not be adversely effected during winter months if advanced treatment is eliminated during this period

--Policy Review

The Division of Water Pollution Control has the final say over the performance level a plant must maintain. The Division has been rather reluctant to allow plants to go to seasonal treatment although several have requested permission to do so. Marlborough, Brockton, and the Old Colony Water Pollution Control District have all sought to gain a seasonal permit for the operation of their advanced component. All have been denied for one reason or another. Fitchburg, on the other hand, does have a permit to operate on a seasonal basis. They operate the treatment plant as an advanced system from May 1 to October 31 and as a secondary plant from November 1 to April 30.

--Costs

Advanced treatment plants are enormously expensive to operated and maintain. They are much more expensive to operate than a plant designed solely for secondary treatment. For example, the cost curves presented in Figure I of Chapter Two show that the annual operation and maintenance cost for a 5.5 MGD advanced treatment plant would be about $900,000 to $1,000,000. A plant with the same capacity, but designed for secondary treatment only would cost somewhere between $300,000 and $400,000 per year for operation and maintenance.

If North Attleborough operated the advanced portion of its plant on a seasonal basis, a considerable savings could be realized although not as large as if the plant was designed only for secondary treatment. As an example, to operate and maintain Fitchburg's 5.5 MGD plant as an advanced system for the full year cost the City $900,000. When they went to a seasonal operation the operation and maintenance cost was reduced to $700,000.

Whitman and Howard has estimated that the annual operation and maintenance for the new plant will run approximately $233,000. Based on the experience of similar plants currently in operation in the area, operation and maintenance may be closer to $700,000 or $800,000 when it becomes operational. If the Town goes to a seasonal use of its advanced component, a 10 to 20 percent savings in could be expected.

1b. Urban Runoff

As mentioned,urban runoff presents a sizeable but undetermined waste load to the Ten Mile. North Attleborough has a completely separated sewer system, and stormwater is discharged at numerous locations without any treatment. While there are several ways to control urban runoff (see Chapter Three - Urban Runoff and Chapter Two-Section C.3) many are structurally intense and costly. The Town might be able to take advantage of its existing sanitary sewer capacity and provide some treatment to the early portions of a storm which usually contain the most important part of the pollution load.

To start, the Town could test the quality of runoff discharged at the storm sewer outfalls to determine which land areas were contributing the most significant pollution loads. Based on the results, an in-line storage or off-line storage program could be developed. In essence, stormwater from selected areas would be pumped to the sanitary sewer. This transfer would continue up to the capacity of the sewer system at which time runoff would again be allowed to discharge to the Ten Mile. Additional storage might be added by creating an off-line storage pond or lagoon.

Both methods would allow for treatment at the plant. With off-line storage, the collected runoff would be pumped back to the treatment plant during periods when capacity was available.

--Environmental Assessment

Collecting runoff in the above manner would eliminate the direct discharge of urban runoff from those areas of North Attleborough which create the most impact. Also, the early or first flash portion of the storm, which contains the greatest pollution concentration, would receive treatment. If the storm is large, however, later portions of the storm flow would have to be by-passed without treatment.

--Policy Review

EPA has issued rules and regulations for the application of the National Pollution Discharge Elimination System permit program to storm sewers. EPA intends to enforce this section of the permit system as runoff abatement technologies become available.

1c. Industrial Wastes

Another component of the treatment plant question is the make-up and quantity of industrial wastes which are sent to the plant. A detailed industrial survey has not been completed for the Town of North Attleborough and hence it is difficult to accurately assess the potential industrial contribution requiring pretreatment. Based upon the Massachusetts Directory and the local Chamber of Commerce, there are a number of large companies on NPDES permits who split their discharges to the river and the Town system. Accordingly, it will be prudent to generate some of this industrial data as work progresses on the design of a tertiary treatment plant.

There may be opportunities identified at that time which can contribute to lowered costs for these industries through joint pretreatment or water reuse projects. The possibility that some of these toxic wastes are going to landfills should also be studied. In addition, based on the results of an industrial survey, the Town should then move toward revising its sewer ordinance in order to regulate the industrial wastes sent to the new treatment plant. SRPEDD has worked on such ordinances and would be available for technical assistance (See Chapter Three for a model ordinance). It is recommended that the process be undertaken with the full cooperation of the industries affected.

--Environmental Assessment

Water reuse will help reduce the demand on the Ten Mile aquifer which is highly developed at this time. Joint pretreatment involves economies of scale which not only saves money, but also reduces the use of raw resources such as power and the material used in the construction of additional treatment units.

Since certain industrial waste products can be harmful to the proper operation of the treatment plant, a sewer ordinance which regulated industrial inputs will help keep the plant operating effectively. This should reduce the episodes of treatment plant malfunction and thereby avoid additional impact on the quality of the river.

--Policy Review

Industrial permits are set and monitored by the Permit Section of the Division of Water Pollution Control. They have jurisdiction over wastes discharged directly to the river, but not over that portion of the waste stream sent to the treatment plant. EPA is in the process of setting new industrial pretreatment standards and revising existing ones. However, this system is not entirely in place at this time. During the process of revising its sewer ordinance, North Attleborough will have to remain alert for new developments in the permit program in order to incorporate them where necessary. Finally, once developed the sewer ordinance will have to gain final approval from the Division of Water Pollution Control.

2. Sewering Options

Although the sewage treatment plant is North Attleborough's main concern, some small increments to the sewer system might be warranted over the next 20 years. (See Figure 4)

Possible areas include:

2a. Sections to the south of the town center, particularly along Route 1 between I-295 and the Washington Street and Route 1 intersection, Anawan Road, Reservoir Street, and also Mount Hope Street in the Falls Pond area.

2b. An area to the West of North Attleborough center particularly around Whiting Pond and West Street, Additional areas would include High Street and Ellis Road where problems have arisen in the past.

--Environmental Assessment

Option 2a addresses several problem areas. Both Anawan Road and the mobile home park which have been identified as problem areas could be tied in. Also, the lower part of the Falls Pond area would be included. While septic tank problems have been at a minimum in the Falls Pond area, sewering would add a measure of protection to the pond. Secondary growth effects would be very minor since a majority of the land along the proposed sewer route is developed.

Under 2b, any threat to Whiting Pond from septic tank leachate would be removed. Further, problem spots along High Street and Bayberry Road as well as Ellis Road would be taken care of. There might be secondary growth implications to sewering these areas, however, since there is much undeveloped land along these roads.

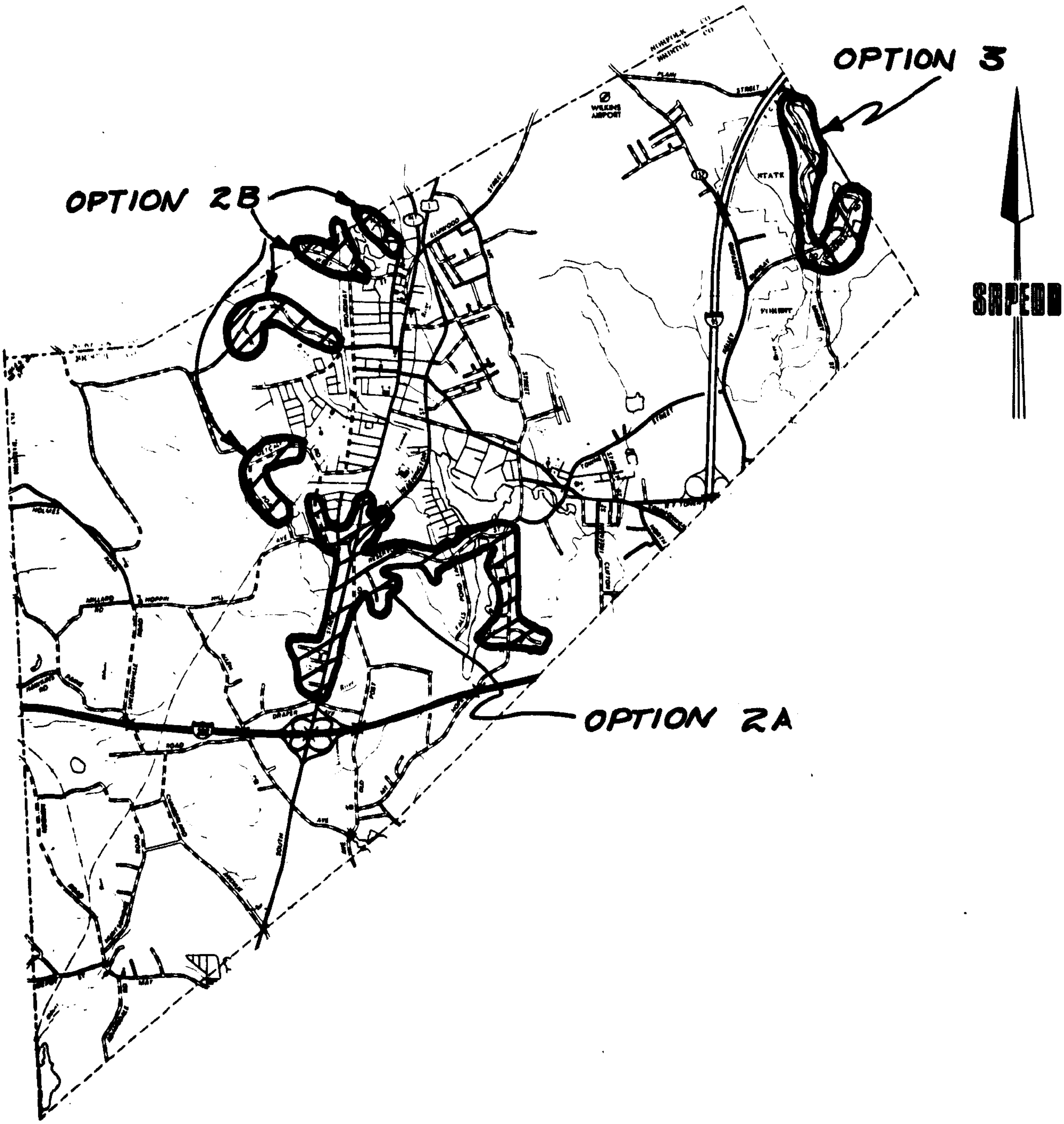


FIGURE 4

SEWERING OPTIONS

TOWN OF

NORTH ATTLEBOROUGH

SCALE

½ 0 1 2 MILES

--Policy Review

It is EPA policy not to fund laterals or collectors in any area that was less than two-thirds developed at a date prior to October 12, 1972. In addition, EPA will not fund laterals until a detailed cost-effectiveness analysis demonstrates that sewers will provide a better solution than the continued use of septic tanks.

--Costs

a.		
	Laterals and Collectors	$1,200,000
	Pump Station and Force Main	520,000
	Total Cost	$1,620,000
	House Connection	$600/unit
b.	Laterals and Collectors	$ 410,000
	Pump Station and Force Main	150,000
		$ 560,000
	House Connection	$600/unit

3. Sewer Bungay Lake

Bungay Lake has shown an increase in algae as well as weed growth over recent years. In this area, several sewer options are possible. (See also option 5 for a discussion of a non-sewer alternative.)

3a. In one case, an interceptor could be built which would extend from the lake down Kelley Boulevard to connect with the Attleboro system on North Main Street. This option will depend on Attleboro expanding its system up North Main Street.

3b. A second solution would be to extend an interceptor from Bungay Lake to the Mansfield sewer system at West Street.

3c. As a third possiblity, the lake area could be sewered with the collected waste treated at a package plant. The plant effluent would be inflitrated to the ground.

--Environmental Analysis

Under all three sub-options septic tank leachate will be elimanated, and therefore, the quality of the lake should improve. However, sewering the Bungay Lake area also has some potentially important environmental consequences associated with it.

If an interceptor is sent to either Attleboro or Mansfield, significant growth related impacts are a potential long range threat. The route down Kelley Boulevard to Attleboro sits above the Bungay aquifer. Growth related problems might include: reduced recharge because of an increase in impervious surface; well field contamination from storage facilities such as gas stations; decline in air quality due to increased automobile traffic. This sub-option is also very energy intensive since four pump stations would be needed. The interceptor route to Mansfield is also through undeveloped land and essentially the same impacts would be possible on this route. A package plant on the other hand, will avoid the threat of any growth induced enviromental impacts. However, it will concentrate all the sewage that is now dispersed around the lake and infiltrate a secondary effluent to the groundwater at one location. Additional renovation should occur through the infiltration process, so the impact on groundwater quality should be minimal.

--Policy Review

EPA funding policy discussed under option 2 applies here also. In addition, the Department of Environmental Quality Engineering might be opposed to the manner of disposing of the secondary effluent since the site is located over an important drining water aquifer. Finally, discharge to the lake or the Bungay River is not possible decause both are protected under the State's anti-degradation policy.

--<u>Costs</u>

a. To Attleboro

Laterals and Collect	$ 850,000
Pump Stations and Force Mains	350,000
Total Cost	$1,200,000
House Connection	$600/unit

A user charge would also be included to cover operation and maintenance and possibly a portion of the capital cost.

b. To Mansfield

Laterals and Collectors	$1,000,000
House Connection	$600/unit

A user charge would also be included.

c. Packaged Plant

Plant	$ 500,000
Laterals and Collectors	510,000
Pump Station and Force Main	190,000
Total Cost	$1,200,000
House Connection	$600/unit

4. <u>Land Use Controls</u>

Large sections of the Town remain undeveloped or sparsely developed. As mentioned earlier, many sections are plagued by poor soils, and the area east of I-95 is critical because of the presence of a vital water supply aquifer. Also, Bungay Lake has many seasonal homes located on its shores, and considerable algae growth has been evident in the lake in recent years. Several land use control mechanisms could be utilized to help protect these zones. (See Chapter Three for more discussion on land use management techniques.)

4a. Increased Lot Sizes

Lot sizes should be increased in certain unsewered areas of Town. Zoning requirements now call for 15,000 square feet over the Bungay River aquifer, the Ten Mile aquifer in the Attleboro Falls area, and the small Seven Mile River aquifer around Cumberland Avenue and Old Post Road. For these specific areas, it is recommended that minimum lot sizes be expanded to about three-quaters of an acre. This is an approximate figure, but according to SRPEDD calculations, lots of this size should provide adequate groundwater protection if septic systems are operated efficiently.

4b. Aquifer Protection Districts

In addition to or in place of changing lot size requirements, the Town could institute measures to protect important aquifer zones. This technique would first require North Attleborough to map aquifer areas or smaller well field areas. Having completed this, one or all the following methods might then be utitlized:

--Establish a restrictive by-law which would prohibit particular activities (gas stations, landfills, certain industries, storage of chemicals, etc.) from locating and operating in aquifers.

--Set up a performance system whereby development would be allowed by permit only. Permits would be issued only upon a demonstration that the particular use would not pose a threat to the aquifer. The burden of proof would rest with the developer.

4c. Lake Shore By-Law

Establish a lake shore protective by-law which would regulate conversion to year around units, lot sizes, location of buildings, type of land use and the type and location of waste disposal units.

--Environmental Assessment

Properly investigated, set up and operated, 4a and 4b could provide effective protection to the Town's aquifer zones. Accurate mapping and thorough enforcement effort is necessary on the part of Town officials to make such a program successful.

It is significant to note here that even if North Attleborough instituted aquifer protection regulations, this would not entirely eliminate the threat to its aquifer system. Simply stated, the aquifers that pass within North Attleborough are not confined solely to its borders. Rather, they flow through several communities, and what happens in these municipalities will eventually have an impact in North Attleborough. Therefore, a much more effective system would be a comprehensive, intermunicipal arrangement which established a continuous aquifer protection zone through several municipalities. The principal towns would include Plainville, Mansfield, Attleboro as well as North Attleborough

Both 4a and 4b should have little secondary impact associated with their implementation. Increasing lot size will reduce traffic flow, impervious area and the volume of waste disposal to the ground. In addition to eliminating those uses which would be harmful to groundwater quality, an aquifer protection by-law would screen out some uses which generate large traffic volumes as well as surface cover. Gas stations and industries, which might be prohibited in certain cases, are two obvious examples.

Lake shore land use is generally neglected throughout the State, and as a result, recreational lakes such as Bungay Lake often experience a speed up of the eutrophication process. A lake shore by-law would attempt to reduce this process by carefully regulating the type, placement and operation of waste disposal units. The ultimate result of such enforcement would be to cut down on the amount of leachate and therefore nutrients which are presently entering the water body. Further, if care is taken in the placement of buildings around the lake (e.g. away from steep slopes or erodible soils), the threat of erosion and sedimentation to the lake will also be reduced. Finally, tight restrictions on lake shore land use could eliminate the need for sewers and the associated construction disruption, energy use and growth incentive which result from the installation of sewers.

--Policy Review

An aquifer protection by-law and/or a lot size increase would have to gain approval by a two-thirds vote at town meeting. The same requirement would hold for a lake shore district and management program.

Undoubtedly, some landowners who would become subject to such regulations would raise objections to the restrictions created by the provisions set up for a aquifer protection district or lake shore district. A carefully prepared argument in support of the land use measures would have to be prepared to convince the Town of its merits.

5. On-Site Alternatives

Many sections of North Attleborough rely on septic systems, and since much of the Town will remain unsewered in the future, the practice of on-site disposal will continue in wide use. However, because of soil conditions and the amount of problems evidenced in the past, (See Section C) it appears imperative that a change in on-site practices be adopted.

A suitable program would institutionalize certain maintenance and operation practices as well as require alternative on-site discharge units in some situations. Components of such a program are as follows:

Inspection and Maintenance

A maintenance and inspection program would be set up requiring the pumping and inspection of septic systems on a regular basis. The interval would be established based on a knowledge of local operating conditions. In areas where problems have occurred or where soil conditions create a greater likelihood of problems, the frequency of pumping would be increased. Once the pumping schedule was set, proof of pumping would be mandatory, and the cost could be borne by the homeowner. See Chapter Three for a further discussion.

No Discharge Units

When failing systems are discovered through the inspection program, no discharge units could be required where the problem is related to soil conditions, high water table or high density development. Where problems are related to improper installation, septic systems may still be allowed. An example of where this suboption might be employed is the King's Grant Estate subdivision. (See Chapter Two for discussion)

Water Conservation Devices

Water conservation devices such as aerated shower heads, aerated faucet nozzle and low flow toilets would prove useful in reducing waste flows to the groundwater and also conserve valuable water supplies. As mentioned in Section B, North Attleborough has tapped most of the available supplies of groundwater. These units might be required for all new development or where problems with septic tanks have been discovered during the inspection process.

--Environmental Assessment

An inspection and maintenance program would help prevent premature septic tank failure and, therefore, help protect groundwater and surface water quality. Further, if such a program is successful, it will help avoid the need for expanded sewer service in the future. This will also eliminate the growth incentives which are frequently associated with the installation of sewers.

In addition to aiding water quality by reducing grey water flows, low flow devices will help reduce water supply demand and stall the need to develop new sources as population grows. All communities in the Ten Mile basin plus Mansfield tap the Ten Mile or Bungay Aquifer, and both systems are developed near capacity (See Section B). In the future, the Town may have to seek sources out of basin which would involve an elaborate conveyance system and also modify the existing hydrologic regime.

--Policy Review

The Board of Health would be responsible for the inspection and maintenance program, and could initiate the program within their existing powers. The Board of Health would also be the agency to require individual households to go to no-discharge units. At this time, humus toilets and other innovative units are permitted by the Department of Environmental Quality Engineering only if it can be demonstrated that their impact will not be greater than other approved systems. The use of water conservation devices may require a modification to the State's Plumbing Code to make specific provisions for these units. North Attleborough may find a modification of their plumbing and/or building code useful also.

--Costs

	Installation Cost	Annual Operation & Maintenance
Inspection & Maintenance program		$ 60/unit
No Discharge Units		
Compost Toilets	$600-2500	$0-75
Incinerator Toilets	$600	$1100
Holding Tank	$2000	$ 250
Grey Water System	$800-1200	$5

Low Flow Devices

Aerated Shower Head	$14-17
Aerated Nozzels	$2-3

6. National Fish Hatchery-Settling Pond

The propagation of fish at the hatchery results in the production and release of large amounts of suspended organic matter to the Bungay River. The effect is a decrease in the dissolved oxygen content of the river immediately below the hatchery. As a preliminary recommendation, it is suggested that either of two options be considered. First, a settling pond could be built in order to remove a good portion of these suspended organics before the hatchery water is released to the Bungay. Alternately, a underdrained rapid sand filter system might be built to remove the organics.

--Environmental Assessment

Dissolved oxygen should increase and suspended solids should decrease if one of the above described techniques is adopted. Which system would perform most effectivly would depend on a detailed study. The first option may be subject to hydraulic overloading, while the second option requires frequent cleaning.

--Policy Review

The hatchery currently has a discharge permit. Before implementing either of the two options mentioned, Water Pollution Control would have to alter the permit by stipulating a removal of some portion of the suspended organic material.

SUMMARY

North Attleborough has several problem areas which can be addressed on an individual basis. First, it may be possible to operate the advance component of the new treatment plant for only part of the year and thereby save a considerable amount of money in operation and maintenance. It is recommended that the Town apply to the Division of Water Pollution Control for a permit to operate the advanced portion of the plant on a seasonal basis.

It is estimated that a savings of between 10 and 20 percent could be realized if the plant is operated on a seasonal basis. This could amount to a considerable savings for the Town if the new plant operates in a manner similar to those which are currently in operation. A well planned sewer ordinance will further improve the operation of the plant and reduce the occurrence of treatment plant malfunction. It is recommended that North Attleborough make this effort to update its sewer ordinance. Also, measures to control runoff would further improve river conditions by eliminating a good portion of the nutrient load that enters the river from the impervious urban area. Before instituting runoff controls, the Town should first determine through storm sampling the actual in stream effect of runoff and which areas of town contribute most to the problem. Based on this information, North Attleborough could proceed with a control program as outlined in 1b.

Sewer options address several problem areas including Anawan Road, Bayberry Road and Ellis Road. They also address other sections which are not problems, but do have a considerable amount of development. Option 2a would cost about 1.6 million and 2b approximately $.6 million. Three sewer options have been introduced for Bungay Lake, and they run from $1.0 to $1.2 million. At this time, sewers do not appear necessary, and land use as well as on-site alternatives can be used instead.

The on-site alternative 5 should be implemented. It will be useful in avoiding the sewer alternatives as outlined in 2a, 2b and 3. It will also improve conditions at those locations with septic tank problems. Lot sizes should be increased in non-sewered areas which sit above important aquifers (option 4a). Further, 4b., an aquifer protection option, should be instituted because of the Town's dependence on groundwater and the threat of development over the Bungay and Ten Mile aquifers. A lakeshore protective by-law, 4c, should also be instituted on Bungay Lake and Falls Pond to prevent the rapid eutrophication of those water bodies. Finally, a settling pond or an underdrain and rapid sand filter system would help solve the pollution problem from the fish hatchery. The exact method of control should be chosen after a detailed study.

TABLE 3

ENVIRONMENTAL ASSESSMENT

	OPTIONS						
	1a	1b	1c	2a	2b	3a	3b
SURFACE WATER QUALITY IMPROVEMENT	+2	+1	+1	+1	+1	+2	+2
GROUNDWATER QUALITY IMPROVEMENT						+1	+1
EXTENT CONSTRUCTION DISRUPTION	-1	-1		-2	-1	-2	-2
ENERGY DEMANDS	-1	-1	+1	-1	-1	-3	-2
CHEMICAL DEMAND	-1		+1				
LAND AREA REQUIRED				-1	-1	-2	-2
DRINKING WATER PURITY						+1	+1
ENDANGERED SPECIES							
COMMERCIAL FISHERIES							
AIR QUALITY						-1	-1
NOISE POLLUTION				-1	-1	-1	-1
SOIL EROSION		+1				-1	-1
FRAGILE AREAS							
PUBLIC HEALTH	+1	+1	+1	+1	+1	+1	+1
USE OF RECREATIONAL AREAS	+1	+1		+1	+1	+2	+2
PREDUCTION IN RUNOFF POLLUTION		+2					

\+ = Beneficial Impact
\- = Adverse Impact
Blank = No Discernible Change/Not Applicable

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

	1a	1b	1c	2a	2b	3a	3b
GROWTH IN RESIDENTIAL LAND USE				+1	+2	+2	+2
GROWTH IN COMMERCIAL LAND USE				+1		+1	+1
GROWTH IN INDUSTRIAL LAND USE							
INCREASED RUNOFF FROM DEVELOPMENT				+1	+1	+1	+1
DISLOCATION OF INDUSTRY OR FIRMS							

\+ = Yes
\- = No
Blank = No Change

TABLE 3

ENVIRONMENTAL ASSESSMENT

	OPTIONS						
	3c	4a	4b	4c	5	6	
SURFACE WATER QUALITY IMPROVEMENT	+2			+2	+1	+2	
GROUNDWATER QUALITY IMPROVEMENT	+1	+1	+2	+1	+2		
EXTENT CONSTRUCTION DISRUPTION	-1					-1	
ENERGY DEMANDS	-1						
CHEMICAL DEMAND							
LAND AREA REQUIRED	-1						
DRINKING WATER PURITY	+1	+1	+2	+1	+1		
ENDANGERED SPECIES							
COMMERCIAL FISHERIES							
AIR QUALITY		+1	+1				
NOISE POLLUTION		+1	+1				
SOIL EROSION		+1		+1			
FRAGILE AREAS		+1	+1	+2			
PUBLIC HEALTH	+1						
USE OF RECREATIONAL AREAS	+2			+2			
CONSERVE WATER SUPPLIES					+1		

+ = Beneficial Impact
- = Adverse Impact
Blank = No Discernible Change/Not Applicable

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

GROWTH IN RESIDENTIAL LAND USE		-1		-1	-1		
GROWTH IN COMMERCIAL LAND USE		-1	-1		-1		
GROWTH IN INDUSTRIAL LAND USE			-1				
INCREASED RUNOFF FROM DEVELOPMENT		-1	-1		-1		
DISLOCATION OF INDUSTRY OR FIRMS							

+ = Yes
- = No
Blank = No Change

LOCAL STRATEGIES - ATTLEBORO

A. INTRODUCTION AND BASE DATA

Spatially, Attleboro demonstrates a fairly compact distribution of land uses around a core commercial and business area. From this core, industrial and residential developments press out in a radial pattern. Another concentration exists in South Attleboro where strip commerce follows Route 1 and housing spreads out on either side of the highway. A lower-density housing concentration has developed in southeastern Attleboro with notable growth around Briggs Corner.

Beyond these areas, residential development is scattered, and only a moderate amount of prime developable land remains available. The southeast quadrant of the City remains largely undisturbed, but the significant wetland areas in this section provide a constraint to its use.

An important feature which characterizes the City is its comparatively large and stable industrial base. Attleboro has had a long history as a jewelry and metal finishing center, and these activities remain strong along with the electrical machinery industry. While the employment level in the City is somewhat in excess of 22,000 jobs, the population for 1975 stands at 32,650. Although Attleboro provides a large employment base, many employees have chosen to live outside of the community. As a result, development pressures have been less than what might be expected.

As mentioned, the commercial structure of the City includes a downtown core area. Like many communities with an older downtown, Attleboro faces problems of congestion and obsolescence. Strip development has increased along Route 1 in South Attleboro, and competition with the downtown area has grown correspondingly.

From 1950 through 1975 Attleboro has undergone a steady but not excessively dynamic rate of growth when compared to neighboring communities. For example, between 1950 and 1960 population increased from 23,805 to 27,118 or 19.7 percent. This is a growth rate slower than 20 of the 30 SRPEDD communities. Attleboro's relative growth rate slipped further from 1960 to 1970 when population increased by 21.3 percent to 32,907. During this period, 24 of the other SRPEDD communities grew at a faster pace.

TABLE 1

HISTORIC AND EXISTING DATA

a. Population

1955	1960	1965	1970	1975	Historical % Change
24,870	27,118	28,690	32,907	32,650	31.3

b. Land Use

Acres	1951	1975	Historical % Change
Residential	2,818	3,823	35.7
Commercial	153	265	73.2
Industrial	253	481	90.1

As in other communities, land use changes since 1951 have shown a large increase in urban land and a corresponding decrease in total acres devoted to forest, agriculture or wetland categories. In 1951, Attleboro had 3,224 acres devoted to intense urban use (residential, commercial, industrial). By 1975, this total had increased an additional 1,345 acres or 43 percent to 4,569 acres. The primary activity which has suffered at the expense of conversion to intense urban land use has been agriculture and open space. According to MacConnell land use information, these two categories have lost a combined total of approximately 1,300 acres since 1951, and the total now stands at about 2,131 acres.

Population projections for the City of Attleboro indicate a very gradual rate of growth. At 19.4 percent over the next 20 years, this rate is about two-thirds the rate of growth which occurred from 1955-1975. Factors which should contribute to a slow down in Attleboro's pace of growth include the large amount of land already developed, a lack of large amounts of prime unbuilt land, and the generally older condition of the City and its infrastructure.

TABLE 2

1995 PROJECTIONS

a. Population

1975	1980	1985	1990	1995	Projected % Change
32,650	36,250	37,450	38,200	39,000	19.4

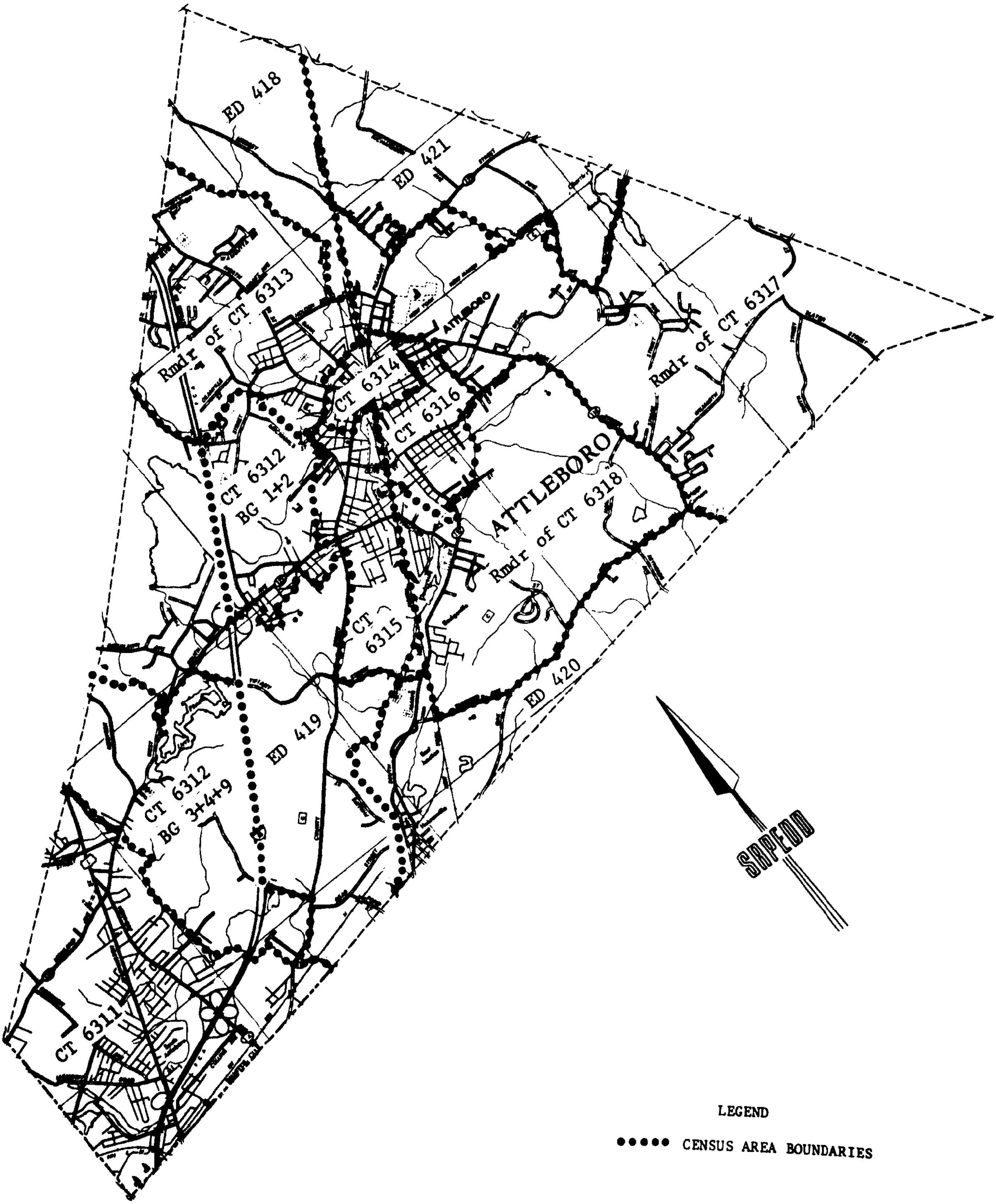
Sub-community Distribution

Census Area	1970	1995	%Change
Tract 6311	5,912	7,350	24.3
ED 419	2,654	3,135	18.1
CT 6312, BG 1, 2	1,720	1,720	-
CT 6312, BG 3, 4, 9	1,098	1,556	41.7
ED 418	198	198	-
Remainder of CT 6313	3,764	3,953	5.0
CT 6314	2,598	2,598	-
CT 6315	2,878	3,067	6.6
CT 6316	4,233	4,440	4.9
ED 421	928	1,562	68.3
Remainder of CT 6317	4,066	5,601	37.8
ED 420	867	1,092	26.0
Remainder of CT 6318	1,991	2,728	37.0
TOTALS	32,907	39,000	

b. Land Use

Acres	1975	1995	%Change
Total Residential	3,823	4,301	12.5
Commercial	265	318	20.0
Industrial	481	554.5	15.3

Given Attleboro's existing concentrated development in the downtown area and in South Attleboro, future residential growth is likely to take place in a scattered fashion throughout the City. Zoning specifications for areas which are as yet unbuilt are primarily for lots of 12,000 and 16,000 square feet. Therefore, much of the single family construction that will take place in the next 20 years should be on small lots compared to some of the neighboring communities.



LEGEND

●●●●● CENSUS AREA BOUNDARIES

SCALE

½ 0 1 2 MILES

FIGURE 1

CENSUS AREA BOUNDARIES
CITY OF
ATTLEBORO

Those areas which are expected to undergo the greatest residential development pressure include the southeast section of Town east of South Main Street and south of Route 123 as well as that section between Orr's Pond and the interchange in South Attleboro (see Figure 1). Pressure for commercial land should be significant although not excessive. Areas subject to greatest demand are expected to involve the Route 123 corridor east of the City center plus the South Attleboro I-95 interchange. The most attractive industrial land exists along I-95, and the industrial park off County Street should remain in demand until it fills up.

B. WATER QUALITY INFORMATION

The central portion of Attleboro is in the Ten Mile River system and receives drainage from North Attleborough. Most of the western part of Town is in the Seven Mile River Basin with the exception of the western most edge of Town which is drained by Abbot Run River. The eastern edge of Town is drained by Chartley Brook and the Wading River.

Stratified glacial deposits form aquifers in the Bungay River valley, the Ten Mile River valley and the Seven Mile River valley.

1. Water Supply

The Attleboro water company uses water from the Seven Mile River-Orr's Pond system (4.3-6.2 MGD), the Wading River in Mansfield (1.5-2.75 MGD), and the Bungay River Aquifer (average 1.5 MGD).

The Attleboro Water Department plans to increase production from the Orr's Pond system by 1-1.5 MGD by installing four eight-inch tubular wells and one pump.

The Attleboro Water Department presently pumps 7.3 to 10.45 MGD from all sources combined. The City has several possibilities open to insure a supply to meet future demand, but as in the case of North Attleborough and Plainville a cheap and efficient method would be to reduce demand through use of 2.5 gallon toilets and water saving plumbing fixtures. See Chapter Two for a complete discussion.

2. Groundwater Quality (see Figure 2)

Quality may be more of a problem for Attleboro than quantity. Four types of quality problems are evident:

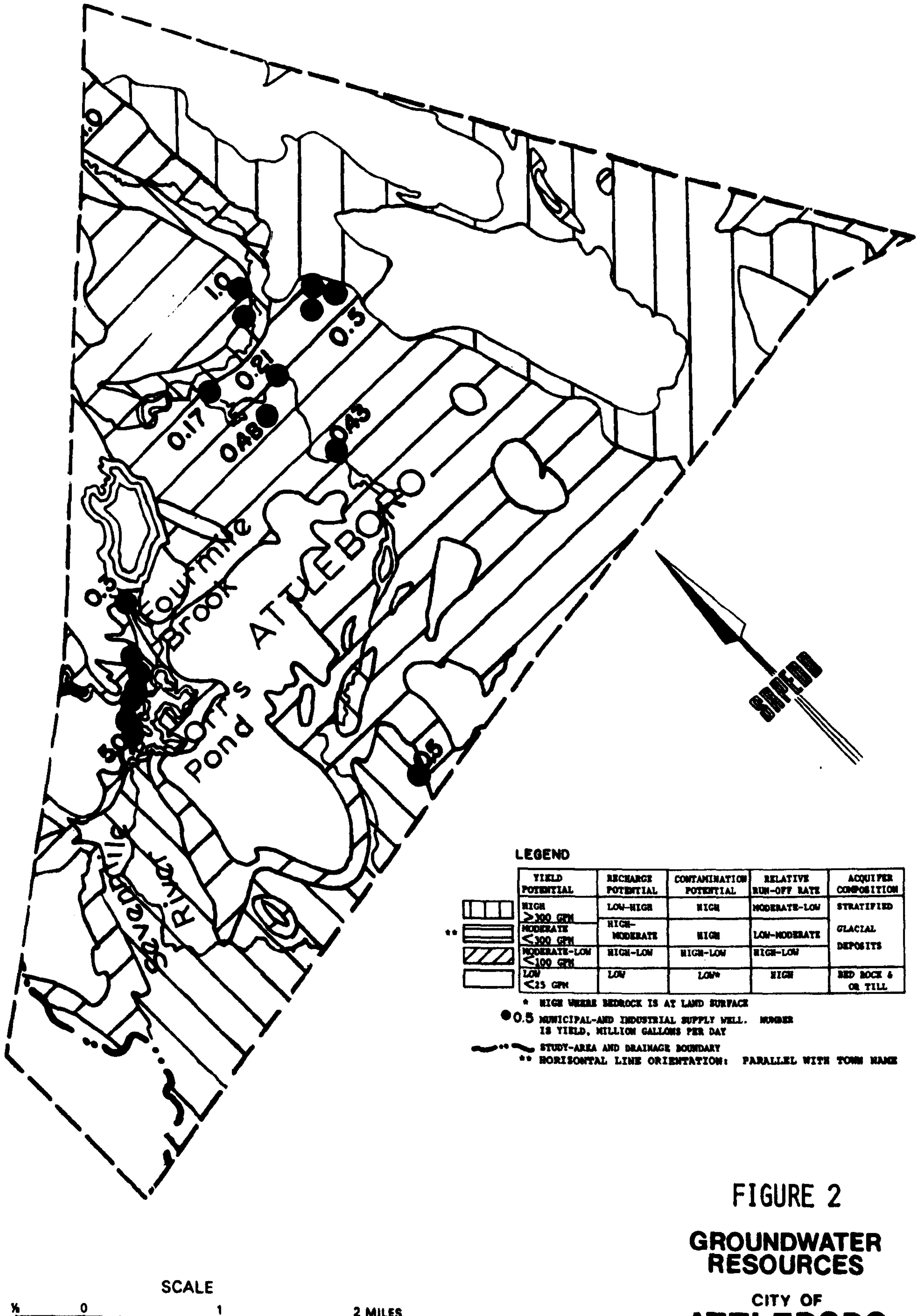
a. Natural iron and magnesium levels are high, especially in the Bungay River Aquifer;

b. High acidity;

c. Highway drainage discharge to the Orr's Pond complex; and

d. Bacteria from agricultural activity in the Seven Mile River above the Orrs Pond complex.

The Bank Street and Holden Street wells in the Bungay aquifer have iron and magnesium levels of 1-2 ppm and as a result up to 6 ppm of sodium hexametaphosphate is added to sequester



LEGEND

	YIELD POTENTIAL	RECHARGE POTENTIAL	CONTAMINATION POTENTIAL	RELATIVE RUN-OFF RATE	ACQUIFER COMPOSITION
(vertical lines)	HIGH ≥300 GPM	LOW-HIGH	HIGH	MODERATE-LOW	STRATIFIED GLACIAL DEPOSITS
** (horizontal lines)	MODERATE <300 GPM	HIGH-MODERATE	HIGH	LOW-MODERATE	
(diagonal lines)	MODERATE-LOW <100 GPM	HIGH-LOW	HIGH-LOW	HIGH-LOW	
(blank)	LOW <25 GPM	LOW	LOW*	HIGH	BED ROCK & OR TILL

* HIGH WHERE BEDROCK IS AT LAND SURFACE

● 0.5 MUNICIPAL-AND INDUSTRIAL SUPPLY WELL. NUMBER IS YIELD, MILLION GALLONS PER DAY

STUDY-AREA AND DRAINAGE BOUNDARY

** HORIZONTAL LINE ORIENTATION: PARALLEL WITH TOWN NAME

FIGURE 2

GROUNDWATER RESOURCES

CITY OF

ATTLEBORO

(mask) the iron. The water is also highly acidic and caustic soda is used to adjust the pH upward. The raw water has a sodium concentration of approximately 14 ppm and as a result of treatment the sodium concentration in the finished water is approximately 45 ppm.

The EPA recommended limit for sodium is 20 ppm and the use of both water treatment chemicals has raised the sodium concentration significantly above this limit. Alternative chemicals such as calcium oxide are available to achieve the desire pH adjustment without the undesired increase in sodium. Alternative iron control methods usually involve chemical precipitation, flocculation and filtration. However, it should be noted that the cost of these alternative chemicals is high compared to the ones used now.

The highway drainage from I-95 which presently goes to the Orr's Pond well field should be bypassed to avoid contributing to the sodium levels which are in excess of the 20 ppm recommended limit of EPA.

Agricultural sources of bacterial contamination to the Seven Mile River above Butler Pond have caused the main flow to be diverted past the Orr's Pond system, and the portion of the flow which is used is chlorinated and pumped to Manchester Reservoir and released to Orr's Pond from there.

3. Stream Conditions

As mentioned, a very small section on the western edge of the City flows to the Abbot Run River and eventually to the Blackstone River in Rhode Island. The Abbot Run River has been classified as an A stream by the Rhode Island Division of Water Pollution Control. The City of Pawtucket actually uses this stream for drinking water. Although only a small portion of Attleboro drains to this system, that portion includes the heavily built up section of South Attleboro. A potential pollution source may exist in the form of runoff from impervious surfaces as well as leachate from the many septic tanks which are in use. At this time, there is no evidence which can substantiate whether these sources are actually creating a problem.

In the Ten Mile Basin, the Seven Mile River has been designated as an anti-degradation stream. This means that no activity which would result in a point discharge to the stream will be allowed to locate on the river in the future. Although the Seven Mile has been assigned an A classification goal above Orr's Pond (suitable for drinking) and a class B classification goal (suitable for fishing and swimming) from Orr's Pond to the Ten Mile, existing pollution loads currently degrade the river to the point where it only meets the criteria set for a C classification. One of the primary reasons for the poor stream condition is the presence of high amounts of coliform bacteria. This may be attributed to urban runoff or possibly even leachate from septic systems which are heavily used. Throughout South Attleboro low dissolved oxygen readings have also been observed in the stream during afternoon periods. This occurrence has been unexplainable up to now.

In the Ten Mile River itself, the stream becomes severely degraded as a result of treatment plant effluent, industrial effluent and urban runoff. Because of the large number of dischargers on the river, the Ten Mile has been assigned a C classification from the North Attleborough treatment plant to the Rhode Island State Line. If in the future the river does meet this goal, it would be suitable for a limited number of uses such as boating, fish and wildlife propagation, fishing and industrial processing and cooling. It is very unlikely, however, that the Ten Mile will achieve the Federal Water Pollution Control Act goal of a swimmable condition by 1983. The sources of pollution are so complex that conventional or best practicable treatment (secondary) will not enable the river to meet this 1983 goal.

One of the main sources of pollution in the Attleboro section of the Ten Mile is the North Attleborough Treatment Plant. Due to frequent overloading and the aged condition of the plant, the stream receives a large biochemical oxygen demand load and thereby suffers a significant dissolved oxygen sag as it travels through the City. The plant also contributes large amounts of suspended solids and nutrients to the Ten Mile system.

Since some heavy metals are toxic to algae, these pollutants have reduced the impact of nutrients on algae growth in the past. More recently, however, as industries have begun to remove metals before discharging their waste, it has been reported that algae growth has been on the increase below the plant and particularly in Farmers Pond.

Below Farmers Pond, the Ten Mile is joined by the Bungay River and then flows into Mechanics Pond. From the outlet of Mechanics Pond, the river passes through Attleboro Center and then another series of impoundments including Dodgeville Pond and Hebronville Pond before it reaches the City limits. In addition to North Attleborough treatment plant effluent, a number of other sources contribute to degrade the river as it moves through the sections of Attleboro described above. Although they receive some treatment, the effluent from the jewelry and metal finishing industries contribute significant amounts of nutrients and metals to the river. As a result, not only are there high concentrations of these pollutants in the water, but the concentration of metals in the sediment is also very high. Urban runoff adds further to the pollution load in the river, and this is particularly true for total coliform and total phosphorus. In addition to the metals and BOD-DO problem, aquatic weed growth is evident in the river and algae production is quite evident in the Dodgeville and Hebronville Ponds.

Also within the Ten Mile Basin, the Bungay River as it flows through Attleboro is burdened by pollution problems that can be attributed to natural conditions as well as man-made impacts. Much of the stream flows through swamp land. As a result, the sluggish flow and the high organic load supplied by the swamp serves to severely deplete the dissolved oxygen levels in the river. Further, the discharge from the National Fish Hatchery in North Attleborough provides additional loads to the river and therefore creates another source of oxygen depletion. Slightly elevated coliform levels have also been noted in the Bungay just before its confluence with the Ten Mile. This problem has been attributed to urban runoff. Because of these problems, the Bungay is currently meeting the criteria of a class C river although it has been assigned a future goal of B.

On the eastern edge of Attleboro, runoff flows to Chartley Brook, which is part of the Taunton River Basin. This brook has been assigned a future use classification of B which would make it useful for contact recreation, fishing and wildlife propagation. Unfortunately, it is difficult to assess the current conditions in the brook as it flows through Attleboro since sampling data is unavailable for this section of the Chartley. However, some sampling has been done at the outlet of Chartley Pond. At this location a strong diurnal dissolved oxygen variation has been observed, and as a result very low DO levels have been recorded in the summer during certain parts of the day. Because of this problem, the Chartley only meets the criteria of a C-1 river. The strong diurnal change in dissolved oxygen indicates a large amount of photosynthetic activity, and, therefore, a good deal of algae growth.

4. Sewage Treatment Plant

The City's secondary sewage treatment plant consists of a primary settling tank, two trickling filters, a secondary settling tank, two sludge digesters, four sand filter beds and a chlorination facility.

The Attleboro sewage flow is a mixture of domestic and industrial wastes. Some industrial wastes are pretreated. The sewage flow passes through the grit chamber where grit and solids are removed and then enters the primary settling tank for settlement of suspended solids. Detention time in the primary tank is two hours. Percentage of removal of biochemical oxygen demand and suspended solids from this operation is 26 percent and 55 percent, respectively.

The primary effluent overflows to the trickling filters which are biological treatment units. This process comprises, essentially, a bed of gravel (size 3/4") on which a population of saprophytic bacteria grows. These bacteria degrade the organic matter, reducing the BOD concentration and suspended solids remaining in the liquor after the primary sedimentation. The percentage removal of BOD varies from 65 to 92 percent, while suspended solids removal is an additional 30 percent. The sewage is applied to the top of the bed by a rotary distributor at a constant rate. Filtered effluent flows to the secondary clarifier where the remaining suspended solids are settled during the two to two and one half hours detention time. As the primary effluent is applied at a constant rate to the trickling filter, current overflow rate depends on the hydraulic load. From the secondary clarifiers, the effluent then flows through two sand filter beds before chlorination and discharge into the Ten Mile River.

The present structure does not meet the standard requirements of a secondary treatment plant. The 2.8 MGD design capacity has already been exceeded, and the plant is presently running at 4.0 MGD. This value includes inflow and infiltration. The hydraulic surcharge of the plant along with non-existence of by-pass facilities for the units results in poor operation, and poor quality effluent is discharged to the Ten Mile River.

Attleboro is well aware of the problems with its plant and is in the Step 2 phase of the 201 process for the design of an advanced wastewater treatment plant.

C. LOCAL WATER QUALITY ISSUES

1. Areas With Wastewater Disposal Problems (See Figure 3)

a. Route 123, Pike and Bishop Street Area

Although sparsely developed, the land within Route 123, Pike Street and Bishop Street is subject to periods of flooding. This condition has caused difficulties in the past. Some action is being taken by Bristol County Mosquito Control to alleviate the problem by constructing a drainage ditch.

b. Chartley Brook

The Chartley Brook watershed is plagued by severe wetness, and the area constitutes an existing as well as future problem. Some on-site sewage disposal problems have shown up in the past due to existing conditions.

c. Collins Street

Since the construction of I-95, drainage problems have appeared around Collins Street. The resultant effect has been the appearance of on-site failures of septic systems in certain lots.

2. Constraints on Future Development

Severe soil limitations appear widely throughout those portions of the town which remain undeveloped at this time. However, within these zones, significant areas of good soil also exist. This suggests that care must be taken when siting new development, since variable conditions may be encountered within individual lots.

Severe limitations due to soil wetness appear extensively in the southeastern corner of town which can generally be defined by the Penn Central Railroad on the north and Park Street on the west. A significant amount of wetness and hardpan appear in the north in a zone east of North Main Street and north of Pleasant Street. Finally, in South Attleboro from Rocklawn Avenue south severe difficulties due to bedrock, hardpan and wetness are also quite apparent.

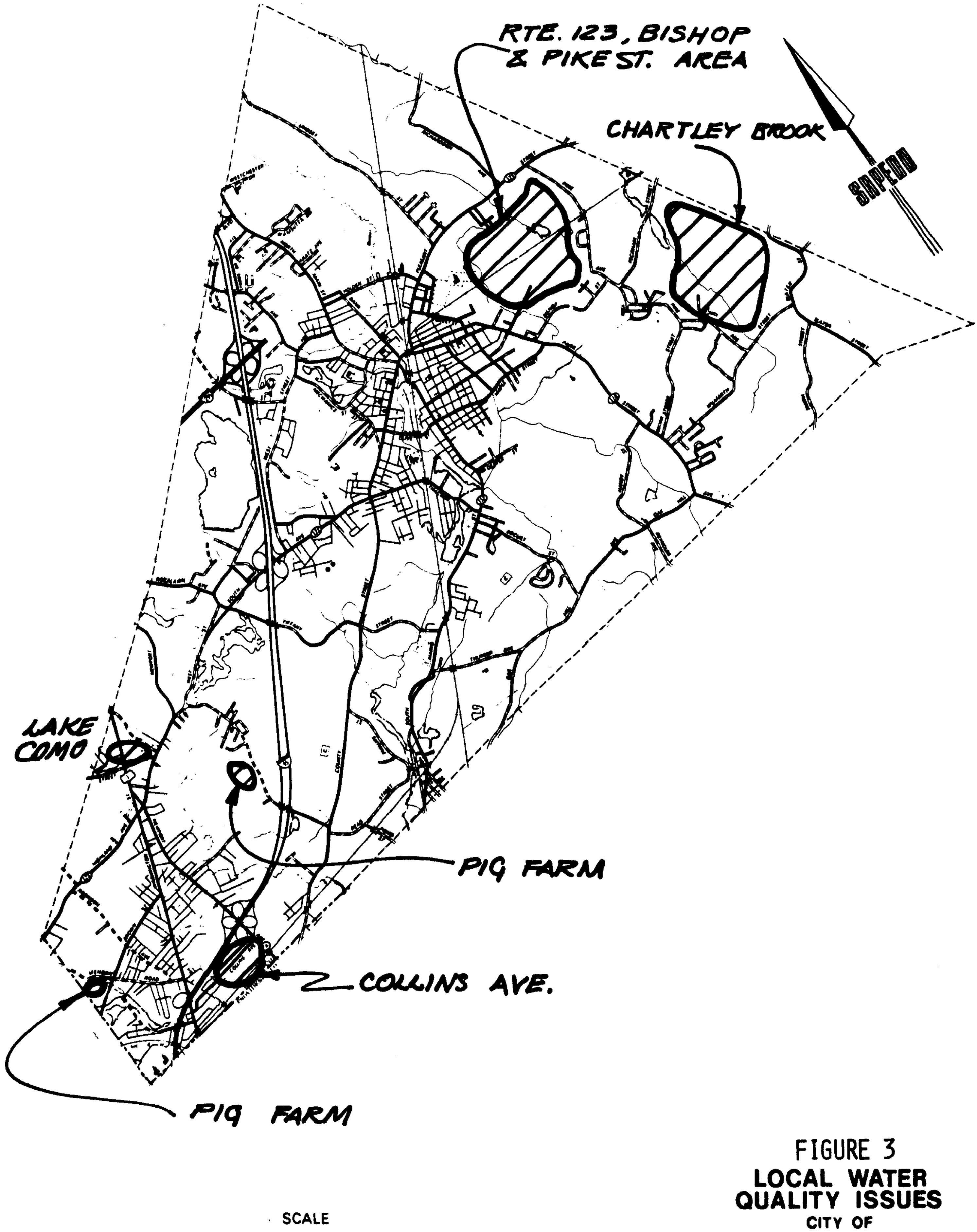


FIGURE 3
LOCAL WATER QUALITY ISSUES
CITY OF ATTLEBORO

For the most part, wetlands are well segregated to the eastern one-third of town. U. S. Geological survey maps indicate a rather large expanse of wetlands along the Bungay River in the north. Large stretches of wetlands also show up in the southeastern corner of town and particularly around Chartley Brook.

Given Attleboro's dependence on groundwater for its drinking water supplies, the aquifer system which exists within the City's limits is of critical importance to the present and future needs of the city. A prime one in the north is the Bungay River aquifer which follows that water course from Farmers' Pond past Holden Street and into North Attleborough. Another important groundwater system exists around Orr's Pond, and, as previously noted, this aquifer is heavily relied upon by the City. Another large yet currently unutilized aquifer spreads out broadly on either side of the Seven Mile River and eventually ties in with a smaller aquifer which appears along the Ten Mile in Hebronville. Although not in use at this time, the aquifer does represent a potentially useful source, and it should be noted that certain land uses pose a threat to its condition.

3. Known Non-Point Source Problems

a. Lake Como

Two problems have arisen in the area nearby Lake Como. In the lake itself, runoff from a nearby shopping center has created a pollution problem. Runoff from the paved area has also been suspected of contributing to periodic flooding problems downstream from the lake. Secondly, the presence of small dams on the Seven Mile has also contributed to the periodic flooding problem and this condition has interfered with the operation of septic systems during severe rainy periods.

b. Pig Farms

Two moderate sized pig farms, one located off Read Street and the other off Brown Street, represent minor potential problems in the Seven Mile River Basin and Abbot Run River Basin respectively. Combined, these two farms have approximately 200 pigs, and it is difficult to assess the magnitude of this source relative to other sources in each basin.

c. Ten Mile Sedimentation

Although specific sources are unidentified, sedimentation has been cited as a problem through the portion of the Ten Mile flowing through Attleboro. Apparently, a good amount of the sedimentation problem stems from the many street drains which discharge into the river. In some portions of the river, the problem has been so severe that sections which were once several feet deep are now only several inches deep.

D. ALTERNATIVE SOLUTIONS

By examining some of the constraints, it is apparent that the City has a fairly well defined number of options to choose from. The major question likely to confront the community is to what extent or intensity will the various options be employed.

A review of the constraints reveals the following. Attleboro needs an expanded treatment plant, and the City has just been awarded an EPA grant to build a new one. While there is not much to debate concerning the need for a new plant, there may be room for discussion with respect to the manner in which the plant is operated. A second constraint is that Attleboro has some older, very densely built-up areas which presently rely on individual on-site systems. It is clear that some of the existing development, notably in South Attleboro, will have to be sewered. The question is which additional areas should be included and to what extent should they be sewered.

On the opposite end of the spectrum, there are also some sections of the City, particularly in the southeast, which are very sparsely developed. Some of these sections are quite sensitive environmentally due to either soil characteristics or the presence of important aquifers or large wetlands. Attleboro will undoubtedly have to make a conscious or default decision with respect to how it intends to have such land used in the future.

In summary, three issue areas to which alternative solutions can be addressed include the following. First, to the extent that there is still room for decision making, some questions may be addressed to the period of time the advanced portion of the plant will have to be used. Second, Attleboro is committed to sewering only portions of the City at this time. Alternative sewering schemes should be addressed to assess their respective merits. Finally, the decisions made over whether to sewer or not sewer a portion of the City also make it imperative to consider which if any land use controls will be utilized to protect those areas that remain unsewered.

1. Treatment Plant

The consultants, Witman and Howard, have designed a tertiary or advanced treatment plant which includes the removal of phosphorous and the conversion of ammonia-nitrogen to nitrate. The advanced treatment requirement has been imposed by the Division of Water Pollution Control.

While the new plant will result in a high quality effluent, it is still uncertain whether significant stretches of the Ten Mile, particularly through Attleboro and below the treatment plant will achieve B quality as required by the Federal Water Pollution Control Act Amendments. It is even possible that smaller sections of the river will fall short of the dissolved oxygen criteria for a C stream. SRPEDD modeled the Ten Mile for dissolved oxygen (DO) and biochemical oxygen demand (BOD) for the critical 10 year 7 day low flow, and the results reinforced this contention. A complete discussion of this analysis is provided at the beginning of the Ten Mile section of Chapter Four.

One of the primary justifications for WPC's decision to have Attleboro upgrade its treatment plant to an advanced system is the eutrophication problem in the impoundments along the Ten Mile. Advanced treatment will eliminate a significant amount of the nitrogen and phosphorous from the treatment plant effluent. Since nitrogen and phosphorous are the key ingredients in the production of algae, removal of these elements at the Attleboro plant will improve the condition of the downstream ponds. However, to what extent advanced treatment will eliminate the algae problem is uncertain. For one, the capability of the model to reliably demonstrate the in-stream effects of a reduction in the treatment plant nutrient load is questionable. First, the model loses accuracy in ponds or large impoundments since it was not designed to handle these water bodies. Second, because the model was designed to simulate DO and BOD, attempts to model nutrients must be viewed with caution. Further, treatment plant effluent is not the only source of nutrients. Urban runoff industrial discharges and the North Attleborough treatment plant also contribute significant amounts to the Ten Mile. Finally, by reducing the amount of nitrogen and phosphorous in the treatment plant waste load, most of the beneficial effect will occur in Central Pond and Turner Reservoir. It is not clear what will happen in Dodgeville or Hebronville Pond.

Given the situation outlined above where the benefits of going to advanced treatment are somewhat in doubt, Attleboro could proceed in the following way.

1a. <u>Treatment Plant Operation</u>

Operate the advanced portion of the treatment on a seasonal basis only. That is, phosphorous removal and nitrification would be carried on for the months during which algae growth normally takes place and shut down during the cold weather months. A reasonable operation period might be mid-April to mid-October. In order to assess the impact of a seasonal advanced treatment operation for Attleboro and North Attleborough (the same option has been made for that community), Dodgeville Pond, Hebronville Pond, Central Pond as well as Turner Reservoir could be monitored during the year for several years to measure the extent of algae growth.

--Environmental Assessment

Operation of the advanced system during warm weather months would eliminate a significant portion of the nutrient load entering the Ten Mile below the treatment plant. Depending on the amount entering the river from other sources, algae growth should diminish in the ponds located downstream. During cold weather, algae production is cut down tremendously or ceases altogether. Stream conditions should not be adversely effected during winter months if advanced treatment is eliminated during this period. It should be noted that phosphorous and nitrogen discharged during the winter may settle out to the bottom sediment. If this happens, these bottom deposits could exert a demand during the summer months.

--Policy Review

The Division of Water Pollution Control has the final say over the performance level a plant must maintain. The Division has been rather reluctant to allow plants to go to seasonal treatment, although several have requested permission to do so. Marlborough, Brockton and The Old Colony Water Pollution Control District have all sought to gain a seasonal permit for the operation of their advanced component. All have been denied for one reason or another. Fitchburg, on the other hand, does have a permit to operate on a seasonal basis. They operate as an advanced plant from May 1 to October 31 and as a secondary plant from November 1 to April 30.

--Costs

Advanced treatment plants are enormously expensive to operate and maintain. They are much more expensive to operate than a plant designed solely for secondary treatment. For example, the cost curves presented in Figure 1 of Chapter Two show that the annual operation and maintenance cost for a 5.5 MGD advanced treatment plant would be about $900,000 to $1,000,000. A plant with the same capacity, but designed for secondary treatment would only cost somewhere between $300,000 and $400,000 per year for operation and maintenance.

If Attleboro operated the advanced portion of its plant on a seasonal basis, a considerable savings could be realized, although not as large as if the plant was designed only for secondary treatment. As an example, to operate and maintain Fitchburg's 5.5 MGD plant as an advanced system for the full year cost the town $900,000. When they went to a seasonal operation the O and M cost was reduced to $700,000.

Whitman and Howard has estimated that the annual operation and maintenance for the new plant will run approximately $785,000. Based on the experience of similar plants currently in operation in the area, O and M may be closer to $1.3 when it becomes operational. If the Town goes to a seasonal use of its advanced component, a 10 to 20 percent savings could be expected.

1b. Industrial Waste Survey

There is a need for an updated industrial survey in this city which can be used to revise the sewer ordinance and pretreatment requirements for companies planning to participate in the tertiary sewage treatment plant. This is especially necessary for the metal-related companies such as in the jewelry field where the waste streams contain toxic materials and pretreatment costs may be high. Also, it is important for the City to prepare the industries in advance for all costs to be associated with the system and its regulations both to guard against plant upset and pass-through and to provide sufficient time for industrial preparations. In this way the advanced combined system can proceed smoothly with its industrial component estimated at over one third of the total plant input for the design year of 2000.

When the survey has been completed, the cost recovery and user charges established, and the pretreatment requirements announced, there will be an opportunity to determine the feasibility of any joint pretreatment projects within the City. In particular, the issue of water reuse should be considered in this potentially water-short area. Companies, especially those requiring large amounts of cooling water, will become more interested in this concept as water rates increase along with the total costs for sewerage.

--Environmental Assessment

Water reuse will help reduce the demand on the Ten Mile aquifer which is highly developed at this time. Joint pretreatment involves economies of scale which not only saves money, but also reduces the use of raw resources such as power and the material used in the construction of the treatment facility. Additional sludge containing toxic metals will be generated at several locations. If not properly handled, these sludges could become a non-point problem.

Since certain industrial waste products can be harmful to the proper operation of the treatment plant, a sewer ordinance which regulates industrial inputs will help keep the plant operating effectively. This should reduce the episodes of treatment plant malfunction and thereby avoid additional impact on the quality of the river.

--Policy Review

Industrial permits are set and monitored by the Permit Section of the Division of Water Pollution Control. They have jurisdiction over wastes discharged directly to the river, but not over that portion of the waste stream sent to the treatment plant. EPA is in the process of setting new industrial pretreatment standards and revising existing ones. However, this system is not entirely in place at this time. During the process of revising its sewer ordinance, Attleboro will have to remain alert for new developments in the permit program in order to incorporate them where necessary. Finally, once developed, the sewer ordinance will have to gain final approval from the Division of Water Pollution Control.

--Cost

One chemist @ $15,000 and one assistant @ $10,000 per year	$25,000
Overhead	25,000
	$50,000

The above figure does not include the cost for sampling and testing equipment, chemicals and other items necessary to fully equip a laboratory. A full outlay for these items could run as high as $160,000. However, the new treatment plant will contain a laboratory and at least some of the equipment.

2. Sewers

Basically there are two options under this category. One is the wall-to-wall option whereby all section of the City presently unsewered would become sewered over time. The other is a limited sewer option. Here only certain areas of town would become sewered depending on several factors including the density of development, the presence of important environmental resources such as a water supply source, or the frequency of on-site system failures.

2a. Whitman and Howard Proposal

The existing sewer system covers all of the densely-developed downtown area and runs out Route 123 to the I-95 interchange. From this core area, the sewer system continues through Dodgeville along South Main Street and finally to the existing treatment plant.

The alternative presented here is a plan which Whitman and Howard initially devised in 1969. Under this option, virtually the entire City would become sewered under a phased development program. The progression of the phases would evolve depending on the financial condition of the City (see Figure 4).

Thus far, Attleboro has committed itself to sewering the older, heavily-developed section of South Attleboro. Also, following through on its 1969 findings, Whitman and Howard and the City have also made progress toward implementation Phase IV of this sewer program. Phase IV calls for sewering west of I-95 from Manchester Reservoir southwest down Newport Avenue, Read Street and also along the Seven Mile River. An important feature of Phase IV is that it will cover Orr's Pond which is important to Attleboro's water system.

--Environmental Assessment

Option 2a will eliminate the threat to the Orr's Pond well complex as well as take care of the needs in South Attleboro. The wall-to-wall option would also take care of any future problems from on-site systems since they would ultimately be sewered. Sewage flows will increase significantly at the treatment plant, but the design capacity seems quite adequate to handle the flows. The Whitman and Howard proposal may, however, promote some important secondary or spinoff effects. A massive sewer program presents the possibility of intensified land development along the sewer system. As a result, a host of adverse environmental effects could

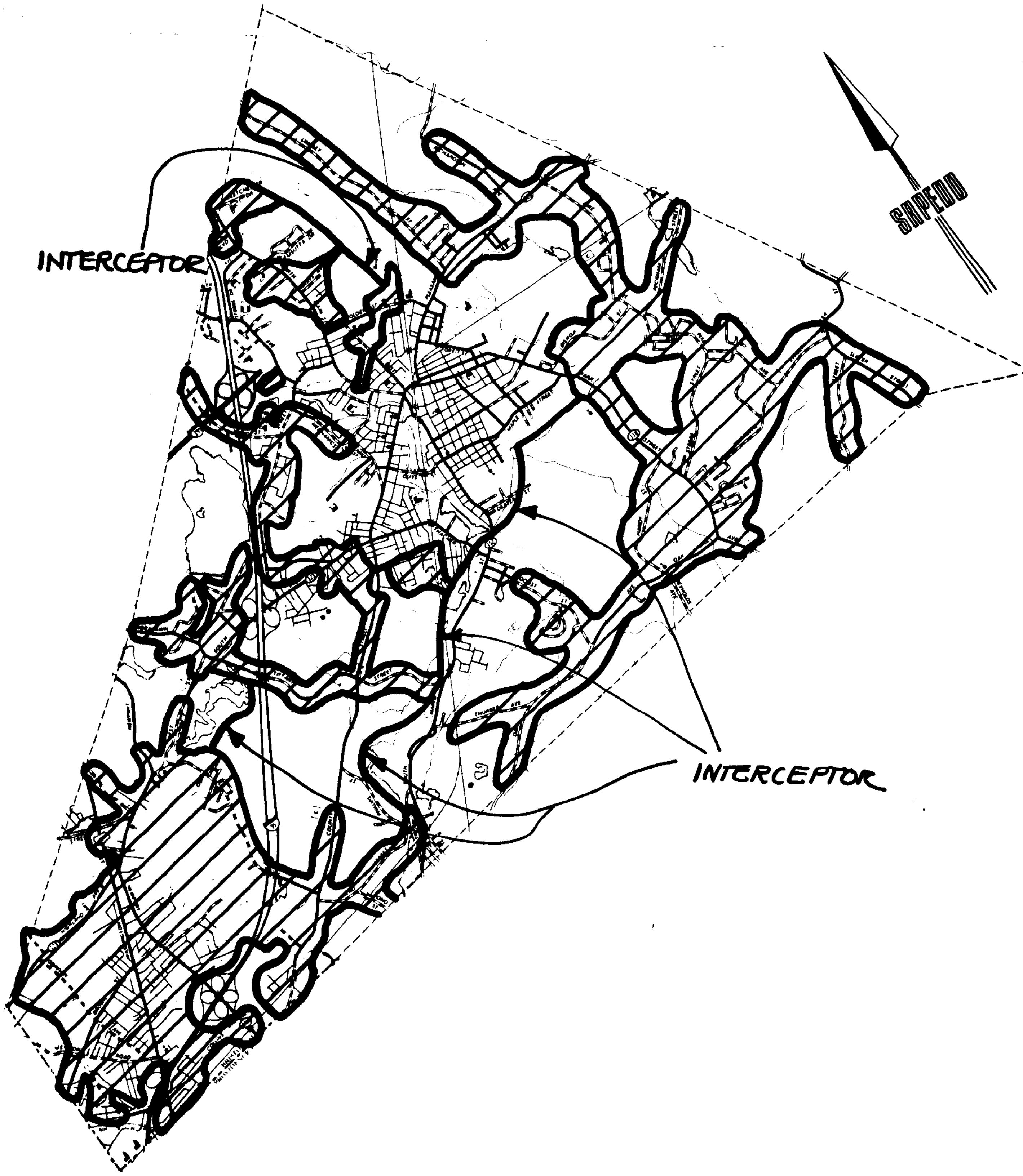


FIGURE 4

SEWER OPTION 2 A

CITY OF
ATTLEBORO

SCALE
½ 0 1 2 MILES

evolve following such growth. For one, although household flows would be handled at the plant, the increase in impervious area and the increase in runoff raises a potential threat to wetlands and streams. A scenario such as this would be particularly accurate in the southeastern portion of Attleboro. In addition, air pollution from increased vehicular traffic suggests another possible problem not to mention the added costs the City would have to assume for extending services to outlying portions of the City. Further down the ecological chain, local wildlife would be disturbed by an expanded sewer system which also promoted land development in presently undisturbed portions of Attleboro.

--Policy Review

It is EPA policy not to fund laterals or collectors in any area that was less than two-thirds developed at a date prior to October 18, 1972, which would make significant portions of option 2a ineligible for federal funds. In addition, EPA will not fund laterals until a detailed cost-effectiveness analysis demonstrates that sewers will provide a better solution than the continued use of septic tanks.

--Cost

The costs presented here are from the 1969 Whitman and Howard report, and they have been updated to present cost (ENR 2600)

Laterals, Collectors, and Interceptors	$32,250,000
Force Mains and Pump Station	2,025,000
	$34,275,000

House Connections-$600/unit

2b. Limited Sewer Option

Under this option, Attleboro would sewer only limited portions of the City while relying on land use controls and various on-site systems to avoid sewering scattered, low-density areas.

Sections that would be sewered include all of South Attleboro as well as that area encompassed by Phase IV of the Whitman and Howard plan. Additionally, based on the projected growth pattern, that area to the east of the City's center including portions of Lindsey Street, Route 123 and Bishop Street would similarly be added to the system at a later date (See Figure 5).

--Environmental Assessment

Since sewers for South Attleboro and the Orr's Pond complex are provided for in 2.b, this alternative similarly gives adequate protection to these critical zones. Further, if land use controls and properly maintained on-site systems eliminate the need for sewers in other parts of the City, then the limited sewer option may actually promote better water quality than 2a. First, since there will be a smaller sewerage flow, overloading and therefore by-passing will be avoided for an extended period of time since the design capacity will be approached at a later date compared to 2a. Second, a smaller daily flow will also mean a smaller daily pollution load into the river.

Option 2 b is not without potential problems. On-site systems, which will be used in place of sewers, are not failsafe particularly if proper operation and maintenance steps are not followed. Therefore, a possible intrusion on groundwater and surface water is certainly not eliminated. However, a large portion of the secondary impacts outlined in the environmental assessment for 2a are eliminated as are any short term aesthetic problems due to extensive construction distruption.

--Policy Review

EPA policy for funding laterals and collectors as mentioned in 2a applies to this option as well.

--Costs (as based on an ENR of 2600)

Laterals, Collectors and Interceptor	$15,934,000
Force Mains and Pump Station	1,322,000
	$17,256,000

House Connection-$600/unit

3. On-Site Disposal Provisions

Option 3 would be implemented as a supplement to 2b, since the limited sewer option would require many lots to rely on individual treatment units. Under this option, a program of maintenance, operation and innovation would be instituted to provide for the proper operation of on-site treatment systems.

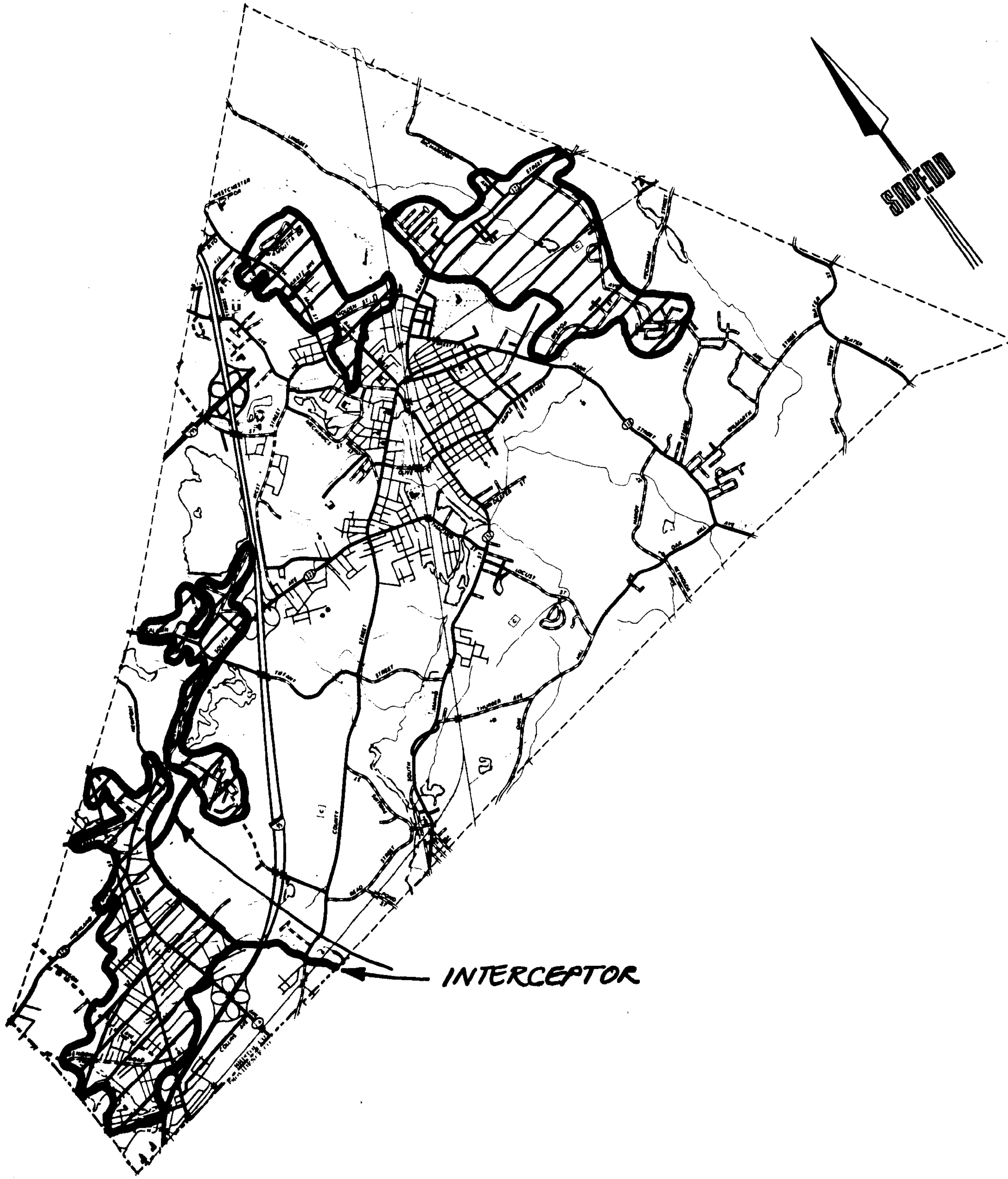


FIGURE 5
SEWER OPTION 2 B
CITY OF
ATTLEBORO

SCALE
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A comprehensive program for the effective use of on-lot systems would include the following:

3a. Inspection and Maintenance Program

All systems would be inspected and pumped on a regular basis. Proof of service would be required. (See Chapter Three for a discussion.) This would help avoid septic system failure from lack of care. The process would also allow the City to impose corrective action on those systems having problems due to age, soil conditions or improper installation.

3b. Alternative Disposal Methods

Identified problem units would be renovated or replaced with a suitable alternative system. Proper action would depend on the type and extent of the problem encountered. Possible alternative systems include compost toilets, water conserving toilets, aerobic treatment units and incinerator toilets (see Chapter Two for a discussion).

3c. Conservation

Water conservation devices such as aerated nozzles and showerheads would be required for some or all new developments and on those lots which have experienced problems in the past. The extent to which this measure would be enforced would depend on local environmental conditions (poor soils, high water table, etc.).

--Environmental Assessment

A city-wide inspection and maintenance program which carefully observed the above procedures would be a very effective means of protecting the ground and surface waters of Attleboro. Weak or spotty enforcement, however, could be damaging.

Alternative disposal methods are designed specifically to reduce the amount of organic matter which leaves the unit to the soil and ultimately the groundwater. If successful, these measures could perform as effectively as sewers in preserving water quality.

Low flow fixtures can be useful in two ways. First, they will reduce greywater flows and improve the efficiency of septic tanks. Second, conservation measures will significantly reduce water consumption, and thereby conserve water supply over the long run. This may be important for Attleboro which is in a potentially water short area.

The secondary effects from sub-options 3a, 3b and 3c would in all likelihood be minimal. Unlike sewers, this option would create no major development shifts, and large commercial and industrial concerns in particular would find little incentive to locate in these unsewered areas.

--Policy Review

It is reasonable to assume that it is within the existing power of the Board of Health to initiate a vigorous inspection and maintenance program. According to the provisions of the Environmental Code, it is apparent that some of the alternative on-site units will be prohibited by the State except under unusual circumstances.

--Costs

The financial burden under Option 3 will fall mainly on the individual home owner rather than the City.

	Capital Cost	Annual Operation and Maintenance
Maintenance	-	$60 pumping
Alternative Disposal Units		
Compact Toilets	$600-2500	$0-75
Incinerator Toilets	$600	$400
Aerobic Systems	$2000-3000	$200
Grey Water Facility	$800-1200	$5
Low Flow Fixtures		
Shower Heads	$13-17	
Faucet Aerators	$2	

4. Land Use Options

If significant portions of Attleboro are to remain unsewered, important steps will have to be made to protect sensitive areas (see Section C) such as the large area in the southeast portion of Attleboro.

Land use measures to protect unsewered areas of the City include:

4a. Enlarge Lot Size Requirements

Current zoning in the undeveloped sections of Attleboro calls for 12,000 and 16,000 square foot lots. SRPEDD calculations suggest that gross lot sizes (including streets, parks and other non-residential lands) of about 3/4 of an acre are necessary to preserve groundwater as a drinking water supply. Because Attleboro relies entirely on groundwater for its supply, it is recommended that Attleboro increase lot sizes in those areas of the City that would remain unsewered under Option 2a or 2b.

4b. Wetlands Protection

This sub-option would involve the use of zoning powers, but first, existing wetlands would have to be delineated and mapped. At this point, the City could establish restrictions on their use. This tool would be particularly applicable in the eastern one-third of Attleboro. (See Chapter Three, Land Use Management Techniques, for a further discussion.)

4c. Provisions to Protect High-Yield Aquifers

Although the Seven Mile River aquifer would be sewered under both Option 2a and 2b, there is another aquifer along the Bungay River and a small one on Chartley Brook which could be protected without sewers. Implementation of this technique would similarly require an accurate mapping of the aquifer or well field boundaries. Once completed, the city could impose restrictions on the type or intensity of land uses which locate within these zones. For example, Attleboro could pre-define particular activities or uses which would be prohibited from locating on the aquifer or within a well field. Alternately, the City could adopt a more flexible program by establishing a performance system. Under this system, permits would be issued upon a demonstration that the use would not threaten the aquifer. (See Chapter Three, Land Use Management Technique, for a further discussion.)

--Environmental Assessment

Enlarging lot sizes reduces the potential density of residences and thereby reduces the amount of waste water that may ultimately be produced and discharged to the groundwater. Larger lots also make it less likely that sewers will be introduced in the future, and thereby avoids the land use effects often generated by sewers. These effects may include an increase in traffic and associated air and noise pollution, increase in impervious surface plus an increase in erosion due to construction.

Restriction on the use of wetlands help to preserve a useful natural purification system as well as maintain a very important flood prevention mechanism. A restrictive aquifer by-law or a performance by-law help preserve groundwater quality by screening out those uses which may be hazardous due to the type of discharge associated with the activity. A protective system might be more effective since proposed uses would be evaluated individually. A prohibitive by-law, on the other hand, might miss certain hazardous activities since it attempts to pre-define all those uses which may be damaging to groundwater quality. Chances are that some harmful activities might not be included.

--Policy Review

A zoning change will have to be approved by the City Council. A wetlands and aquifer or well field protection district would have to gain similar approval.

--Cost

Costs involved include field surveying, mapping as well as administrative costs such as preparing and adopting a zoning by-law and then enforcing the provision.

The cost of mapping wetlands at 2' to 5' contours at a scale of 1"=100' may range from $15 to $40 per acre. If wetlands are interpreted instead from air photos with a follow up field check performed by volunteers, costs should be reduced to approximately $2 to $5 per acre.

SUMMARY

Operation of the advanced portion of the new treatment plant on a year round basis will be an extremely costly affair. All the cost for operation and maintenance will have to be carried by the City. Seasonal operation will provide a 10 to 20 percent cost savings on an O & M bill which has been estimated at about $785,000 per year, but which may reach even higher. Stream conditions will probably not decline significantly under seasonal operation since algae growth does not normally take place during winter months. It is recommended that the City apply for a permit based upon 6 months operation of the advanced portion. An industrial survey may further help the improvement of the operation of the plant by identifying any toxic waste streams which might disrupt plant performance. Cost for this effort could run as high as $50,000 per year, and funds should be sought to undertake this effort.

The City has basically two sewer scenarios it can pursue. One is the "wall-to-wall" scheme which has been studied by Whitman and Howard. Nearly all the City would be sewered under this option, and the total capital cost would run in the order of $34.3 million. The less intense sewer option is preferable if land use techniques are used to protect sensitive areas and tighter restriction are placed on the use of on-site disposal units. At $17.3 million, a limited sewer option which would include the Orr's Pond complex, South Attleboro, an area around North Main Street and a section encompassing Route 123 and Bishop Street would be about half the cost of the full sewer alternative. Some of this work is about to commence. Companion measures that should be adopted under a modified sewer alternative include the protection of wetlands, important well fields and an increase in lot size in certain areas the City now zoned for 12,000 or 16,000 square feet. Finally, steps to insure the reliable operation of septic units would also have to be incorporated through a regular pumping and inspection program. The cost for this effort is likely to run at about $60 per pumping. Regular inspection may discover particular conditions or circumstances where no discharge toilets such as compost units may be better suited than a septic tank.

TABLE 3

ENVIRONMENTAL ASSESSMENT

	OPTIONS						
	1a	1b	2a	2b	3a	3b	3c
SURFACE WATER QUALITY IMPROVEMENT	+2		+2	+2	+1	+1	+1
GROUNDWATER QUALITY IMPROVEMENT			+2	+2	+2	+1	+1
EXTENT CONSTRUCTION DISRUPTION			-3	-2			
ENERGY DEMANDS	+1		-2	-1			
CHEMICAL DEMAND	+2		-2	-1		-1	+1
LAND AREA REQUIRED			-1	-1			
DRINKING WATER PURITY			+2	+1	+1		
ENDANGERED SPECIES							
COMMERCIAL FISHERIES							
AIR QUALITY			-2	-1			
NOISE POLLUTION			-2	-1			
SOIL EROSION			-2	-1			
FRAGILE AREAS			-2	-1			
PUBLIC HEALTH	+1		+1	+1	+1	+1	
USE OF RECREATIONAL AREAS	+1						

\+ = Beneficial Impact
\- = Adverse Impact
Blank = No Discernible Change/Not Applicable

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

	1a	1b	2a	2b	3a	3b	3c
GROWTH IN RESIDENTIAL LAND USE			+3	+1			
GROWTH IN COMMERCIAL LAND USE			+3	+1			
GROWTH IN INDUSTRIAL LAND USE			+1				
INCREASED RUNOFF FROM DEVELOPMENT			+3	+1			
DISLOCATION OF INDUSTRY OR FIRMS							

\+ = Yes
\- = No
Blank = No Change

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

TABLE 3

ENVIRONMENTAL ASSESSMENT

	OPTIONS						
	4a	4b	4c				
SURFACE WATER QUALITY IMPROVEMENT		+1					
GROUNDWATER QUALITY IMPROVEMENT	+1	+1	+2				
EXTENT CONSTRUCTION DISRUPTION	+1	+1	+1				
ENERGY DEMANDS							
CHEMICAL DEMAND							
LAND AREA REQUIRED	+1	+1					
DRINKING WATER PURITY	+1	+1	+2				
ENDANGERED SPECIES							
COMMERCIAL FISHERIES							
AIR QUALITY	+1	+1					
NOISE POLLUTION	+1	+1					
SOIL EROSION	+1	+2					
FRAGILE AREAS	+1	+2					
PUBLIC HEALTH	+1	+1	+1				
USE OF RECREATIONAL AREAS		+1					

+ = Beneficial Impact
- = Adverse Impact
Blank = No Discernible Change/Not Applicable

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

GROWTH IN RESIDENTIAL LAND USE	-1	-2					
GROWTH IN COMMERCIAL LAND USE	-1	-2	-1				
GROWTH IN INDUSTRIAL LAND USE			-1				
INCREASED RUNOFF FROM DEVELOPMENT	-1	-2					
DISLOCATION OF INDUSTRY OR FIRMS							

+ = Yes
- = No
Blank = No Change

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

LOCAL STRATEGIES - SEEKONK

A. INTRODUCTION AND BASE DATA

Seekonk forms the border between Massachusetts and East Providence, Rhode Island. Although the community lies just to the east of Providence, Seekonk has remained at a surprisingly low density. Since 1955 when population totalled 7,290, that figure has increased at a moderate rate of approximately 1,000 people every five years to a figure of 11,351 in 1975.

Most of the development in Seekonk has taken place in the western portion of town, while non-urban and open space is predominant in the central and eastern sections of Seekonk. There is a lack of cohesiveness to the pattern of the Town's development, and much of the land use has been influenced by the major highway routes passing through Town. These include the parallel east-west configuration of I-495 and Route 6 in the south, Route 44 to the north, and Route 152 which travels north to south along the western edge of Town. Two of the more significant images of Seekonk are its older residential section in the northwest and the highway oriented commercial and industrial establishments in the southwest. The very compact, high density residential area on Central Avenue in the northwest reflects a period of time when many Seekonk residents needed easy access to the industrial jobs in Attleboro. The more recent commercial and industrial growth in the southwest demonstrates the influence I-195 has had on the development of this area.

As mentioned, Seekonk has maintained a very modest population level despite its close proximity to the Providence area. Undoubtedly, the State line has provided an important psychological and economic obstruction in the decision making process of Rhode Island people who have considered the Seekonk housing market in the past.

In any event, Seekonk has grown by about 4,061 people in the past twenty years, and while proximity to a large urban city has not drastically influenced population growth, the locational pattern indicates a distinct orientation to Providence. Most of the development is still along the western fringe of Town.

TABLE I

HISTORIC AND EXISTING DATA

a. Population

1955	1960	1965	1970	1975	Historical % Change
7,290	8,399	9,880	11,133	11,351	55.7

b. Land Use

Acres	1951	1975	Historical % Change
Residential	1,640	2,237	36.4
Commercial	58	144	148.3
Industrial	4	45	1,002.5

During the past twenty year period, the locational pattern of residential growth in Seekonk has begun altering somewhat. Since 1955, housing has made its way further to the east and away from the western edge of Town. This trend has been particularly apparent between Route 44 and I-195. On the average, these more recent housing units have been built on lots of approximately one-half acre. This reflects the larger lot size requirements (AA - 22,500 square feet and AAA 62,500 square feet), which has been assigned to the large portions of open land in the western part of Town.

Commercial land has similarly undergone a fairly sizeable increase since 1955, and much of this development reflects the completion of I-195. The area including Route 6 and Route 114, which intersects both Route 6 and I-195, has been the most active commercial area in Town. The Ann & Hope Mall, a major furniture outlet, a fast food restaurant and a cinema complex have all been built here within the past five years. A smaller shopping complex has also been constructed at the intersection of Route 44 and Route 114.

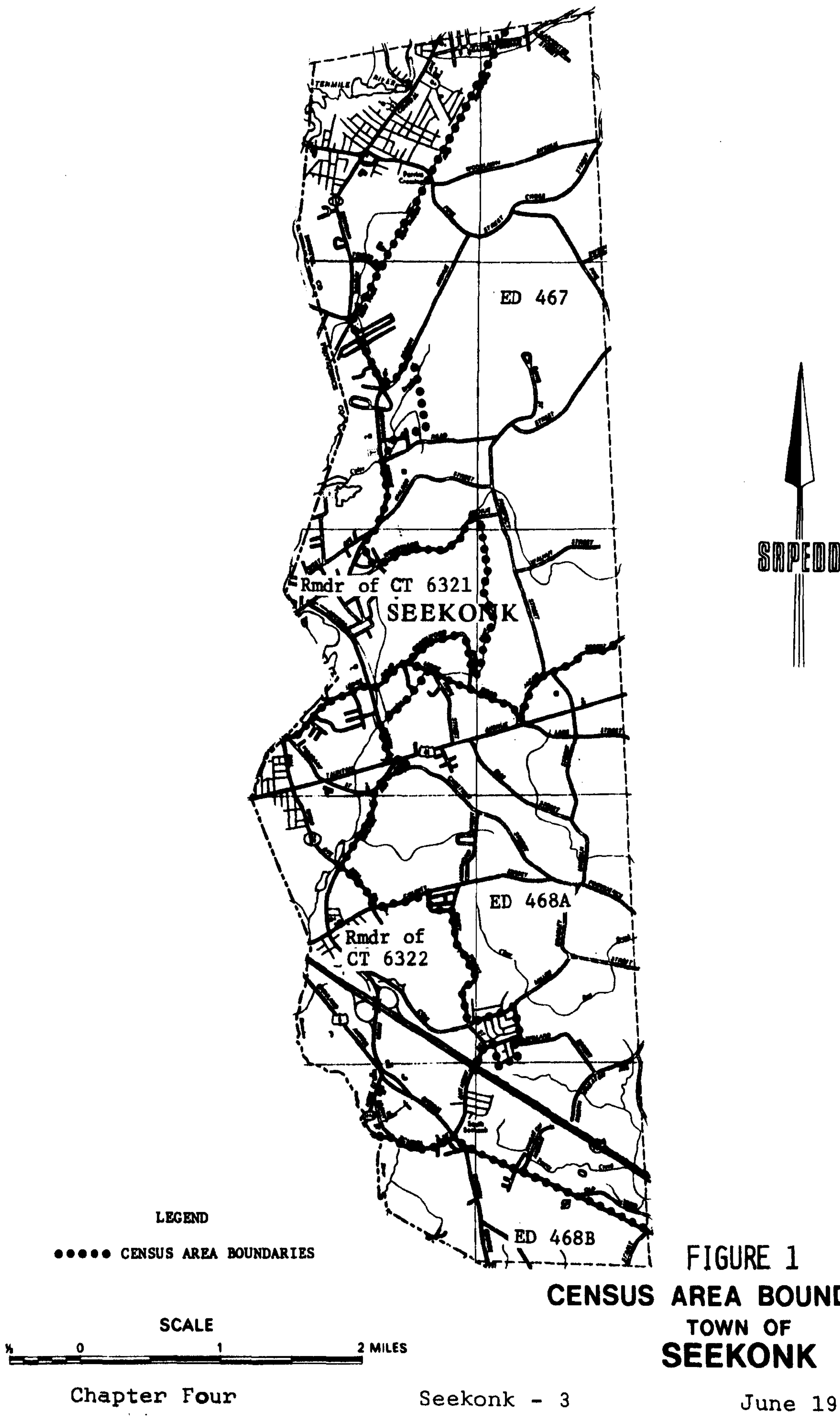


FIGURE 1
CENSUS AREA BOUNDARIES
TOWN OF
SEEKONK

The industrial base in Seekonk has been and remains of limited scope and size. Some trucking and warehousing activity has located off of Route 6 in a small private industrial park. This has been the most active site in Town, and it accounts for much of the industrial acreage consumption since 1951.

In terms of absolute numbers, population growth in Seekonk is expected to be somewhat less than what took place since 1955. Total change is projected to be approximately 3,750 people which represents a 33.3% growth rate or two-thirds the rate which took place from 1955 to 1975.

TABLE 2

1995 PROJECTIONS

a. Population

(1) Community

1975	1980	1985	1990	1995	Historical % Change
11,351	13,150	14,100	14,600	15,100	33.3

(2) Sub-Community Distribution

Census Area	1970	1995	Increase
ED 467	1,053	1,700	647
Rmdr. of CT 6321	4,469	4,870	401
ED 468A	1,576	2,830	1,254
ED 488B	556	907	351
Rmdr. of CT 6322	3,462	4,793	1,331
TOTAL	11,116	15,100	3,984

b. Land Use

Acres	1975	1995	% Change
Total Residential	2,237	2,965	32.5
Commercial	144	266	84.7
Industrial	45	49.5	10

As the figures in Table 2 show, the greatest amount of residential development is expected to take place in southern Seekonk (ED 468A and Rmdr. of CT 6322 on Figure 1). Much of this area, particularly between Route 195 and County St., is zoned Residence "A" which permits homes on 14,400 square foot lots. The remaining residential land south of Taunton Ave. is zoned Residence "AA" for homes on 22,500 square foot lots.

It is expected that the recent trend of commercial and industrial development in the Route 6 - Route 195 area will continue. The presence of large tracts of undeveloped land zoned for business or industrial use, plus the convenient access to Route 195 suggests that the Route 6 area will retain its attractiveness for non-residential development over the next 20 years.

Although most development, both residential and non-residential, is expected to take place in the South Seekonk area, Table 2 shows that several hundred new homes can be expected to be built north of Route 44 by 1995. Much of the undeveloped land in the northern part of Town is zoned Residence "AAA" for homes on 62,500 square foot lots. The limited commercial and industrial growth in this area is expected to be scattered, and to consist primarily of the expansion of existing establishments and the development of locally oriented businesses.

B. WATER RESOURCE INFORMATION

The Town of Seekonk is situated in two major drainage basins. The northern part of town is drained by the Ten Mile River, while the southern part drains south to Narragansett Bay. North Seekonk is in the Ten Mile and Coles Brook Basins, central and southwestern Seekonk are in the Runnins River basin and southeastern Seekonk is in the Palmer River basin.

The streams and adjacent lowlands are underlain by stratified glacial deposits which form important unconfined aquifers. North Seekonk groundwater resources are mapped on U.S.G.S. Hydrologic Atlas HA-300 and the southern half of Town on the New England River Basins Commission "A Map of Narragansett Bay, Coastal Streams, and Block Island" (see Figure 2).

1. Water Supply

The Seekonk water department draws its supply from two well fields. On Coles Brook off Brown Avenue, the Town has a field of 48 tube wells which produce .49 mgd. The Newman wellfield by Central Pond has three gravel packed wells which when combined, produce 2.8 mgd.

2. Groundwater Quality

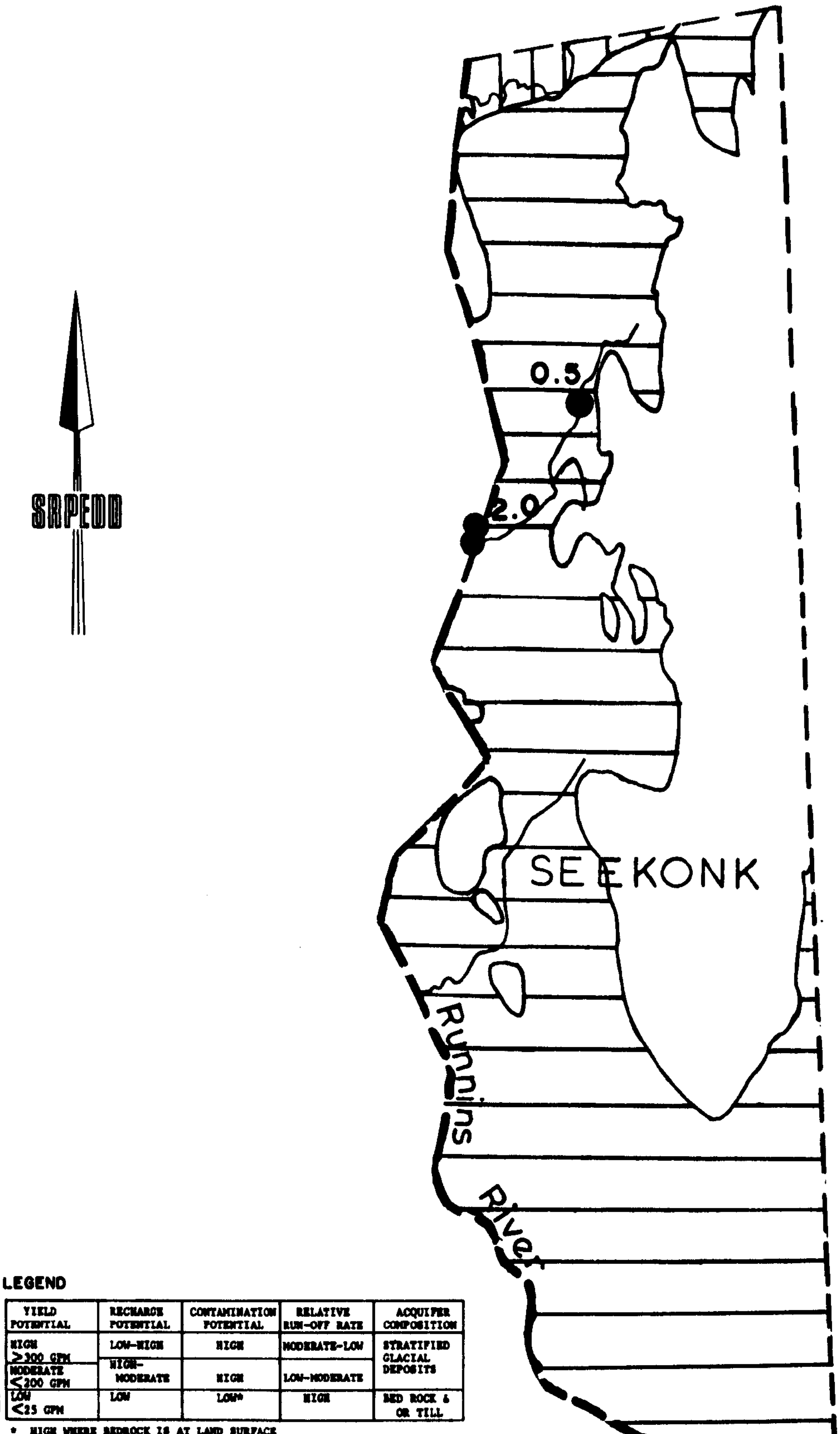
Iron and manganese levels have caused the closure of Rhode Island wells bordering Central Pond and the temporary closure of Seekonk's #2 well in the Newman wellfield. The iron and manganese are presently sequestered with chemical additions.

The anticipation of continued iron and manganese in the Newman wellfield has caused the Towns' Water Commissioners to seek other sources. The Town has engineering plans completed for a connection with the Pawtucket water system and is considering buying up to 4.0 mgd.

The old Seekonk landfill is 1800 feet southwest of the Newman wellfield but it is not believed to be related to the wellfields' quality problems.

3. Stream Conditions

At the present time, the Seekonk portion of the Ten Mile River is severely degraded primarily from upstream industrial discharges and the Attleboro



LEGEND

	YIELD POTENTIAL	RECHARGE POTENTIAL	CONTAMINATION POTENTIAL	RELATIVE RUN-OFF RATE	ACQUIFER COMPOSITION
(vertical lines)	HIGH $\geq$300 GPM	LOW-HIGH	HIGH	MODERATE-LOW	STRATIFIED GLACIAL DEPOSITS
** (horizontal lines)	MODERATE $\leq$200 GPM	HIGH-MODERATE	HIGH	LOW-MODERATE	
(blank)	LOW <25 GPM	LOW	LOW*	HIGH	BED ROCK & OR TILL

* HIGH WHERE BEDROCK IS AT LAND SURFACE

● 0.5 MUNICIPAL-AND INDUSTRIAL SUPPLY WELL. NUMBER IS YIELD, MILLION GALLONS PER DAY

STUDY-AREA AND DRAINAGE BOUNDARY

** HORIZONTAL LINE ORIENTATION: PARALLEL WITH TOWN NAME

SCALE

½ 0 1 2 MILES

FIGURE 2
GROUNDWATER RESOURCES
TOWN OF
SEEKONK

Sewage Treatment Plant. From North Seekonk to the inlet of Turner Reservoir, the Ten Mile is so severly polluted that the Division of Water Pollution Control has listed the present condition of the river as unclassified. The projected water classification goal for this same stretch of river is C. However, even to achieve the C goal, which would allow for minimal uses of the river such as industrial cooling and processing plus the propagation of some types of fish and wildlife, control measures will have to be applied to point sources that go beyond the application of conventional secondary treatment. It should be noted that even with the use of advanced sewage treatment techiques by upstream dischargers some segments of the river may still fall short of meeting the Federal water quality goal of fishable and swimmable waters (Class B), during extreme low flow conditions.

As the river passes through Turner Reservoir, stream conditions improve somewhat. Presently, Water Pollution Control classifies this segment as "C". It is anticipated that this segment of the Ten Mile will eventually be able to meet Class B water quality criteria. However, the Turner Reservoir segment is water quality limited which means that a level of treatment beyond secondary will be required to achieve the B goal.

The main dischargers in the Seekonk portion of the Ten Mile are the Attleboro Dyeing and Finishing Company and the Attleboro sewage treatment plant. The above two sources contribute large amounts of organic pollutants. As a result of these and numerous upstream industrial dischargers in Attleboro, the river suffers from high levels of biochemical oxygen demand, total coliform bacteria, ammonia-nitrogen and phosphorus. Because the river moves slowly through the impoundments of Central Pond and Turner Reservoir, and since the loading of nutrients to the ponds from upstream sources is large, eutrophication is a very significant problem for this portion of the Ten Mile.

Coles Brook, a small tributary to the Ten Mile, drains a portion of northern Seekonk and empties into Central Pond. There are no point sources on this stream, but nutrient levels have been discoverd to be quite high. It is suspected that runoff from residential areas as well as leachate from subsurface sewage disposal may be the main sources of these nutrients. Because there are no existing point sources on the brook, it is also classified as an anti-degragation segment. Under the Massachusetts Clean Waters Act, no industrial discharges to anti-degradation streams will be allowed in the future.

The Runnins River is the other large drainage system in Seekonk. It has been given a classification goal of a "B" river by the DWPC. Since sampling has not been carried out on the river an accurate assessment of its present condition is impossible at this time. However, using general knowledge of the basin, some inference might be made concerning water quality in the Runnins River Basin. Since the upper portion of the stream passes through residential land of light to moderate density, water quality problems might develop as a result of runoff from roads, fields, and lawns. Also, because many septic tank problems have occurred in the southern portion of Seekonk, higher nutrient levels might be suspected. Further downstream, the river passes two major highways, I-195 and Rt. 6, plus the associated commercial development. Again, runoff might be considered as a suspected problem in the form of higher loads of chloride, lead, solids, BOD and nutrients. It must be reiterated, however, that these can only be considered suspected problems. They have not been substantiated by the sampling data. Because of the absence of existing point sources, the Runnins River is considered an anti-degradation stream.

C. LOCAL WATER QUALITY ISSUES

1. On-site Sewage Disposal Problems

A very detailed map of septic tank failures since 1970 has been prepared by the Town. It details almost on a lot by lot basis where recent failures have occurred.

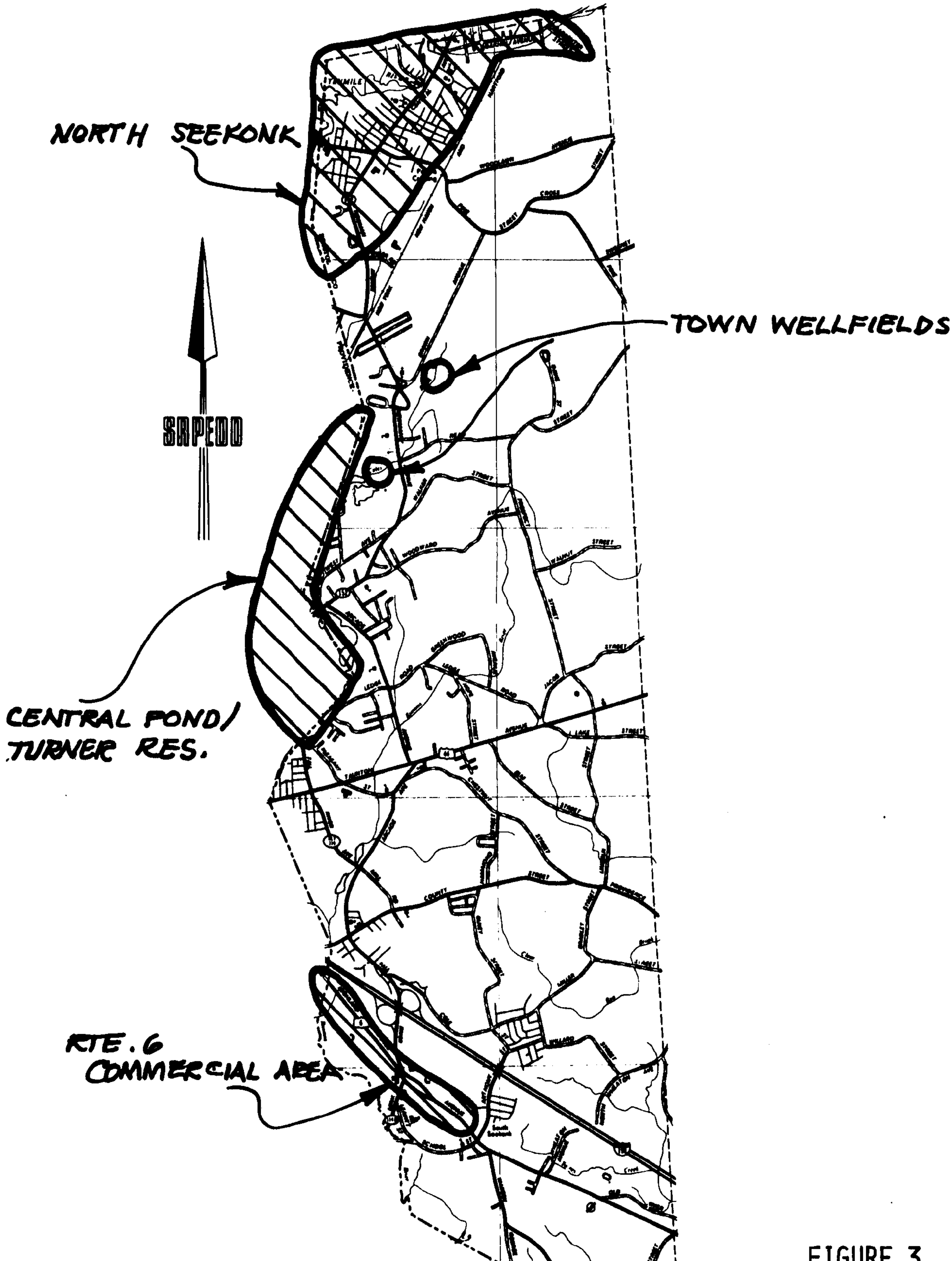
Townwide, the number of repairs since 1970 have totaled 241. By far, most of these repairs (132) have been required in the area south of Taunton Avenue. Over the rest of Town, the central area (Towers Road to Taunton Avenue) has required 71 repairs while north of Tower Road there have been 38 repairs. These figures indicate that septic system failures are more common among newer homes than older ones. The primary reason for this seems to be the fact that older homes were built on the best soils, while newer developments have taken place on more marginal land with wet or hardpan soils.

In the North Seekonk area, inadequate design (i.e. cesspools) and lack of maintenance seem to be the major cause of failure for subsurface disposal systems. Among the newer homes, improper installation or location of leaching systems appears to be the chief cause of failures. These systems generally fail either because they are installed too close to the water table, or because of soil smearing during installation in hardpan or silty soils. Rebuilding of the leaching system is generally required to correct such failures.

2. Constraints on Future Development

The primary constraint on future development in Seekonk is the generally poor suitability of soils for septic systems in undeveloped parts of Town. Past development has occurred chiefly in the western part of Town where soil conditions are generally favorable. It is likely, however, that future development will generally take place on poorer soil.

Much of the undeveloped land in Town consists of wetlands. Gradual encroachment onto these delicate



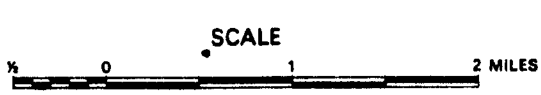


FIGURE 3

LOCAL WATER QUALITY ISSUES

TOWN OF

SEEKONK

areas is likely as the Town continues to grow unless protective measures are adopted.

The Town's municipal water supply relies heavily on the Coles Brook drainage area in the northern part of Town. This stream provides recharge for both the Brown Avenue and Newman wellfields. Because virtually the entire drainage basin is zoned for residential use on 62,500 square foot lots, future development poses little threat to the quality or recharge characteristics of the aquifer. Existing supplies will not be sufficient to meet future water demands, however. Therefore, if arrangements are not made to purchase water from Rhode Island, the Town should acquire and protect sites for future Town wellfields in the southern part of Town.

3. Known Non-Point Pollution Problems

The primary non-point source of pollution in Seekonk is septic systems. When they fail, such systems add bacteria and nutrients to surface waters. When they are functioning normally, however, they contaminate the groundwater with nutrients. Nutrient build up in the groundwater becomes particularly noticeable under high density development. Because the nutrient enriched groundwater below North Seekonk flows into the Ten Mile River and Central Pond, subsurface sewage disposal in this area is adding to the Pond's eutrophication problem. Although the Pond is suffering mostly from the effects of upstream pollution sources, in the future, as these sources are cleaned up, the effects of septic system leachate from homes in North Seekonk will become more noticeable.

D. ALTERNATIVE SOLUTIONS

The restoration and protection of Seekonk's water resources will require the implementation of both structural and regulatory measures. While the installation of sewers may be necessary to deal with some existing problems, judicious use of regulatory measures may prevent the need for extensive sewering in the future.

Because of the long narrow shape of Seekonk, the installation of a townwide sewage collection system would be an expensive proposition. In addition, many parts of Town do not need sewers now, and will not need them in the future. Therefore, the alternatives below discuss discrete, isolated sewage collection systems designed to solve specific problems. The Town is fortunate in that adjacent communities have, or will have, new sewage treatment plants quite near potential sewage service areas. The use of these facilities would be considerably less expensive than building new treatment works solely to treat sewage from Seekonk.

It should be noted that a detailed sewage facilities study has never been prepared for the Town. Such a report would be required prior to the construction of any sewers.

1. Maximum Sewering

This alternative would make maximum use of sewers to deal with the Town's present and future water quality problems. As shown on Figure 4, the older residential North Seekonk area would be sewered and connected to the Attleboro sewage treatment plant. Designs are presently being prepared for the expansion and upgrading to advanced treatment of this plant. Sufficient capacity is being included in this expansion to handle sewage from North Seekonk.

A second sewage collection system would serve the central and southern portions of Town. The sewered area would extend from West Avenue south to the Route 6 area. Sewage from this collection area would be treated at the new East Providence sewage treatment plant. Although this plant was not specifically designed to handle sewage from Seekonk, it is presently operating far below capacity and appears to be able to easily accommodate such flows.

Average sewage flows from these collection systems by the year 1995 would be about 2.3 mgd. Ultimate development within the service areas would generate waste flows of about 3.5 mgd.

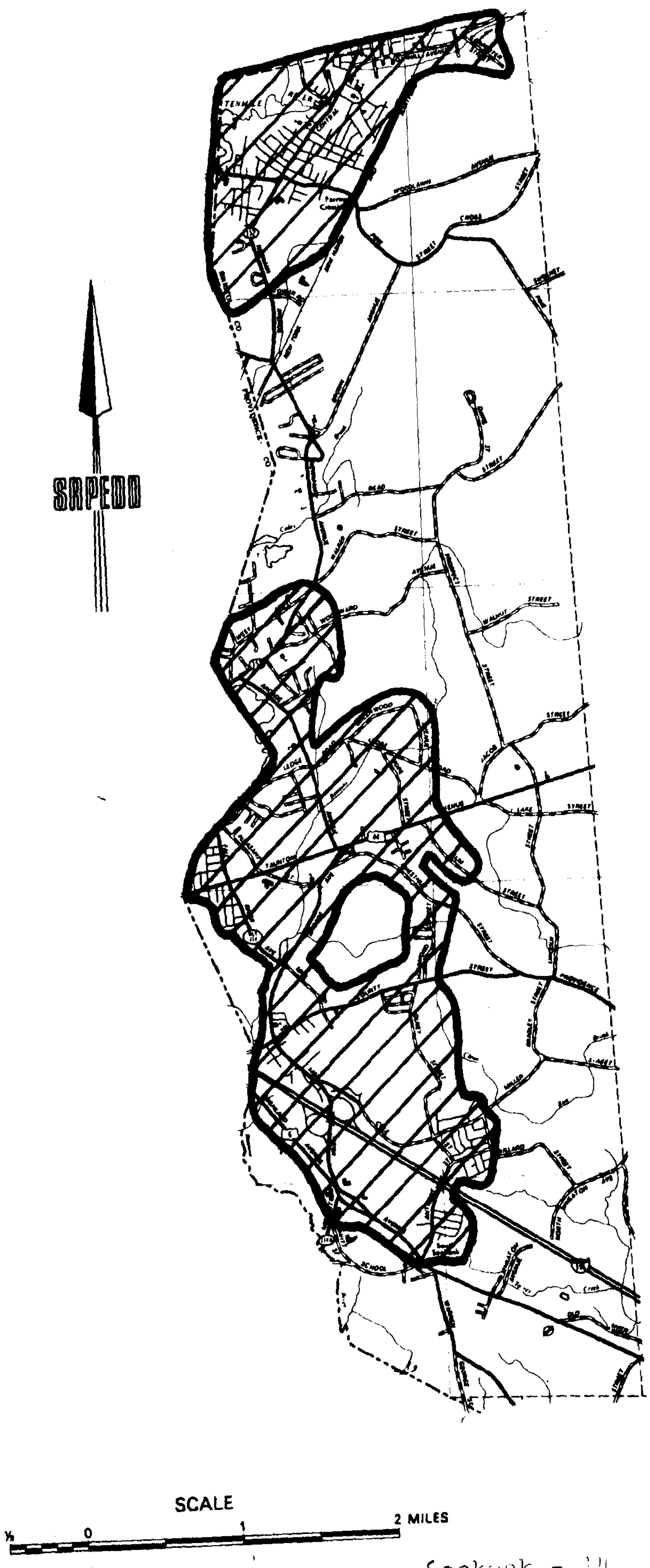


FIGURE 4
ALTERNATIVE 1
TOWN OF
SEEKONK
June 1977

--Environmental Assessment

Because sewers would be extended to most homes in Town, the problems of failure and groundwater contamination associated with septic systems would be largely eliminated.

Development would be encouraged within the sewered area. Land which is presently unbuildable due to soil limitations would become developable. Wetlands would be encroached upon.

--Policy Review

The connection of a North Seekonk sewage collection system to the Attleboro treatment plant has been discussed for years. This program is consistent with the Ten Mile River Basin Plan, and with designs presently being prepared by the City of Attleboro.

Use of the East Providence sewage treatment plant has not been agreed to by City or Rhode Island officials. An agreement between Seekonk and East Providence to share the facility would have to be negotiated. Legislative action would also be required to allow the interstate connection of the sewerage systems.

--Costs

The capital cost of installing the collection system shown on Figure 4 (not including treatment plant costs) would be about $16,200,000. The operation of this collection system plus a share of the operating cost of the Attleboro treatment plant would be about $465,000 per year.

2. Moderate Sewering

This alternative includes the minimum amount of sewering that the Town will require if present zoning is retained. The sewer service areas (shown on Figure 5) include North Seekonk as in Alternative 1, and Southern Seekonk in the Route 195 area including the large Residence "A" district.

This sewering configuration is designed to provide service only for densely developed residential and commercial areas where unacceptable groundwater contamination would otherwise occur. The remaining parts of Town would continue to rely on septic systems. Adoption of a septic system maintenance program would be required to assure satisfactory on-site sewage disposal in unsewered areas.

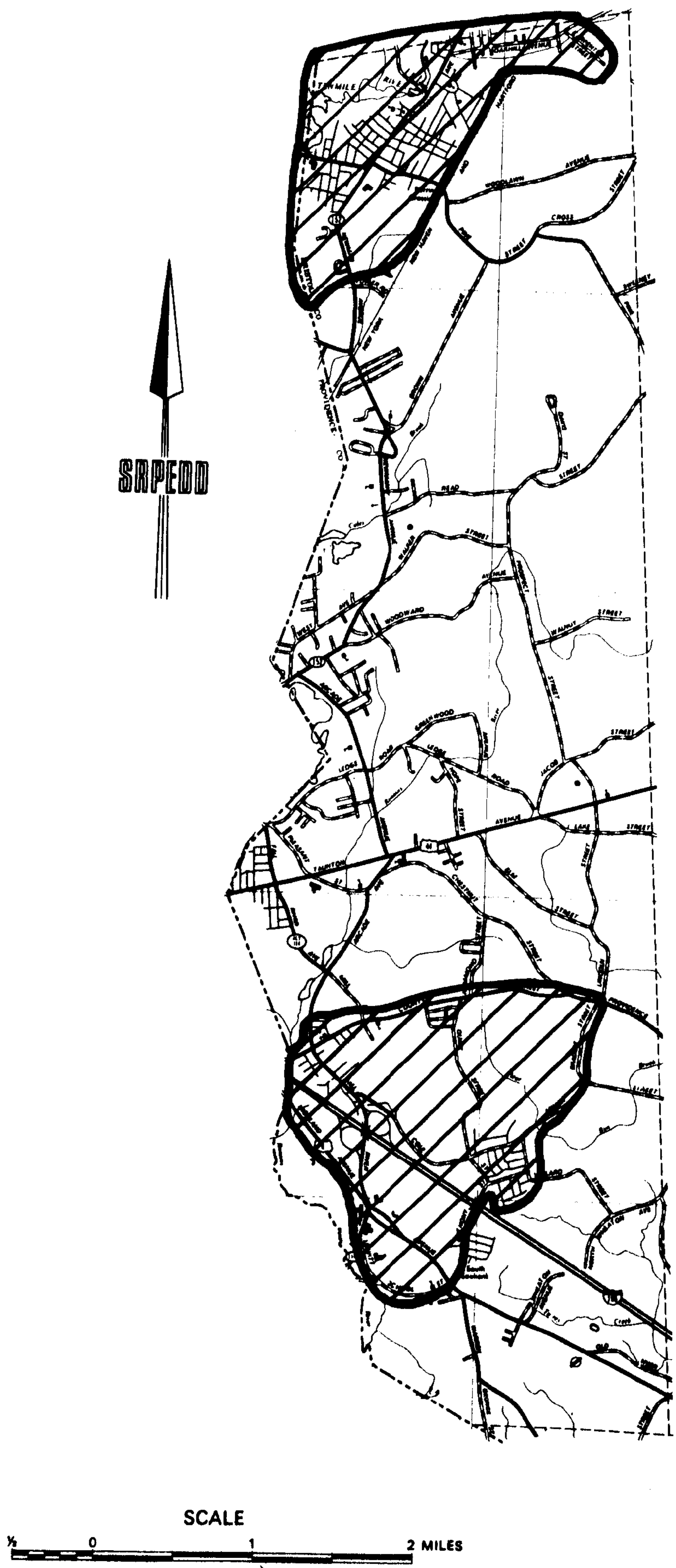


FIGURE 5
ALTERNATIVE 2
TOWN OF
SEEKONK
June 1977

Sewage flows from these collection systems for the year 1995 are estimated to be 2.2 mgd. Sewage from the North Seekonk area would be treated at the Attleboro plant, and waste from the southern area would go to East Providence.

--Environmental Assessment

Many of the areas presently reporting septic system failures would be sewered. Nutrient enrichment of the Ten Mile River due to septic system leachate from North Seekonk would be stopped.

Much of the land within the southern sewage collection area is presently undeveloped. The presence of sewers here would encourage residential development on small (14,500 square foot) lots that would otherwise be restricted by poor soil conditions. Storm runoff from this area will increase significantly as it develops toward saturation density.

--Policy Review

Same as Alternative 1. As with Alternative 1, extensive areas of undeveloped land would be sewered.

--Costs

The capital cost of installing this collection system as shown on Figure 5 would be about $10,370,000 (not including treatment plant costs). Take operation and maintenance of this system, including treatment is expected to cost the Town about $460,000 per year.

3. <u>Limited Sewering</u>

This alternative provides the minimum amount of sewering required in Seekonk, and relies heavily on regulatory measures. As Figure 6 shows, sewers would be installed only in North Seekonk with the sewage being treated at the Attleboro treatment plant. The average sewage flow from this area (including Attleboro Dying and Finishing) is estimated to be 1.32 mgd.

All remaining parts of Town would continue to rely on on-site disposal systems. For residential developments, this would generally mean septic systems. For larger commercial or industrial developments, packaged treatment plants (as described in Chapter Two) could be used. To protect the groundwater from excessive contamination, and to provide adequate space for a reserve leaching area, the lot size of undeveloped Residence "A" zones would have to be increased to 30,000 square feet. Adoption of a septic system maintenance program would also be required.

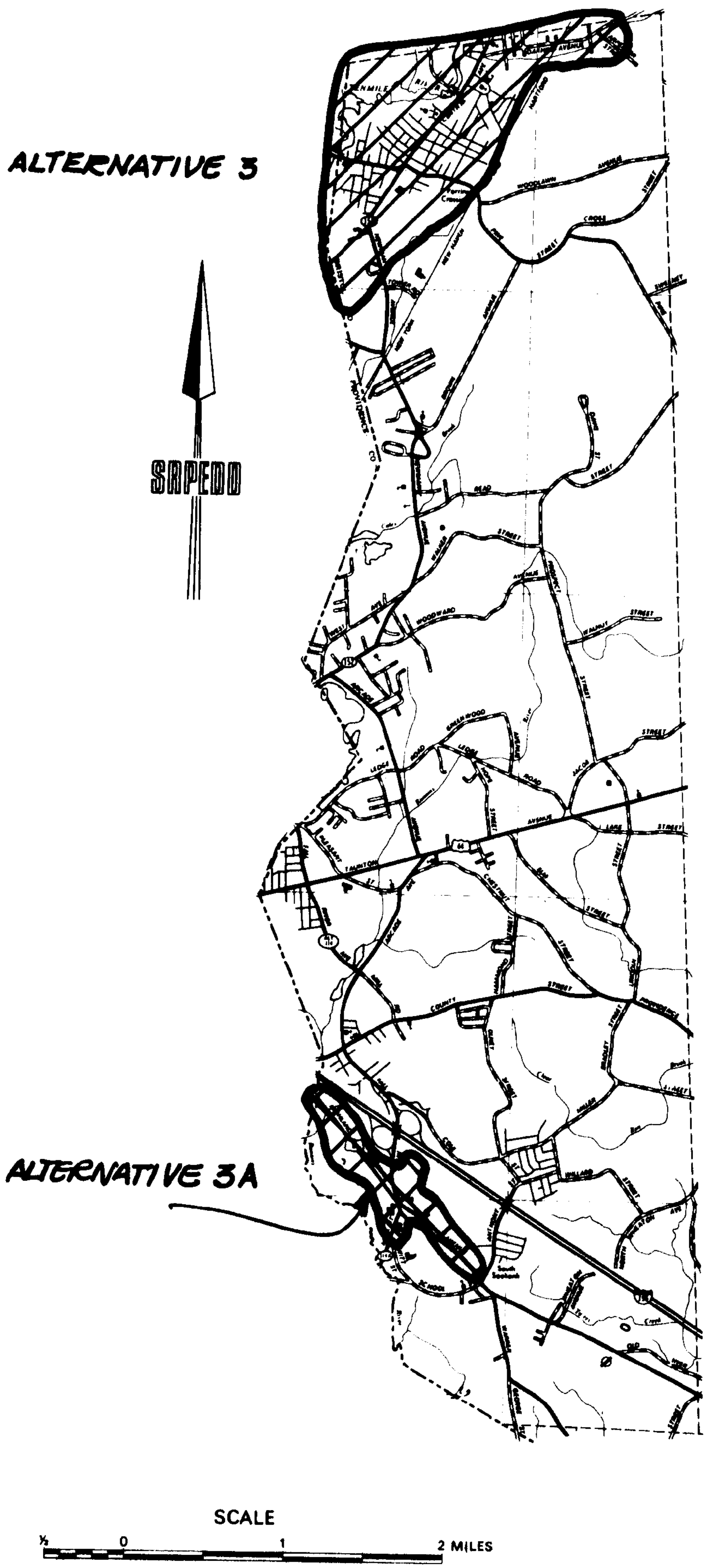


FIGURE 6
ALTERNATIVE 3 & 3a
TOWN OF
SEEKONK
June 1977

--Environmental Assessment

The nutrient enrichment of the Ten Mile River by septic systems in North Seekonk would be eliminated. Septic systems in the remaining areas of Town would continue to contribute some contaminants to local groundwater. However, density restrictions would generally keep the groundwater of drinkable quality. Because the only area to be sewered is essentially 100 percent developed, sprawl or accelerated growth would not be stimulated.

--Policy Review

The required zoning changes would require a 2/3 vote of Town Meeting, and would result in fewer residential lots being available to develop.

Connection of the North Seekonk area to the Attleboro Treatment plant is consistent with designs presently being prepared for the City.

--Costs

The cost of installing the North Seekonk sewage collection system as shown on Figure 6 (not including treatment plant costs is about $4,354,000. The operation and maintenance of this system including treatment is expected to cost the Town about $290,000 per year.

3a. Sewer the Route 6 Commercial Area

This option could be adopted in conjunction with Alternative 3. By itself, this alternative does not meet the Towns' water quality needs. As Figure 6 shows, the sewage collection system would serve Highland Avenue from the State line to Fall River Avenue, and Fall River Avenue from Route 195 to Anthony Street. As mentioned previously, this area has seen a good deal of commercial development in the past few years. Convenient highway access, favorable zoning, and the presence of large tracts of undeveloped land suggest that business development in this area will continue. Because of the relatively small sewage flow that would ultimately be expected from this area (0.3 mgd), a packaged sewage treatment plant could be used, with subsurface disposal of the effluent.

--Environmental Assessment

By providing sewage disposal facilities to undeveloped land with poor soils, this sewering program would stimulate development that might otherwise not take place. The large areas of impervious surface that accompany this type of development to lead to significantly increased runoff.

--Policy Review

The land served by this system is largely undeveloped. This sewer would be installed to encourage future business development rather than to solve existing sewage disposal problems.

Although DEQE does not encourage the use of package treatment plants, the use of such a facility would obviate the need for negotiating an agreement with East Providence for the use of their plant.

--Costs

The capital cost of installing the sewage collection system described above, plus a packaged sewage treatment plant with subsurface effluent disposal would be about $1,740,000.

Because preliminary cost cost estimates showed the construction of a major, separate sewage treatment plant to be far more expensive than use of existing plants in Attleboro or East Providence, only out of town treatment of sewage is considered for large sewage flows (Alternatives 1, 2, and 3). A local packaged treatment plant is included in Alternative 3a.

SUMMARY

Both structural and regulatory measures appear to be required for Seekonk to restore and protect the quality of its water resources. At a minimum, sewers appear to be required in the North Seekonk area. The degree to which further sewering will be required depends largely on the amount of preventative action the Town takes.

Below is summary of the cost of the sewering portions of the four alternatives. In addition to these costs, the costs to unsewered homeowners of $20 per year for septic system maintenance and $1,500 for rebuilding of failed systems must also be considered.

Alternative	Capital Cost	Annual Operation & Maintenance
1. Maximum Sewering	$16,200,000*	$ 465,000
2. Moderate Sewering	10,370,000*	460,000
3. Limited Sewering	4,354,000*	290,000
3a. Route 6 Sewering/Package	1,740,000	

*Treatment plant costs not included

Alternative 3, Limited Sewering, with flows from North Seekonk being treated in Attleboro and Alternative 3a, with flows from South Seekonk being treated in East Providence or in a packaged plant are recommended for priority consideration. If the packaged plant option is chosen for South Seekonk, it will limit the potential for expansion to areas covered in Alternative 2. The decision of connecting to Rhode Island or building a packaged plant will have to be made on the basis of future sewer line expansion and negotiation with East Providence and the State of Rhode Island. Septic system failures are not concentrated in any particular area of Seekonk, so a septic system maintenance program is important to avoid the more costly sewering configurations presented in Alternatives 1 and 2.

Regardless of which sewering alternative is adopted, the following recommendations should be followed:

1. The Board of Health should institute a septic system maintenance program as described in Chapter Three.

2. A water conservation program requiring the use of low-flow plumbing fixtures in new homes and renovations should be adopted by the Town.

3. Town zoning by-laws should be revised to:

   --establish a wetlands protection district (once current wetlands mapping is completed)

   --increase lot size in the Residence "A" district along Route 195 to 30,000 square feet unless the Town plans to sewer this area as provided in Alternative 1 or 2.

TABLE 3

ENVIRONMENTAL ASSESSMENT

	OPTIONS						
	1	2	3	3a			
SURFACE WATER QUALITY IMPROVEMENT	+2	+2	+2				
GROUNDWATER QUALITY IMPROVEMENT	+3	+3	+3	+2			
EXTENT CONSTRUCTION DISRUPTION	-3	-2	-2	-2			
ENERGY DEMANDS	-3	-3	-3	-2			
CHEMICAL DEMAND	-3	-3	-3	-2			
LAND AREA REQUIRED	-3	-2	-1	-1			
DRINKING WATER PURITY	+1	+1	+1				
ENDANGERED SPECIES							
COMMERCIAL FISHERIES							
AIR QUALITY							
NOISE POLLUTION							
SOIL EROSION							
FRAGILE AREAS	-3	-2		-2			
PUBLIC HEALTH	+3	+3	+3	+1			
USE OF RECREATIONAL AREAS	+2	+2	+2				

\+ = Beneficial Impact
\- = Adverse Impact
Blank = No Discernible Change/Not Applicable

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

GROWTH IN RESIDENTIAL LAND USE	+3	+3	-	-			
GROWTH IN COMMERCIAL LAND USE	+3	+3	+1	+3			
GROWTH IN INDUSTRIAL LAND USE	+3	+3	+1				
INCREASED RUNOFF FROM DEVELOPMENT	+3	+3	+1	+3			
DISLOCATION OF INDUSTRY OR FIRMS	-	-	-	-			

\+ = Yes
\- = No
Blank = No Change

LOCAL STRATEGIES - REHOBOTH

A. INTRODUCTION AND BASE DATA

Up to the present time, Rehoboth has been able to retain its rural and open character. Despite a geographical location that lies within the urbanized perimeter of Taunton, Attleboro, Providence and Fall River, roughtly 25,000 of its nearly 30,500 acres remain as agricultural or forest land. An obviously significant factor which can account for this large amount of non-urbanized land is a small population and a slow rate of growth. Since 1950, when the figure stood at 3,700, the population level has expanded to an estimated amount of 7,009 in 1975.

The small population and large land area have worked together to leave a low-density residential pattern throughout the Town. In addition, residential locational patterns have shown a preference for scattered development with some exceptions noted along the highway Routes 44 and 118 and in North Rehoboth and Rehoboth Village.

In line with Rehoboth's small-town nature, it is not surprising to find that there is little commercial and business activity. Most of the existing commercial enterprises are located along Routes 44 and 118.

It is interesting to note how land uses have responded to the minimal growth pressures evident in the Town since 1950. The least affected category has been forest land, which is virtually unchanged from an initial amount of approximately 20,900 acres. Agricultural land and wetlands on the other hand have experienced declines of about 26 percent and 25 percent respectively. At the same time, urbanized land, although a small portion of the total, has expanded nearly 2,365 acres. Finally, recreation land has been added to, many times since 1950, but its present total is only about 700 acres.

TABLE 1

HISTORIC AND EXISTING DATA

a. Population

1955	1960	1965	1970	1975	Historical % Change
4,211	4,953	5,489	6,512	7,009	60

b. Land Use

Acres	1951	1975	% Change
Residential	567	2,258	298
Commercial	25	47	88
Industrial	9	60	567

The numbers in Table 1 showing the massive percentage increases in land use over the past twenty-five years can be somewhat misleading if not examined carefully. The increase of nearly 300 percent in residential land use is indicative of development taking place at a lower density than in the past, and does not represent an equivalent population increase. Assuming an average household size of three persons, then the acreage increase over twenty-five years has been one unit per 1.8 acres. The increases in commercial and industrial land uses are impressive percentage-wise, but do not represent a significant numerical increase.

TABLE 2

1995 PROJECTIONS

a. Population

(1) Community

1975	1980	1985	1990	1995	Projected % Change
7,009	8,300	9,050	9,500	9,900	41

(2) Sub-Community Distribution

Census Area	1970	1995	Projected % Change
ED 462	2,004	2,852	42
ED 463	1,320	2,098	59
ED 464	2,022	3,139	55
ED 465	884	1,358	54
ED 466	282	453	61

b. Land Use

Acres	1975	1995	Projected % Change
Residential	2,258	3,335	48
Commercial	53	76	43
Industrial	60	61	2

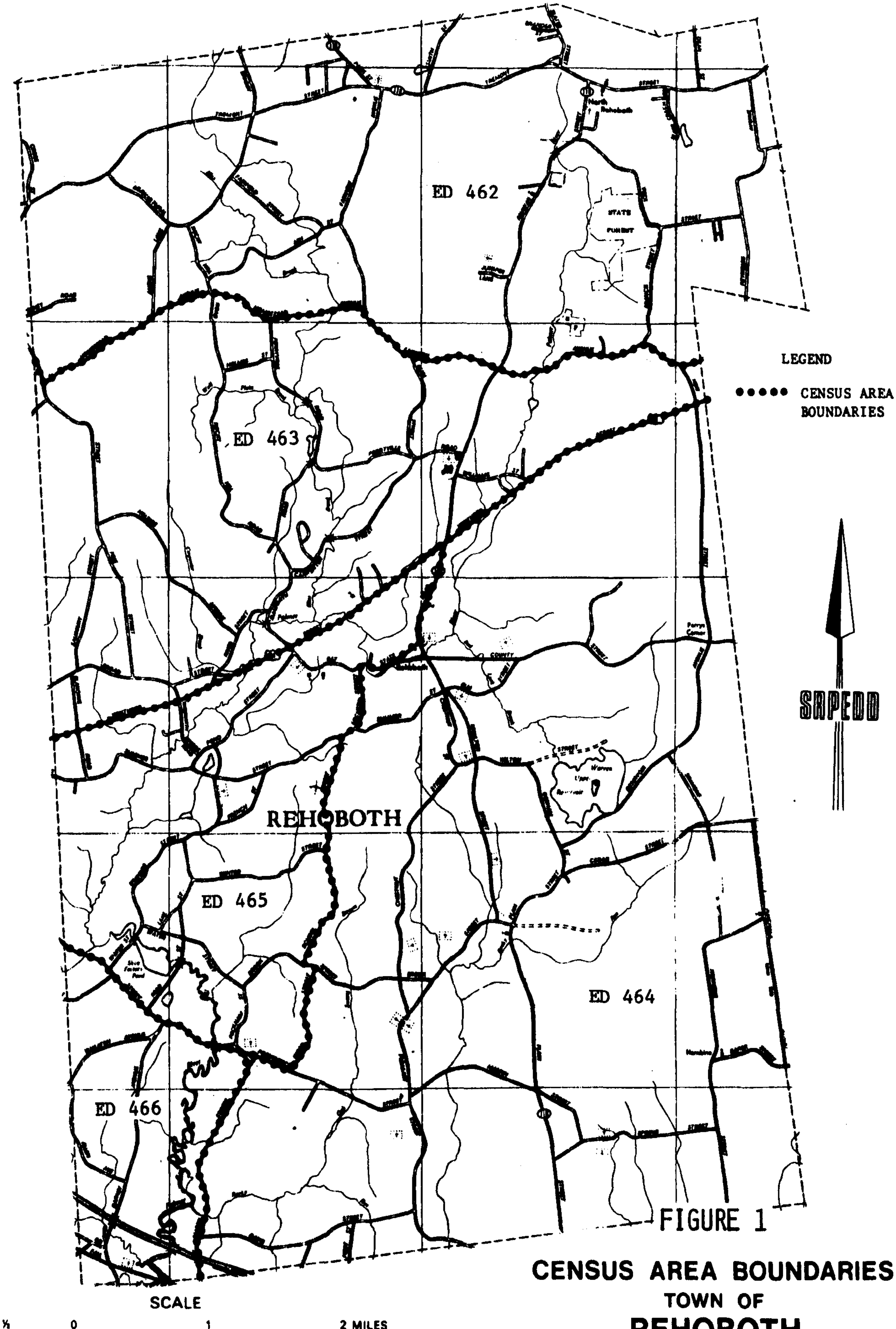


FIGURE 1

CENSUS AREA BOUNDARIES
TOWN OF
REHOBOTH

The Town's twenty-year projected population growth is expected to be at a rate of 2 percent per year, which is close to the historical rate. Due to the uniform lot size and absence of utilities, the projected growth does not exhibit any well-defined pattern but is generally scattered throughout Town.

Commercial growth is expected to increase at an unspectacular but steady rate, with the additions due to strip development along major arteries. Industrial growth is expected to be nil, given Rehoboth's lack of utilities and subdued attitude to industrial growth.

B. WATER RESOURCE INFORMATION

The Town of Rehoboth is primarily drained by the Palmer River basin which empties into Narragansett Bay. The southeastern corner is drained by the Kickamuit and Cole River basins. The northeastern corner is in the Taunton River basin and the northwestern corner is in the Runnins River basin.

The stream valleys and adjacent low lands are underlain by stratified glacial deposits which form important unconfined aquifers. The aquifer areas were mapped by the U.S.G.S for the New England River Basin Commission on "A Map of Narragansett Bay, Coastal Streams, and Block Island."

1. Water Supply

The entire Town relies upon individual wells for water supply.

The Town of Warren, Rhode Island, has the "Upper Warren Reservoir" as a surface supply in Rehoboth.

2. Stream Conditions

The Palmer River has been issued a B classification goal by the Division of Water Pollution Control (WPC). In addition to being of excellent aesthetic value, class B waters are suitable for water contact recreation, fishing, certain agricultural and industrial uses, and water supply after proper treatment. Since the Palmer receives no discharge from a municipal treatment plant, the river also comes under the anti-degradation clause of the Massachusetts Clean Waters Act. Under the requirements of the law, no new industrial discharge will be allowed to the river in the future.

The Palmer River was sampled by WPC for the first time in early June of 1977. At the time of this publication, analysis of the results had not been completed and published. Preliminary results, however, suggest the Palmer is reasonably clean and within class B standards. Coliform bacteria counts were generally low, and dissolved oxygen exceeded 9 mg/l in eleven of thirteen stations. Five-day biochemical oxygen demand (BOD_5) and chemical oxygen demand levels were within reasonable limits.

In addition to the Palmer, all other streams and brooks in Rehoboth are classified anti-degradation. Some of the larger ones included in this category are the following: Wolf Plain Brook, Carpenter Brook, Fullers Brook, Bad Luck Brook, Oak Swamp Brook and Rocky Run Brook.

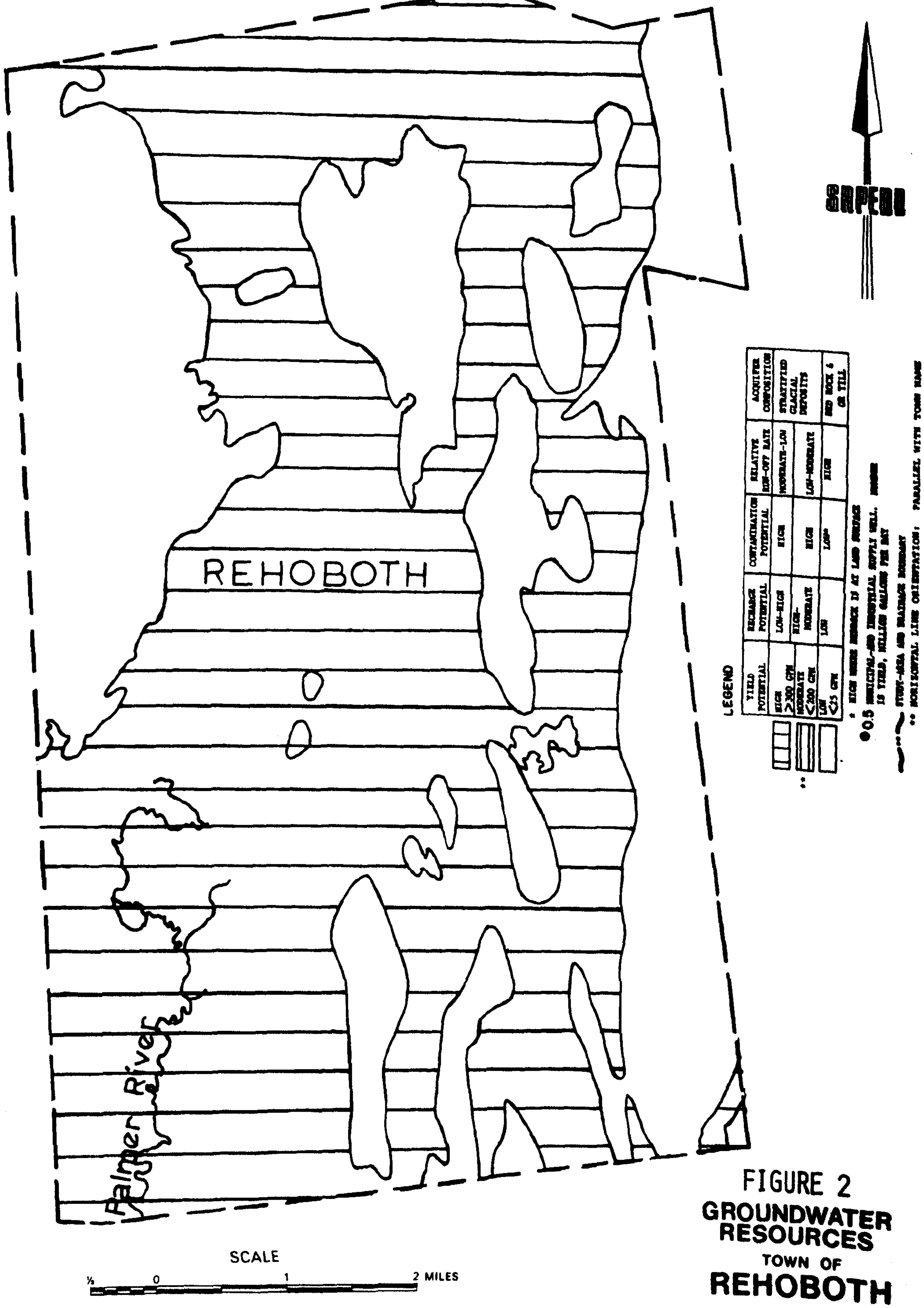


FIGURE 2
GROUNDWATER RESOURCES
TOWN OF
REHOBOTH

C. LOCAL WATER QUALITY ISSUES

1. Physical Features

A large percentage of Rehoboth is plagued with a problem of poor soils for on-site sewage disposal. Areas that have a high watertable, or hardpan and bedrock make up over 75 percent of the Town's land. In general, the better soils for development are found along main roads (primarily Routes 44 and 118) with concentrations of suitable soil areas found in the southwest corner, and central parts of Town.

Soils are a critical factor when one considers that all of Rehoboth is dependent on groundwater from individual wells and all sewage is disposed of to the ground. Most of Rehoboth is underlain by a moderate yield aquifer (less than 200 gallons per minute) which is the Town's only source of water supply (Figure 2). Surface water rights of the Upper Warren Reservoir are controlled by the Bristol County (Rhode Island) Water Company.

2. Non-Point Sources

Agriculture, both in the form of livestock and crop raising, are significant factors in Rehoboth's economy and land use. Piggeries are well regulated in the Town's Board of Health Regulations. It is recommended however, that Rehoboth adopt the "Best Management Practices" for dairy and fruit and vegetable activities contained in Chapter Three of this plan.

D. ALTERNATIVE SOLUTIONS

The development of a centralized sewer system is not presented as an alternative for Rehoboth. The Town does not have, nor is it expected to have a pattern of development that requires sewering now or in the next twenty years. It is the Town's expressed desire to avoid sewers by judiciously using non-structural alternatives, such as zoning. Because there are no real concentrated areas of development presently and because the zoning is generally uniform throughout Town it is highly unlikely that any such concentrations of development will occur.

The fact that sewering is not deemed to be necessary does not imply that Rehoboth should be lax in the future on water quality issues. To the contrary, there are a number of steps that Rehoboth can take, in addition to many that it has taken, to preserve its rural character and high level of environmental quality.

1. Zoning Alternatives

The current Town by-law has a number of features that serve to promote water quality goals. Lot size (minimum 60,000 square feet) is more than adequate for on-site sewage disposal if there are proper conditions on a lot. The 200 foot frontage requirement promotes a development pattern that would be very expensive to sewer, if that were to become necessary in the future. The Town has flood-plain zoning, and industrial zoning which includes performance standards for disposal of liquid wastes, among other features. This reads as follows: "No discharge at any point into any private sewage-disposal system, stream, or the ground of any materials in such a way or of such a nature or temperature as can contaminate any running stream, water supply or otherwise cause the emission of dangerous or objectionable elements is permitted."*

This paragraph in the by-law is laudable, but it is recommended that more specific criteria or standards be added to enhance the by-law's enforcability. More specific standards for particulate matter in the air, vibration, and noise levels are contained in the by-law. SRPEDD could assist Rehoboth in clarifying this section.

*By-Laws of the Town of Rehoboth, 1975, page 29.

A notable omission from the by-law is a provision to protect wetlands other than floodplains. Because of their importance in the overall water quality picture and the need to prevent development in wet areas, Rehoboth should designate wetlands as a special wetlands district and then amend the Town's zoning by-law to carefully restrict the uses permitted within these zones. (See Chapter Three, Land Use Management Techniques for additional discussion.) As a supplement, the Town may further desire to set up buffer zones around wetlands to prohibit development from infringing on wetland boundaries.

--Environmental Assessment

Restrictions on the use of wetlands preserve their existence and as a result maintain a valuable natural purification system. In addition, wetlands are a vital flood prevention mechanism. They will help to protect not only Rehoboth properties but also properties in other municipalities which are in the same basin.

--Policy Review

Restricting large amounts of land from certain types of development is usually a controversial issue, particularly among those whose property in effected.

--Costs

The costs of mapping wetlands at 2' to 5' contours at a scale of 1" = 100' may range from $15 to $40 per acre. If wetlands are interpreted from air photos without a follow up field check, costs could be reduced to approximately $2 to $5 per acre.

2. <u>Protection of the Town's Aquifer System</u>

Because of Rehoboth's total dependence on groundwater for water supply, there is all the more reason to provide protection for this resource. At the moment, existing development over the aquifer is limited and growth pressures are not extensive. In order to provide long-term protection, Rehoboth could initiate one, all, or a combination of the following steps. All these measures would be predicated on an accurate mapping of the aquifer or a particular well field area. (See the section on Land Use Management techniques in Chapter Three for additional discussion on aquifer protection.)

2a. No Discharge

No discharge to the ground would be allowed over the aquifer area. This does not mean that development would be precluded from locating in the aquifer zone. Rather, it would require that wastewater be handled in some manner other than by discharging it to the ground. (See Chapter Two for discussion of no discharge toilets.)

2b. Restrictive By-Law

A restrictive by-law would be established whereby certain predefined uses would be prohibited from locating and operating within the aquifer zone. Examples of prohibited uses include landfills, gas stations and industries which use or produce hazardous chemicals.

2c. Use by Permit or Performance Zoning

Under a more flexible program, a performance system would be set up whereby a proposed use would be assessed for its potential impact. Depending on the results, the use would either be: permitted as proposed; permitted with modifications or restrictions; or denied. The performance standards within the current zoning by-law are a step in this direction.

--Environmental Assessment

All the above methods provide for the protection of groundwater quality. A no discharge policy would provide the most iron clad protection since the only volume reaching the groundwater table would consist of natural recharge from rainfall. The recharge water would of course contain some contaminants from land runoff and runoff from developed areas. Presumably this would only be a minor amount.

Restrictive by-laws or a performance system would allow for certain pollutants to reach the groundwater. However, certain uses would be screened out based on the impact they would have on the aquifer. If designed carefully, either of these two methods could provide adequate protection to the aquifer while allowing for flexibility.

--Policy Review

The Town has the power under the State zoning enabling legislation to designate a district and establish a by-law for the protection of an aquifer or well field. The Board of Health under powers granted by the Environmental Code could require more stringent disposal methods where conditions warrant it.

3. On-Site Wastewater Disposal Alternatives

As mentioned, many areas of the Town have very limiting soil conditions. There are a number of ways in which the Town can deal with such problems, and these methods cover the installation, operation, and maintenance of on-site systems as well as the type of disposal system which is used. In the future, in order to reduce the number of on-site failures, Rehoboth could employ several methods.

3a. Installation

Before on-site units are installed, a strict site inspection would be undertaken to assess the suitability of the site and determine what modifications may be necessary to insure that the system will function effectively. As required by State Environmental Code, percolation tests are required on all building lots. Additionally, deep hole tests area also required by the State Code, but the Town could supplement this procedure by requiring an analysis of the soil profile in the lot. By this means, it will be possible to gain an idea where historical high water levels have occurred in the past.

By supplementing the inspection process with the above steps, the Town could more accurately determine whether a development should be allowed at all or whether restrictions should be placed on the type of disposal unit used or the amount of wastewater produced.

3b. Maintenance and Enforcement Program

In order to insure that all on-site systems receive proper and timely maintenance and repair, the Town could institute a mandatory pumping and inspection program. All units would be pumped and inspected on a regular basis with the cost assumed by the homeowner. In this manner, it would be possible to avoid failure from lack of proper care. Further, it would provide Rehoboth with a means of correcting those systems which are having problems due to age, soil conditions, or improper installation. (See Chapter Three for further discussion.)

3c. Alternative Disposal Methods

In place of the septic tank, Rehoboth could require some alternative on-site system on particular lots or in certain areas of Town. Some possibilities include: compost toilets, incinerator toilets, or aerobic treatment units (See Chapter Two for a complete discussion). The exact system would be chosen based on the type of problem encountered (e.g. poor soils) or the location (e.g. aquifer zone). These systems would still require grey water facilities.

--Environmental Assessment

All the above sub-options are designated to reduce the amount of sanitary waste which ultimately reaches the groundwater system. Proper installation and maintenance will help avoid premature septic system failure. Alternative disposal methods are specifically designed to cut the amount of solids that leave the unit while low-flow devices help reduce the grey water volume.

--Policy Review

At this time, the State will not allow some on-site alternatives discussed in Chapter Two. On the local level, it is reasonable to assume that it is within the power of the Board of Health to require tighter restrictions for the installation and operation of on-site units. Some residents would undoubtedly balk at the idea of using low-flow water devices or being told when to have their systems pumped and inspected. The probability of initiating option 3 would be related to the awareness by the public that the measures outlined above would create less work and save money over the long run.

--Cost

	Capital Cost	Annual Operation and Maintenance
Maintenance Program	-	$60/pumping
Alternative Disposal Units		
Compost Toilets	$600 - $2500	$0 - $75
Incinerator Toilets	$600	$400
Aerobic Systems	$2000- $3000	$200
Grey Water Facility	$800 - $1200	$5
Low-Flow Fixtures		
Shower Heads	$13 - $17	
Faucet Aerators	$ 2	

SUMMARY

Rehoboth is one of the few study area communities which has a well-articulated Town policy of remaining rural and agricultural. In order to achieve this goal while continuing to maintain high environmental quality standards in light of mounting development pressures, the Town must have strict and well-enforced regulations for the protection of its natural resources. Rehoboth has made great progress in this regard, and the Town by-laws reflect this progress.

The recommendations in this report are made as suggestions to enhance these by-laws, and two points in particular should be re-emphasized.

1. Wetlands zoning is an extremely important tool for water quality protection, and should be adopted in Rehoboth. The Wetlands Protection Act cannot be considered an adequate vehicle to protect these areas.

2. Septic system maintenance, as described in Chapter Three is another important preventative mechanism to keep the Town's groundwater clean and to insure that sewers will not be necessary to solve problems of septic system failures.

Although the disposal of residuals and septage is discussed later in this Chapter, Rehoboth's project of composting septage with Seekonk and Swansea should be mentioned. The pilot project that is underway will hopefully result in a permanent solution that is far cheaper and environmentally sounder than other methods of septage disposal. The three towns should continue to work together and with the newly organized Watershed Management Councils to develop this method in a manner that can be a model for other communities in the area.

TABLE 3

ENVIRONMENTAL ASSESSMENT

	OPTIONS						
	1	2	3				
SURFACE WATER QUALITY IMPROVEMENT	+1						
GROUNDWATER QUALITY IMPROVEMENT	+2	+3	+3				
EXTENT CONSTRUCTION DISRUPTION							
ENERGY DEMANDS							
CHEMICAL DEMAND							
LAND AREA REQUIRED							
DRINKING WATER PURITY		+3	+2				
ENDANGERED SPECIES							
COMMERCIAL FISHERIES							
AIR QUALITY							
NOISE POLLUTION							
SOIL EROSION	+1						
FRAGILE AREAS	+3	+3					
PUBLIC HEALTH	+1	+2	+1				
USE OF RECREATIONAL AREAS							

\+ = Beneficial Impact
\- = Adverse Impact
Blank = No Discernible Change/Not Applicable

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

GROWTH IN RESIDENTIAL LAND USE	-1	-1					
GROWTH IN COMMERCIAL LAND USE							
GROWTH IN INDUSTRIAL LAND USE							
INCREASED RUNOFF FROM DEVELOPMENT							
DISLOCATION OF INDUSTRY OR FIRMS							

\+ = Yes
\- = No
Blank = No Change

3 = Maximum Impact
2 = Moderate Impact
1 = Minimal Impact

CHAPTER FIVE

DESIGNATION OF MANAGEMENT AGENCIES

SUMMARY

A. Who Shall Manage Water Quality?

The basic question to address for the institutional portion of the Environmental Impact Assessment is does the authority and the funding capacity exist to carry out the 208 plan? If we cannot assure ourselves that agencies are empowered to follow through on the requirements of the Plan, then the possibility exists that the benefits anticipated for the environment in the Plan will not be implemented. This basic question dealing with authority and finance is not capable of a simple answer. The paradox is that if we seek new institutions to improve present performance, then they will not have the authority or financial power. The process of filing new legislation will take some time. If we are then forced to designate existing institutions to ensure authority, other desired results cannot be assured. The political process which has been used to solve this dilemma has achieved a useful compromise of using existing authority, but has set a process in motion that will make incremental improvements over time.

As can be noted in the Plan, Chapter Four, each recommendation for each jurisdiction is accompanied by a designated agency to implement the recommendation. In Chapter Five, the rationale for designations is developed. In this summary, only the most basic concerns are expressed and a description of the problem resolution is provided. In the most general form, the conclusion from two years of public participation and elected official meetings is that the existing system of water quality management works well enough in a number of specific instances such that a designation of existing agencies for immediate implementation of the Plan satisfies many requirements. Nevertheless, the management system fails in enough respects that selected, but significant, change is required before the environmental impact assessment can be termed acceptable. The desired change basically consists of the formation of groups to coordinate local actions in three Watershed Management Councils.

This general conclusion arises from numerous specific meetings throughout the region with citizens and citizen groups who raised the concerns of those who live near rivers and lakes or are otherwise interested in water quality. It was finally formulated by elected officials as members of ACQUA (the advisory body to the 208 agency) and its Executive Committee. This process took many months and formal and informal meetings throughout the 30 towns and cities of the region. Numerous different formulations of the issues and solutions were discussed in a series of debates. Compromise was finally achieved near the end of the decision process in June.

The program of institutional development calls first for the designation of existing agencies to carry out the Plan, as designated in sections C + D of this chapter. This designation meets the criteria which has to be met before they are satisfied with the projection for an acceptable environmental inpact of the Plan.

The first criterion is that the management agency have some geographic relevance to the actual water quality problems. That means that towns and cities are too small units to deal with regionally significant resources and that state agencies are too large. Therefore, they recommend that watersheds be used as the basis for management and have directed the formation of Watershed Management Councils in the Ten Mile, Taunton and Coastal Wastersheds. This geographic orientation does not imply that federal, state, and local governments are not also key units for water quality management, but it does suggest that the watershed is also a useful boundary definition for many water quality problems.

The second criterion is that in the final decision process, the principle of judgment by peers be applied. In the region peers tend to respect their peers and will be more willing to initiate action and follow through on implementation if neighboring community representatives have judged the merit of an issue. The conversion of this principle into a real management framework can mean that some decisions should be made by groups of local officials, while others might be made by a higher authority, but only after the towns and cities had an opportunity to pass judgment on the issues involved.

The third criterion is that some form of generation of regulatory and planning activities be encouraged because applicants now must put together an answer from a series of unrelated agency decisions. The delays have been costly and relief is sought by making some changes. The recommended change is that the state offices for water quality be decentralized and brought closer to the problems to be solved. They can then perceive how the elements of problem solving relate to each other and be more sensitive to local needs.

The fourth criterion is simply one of reasonableness. At present the water quality management system appears to work behind closed doors for many decisions appear arbitrary to local officials. An open decision process, for example in the area of setting priorities for the use of state and federal funds, would make local officials feel that judgments were reasonable. In addition, a more effective explanation of how basin plans and effluent limitations are related would provide the justification to spend the money being requested of the local governments. The assumption is that there are reasonable men making reasonable decisions at a higher authority, but those decisions are not well received for the decision process did not include local officials. The institutional consequences of this criteria is selected participation of the Watershed Management Councils in the activities of decentralized state management decisions.

Thus, the result of applying the four criteria is to develop additional institutional activity which will augment the existing institutions. The emphasis is on augmentation rather than replacement. State and local institutions will remain to perform current functions. Only over time will an evolutionary program make significant variation in where authority may be placed. ACQUA has expressed interest in sharing some of the state powers which are currently assigned to the Department of Environmental Quality Engineering. The basic reason for changing the current partnership is to make the state more responsive to the local implications of water management programs that are developed for the entire state.

This evolutionary program will take the following form as voted by the members of ACQUA on June 23, 1977.

B. CREATION OF WATERSHED MANAGEMENT COUNCILS

This adopted plan sets forth a two-step process for the designation of a water quality management system. The relationship between a management system and the continuing planning function for southeastern Massachusetts is also shown. The proposal calls for the initial creation of three Watershed Management Councils by the fall of 1977 to comply with EPA requirements. An interim management designation must be in place at the conclusion of the 208 planning process. The proposal allows for each basin to further select a more complete management system.

Step 1 - Designation of Watershed Management Councils

Under this process, the final 208 plan would formalize the creation of three Watershed Management Councils which would be responsible for overseeing the execution of certain plan recommendations and for selecting and developing a permanent management system. These Councils would be formed around the three major drainage basins in the region, and would include the following:

- Ten Mile - Plainville, North Attleborough, Attleboro, Seekonk and Rehoboth;
- Taunton/ Mt. Hope - Foxborough, Mansfield, Norton, Taunton, Dighton, Raynham, Lakeville, Middleborough, Berkley, Freetown, Swansea, Somerset, Tiverton, Fall River, Westport; and
- Coastal - Dartmouth, New Bedford, Acushnet, Fairhaven, Mattapoisett, Rochester, Marion, Carver, Plymouth and Wareham.

Dual membership of communities would be possible at local request.

Voting would be on the basis of one vote per 25,000 unit of population, and any fraction thereof, with a minimum of one vote per municipality, up to a maximum of four votes. Financing would be initially based on a contribution not to exceed 10¢ per capita and could vary in the future, depending upon the course of action selected by the Councils for Step 2. Federal and State funding would also be sought.

Within the Watershed Management Council, smaller working groups may be established for special problems such as lake management for the Lakeville Ponds; septage composting in Seekonk, Rehoboth and Swansea; a multi-community sewer arrangement for Fall River, Freetown, Tiverton and Westport; or aquifer management by Fairhaven, Rochester, Marion and Mattapoisett; as well as functional groups for all local Boards of Health or Sewer Commissions.

The responsibilities of the Watershed Management Councils would be:

a. - Participation in inter-municipal management functions assigned by the 208 plan, such as initiation and review of intermunicipal contracts or formation of sewer districts under Chapter 21, Section 43;

   - Interaction with the regional offices of DEQE (Department of Environmental Quality Engineering) and DWPC (Division of Water Pollution Control) on regional water quality issues. An Executive Order upon Certification of the 208 plan by the Governor consistent with the Administrative Procedures Act would set forth the basis for such interaction.

b. - Select and begin inplementation of a management system as outlined in Step 2 of this paper.

The Councils would commence operations prior to the end of the 208 planning process (the fall of 1977). They would proceed to select one of several permanent management arrangements as presented in Step 2, and to write by-laws, file legislation, negotiate contracts or otherwise begin to set in place the selected course of action. The Councils would be encouraged to work together and to follow a common strategy; however, this would not be mandatory.

As the comprehensive planning agency for southeastern Massachusetts, SRPEDD would continue to be responsible for the continuing planning functions with technical assistance capability. If SRPEDD were to receive third year funding for the purpose of supporting management activities, ACQUA would be continued as a composite of the three Councils during this first year transitional period, and would also work with DEQE and WPC.

Step 2 - Development of Watershed Management Agencies

Various models for each of the Watershed Management Agencies have been suggested and three are presented here for final decision by each of the Councils.

a. A management agency for each watershed area deriving powers through legislation and the decentralization of certain state powers.

b. A confederation arrangement for each watershed area which derives power through inter-municipal contracts and contracts with State agencies; and

c. An advisory group arrangement for each watershed area providing for the cooperative exercise of local powers and advising state agencies.

These models have all been proposed and discussed during the 208 planning process. They can be developed in sequence - that is, a Council can proceed from a confederated management agency to the filing of legislation. During the procedure of evolving from a Council in Step 1 to an actual agency in Step 2, voting, financing and even boundary arrangements can be adjusted.

The three alternatives below were presented to ACQUA on June 23, and the first (a) was chosen as a recommended, though not binding choice for the Councils.

a. Watershed Management Agency through legislation

The powers and duties are as follows:

-- supplementary monitoring of critical water quality areas;

-- additional enforcement of federal and state water quality standards where appropriate;

-- planning for areawide water quality problems through participation in the continuing planning process;

-- priority setting of federal constitution grant (201) funds for waste treatment works in the region through the continuing planning process;

-- regionally coordinated state and local laboratory facilities for water quality testing;

-- technical assistance to communities;

-- protection of critical resource areas for predefined activities;

-- approval of landfill siting, and monitoring of water quality impact;

-- Cooperative purchasing and personnel sharing upon request for improved operation and maintenance of municipal sewage treatment plants;

-- regional review and approval of design, location, installation, and performance monitoring of septic tanks between 2000 and 15000 gpd; and

-- appeal by member jurisdiction of certain local decisions regarding critical water resource areas before a regional appeals board comprised of local representatives.

Given the speed of the legislative process, it is unlikely that this agency could be in place before 1980, so a phased approach using option b and/or c should be considered.

b. Confederated Areawide Management Agency (CAMA)

This alternative was proposed in Subtask 2.6, published in 1976. In essence, it represents the creation of one or several areawide agencies which derive their powers for joint performance of certain functions through contracts between member communities and state agencies. This arrangement hinges on a willingness of the parties to become involved in such an arrangement.

The negotiation process can be lengthy, so it is assumed that a CAMA-type agency could be in full operation by January 1, 1979.

c. Basin Advisory Group (BAG)

This would be a weaker arrangement under which basin committees would have advisory status to state agencies and basin cities and towns. Basin Advisory Groups would be a continuation of the Councils outlined in Step 1.

This summary was voted on by ACQUA and represents current thinking on how to augment current institutional capability. With the modifications to the existing system selected by each Watershed Council, the need for local particiation in water quality management will be satisfied. At that point, the environmental impact of the water quality management program of the 208 Plan will be judged to be favorable.

C. Designation of Local Responsibilities

The responsibility for seeing that many plan recommendations become implemented lies with a variety of local officials. The following pages delineate the specific responsibilities of local agencies or officials for each of the plan recommendations presented in the local alternatives. The communities are grouped according to basins.

TEN MILE RIVER DRAINAGE BASIN

Plainville

1. The Planning Board should initiate Town Meeting action to amend the zoning by-law to include protection of the aquifer shared by Plainville and North Attleborough.

2. The decision on sewer expansion is the responsibility of the Town Meeting.

3. The Board of Health should institute a septic system maintenance program.

4. The Ten Mile Watershed Management Council should investigate the sedimentation problem at the headwaters of the Ten Mile River.

5. The Board of Health should take steps to cap the Lowell Street landfill.

6. The Division of Water Pollution Control should conduct a year round lake study including monitoring and analysis on Turnpike Lake.

North Attleborough

1. The Sewer Department, in conjunction with the Division of Water Pollution Control, should explore operating the advanced component of the treatment plant for only part of the year.

2. The Sewer Department, with the assistance of the Ten Mile Watershed Management Council, should adopt a sewer ordiance and initiate its enforcement.

3. The Planning Department, working with the Sewer and Water Departments, should initiate zoning amendments to increase lot sizes and provide an aquifer protection district.

4. The Health Department should initiate a septic tank maintenance program, and should adopt regulations to allow for a variety of on-site subsurface disposal technologies.

Attleboro

1. The City Council should select a sewering option, and, with the Sewer Department, explore seasonal operation of the advanced component of the treatment plant.

2. The Sewer Department should undertake an industrial survey, and with the City Council, should update the sewer ordinance.

3. The Board of Health should initiate a septic tank maintenance program and adopt regulations to promote water conservation.

4. The Planning Board should initiate a zoning amendment to increase residential lot sizes to 3/4 of an acre, to adopt a wetlands district, and to adopt aquifer protection measures in the Bungay River Aquifer and the Seven Mile River Aquifer.

5. The City Council should, with the assistance of the Watershed Management Councils, explore the feasibility of solving sediment problems in the Ten Mile.

Seekonk

1. The Board of Selectmen should apply to the Division of Water Pollution Control for a Step One 201 facilities plan.

2. With the assistance of the Watershed Management Council, the Board of Selectmen should negotiate an agreement with the City of Attleboro for sewerage disposal from North Seekonk.

3. The Board of Health should adopt water conservation regulations and a septic tank maintenance program.

4. Town Meeting,with the recommendation of the Planning Board, should adopt wetlands zoning,and increase lot size in unsewered areas.

Rehoboth

1. Planning Board should review performance standards for industrial discharges into surface or groundwater and with SRPEDD's assistance specify standards more clearly.

2. The Planning Board should submit a zoning amendment to Town Meeting in order to create a wetlands zoning district.

3. The Board of Health should initiate a septic tank maintenance program.

Rehoboth Continued.

4. The Board of Health should adopt rules and regulations which provide for a variety of on-site subsurface disposal technologies.

5. The Board of Health should continue to work with neighboring towns, through the Basin Management Council, to develop the composting septage treatment project.

TAUNTON RIVER/MOUNT HOPE BAY DRAINAGE BASIN

Foxborough

1. The Selectmen should recommend a sewering alternative to Town Meeting for adoption.

2. The Board of Health should adopt a septic tank maintenance program and should adopt regulations designed to promote water conservation.

3. The Planning Board should recommend a zoning amendment to provide for water supply protection.

4. Town Meeting should authorize the construction of runoff detention facilities for Schaefer Stadium and Bay State Raceway.

5. Working through the Basin Advisory Groups, the selectmen should take steps to reclain Neponset Reservoir and Crackrock Pond.

Mansfield

1. Working with the Watershed Management Council, the Selectmen should present a recommended sewering option to Town Meeting.

2. The Board of Health should initiate a septic tank maintenance program, and should adopt regulations designed to promote water conservation.

3. The Planning Board should initiate changes to the zoning by-law to eliminate the "Business C" zone along the shore of the Norton Reservoir, and to adopt a water supply protection district for the Canoe River aquifer.

4. With the assistance of the Watershed Management Council, the Board of Selectmen should examine the feasibility of neutralizing the sludge deposits in Back Bay Brook.

5. The Board of Selectmen, with the assistance of the Highway Department, should examine the feasibility of constructing stormwater detention facilities along Back Bay Brook.

6. The Board of Selectmen should propose the adoption of a sewer ordinance, and its attendent enforcement program to Town Meeting.

Norton

1. Working through the Watershed Management Council, the Selectment should present a recommended sewering otpion for Town Meeting.

2. The Board of Health should initiate a septic system maintenance program, and should adopt regulations designed to promote water conservation.

3. The Board of Health, with the assistance of the Watershed Management Council, should monitor the location of the watertable, and should install (an) observation well(s) below the Town landfill upgradient of the Pine Street well.

4. The Planning Board should initiate changes in the zoning bylaw to eliminate the strip commercial zone along Route 140 near the Norton Reservoir, and to create a water supply protection district for the Canoe River aquifer.

5. The Board of Selectmen should, with the assistance of the Watershed Management Council, investigate the feasibility of removing the sediment from Norton Reservoir.

6. The Board of Health, with the assistance of the Watershed Management Council, should undertake a survey of septic systems around Winnecunnet Pond.

Middleborough

1. The Planning Board should evaluate the Route 28 General Use Zone to consider restrictions on uses that could be detrimental to the aquifer.

2. The Planning Board should consider moving the industrial zone in the Town's northeast corner to an area in closer proximity to Town utilities.

3. The Board of Health should institute a septic system maintenance program, and adopt water conservation regulations.

Taunton

1. The Health Department should adopt regulations to insure that when summer homes are converted to year-round use, adequate septic systems are installed.

2. The Planning Board should initiate steps towards the adoption of a Wetlands Zoning District in the area west of Route 140 and between the Norton Town Line and Whittenton junction.

3. The City Council should negotiate an agreement with the DPW similar to the one between Norton and the DPW to control road salting along the proposed extension of Route 495.

4. The Planning Board with the assistance of the Highway Department should adopt regulations to encourage permeable paving whenever possible.

5. The Sewer Commission and the City Council should adopt a revised sewer ordinance, with the assistance of the Watershed Management Councils.

Raynham

1. Future expansion of the sewer system must be voted by Town Meeting.

2. The Board of Health should adopt a septic system maintenance program, and adopt water conservation regulations.

3. Monitoring of leachate from the Taunton and Raynham landfills should be undertaken by the Watershed Management Council, and the North Raynham Water District should closely monitor the First Street well.

4. The Planning Board and the Raynham Center Water District should initiate any necessary zoning changes to protect the aquifer at Lake Nippinicket.

Dighton

1. The Division of Water Pollution Control should re-examine its position on Dighton's sewer plans to assure that the most effective but least costly option is available to the Town.

2. Town Meeting, upon the recommendation of the Board of Selectment should authorize the selected alternative.

3. The Board of Health should initiate a septic tank maintenance program, and should adopt water conservation measures.

Berkley

1. The Board of Health should establish a septic system maintenance program.

2. The Land Use Planning Committee should continue its efforts to map wetlands and promote passage of a protective wetlands by-law by Town Meeting.

3. The Board of Health should check abandoned landfills for the adequacy of cover material.

4. The Board of Health should educate and promote water conservation in the two areas where saltwater intrusion has been identified.

Freetown

1. The Board of Health should institute a septic tank maintenance program, to include the replacement of failing systems.

2. The Planning Board and the Conservation Commission should recommend Wetlands Zoning District amendment to the zoning by-laws.

3. Working with the Basin Management Council, the Board of Selectmen should recommend a selected sewering plan to Town Meeting.

4. The Board of Health should initiate a water conservation program.

Swansea

1. The Board of Selectmen should apply to the Massachusetts Division of Water Pollution Control for a step one 201 Facilities Plan grant.

2. The Board of Health should initiate a septic system maintenance program, and adopt water conservation regulations.

3. The Planning Board should initiate an amendment to the zoning by-law to create a wetlands district.

Fall River

1. The City Council, upon recommendations from the Sewer Commission, should select a scheme for solving the City's combined sewer overflow problem, for the design of a sewer treatment plant, and for the extent of sewering.

2. The Sewer Commission should adopt a sewer ordinance, develop a capital cost recovery and user charge system for industry, and implement a permitting and enforcement program for industrial users for the municipal facility.

3. The industrial task force should continue to explore opportunities for joint industrial pretreatment, process changes, and water reuse. EPA should adopt procedures to encourage joint industrial treatment.

4. The Executive Office of Environmental Affairs should designate and develop a site for the disposal of hazardous or toxic materials.

5. The Planning Department should initiate zoning change to increase lot sizes in the areas near South Watuppa Pond and Sawdy Pond.

6. The Health Department should initiate a septic tank maintenance program; and allow no-discharge toilets in specified areas.

7. The Water Department and the Plumbing Inspector should adopt regulations to encourage water conservation.

Tiverton, RI

1. The Division of Water Pollution Control for the State of Rhode Island should upgrade the classification of Adamsville Brook from B to A, to make it compatible with the West Branch Westport River.

2. The choice of sewering alternatives must be made by Town Meeting upon recommendation of the Sewer Commission.

3. The Town Council and Sewer Commission assisted by the Watershed Management Council, should initiate negotiations with the City of Fall River for treatment of sewage.

4. The Rhode Island Department of Health should initiate a septic system maintenance program in Tiverton.

5. The Planning Board should initiate zoning changes in the Pocasset Cedar Swamp (and North Tiverton if sewers are not provided).

6. Water Conservation in Sapowet, Fogland and High Hill Point should be initiated by the State Department of Health and the Town Council.

Lakeville

1. The Massachusetts Department of Public Works should complete their analysis of wells in the County Road area for salt pollution emanting from the abandoned salt pile.

2. The Board of Selectmen should apply for a Step One 201 Facilities study to resolve sewerwing as presented in this study and the DCA lake study.

3. The Board of Health should continue their efforts at enforcing the State Environmental Code for septic systems and should adopt a septic system maintenance program. The Board of Health should further consider provisions relating to water conservation and no-discharge toilets.

4. The Planning Board should review the land use control options in conjunction with the Board of Selectmen/Board of Health for recommendations for Town Meeting action.

COASTAL DRAINAGE AREAS

Westport

1. The Board of Health should adopt a septic system maintenance program.

2. The Board of Health should work with the two private water companies in Westport Harbor to implement low flow and water conservation.

3. The Planning Board should initiate Town Meeting action to modify the unrestricted zone, probably through the use of special permits on certain activities.

4. Town Meeting action should be initiated by the Planning Board to adopt a Wetlands Zoning By-Law. The Conservation Commission should assist with the identification.

5. The Board of Selectmen and River Improvement Commission should work with the Massachusetts Department of Environmental Management for making a scenic rivers designation.

6. Recommendations for action following the 201 study should be handled through the Boards of Health and Selectmen and referred to Town Meeting for action. The Board of Selectmen should be responsible for intermunicipal arrangements with Fall River, working with the Watershed Management Council.

Dartmouth

1. The degree of sewer expansion must be decided by Town Meeting upon recommendation of the local Department of Public Works and Board of Selectmen.

2. The Board of Health should adopt a septic system maintenance program, including renovation or replacement on Noquochoke Lake.

3. Monitoring of PCB's from the New Bedford landfill should be undertaken by EPA and the Watershed Management Council.

4. The Division of Water Pollution Control should expand its lakes study program to do year-long monitoring and analysis on Noquochoke Lake.

5. The Board of Health assisted by the Watershed Management Council should follow the recommended steps in Chapter Three to cut down on runoff from boatyards.

New Bedford

1. The City Council should select a plan for correcting combined sewer overflows.

2. The City Council should authorize flood protection measures for the existing treatment plant.

3. The Sewer Commission should select a plan for upgrading the treatment plant to secondary treatment to recommend to the City Council.

4. EPA with assistance from the Watershed Management Councils, should permanently monitor groundwater in the vicinity of the New Bedford landfill.

Acushnet

1. The Board of Selectmen should be responsible for negotiating an intermunicipal agreement for sewage treatment with the City of New Bedford, with both parties working with the Watershed Management Council.

2. The Planning Board should undertake the tasks of developing a zoning by-law for the purpose of controlling growth, minimizing utility costs, and protecting groundwater.

Fairhaven

1. The degree of expansion of the sewer system must be voted by Town Meeting upon recommendation from the Board of Selectmen, Department of Public Works, and Planning Board.

2. A septic system maintenance program should be adopted by the Board of Health.

3. The Board of Health assisted by the Watershed Management Council should take the recommended steps to cut down on runoff from boatyards.

Mattapoisett

1. The Board of Selectmen should recommend a selected plan for sewering to Town Meeting.

2. The Board of Health, assisted by the Watershed Management Council, should take the recommended steps to cut down on runoff from boatyards.

3. The Board of Health should institute a septic tank maintenance program.

4. The Planning Board should initiate zoning changes to be voted by Town Meeting to establish a wetlands zoning district.

Rochester

1. The Board of Health should adopt a septic system maintenance program.

2. The Planning Board should initiate Town Meeting action to adopt a Wetlands Protection Provision in the zoning by-laws. The Conservation Commission should assist in the delineation of the wetland areas.

Marion

1. The Board of Health should institute a septic system maintenance program.

2. The Board of Health should amend their regulations to provide for no-discharge toilets and water conserving fixtures.

3. The Board of Selectmen and the Planning Board should make a recommendation for Town Meeting action on sewerage expansion options.

4. The Board of Health, assisted by the Watershed Management Council, should follow the recommended steps to cut down on runoff from boatyards.

Wareham

1. The decision of which areas of Town are to be sewered is the responsibility of the Town Meeting, although recommendation should be made by the Sewer Commission, Board of Selectmen and Planning Board.

2. A septic system maintenance program should be adopted by the Board of Health.

3. Water supply protection zoning should be initiated by the Planning Board for Town Meeting action.

4. The Board of Health should exercise its authority to require sewer hook-ups.

5. The Board of Health assisted by the Watershed Management Council should take the recommended steps to cut down on runoff from boatyards.

Carver

1. The Board of Health should institute a septic system maintenance program.

2. Sewage disposal plans of local mobile home parks should be approved by DEQE and reviewed by the Watershed Management Council.

Plymouth

1. The Massachusetts Division of Water Pollution Control, Plymouth Board of Selectmen and the watershed management council should resolve the question of sewering Kingston given the serious demand for sewering in the Route 44 area in Plymouth.

2. The Board of Selectmen, upon recommendation from the Manomet Sewage Disposal Study Committee and the Planning Board should develop a position relative to sewering Manomet and present this issue to the Town Meeting.

3. The Division of Water Pollution Control and the Plymouth Planning Board should encourage packaged plants to service concentrated development in remote areas of Plymouth.

4. The Board of Health should adopt a septic system maintenance program.

5. The Board of Health and the Building Inspector should identify and require necessary septic system replacement associated with summer home conversion.

D. Designation by Management Agency

The following charts show various agencies responsible for typical plan recommendations. There is one chart for each agency. Further detail will be provided when alternatives are selected.

PRIMARY AGENCY State Building Commission, Board of Plumbing Inspector

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Include specifications for low-flow toilets and other fixtures in the state building code.		
Amend state building codes to include meeting all requirements of the Flood Insurance Program		

PRIMARY AGENCY State Legislature

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Make Industrial Revenue Bonds available for joint (pre) treatment equipment for industries.		
Pass and appropriate funds for S. 302, A bill to regulate coal mining.		
If considering bills to provide funds for water treatment plants for drinking water supplies, also make funds available to communities to assist them in taking preventative actions outlined in 208 plan.		

PRIMARY AGENCY Coastal Communities/Selectmen

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Install sediment catchment basins to contain runoff from boat bottom washing in boatyards		

PRIMARY AGENCY County Conservation Districts

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Develop an educational program and provide technical assistance to farmers on Best Management Practices		
Act as a coordinating party between agricultural interests and various local, regional and state agencies.		
Set priorities for Soil Conservation Service in accordance with MOU	SCS	
Investigate complaints of agricultural pollution referred from other agencies	Boards of Health	
Participate with DWPC through Watershed Management Councils in the process of wasteload allocations as they relate to agricultural sources	DPW Basin Watershed Management Council	

PRIMARY AGENCY Selectmen/City Councils

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Select sewering options	D.W.P.C. E.P.A. Town Meeting	
Make sure all auxiliary actions implicit in sewering choice are being undertaken by other Town Boards	Planning Board Board of Health	
Review salt storage practices	Highway Departments Basin Watershed Management Councils	
Review local by-laws on gravel removal, storage of gasoline underground.	D.W.P.C.	

PRIMARY AGENCY Soil Conservation Service

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Expand budget to provide technical assistance for review of subdivision plans and other assistance to communities.		

PRIMARY AGENCY Environmental Protection Agency

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Settle uncertainties in industrial pretreatment standards by writing clear guidelines.		
Pretreatment standards should recognize differences in municipal treatment design and receiving waters		
Pretreatment program should have provisions which include provisions for industry changing its wastewater discharge at any time.		
Use consistent set of parameters for all permits, both industrial and municipal.	DWPC	
Permits should include all disposal media, not just water.		
Variances for joint industrial treatment in the compliance schedules of industries should be permitted.		

PRIMARY AGENCY Planning Board

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Review/amend zoning by-laws	Town Meeting Flood Plain Insurance Conformance to 40A	
Review/amend subdivision controls	S.C.S.	

PRIMARY AGENCY Board of Health

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Change regulations to require low-flow plumbing fixtures.	State Board of Plumbing Examiners	
Change regulations to allow no-discharge toilets.		
Establish septic tank maintenance program		
--distribute maintenance manuals to homeowners with septic tanks.		
--set up inspection program to locate problem septic tanks.		

PRIMARY AGENCY The Federal Highway Administration

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Change design speed for interstate highways to all for 55 mph design speed instead of 70 mph.	DPW	

PRIMARY AGENCY Office of Environmental Affairs

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Fulfill mandate of the Resource Recovery and Conservation Act.		
Seek regional facility to handle hazardous wastes.		
Establish communications with Watershed Management Councils.		

PRIMARY AGENCY Watershed Management Councils

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Develop regional laboratory facilities with capacity to test toxic materials		
Establish regional water re-use program which coordinates industrial water re-cycling		
Provide technical assistance to communities to assist in establishing sewer ordinances, monitoring, and enforcement programs.		
Set priorities for 201 construction grant funds		
Calculate water balances for regional aquifers, assist communities in setting targets for water conservation, especially in coastal communities with salt water instrusion problems.		

PRIMARY AGENCY Department of Public Utilities

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Examine water rates and redesign schedule to encourage water conservation, apply to private water companies as well as to public water companies.		
Control vegetation on rights of way of physical rather than chemical means.		

PRIMARY AGENCY Division of Water Pollution Control

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Rely less on low-flow steady-state modeling, especially for use in NPDES permit program, and construction grants division.		
Include conservative substances in the list of substances which should be sampled and included in NPDES permits, analyze more systematically.		
Incorporate non-point sources in water quality modeling effort.		
Expand range of treatment options available to communities when necessary conditions, such as increased monitoring, are provided.		
Accept advice from Watershed Management Councils on issues of monitoring, load allocations, priorities for 201 funds and other decisions having a direct impact on the region's surface and groundwater.		

PRIMARY AGENCY Department of Environmental Quality Engineering

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Revise regulations for sanitary landfills to require monitoring of groundwater.		
Accept advice from Watershed Management Councils on decisions related to surface and groundwater quality in the region.		

PRIMARY AGENCY County Conservation Districts

RECOMMENDATIONS	Other Agencies	Implementation Deadline
Develop an educational program and provide technical assistance to farmers on Best Management Practices		
Act as a coordinating party between agricultural interests and various local, regional and state agencies.		
Set priorities for Soil Conservation Service in accordance with MOU	SCS	
Investigate complaints of agricultural pollution referred from other agencies	Boards of Health	
Participate with DWPC through Watershed Management Councils in the process of wasteload allocations as they relate to agricultural sources	DPW Basin Watershed Management Council	

E. CONTINUOUS PLANNING PROCESS

1. Need for Continuing Planning

Abraham Lincoln defined the scope of planning as "where we are, where we want to be and how to get there." This definition makes it clear that planning does not end when a "plan" is made, but is a continuing process. It maps out the way of achieving the next step of objectives or of holding on to our achievements in the light of changing circumstances.

Recognizing this, the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) Section 208 provides in Section (b) (1) that...
"Not later than one year after the date of designation of any organization under subsection (a) of this section such organization shall have in operation a continuing areawide waste treatment management planning process consistent with Section 201 of this Act."*

"(b) (3) Areawide waste treatment management plans shall be certified annually by the Governor or his designee ..." and "(f) (1) The Administrator shall make grants to any agency designated under subsection (a) of this section for payment of the reasonalbe costs of developing and operating a continuing areawide waste treatment management planning process* under subsection (6) of this section."*

It is, then, the intent of the law that continuing planning be one of the management functions indicated in the 208 management designation.

2. Summary and Outlook

SRPEDD is the areawide 208 and comprehensive planning agency designated to carry out a continuous planning process for waste treatment management and water quality. This process is a necessary continuation of the last two years' effort of "208" plan preparation; it is, however, dependent on funding by local agencies, the State and EPA.

**Emphasis supplied*

In the continuous planning process, SRPEDD will monitor "208" plan implementation and assist municipalities and water quality management agencies. SRPEDD has statutory powers which can be of great help to management agencies.

The initial funding should be approximately $100,000 of which 75 percent is to be the federal share. As plan implementation (structural and non-structural), the level of funding should gradually decrease (by about 10-15 percent annually). However, a more sensible and cost-effective approach would be to pool water quality planning with other types of pollution-abatement or environmental planning (air quality, solid waste, water supply, coastal zone, etc.). At the same time, the fragmented environmental management functions should also be consolidated .

3. Coordination with Management

Planning and management are separate, but closely related processes. Both by law (40 CFR 131.1 (d) (6) op. cit.) and in order to be effective, planning must be coordinated with day-to-day management and must, therefore, be responsive to the needs of local officials and designated management agencies, as well as consistent with State plans and with the accepted engineering standards.

While planning is primarily advisory to the decision-makers, SRPEDD as the regional (areawide) comprehensive planning agency has certain statutory functions which it can use to assist local and State officials in their management tasks. These include:

a. A-95 Reviews.

b. Required conformance of 201 plans to 208 plans.

c. Zoning change referrals under Chapter 40A.

d. Authority to enter into contractual arrangements with municipalities and management agencies.

e. Management agency identification for Governor's designation.

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**Emphasis supplied*

In the continuous planning process, SRPEDD will monitor "208" plan implementation and assist municipalities and water quality management agencies. SRPEDD has statutory powers which can be of great help to management agencies.

The initial funding should be approximately $100,000 of which 75 percent is to be the federal share. As plan implementation (structural and non-structural), the level of funding should gradually decrease (by about 10-15 percent annually). However, a more sensible and cost-effective approach would be to pool water quality planning with other types of pollution-abatement or environmental planning (air quality, solid waste, water supply, coastal zone, etc.). At the same time, the fragmented environmental management functions should also be consolidated .

3. Coordination with Management

Planning and management are separate, but closely related processes. Both by law (40 CFR 131.1 (d) (6) op. cit.) and in order to be effective, planning must be coordinated with day-to-day management and must, therefore, be responsive to the needs of local officials and designated management agencies, as well as consistent with State plans and with the accepted engineering standards.

While planning is primarily advisory to the decision-makers, SRPEDD as the regional (areawide) comprehensive planning agency has certain statutory functions which it can use to assist local and State officials in their management tasks. These include:

a. A-95 Reviews.

b. Required conformance of 201 plans to 208 plans.

c. Zoning change referrals under Chapter 40A.

d. Authority to enter into contractual arrangements with municipalities and management agencies.

e. Management agency identification for Governor's designation.