WASTEWATER MANAGEMENT STUDY
FOR
ESSEX, CONNECTICUT

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Executive Summary

This Wastewater Management Study was prepared in response to a CTDEP Order requiring an engineering report to evaluate the current wastewater disposal needs, develop and evaluate alternatives for wastewater disposal and prepare a schedule for implementation of the selected alternative.

This Study was performed over a period of several years. A draft Wastewater Management Plan was submitted to the CTDEP in October 1991. The current report incorporates the information in the 1991 Draft along with new wastewater management evaluations and developments in the following manner:

- Chapters 1-4 address background information and evaluations that formed the basis of the 1991 report. Some material from the 1991 Draft (e.g., Harbor Management and Aquifer Protection) has been relocated to appendices.
- Chapter 5 addresses actions taken between 1991 and 1996.
- Chapter 6 uses the above information as the basis for a recommended plan. An On-Site Wastewater Management Plan is a key element of the recommended plan and is included in this chapter.
- Chapter 7 includes an Environmental Assessment of the recommended plan.

As detailed in Chapters 1-4, wastewater management needs were assessed by reviewing historical performance and physical characteristics of wastewater disposal systems throughout the entire town in order to determine where on-site disposal was and was not likely to be a viable long term wastewater management solution. Historical performance data, including system repairs, pumpout frequency, and recommendations from a 1979 Malcolm Pirnie report, the Town Sanitarian and the Water Pollution Control Authority (WPCA) were considered in developing potential areas of concern. Physical characteristics such as lot size, soil limitations, depth to groundwater, source of drinking water supply, and age of dwelling were considered in developing the 18 final study areas. Walkovers and water quality monitoring were conducted in several areas to gain more information about the effectiveness of on-site wastewater disposal.

Of these 18 study areas, eleven study areas were given the rating of "A", indicating that continued conventional on-site sewage disposal is indicated. Four of the study areas were given the designation of "B" indicating that these areas have some on-site disposal restrictions and should be closely monitored. In the 1991 report, the remaining three areas were given the designation of "C" indicating that they were areas of concern for continued on-site subsurface disposal.

As detailed in Chapter 5, during the next several years, a variety of other wastewater management evaluations and developments occurred, including:

- Two years of quarterly sampling of groundwater quality under Essex Village;
- Consideration of a variety of structural solutions:

- Several attempts to reclassify the groundwater under Essex Village;
- Increased staffing of the Town Sanitarian position (full-time instead of part-time, with an individual experienced in aggressive on-site management).
- Development of an On-Site Wastewater Management Plan;
- Walkovers of 452 properties during the spring and summer of 1997 and
- Re-evaluation of the study areas classified as "C" based on recent performance.

As a result of these recent efforts, two of the study areas formerly designated as "C" have now been given the designation of "B" because repairs have been successful and they have not been problem areas for the past several years. A variety of on-site repair options for properties in these "B" areas have been presented in the recommended plan in Chapter 6. These areas will continue to be actively monitored as part of the town-wide on-site wastewater management plan. The on-site wastewater management plan includes the following elements:

- Design and Construction Standards
- Land Use Controls
- Septic System Permitting
- Septage Management
- Walkovers
- Public Education
- Water Quality Testing
- Enforcement, and
- Recordkeeping.

As part of the recommended plan, Essex Village was the one area for which off-site wastewater management may be required in the future. A conceptual plan was developed for installing sewers and a multi-user SSDS to serve approximately 8 properties which may not be able to make future SSDS repairs. The proposed location for the community SSDS is in the Town Park on Main Street. The site has hydraulic capacity of 8000 gpd (adequate to serve the proposed service area), though natural capacity for nitrogen dilution and bacterial removal are more limited. Pretreatment costs for nitrogen removal and disinfection were evaluated, and pretreatment was found to be the largest component of project cost.

The recommended plan is to continue on-site disposal in Essex Village as long as property owners can manage their own wastewater. Should off-site disposal be needed, then the septic tank and leaching field in the Town park as well as the connecting sewer system would be installed. If flow from the connected properties eventually exceeds the naturally occurring capacities for nitrates and bacterial die-off, then a pretreatment system may be needed to remove nitrogen and provide disinfection. This phased approach is designed to match community system construction with real off-site needs.

The Order also included a requirement to focus on the interrelationship between the potential for on-site wastewater disposal and land use management of the aquifer recharge areas of Essex. This requirement was met through the following steps:

- Delineating significant aquifers in Essex and illustrating them on 1"=800' scale mapping;
- Coordinating with the Town's Planning Commission during the updating of the Town's Plan of Development in the early 1990's.
- Developing a non-residential land use summary noting activities of concern; and
- Suggesting a list of activities to prohibit in aquifer protection zones.

In addition, the CTDEP is actively developing a statewide aquifer protection program that may fall under the purview of an agency other than the WPCA.

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1.0 INTRODUCTION

1.1 Project Background

Previous studies by Malcolm Pirnie have documented wastewater disposal concerns in the Town of Essex for a number of years. Their initial study, dated September, 1979 and revised March, 1980 divided the town into three subsurface disposal categories. They concluded that the village area of Essex required an immediate off-site structural solution to wastewater disposal needs and proposed a low pressure septic tank effluent pump (STEP) collection system which would deliver the partially treated septic tank effluent to a conventional leachfield system for further treatment.

Potential sites for community leaching fields were recommended at this time, but these properties were subsequently developed or found to be unsuitable. In a 1987 report, Malcolm Pirnie addressed the current infeasibility of their original recommendation for the village area by recommending that the Town conduct additional studies to determine the feasibility of alternative means of wastewater treatment and disposal.

The western portion of Ivoryton fell into the second category in which wastewater disposal problems were not considered severe enough to warrant an immediate structural solution, but should be closely monitored for future needs. The remainder of Essex was considered to have no wastewater disposal problems which could not be managed with on-site wastewater disposal and would comprise a "Sewer Avoidance Zone."

1.2 DEP Order

The Department of Environmental Protection (DEP) issued an Order (No. 4768 - see Appendix A) to the Town of Essex on December 21, 1988 requiring an engineering report to evaluate the current wastewater disposal needs, develop and evaluate alternatives for wastewater disposal in problem areas and prepare a schedule for implementation of the selected alternative.

This order was modified on June 15, 1990 to include a greater focus on the interrelationship between the potential for onsite wastewater disposal and land use management of the aquifer recharge areas of the town. The increased emphasis on aquifer protection in Essex reflects heightened statewide concern and resulting DEP requirements for protection of the State's groundwater resources. It is also timely as Essex was undergoing an update of their Plan of Development. This modification also separated the report submission dates for the village area (June 30, 1991) from the rest of the town (December 31, 1990).

1.3 Scope of Study

This report will address wastewater management as required in the original DEP Order and aquifer protection as required in the Order Modification. This wastewater management report will address the following scope:

1. Identify Wastewater Disposal Needs:
   Assess performance of existing subsurface sewage disposal systems to determine where limitations to adequate disposal may exist. Data on physical characteristics (e.g. soils, groundwater), wastewater generation, historical performance (e.g. past failures and repairs), present performance (e.g.

walkovers) and water quality impact will be reviewed to assess needs of present development in Essex. Future wastewater disposal needs will also be addressed.

2. Evaluate Continued On-Site Disposal:
   Areas identified above will be examined in detail to determine whether on-site repairs can reasonably be made to subsurface systems, and whether continued use of on-site disposal is viable.

3. Evaluation of Off-Site Alternatives:
   Alternative wastewater disposal methods will be developed for those areas where continued on-site disposal is not possible or where desired for future needs.

4. Sewer Avoidance:
   An on-site management program is recommended to encourage proper use of subsurface systems and to vigorously identify and repair failed systems.

5. Septage Disposal:
   The present means of septage disposal, at the Town's septage lagoons, was reviewed and improvements were recommended. Other available disposal methods were also evaluated.

6. Aquifer Protection:
   Potentially significant aquifers in Essex will be identified and the existing and future land uses over these aquifers will be identified. Suggestions for regulating land use to control potential degradation of the aquifers will be made.

2.0 PHYSICAL CHARACTERISTICS OF ESSEX

2.1 Topography

The Town of Essex has a total area of approximately 12.2 square miles, of which 10.1 square miles is land. The Town is bordered by the Connecticut River to the east, Deep River to the north, Westbrook to the west, and Old Saybrook to the south.

The topography of this region is comprised of three principal types. There is a sandy shoreline along the Connecticut River at the eastern edge of the Town, river valleys along the Falls and Mud Rivers, and hilly uplands in the rest of the town. In the hilly regions in the less developed portions of town, slopes are moderately to very steep. There are significant stratified drift areas along both the Falls and Mud Rivers.

2.2 Soils

The soils of Middlesex County have been mapped by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS). Essex soils fall into four main groups:

Hickley-Agawam-Merrimac in the glacial plains from the Central section of the Connecticut River to the eastern side of Ivoryton,

Hollis-Charlton curve on bedrock-controlled glacial till uplands from the northeast portion of Essex to the western part of the Old Saybrook border; also found in the southeast section near South Cove,

Canton-Hollis in the glacial till uplands in the western part of Essex, and Paxton-Woodbridge in a very small western section adjacent to the Westbrook and Deep River borders.

The specific soil types have been rated by the Middlesex County Soil and Water Conservation District as to their potential for septic tank absorption fields systems, based on slope, percolation rate, depth to water table and bedrock, and flood potential. Figure 1 shows these ratings graphically for soils with poor potential for septic systems. The potential is considered extremely low if it the soil has severe limitations for absorption fields that are extremely difficult to overcome and is is unlikely that the soils can be improved sufficiently to construct a system which would meet state health code requirements. Very low potential soils are rarely used for septic tank absorption fields and have severe soil limitations requiring extensive site design and preparation to overcome. Soils with low potential are commonly used for absorption fields which require extensive design and site preparation. Based on Figure 1, it is clear that about half of Essex has significant soil potential limitations.

2.3 Drainage Areas

The drainage areas for Essex's numerous small waterbodies and tributaries are shown in Figure 2. These can be agglomerated into three major drainage areas that feed into Essex's three principal rivers. The largest drainage area covers the northern and western sides of Essex and flows into the Falls River. The second largest drains the south-central portion of Essex into the Mud River. The smallest drains the eastern edge of Essex directly into the coves of the Connecticut River. These three drainage basins are interrelated, with the Mud River flowing into the Falls River which flows to the Connecticut River.

2.4 Water Quality

The Connecticut Department of Environmental Protection (DEP) has classified surface and groundwaters throughout the State.

Surface water classifications for Essex are shown on Figure 2. Surface water classifications are defined as follows:

CLASS	CLASS DESCRIPTION
Class AA -	Existing or proposed drinking water supply impoundments and tributary surface waters. No such waters are present in Essex.
Class A -	May be suitable for drinking water supply and/or bathing; suitable for all other water uses; character uniformly excellent.
Class B -	Suitable for bathing, other recreational purposes, agricultural purposes, certain industrial processes and cooling; excellent fish and wildlife habitat; good aesthetic value.
Class B/A -	Currently classification B with a long term goal of being upgraded to A.
Class SB -	Indicates a saline segment of a Class B surface water

Groundwater classifications are also shown on Figure 2 and are defined as follows:

CLASS	CLASS DESCRIPTION
Class GAA -	Existing or proposed public water use without treatment.

CLASS	CLASS DESCRIPTION
Class GA -	May be suitable for public or private drinking water use without treatment.
Class GB -	May not be suitable for public use as drinking water without treatment.

Certain limitations restrict use of surface and groundwater resources in the state as dictated by water quality standards. Water classification limitations as related to sewage effluent discharges are as follows:

CLASS	CLASS DESCRIPTION
Class AA -	Surface waters are not suitable to receive wastewater discharges.
Class A -	Surface waters are not suitable to receive wastewater discharges.
Class B -	Surface waters are suitable to receive major and minor discharges from municipal and industrial wastewater treatment systems.
Class GAA -	Groundwaters are suitable for individual domestic septic systems.
Class GA -	Groundwater suitable to receive septic system discharge and septage of human or animal origin.

Class GB - Groundwaters are presumed degraded due to a variety of pollution sources. State's goal is to prevent further degradation by preventing any additional discharges which would cause irreversible contamination.

The majority of Essex's groundwater is classified as GA. Exceptions include GAA areas around public water supply wells which are owned by the Connecticut Water Company, and wells which serve community water systems at Hemlock Apartments, Meadowbrook Rest Home, and Heritage Cove Condominiums. GB/GA areas are found in two industrial areas, around an oil spill, and in areas impacted by the Town of Essex landfill, road salt storage, and septage lagoons. With the exception of GAA areas, Essex's groundwater is suitable, from a water quality standpoint, to accept treated municipal wastewaters from a community subsurface or land-treatment system.

Based on water classification, disposal of treated municipal wastewater effluent would be allowed to either the Falls River or the Connecticut River with approval from the DEP. However, when selecting a receiving stream for treated wastewater disposal, the amount of natural self-purification that the stream can provide must be considered. This self-purification capacity, often called the waste assimilative capacity, depends on the flow of the river, its oxygen content, and its ability to reoxygenate itself. Because of its relatively low flow, the assimilative capacity of the Falls River is low, so waste disposal to the Falls River would be quite limited. The waste assimilative capacity of the Connecticut River is significantly higher and discharge of treated wastewater to the Connecticut River is a disposal alternative that can be considered. The DEP has stated that should a treatment plant be constructed, the

outfall would have to be constructed to the Connecticut River proper and not to any of the coves. The remainder of Essex's surface water is either classified as A or has a goal of A so and would not be suitable to receive effluent from a wastewater treatment facility.

2.5 Water Supplies

Approximately half of Essex is is served by public water systems. The largest water purveyor in the area is the Connecticut Water Company, which in 1987 served approximately 2300 residential customers. Other community water systems serve Hemlock Apartments, Heritage Cove Condominiums and Meadowbrook Rest Home. The remainder of the Town obtains drinking water from individual wells.

2.6 Land Use/Zoning

Essex is generally rural and has large expanses of undeveloped land, however, there are numerous clusters of densely developed small lots. Much of the heavily developed area is along the Connecticut River and in Ivoryton and Centerbrook.

Zoning districts in Essex are shown in Figure 3. Zoning Districts and minimum lot sizes are as follows:

DESIGNATION	DISTRICT	MINIMUM LOT SIZE
VR	Village Residential	30000 sq. ft.
RU	Rural Residence	40000
RU-M	Rural Residence - Multi Family	40000
EV	Essex Village	15000
WF	Waterfront Business	30000
C	Commercial	30000
LI	Limited Industrial	80000

cons	Conservation	Residences Prohibited
RLC	Residential Life Care	

2.7 Population

Estimates of Essex's population in 1990 range from 5650 estimated by the Connecticut Office of Policy and Management to 5833, estimated by the U.S. Bureau of the Census in their preliminary report on the 1990 Census. The Office of Policy and Management predicts continued steady growth, with a projected population of 6300 in 2010.

2.8 Essex Harbor

Essex Harbor, located along the Connecticut River at North and Middle Coves provides safe harbor for many boats. Four marinas and five yacht clubs provide slips and moorings for a total of 512 boats. Private facilities include 126 moorings and 80 slips, thereby bringing the total number of boats in Essex Harbor to 718. Currently no pumpout facilities exist in Essex for wastewater from these boats.

3.0 INVESTIGATION OF SEWAGE DISPOSAL NEEDS

Wastewater management needs were assessed using a variety of information sources which will be detailed in this report.

3.1 Investigation Methodology

The initial steps of this investigation involved a review of physical characteristics and of historical performance of subsurface wastewater disposal systems throughout the entire town in order to determine portions of Essex where on-site disposal should be a viable long term wastewater management technique and where it is not. This is not generally a crisp yes or no delineation and requires review of many types of information to arrive at a judgment regarding feasibility of subsurface disposal.

This study followed an iterative approach to determining areas where on-site disposal is not viable. "Areas of concern" were identified where either past septic system problems or physical characteristics indicated conditions were not ideal for subsurface disposal. A more detailed investigation of these areas was conducted and is described below.

Initially data was gathered about septic system repairs and pumpout frequencies for the entire town. Lot size, soil limitations, depth to groundwater, and age of structure were considered in order to assess the feasibility of making on-site repairs. Discussions with the town sanitarian and recommendations from the previous wastewater study were also considered in developing areas of concern. Site walkovers and detailed review of building department files were used to supplement this information in order to determine the magnitude of subsurface disposal problems in areas where recorded data was

inconclusive. From these multiple sources of information, final study areas were developed.

Water quality sampling and analysis was also conducted to provide another means of assessing possible impacts to the environment. Parameters such as fecal coliform and nitrogen compounds such as ammonia and nitrate are components of domestic wastewater and may indicate possible contamination by incompletely renovated sewage from subsurface disposal systems.

3.2 Review of Past Data

Malcolm Pirnie conducted a study of wastewater mangement in the Town of Essex beginning in 1979. They reviewed data on septic tank pumpouts and subsurface failures and repairs to arrive at "action designations" based on the need for off-site disposal. They concluded that the downtown area and "Middlesex Turnpike" (just south of downtown) areas of Essex were in immediate need of off-site disposal because of past septic system problems and site conditions which would make on-site repairs difficult.
Two sections of Ivoryton, Comstock Avenue and Summit Street, were designated as areas where future action may be necessary because of past problems (to a lesser degree) and small lot sizes which limit repairs. The Mill Pond area was also analyzed in detail, and it was found that continued on-site disposal would be feasible. Similarly, the remainder of Essex was not believed to need a structural solution to wastewater disposal needs.

3.3 Review of Health Department Records

The Essex Health Department maintains a permit book containing permits for all subsurface disposal system repairs, additions, and new systems. This permit book was reviewed for the years 1980-1988 and the number of each type of permit was recorded. Locations of repairs for the entire Town were plotted on Town Assessor's maps and are shown in Figure 4.

Table 1 shows repair rates by area for areas with higher repair rates, and shows that the highest reported failure rates are in Centerbrook Center, Comstock Avenue, and Essex Village. Overall failure rates for the study areas are 13.5% during the 9 years reported, or 1.5% per year. This is only slightly higher than the 1% per year failure rate that many engineers consider to be a typical reasonable rate of failure for subsurface disposal under good conditions.

Pumpout records have been maintained by the Health Department since April, 1982 and were reviewed to determine which properties had frequent pumpouts which may be indicative of septic system problems. Only discharges to the Essex Septage Lagoons are recorded on the pumpout records. Some property-owners may have their septic tanks pumped by haulers who do not discharge to the Essex lagoons, and these pumpouts are not reflected in the Sanitarian's records.

Typically a well-functioning septic tank only needs to be pumped out every three to five years. However, some septage haulers encourage more frequent pumping and homeowners may choose to pump their tanks more frequently in an attempt at preventive maintenance. For the purposes of this analysis a residential pumpout frequency of more than once per year was considered excessive and likely to be indicative of septic system problems. Higher frequencies were noted and are shown on Figure 4.

3.4 Physical Characteristics

Potential study areas were identified based on past problem areas developed by Malcolm Pirnie and areas of concern noted by the sanitarian in a tour of Essex and subsequent discussions. The Water Pollution Control Authority (WPCA) also identified further areas of concern. Many characteristics were developed

for each of these areas, including lot size, soil limitations, depth to groundwater, source of water supply, and age of dwellings. The physical characteristics were compared with actual septic system repair rates and pumpout records from the Sanitarian's files in order to refine the study areas. Areas in which on-site repairs should clearly be feasible were eliminated from the study. Final study areas along with physical characteristics are summarized in Table 1 and illustrated in Figure 4.

3.5 Walkovers

After review of the Sanitarian's records and review of physical characteristics, certain areas of Essex were selected for walkovers to provide more information on septic system performance. In this visual field study, conducted in April and June, 1989, each property in the selected study area was evaluated by an engineer or technician to determine whether there was any evidence of septic system failure. Field data was collected in the spring because it is the wettest time of the year and offers worst case conditions for subsurface disposal system operation. System operation was discussed with homeowners if they were present during the walkover. Subsurface disposal system failure is suspected when such evidence as very wet areas, lush green vegetation, septic odors, or effluent breakout is detected in walkovers.

Walkovers were conducted on a total of 185 properties in the Summit Street, Comstock Avenue, Hickory Lane, Charles Street, Stumpet Hill, and Ivoryton Center areas. The results of these walkovers are summarized in Table 2. As can be seen from this table, ten failures (5.4% of walkovers) were suspected from this fieldwork. Three of these properties were among the 15 inspected on Charles Street, giving it a relatively high suspected failure rate. Information on properties with

TABLE 1
ESSEX WASTEWATER MANAGEMENT STUDY
CHARACTERISTICS OF STUDY AREAS

AREA	NO. OF LOTS DEVEL. (1)	NO. OF LOTS VACANT (1)	TYPICAL AGE (YRS) (2)	MEDIAN LOT SIZE (SQ.FT.) (3)	SOIL LIMITATIONS FOR SUBSURFACE DISPOSAL (4)	DEPTH TO GROUND-WATER (FT) (5)	WATER SUPPLY (6)	NO. OF REPAIRS 80-88 (7)	NO. OF HIGH FREQUENCY PUMPOUTS (8)	LOTS OF INADEQUATE SIZE (9)	WALKOVER DONE	NO. OF GROUND-WATER SAMPLES
Essex Plaza	1	0	20	52,300	Slight	6-8	Public	4	1	Few	N	0
Summit Street	44	2	25	15,700	Moderate	2-4	Public	5	0	Few	Y	1
Ivoryton Ctr.	30	2	25	15,000	Slight	4-6	Public	3	0	Few	Y	0
Comstock Ave.	42	1	25	17,400	Severe	2-4	Public	8	0	Many	Y	1
Hickory La.	37	5	30	22,700	Severe	2-4	Private	7	0	Many	Y	3
Charles St. No.	19	2	25	14,800	Moderate	4-6	Mostly Public	1	1	Few	N	0
Charles St. So.	15	3	25	14,000	Severe	2-4	Mostly Private	1	0	Many	Y	1
Woodland Dr.	41	2	15	31,000	Severe	2-4	Private	7	1	Few	N	0
Bokum Ctr.	2	0	20	127,000	Moderate	204	Public	2	1	Few	N	0
Industrial Park	9	3	15	40,500	Moderate	3-5	Mostly Public	1	2	Few	N	3
Centerbrook Ctr.	38	3	20	31,400	Slight	6-8	Public	18	5	Few	N	1
Brookside Lane	9	0	15	16,600	Slight	4-6	Mostly Private	1	2	Few	N	0
Stumpet Hill	132	16	15	15,700	Moderate	4-6	Public	15	3	Few	N	0
Essex Ctr.	66	6	25	13,100	Moderate	4-6	Mostly Public	2	0	Few	N	1
Middle Cove	58	4	20	17,400	Moderate	6-8	Mostly Private	7	1	Few	N	0
Partridge La.	19	2	15	19,600	Severe	2-4	Public	1	0	Few	N	1
North Cove	12	0	20	11,800	Slight	6-8	Public	1	0	Few	N	3
Essex Village	120	7	35	10,500	Slight	6-8	Public	23	6	Many	N	3

Sources of Data:

(1) Assessor's information

(2) Assessor's information

(3) Analysis of Assessor's information

(4) SCS Soils Data

(5) - SCS Soils Data
- Shallow well Water Level Measurements
- Recent soil testing for subdivisions in Essex

(6) CWC Mapping

(7) Health Dept. Records

(8) Health Dept. Records

(9) General Estimate

TABLE 2

WALKOVER DATA APRIL 24-27, 1989
ESSEX WASTEWATER MANAGEMENT STUDY

AREA	NO. OF PROPERTIES	POSSIBLE FAILURES
Summit Street	23	0
Ivoryton Center	17	2
Comstock Avenue	28	2
Hickory Lane	45	2
Charles Street	15	3
Stumpet Hill	52	1
	185	10

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indications of subsurface disposal system problems was given to the Town Sanitarian for future follow-up. The overall failure rate found in the walkovers was encouraging because, consistent with the Health Department records, it suggested that subsurface failure rates were not extremely high and that continued on-site disposal is viable in many areas of Essex.

3.6 Water Quality Monitoring

Another aspect of field work done for this wastewater management study was water quality monitoring. Samples from three primary sources - groundwater, water from the Falls River and its tributaries, and water from the Connecticut River and its coves were collected and analyzed. Locations for sampling conducted in May, August, and October, 1989 are shown on Figure 5.

3.6.1 General

The groundwater was sampled for a variety of contaminants which indicate possible contamination with sewage. Fecal coliform and fecal streptococci are found in the intestines of man and are discharged in significant quantities in domestic sewage and are thus considered indicators of wastewater contamination.

Nitrogen species, including ammonia and nitrate can also indicate contamination with domestic wastewater. Unassimilated protein is excreted as organic nitrogen in wastes from man and animals. Organic nitrogen is quickly converted to ammonia and the ammonia is gradually oxidized to nitrite and nitrate. This progression allows some interpretation of how recently waters have been polluted. If nitrogen is mostly found as ammonia or organic nitrogen, it may indicate that the water has been polluted recently. Conversely, nitrogen in the form of nitrates or nitrites only may indicate less of a threat to public health.

3.6.2 Groundwater Sampling Methodology

Twenty-three groundwater sample locations sampled, covering scattered areas throughout Essex. Eleven soil borings were installed for this study to provide data on soil types, bedrock depth, and groundwater depth. Monitor wells were installed in nine of these borings to allow sampling of the groundwater. The remaining 14 groundwater monitoring points were shallow drinking water wells, either active or abandoned. Three times the volume of water in the well was bailed from each well before a sample was collected for analysis. Water samples were preserved on ice and taken to the laboratory immediately after collection.

3.6.3 Surface Water Sampling Methodology

To allow for appropriate comparison between sampling events, all Connecticut River samples were taken during slack (low) tide. These samples were collected by boat between 1 and 2 feet below the surface of the water. Falls River samples were collected from the edge of the stream. Care was used to take samples where the water was flowing and stagnant pools were avoided.

3.6.4 Results of Water Quality Sampling

Detailed results of water quality sampling conducted in 1989 can be found in Appendix A. Essex Village groundwater data is summarized in Table 3 and surface water (Connecticut River) quality near Essex Village is summarized in Table 4.

3.6.5 Findings/Discussion

The water quality data can be used to assess the degree to which the nearby ground and surface waters have been impacted by incompletely renovated sewage. Typically, for uncontaminated surface and ground waters, ammonia and nitrate levels are less than 1 mg/L. Fecal coliform is not usually found in uncontaminated groundwater samples; for surface waters, it is difficult to estimate an unimpacted level since wildlife can be

TABLE 3
ESSEX VILLAGE GROUNDWATER QUALITY DATA
ESSEX WASTEWATER MANAGEMENT STUDY

GROUNDWATER

LOCATION	DATE	NO_3	NH_3	F.C.
MW-1	5/17/89	3.17	0.26	2.2
	8/29/89	4.7	0.44	0
MW-2	5/17/89	1.61	8.72	<1.1
	8/29/89	<0.1	12.1	0
MW-5	8/29/89	5.75	0.35	0
MW-6	8/29/89	16	0.44	0
MW-7	8/29/90	6.9	0.18	10
MW-8	8/29/89	0.2	49.4	0
MW-9	8/29/89	3.9	0.44	0
W-11	5/17/89	7.70	<0.05	<1.0
	8/25/89	4.5	0.18	0

NOTES:

NO_3 = Nitrate, mg/l as N
NH_3 = Ammonia, mg/l as N
F.C. = Fecal Coliforms, Colonies per 100 ml

GA Standards:
Nitrate 10 mg/l
Fecal Coliform $\leq$ 1 Monthly Average
$\leq$ 4 Individual Sample

TABLE 4
CONNECTICUT RIVER WATER QUALITY DATA
ESSEX WASTEWATER MANAGEMENT STUDY

SURFACE WATER (CLASSIFICATION SB)

LOCATION	DATE	NO_3	NH_3	F.C.
SW-10	5/23/89	1.40	0.13	1
	8/29/89	0.2	0.88	117
	10/27/89	<0.5	0.32	144
SW-11	5/23/89	1.34	0.13	0
	8/29/89	0.25	0.61	84
	10/27/89	<0.5	0.29	158
SW-12	5/23/89	1.34	0.13	10
	8/29/89	<0.1	0.44	71
	10/27/89	<0.5	0.28	180
SW-13	5/23/89	1.40	<0.05	0
	8/29/89	0.25	0.61	>2,400
	10/27/89	<0.5	0.28	350
SW-14	5/23/89	1.34	0.66	4
	8/29/89	0.3	0.61	>2,400
	10/27/89	<0.5	0.26	154
SW-15	5/23/89	1.34	0.13	1
	8/29/89	0.2	0.53	>2,400
	10/27/89	<0.5	0.28	350
SW-16	5/23/89	----	----	----
	8/29/89	0.25	0.53	400
	10/27/89	<0.5	0.24	800
Standard for SB		----	-----	200 log mean 400 for <10% of samples

NOTES:

NO_3 = Nitrate, mg/L as N
NH_3 = Ammonia, mg/L as N
F.C. = Fecal Coliforms, Colonies/ 100 mL

a source of bacterial contamination so comparison with historic data may be necessary to assess possible human impacts. These approximate concentrations can be used as guidelines to indicate the relative degree of contamination in the study areas.

3.6.5.1 Essex Village Groundwater

Based on ammonia and nitrate results it is clear that the groundwater in the Essex Village area has been impacted by nitrogen loading. As can be seen from Table 3, this contamination is most evident from elevated ammonia concentrations at MW-8 and MW-2, elevated nitrates at MW-1,MW-5, MW-6, MW-7, MW-9 and W-11. The ammonia concentration of 49.4 mg/L in the August sample of a monitor well located downgradient from the Griswold Inn indicates a significant impact to groundwater quality, likely from unrenovated sewage. The nitrate level of 16 mg/L at MW-6 is of concern because it exceeds the Connecticut groundwater quality standard for groundwater classified as GA.

Fecal coliform was only detected in two of the Village area groundwater samples. Fecal coliform levels of 2.2 colonies/100ml and 10 col./100ml exceed GA standards for average and maximum coliform counts. Concentrations of these parameters are not elevated at W-10, the nearest well located upgradient of Essex Village.

3.6.5.2 Connecticut River and Coves

As can be seen from Table 4, the Connecticut River water quality data varied significantly between the three dates on which samples were taken. This variation was observed in both the dissolved ion data in Appendix B which may indicate saltwater influences and in the nitrogen and bacteria data which may indicate wastewater impacts.

Although all three samples were taken under similar (slack) tidal conditions, only the August sample showed definite saltwater influence. This is evident from data on specific conductance, chlorides, and sodium which are approximately 25 - 150 times higher for the August sample than for the May sample. Measurements of specific conductance made in October are similar to values from May, indicating that no salt influence occurred at that time. It is expected that salt influence would occur in August because the fresh water River flow is lower during the drier weather therefore dilution of the salt water is less.

Nitrogen and bacteria concentrations also varied among the three sampling events. While no grossly elevated nitrate or ammonia levels were found in the Connecticut River or its coves during any of the sampling events, the relative concentrations of these parameters showed an interesting pattern. In general, nitrate concentrations were highest in May and ammonia and fecal coliform were lowest in May.

As can be seen from Table 3, the August sampling event showed coliform levels of more than 2400 colonies/100 ml for all samples taken in Middle Cove. Possible sources of significant bacterial contamination are wastewater discharges from boats docked in the area and wastewater treatment plant discharges upstream. It is not likely that the bacteria would have resulted from septic system effluent breakthrough because contamination was not present in May.

Another potential source of bacteria in the Connecticut River could be from the numerous swans which flock in the coves near Essex Village. One analytical tool which is sometimes used to determine whether bacterial contamination is from an animal or human source is the ratio of fecal coliform (FC) to fecal

streptococci (FS). Both humans and animals discharge significant quantities of fecal coliforms (FC) and fecal streptococci (FS). However, the ratio of these two bacteria (FC/FS) is significantly different for man and animals. Typically the FC/FS ratio is less than 1.0 for animals and more than 4.0 for man (Metcalf & Eddy).

The FC/FS ratio calculated from the October, 1989 samples ranged from approximately 4.1 to 17.5, thereby suggesting that the source of contamination is may be more likely human than animal. Some caution should be used in interpreting this data because the 17.5 value is much higher than 4.0, raising the possibility that streptococci die-off may have contributed to the high ratio.

Samples from North Cove also showed slight wastewater impacts. Fecal coliform levels, while highest in October, were lower than those found in the Middle Cove. Similar to Middle Cove, nitrate concentrations were highest in May, and ammonia concentrations were highest in August. The lower degree of surface water impact evident in North Cove can be explained by the higher flow in North Cove. The Falls River flows into North Cove, providing water circulation, while Middle Cove is relatively stagnant.

3.6.5.3 Village Groundwater and Surface Water Interrelations

The results from the groundwater sampling in Essex Village and the surface water sampling around Essex Village show significantly different impacts. Village Area groundwater data shows that nitrogen loading is cause for greater concern than bacterial contamination. In the Connecticut River, the inverse is true - some bacterial counts have been excessive while nitrogen concentrations are relatively low. The low levels of

bacteria in the Village groundwater suggest that groundwater contamination is not causing surface water contamination. The low nitrogen concentrations in the Connecticut River suggest that there is sufficient dilution to offset potential nitrogen contributions from the groundwater to the surface water.

3.6.5.4 Hickory Lane/Melody Lane Groundwater

Three wells in the Hickory Lane/Melody Lane area were sampled. Of these, one well (W-3) had a nitrate level of 6.3 mg/L in the August sample which suggests possible impact from subsurface disposal. Sodium levels of 76 mg/L in both the May and August samples also indicate possible contamination (possibly from road salt or water softener discharges) and exceed Connecticut guidelines for drinking water (20 mg/l). This area is currently served only by shallow drinking water wells, so the area should be closely monitored for compliance with drinking water criteria and to determine the source and extent of subsurface failure. If groundwater contamination is found to exceed federal or state criteria, alternative water supply should be provided.

3.6.5.5 Comstock Avenue Groundwater

The one well (W-4) which was available for monitoring in the Comstock Avenue area showed impact in both the spring and summer sampling events. Though the sodium levels are above Connecticut guidelines, they do not pose an immediate health threat because the area is served by public water supply. However, the nitrate levels above background (1.6 to 1.8 mg/l) do suggest possible impact from subsurface disposal, so sampling of this well should also be continued and subsurface disposal systems monitored periodically.

3.6.5.6 Summit Street Groundwater and Surface Water

The well (W-5) sampled in the Summit Street area also had significant nitrate concentrations (3.25 and 5 mg/l) in both the

spring and summer samples, though these are below the drinking water standard of 10 mg/l. Review of the surface water quality data (SW-3) in Appendix B indicates that some nitrogen is present in a small tributary of the Falls River. Again, this indicates that further investigation and repairs of subsurface systems are likely necessary.

3.6.5.7 Charles Street Groundwater

The samples from the well (W-6) in the Charles Street area show no impact from nitrogen loading. One sample contained 11 fecal coliform/100 ml, so there is a possibility of groundwater impact from domestic wastewater. However, it is important to note that the well in which the coliform was detected is upgradient of most of the Charles Street homes. In addition, there is a horse pasture in this area, thus suggesting that the impact could be from sources other than domestic wastewater.

3.6.5.8 Industrial Park Groundwater and Surface Water

Samples taken near the industrial park (MW-3, MW-4, and W-8) showed possible impact from both domestic wastewater and industrial processes. Samples taken in May and August had elevated nitrates, and one taken in August also had elevated ammonia and fecal coliform. Low levels of three volatile organic compounds were also detected in the May samples. The stream running through the industrial park was also sampled (SW-5 and SW-6) and fecal coliforms were found in spring and summer (1 to 80 organisms per 100 ml). The source of this bacteria is unknown and is below state standards for bathing beaches.

3.6.5.9 Falls River

Surface water quality data from the Falls River has also been analyzed to determine whether it has been impacted by

wastewater. A comparison of nonpoint source nitrogen loadings, detailed in Appendix C, showed that nitrogen contributions from highly developed areas of Essex such as Ivoryton and Centerbrook were significantly higher than those from less dense areas. However, even the levels in the more urbanized areas did not represent a water quality impact at the flows measured in May. The area was resampled in the summer and nitrogen loadings were found to be significantly lower. If there had been significant sewage impacts, it would be expected that high nitrogen levels would have continued into the summer months.

4.0 WASTEWATER DISPOSAL ALTERNATIVES

The results of the wastewater disposal needs analysis discussed in the previous chapter indicate that in most of Essex subsurface disposal systems function properly without negative impacts to public health or quality of groundwater or surface waters. Continued use of this wastewater disposal method is generally viable with some limitations as discussed below.

4.1 On-Site Disposal (Repairs)

A key criterion in identifying long term wastewater disposal needs for Essex is determining whether repairs can be made to subsurface systems if and when these systems experience failures. Where viable, the repair of subsurface systems is generally the most economical means of sewage disposal. To determine whether such repairs are possible, the physical characteristics of the subject properties must be considered along with the design requirements for disposal systems to see if proper repairs can be made within the site constraints of individual lots. The environmental ramifications of continued on-site disposal must also be explored. For example in the following section the pertinent water quality data and walkover and town record results are reviewed for each study area.

Connecticut Department of Health Services (DOHS) criteria were used in this analysis. These criteria can to used to determine the square feet of leaching area required based on the percolation rate and number of bedrooms in the house. For potential problem areas, each lot was analyzed to determine whether there was sufficient space to repair a septic system for a three bedroom house. Appendix D contains examples of these lot analyses.

The DEP also has developed criteria which are used to determine subsurface disposal requirements based on hydraulic capacity, pathogen destruction, and nitrogen dilution. These criteria

generally apply to subsurface systems with flows of over 5000 gallons per day and therefore are not required to be evaluated for new septic systems or repairs in most of Essex.

4.1.1 Areas Where On-site Subsurface Disposal is Viable

The majority of Essex can continue to use conventional on-site subsurface disposal systems. While subsurface systems will fail over time with continued use, there is adequate area and appropriate soil characteristics to allow successful repairs. Subsurface failure, in and of itself, is not of major concern. Subsurface disposal systems have a limited life and will eventually fail. The important issue is whether the systems can be, and are, properly repaired. The Town does not keep records of the cost of subsurface repairs, but they believe repairs generally cost between $5,000 and $15,000.

The majority of the land area of Essex is either not developed, or developed with low enough density that subsurface disposal areas can clearly be repaired on-site. Such areas were not scrutinized to the degree that the denser areas of concern were in this wastewater management study. The more detailed analysis of the study areas showed that continued on-site disposal was also feasible for most of these areas. The primary reason for continued feasibility is that most of the lots have sufficient area to make proper repairs given the soil types and site conditions.

4.1.2 Areas with Some On-site Disposal Restrictions

As shown in Figure 4, four of the study areas (labeled "B"), Hickory Lane/Melody Lane, Comstock Avenue, Ivoryton Center, and the southern portion of the Charles Street area were found to have some limitations for continued on-site disposal. Continued on-site disposal is viable in these areas, but the areas should be closely monitored and repairs made as needed. In addition it

may be necessary for a small number of the systems to be repaired off-site, so it is recommended that the Town consider purchasing vacant lots in these areas to ensure that land will be available when it is needed.

4.1.2.1 Hickory Lane/Melody Lane

Most of the lots in the Hickory Lane/Melody Lane area have areas of 1/2 acre or more, which is sufficient to make a DOHS approved repair for the soils in the area which are Paxton and Montauk. While they are rated as having "medium potential" by the Middlesex County Soil and Water Conservation District, they typically have a slow percolation rate and shallow water table and are considered by the Soil Conservation Service to have "severe" limitations for septic tank absorption fields. Groundwater in this area is relatively shallow and on a seasonal basis may contribute to the relatively high rate of subsurface repairs in this area. To overcome this limitation, mounded systems could be used.

This area is served by private wells, some of which are shallow, so it is important to monitor them closely for compliance with drinking water criteria. If groundwater contamination is found to exceed state or federal standards, alternative water supply should be provided. Alternate sources could include installation of bedrock wells or extension of the Connecticut Water Company system. As noted in Section 3.6.5.4, elevated nitrate concentrations have been observed and sodium levels have been above drinking water guidelines.

4.1.2.2. Comstock Avenue

On-site wastewater disposal is also viable with restrictions in the Comstock Avenue area. Soils in most of this area are Paxton and Montauk which as described above, have some limitations for subsurface disposal. At the eastern end of Comstock Avenue are

Woodbridge soils which have low potential for septic tank absorption fields according to Middlesex County Soil and Water Conservation District.

Lot sizes in this area vary widely, ranging from less than 10,000 square feet to over an acre. Two of the lots have insufficient area to make a conventional DOHS repair when their subsurface disposal systems fail. It may be possible to serve these homes with on-site subsurface disposal systems using low flow water fixtures and/or innovative leaching structures. Alternatively, if no other method were feasible a nearby vacant lot could be purchased and used to repair these systems.

Groundwater samples taken in this area showed slight impact, but not gross contamination. Groundwater quality in this area is of slightly less concern than in the Hickory Lane/Melody Lane area because Comstock Avenue is provided with public water supply by Connecticut Water Company.

4.1.2.3 Ivoryton Center

Most of the lots in Ivoryton Center are relatively large and have sufficient area for on-site repairs, given the good soil conditions in much of the area. However there is one lot with an area of less than 6000 square feet at the edge of the study area that would not have adequate space for a DOHS repair if there were a subsurface disposal system failure. Although no water quality samples were taken in this area, drinking water quality is less of a public health concern because the area is served by public water supply.

4.1.2.4 South Charles Street Area

The fourth area with some restrictions on subsurface disposal is the southern end of the Charles Street area (which includes Charles Street, Earl Street, View Street, and Cedar Street.)

Although the entire Charles Street area was included in the study areas, the southern portion had soil characteristics which indicated some cause for concern about subsurface disposal. The northern section of the Charles Street area has mostly coarser Agawam soils which have a high potential for septic tank absorption fields.

The southern portion has Paxton and Montauk soils which have a slow percolation rate and shallow depth to groundwater and are thus considered by SCS to be have severe limitations for septic tank absorption fields. Two lots in the South Charles Street area have insufficient area to make a proper repair meeting DOHS criteria. Most of this area is served by private wells so failures could impact drinking water quality. The Connecticut Water Company serves nearby areas, so it would be possible to extend water service to the Charles Street area if and when it becomes necessary. Water quality sampling from 1989 indicated only slight bacterial contamination (which may not have been from human sources) and no significant other wastewater contamination.

Future subsurface failures are likely to occur in these four areas, and measures can be taken to improve the success of repairs under these relatively limiting physical conditions. Measures to overcome low percolation rate and high groundwater include mounding the system using fill, installing curtain drains and drainage swales, and designing the absorption field to distribute effluent over a larger area. Wastewater flow to a subsurface system can be limited by installing low flow plumbing fixtures. The need for future repairs can be planned for by purchasing vacant lots to accommodate repairs on small lots on which it will not be possible to make proper repairs.

4.1.3 Areas of Concern for Continued Subsurface Disposal

As can be seen from Figure 4, there are three small areas (labeled "C") where it may be difficult to continue on-site subsurface disposal. In both the Essex Plaza and Bokum Center areas, concern about subsurface disposal is largely due to numerous failures and repairs at three commercial establishments which have been working in recent years.

4.1.3.1 Essex Plaza

The Highlander Center Laundromat, located in Essex Plaza has made repairs in 1981, 1984, 1986, and 1987. They had been ordered by the DEP to have pretreatment and subsurface disposal needs investigated by a professional engineer and install pretreatment and subsurface disposal facilities which will protect the waters of the state from pollution. Most recently, the DEP has indicated that the laundromat has installed a lint pretreatment system and that they are satisfied with the current repairs.

4.1.3.2 Bokum Center

The two businesses in the Bokum Center area with histories of failed septic systems are Oliver's Taverne and Colonial Market. Both have been working to make improvements to their systems. Oliver's Taverne has recently rebuilt much of their leaching field, raising it further above the groundwater table. Colonial Market has had problems with grease and clogging in the past and Town records show they have hauled a significant volume of septage/sewage to the Town lagoons in recent years. The town sanitarian reports they have been working to replace the system.

Since satisfactory progress has been, or is being, made in remediating the problems with subsurface disposal systems at the three businesses in Essex Plaza and Bokum Center, it would

appear that off-site wastewater disposal is not needed in these areas at present. However, monitoring of these areas should be continued, and alternative wastewater disposal means provided if necessary.

4.1.3.3 Essex Village

Essex Village was studied in greater detail and is the most interesting area from a wastewater disposal perspective. This area is densely developed with commercial and residential uses. Town records indicate a history of frequent septage pumpouts (though some of these pumpouts are for grease traps at restaurants) and repairs. The soils in Essex village are Agawam which have a fast percolation rate, significant unsaturated depth and have a high potential rating for septic tank absorption fields. It is lot size, and not soil characteristics which limit on-site subsurface disposal for any given individual lot in Essex Village.

The very permeable soils, while they are not limiting hydraulically, do not generally provide as complete treatment for septic tank effluent as the finer soils, due to the rapid passage of wastewater down to the groundwater regimes. It is clear from the water quality sampling results that the groundwater in this area has been impacted to some extent by incompletely renovated sewage and does not consistently meet Class GA standards.

Each lot in Essex Village has been analyzed to determine whether a proper repair could be fit on the lot. Repair schemes were evaluated using precast concrete drywell leaching systems, due to the large depth of unsaturated soils. A field walkover was conducted of the area in October 1989 to estimate wastewater flowrates from buildings in the village, including various commercial uses and an estimate of the number of bedrooms for

all residential buildings. During this walkover the extent and location of structures, previously plotted from an aerial photograph of the Village area, were revised.

The findings of this analysis, as shown in Figure 6 are that DOHS repairs could be made if needed on almost all lots in Essex Village. This is not to say that such repairs would not be disruptive to lawns, plantings, parking lots, driveways, etc. on any given lot.

The exceptions were eight of the lots in Essex Village where repairs meeting DOHS standards could be made only if variances in separating distances were made and/or if low flow plumbing fixtures were used.

For four other properties, the portion of the lot that does not have a building on it is so small that no reasonable repair could be made on-site. The four properties which do not have adequate space for subsurface disposal system repairs are all businesses - Essex Pharmacy, Silkworm, the building at the intersection of Pratt and North Main Streets containing Seaflower Florist, TCBY Yogurt, Chester Breadworks, and Danos Antiques and Griswold Inn.

The wastewater generated by Essex Pharmacy is currently treated using a leaching field located under their basement. The building at the corner of Pratt and North Main Streets is served by a subsurface disposal system with a leaching field in Pratt Street. The Silkworm is part of a community subsurface disposal system which serves seven residential units and two businesses. There have been no reported problems for these three systems other than a problem in 1990 with the Pratt Street system which was allegedly due to a leaking plumbing fixture which has since been fixed. However there is no space on these lots for them to make repairs in the future when they are needed.

The Griswold Inn also warrants special mention. The Griswold Inn has made numerous repairs to their subsurface disposal system in the past. Most recently, in Spring, 1989 they performed a major repair in conjunction with expansion of their facility in cooperation with the Town Sanitarian. They rebuilt their leaching field, which included removing a shed in order to obtain more space. They also added another grease trap and installed low flow fixtures including low flow toilets, low flow plumbing in the restaurant kitchen, and an air cooled ice machine. The subsurface system was designed for 6000 gpd. In November, 1989 the sanitarian reported that the system was working properly and that the grease traps had been pumped three times since June.

The Griswold Inn currently appears to be handling their flow hydraulically but effluent quality is a concern. As mentioned previously, for systems with flows greater than 5000 gpd, the DEP requires that pollutant renovation criteria be met. These standards, which include nitrogen dilution and pathogen destruction are not likely to be met for a system installed in such a small area. In addition, Griswold Inn does not appear to have the DEP discharge permits typically required for subsurface disposal systems and repairs of this size.

4.2 Off-Site Disposal Needs

Currently on-site subsurface disposal is serving the most of Essex adequately. Failures and repairs have occurred at reasonable rates, and impacts to water quality have been limited. Essex Village hydraulic wastewater disposal needs are being met (i.e. the sewage is going into the ground without effluent breakouts), but GA water quality standards are not being met consistently. In addition, there are some properties in Essex Village with no space for repairs to occur as needed in

the future. Therefore, at least limited future wastewater disposal needs to be planned for in Essex Village.

Most of the rest of Essex's wastewater treatment demands can be met by conventional on-site subsurface wastewater disposal. For about five properties outside Essex Village, there is not enough area for future conventional DOHS repairs. When these systems fail, it may be necessary to install low flow plumbing fixtures, use mounded systems, use innovative leaching structures, and/or request variances from separating distances. The Town should also consider purchasing vacant properties in these areas as insurance that future repair needs can be met.

5.0 WASTEWATER MANAGEMENT ACTIVITIES 1991-1997

The Draft Wastewater Management Study report was submitted to the CTDEP in October 1991. Since then the Essex WPCA has made significant progress in characterizing groundwater quality in Essex Village, as well as in developing an active On-Site Wastewater Management Program. Requests for groundwater reclassification in Essex Village have also been made. In addition, at the request of the WPCA, a variety of additional sewerage alternatives were evaluated.

5.1 Groundwater Monitoring in Essex Village

Groundwater monitoring was conducted quarterly for two years, beginning in October 1994 and concluding in July 1996. The wells that were sampled as part of the quarterly monitoring program include six wells (MW-2, MW-5, MW-6, MW-7, MW-8, and MW-9) that were included in the original 1989 groundwater sampling by Fuss & O'Neill. One well, MW-1, could not be located due to new landscaping in that area. A shallow dug well (W-11) was sampled until October, 1994. It was replaced by MW-10A during December 1995 due to concern that samples from it were not representative of groundwater quality due to its proximity to a subsurface sewage disposal system (SSDS). During December 1995, four additional wells were installed by the Town, including:

- MW-5A, in the Town Park;
- MW-6A, in the Post Office Parking Lot;
- MW-7A, at the intersection of Main Street and Scholes Lane and
- MW-10A, at the intersection of Main Street and Novelty Lane.

All wells included in this program are shown in Figure 6.

Parameters analyzed included nitrate nitrogen, ammonia nitrogen, total coliform, total sodium, pH, specific conductance, and temperature. Of these, the first three parameters are considered to be the best indicators of possible groundwater contamination by septic systems. These data, from the 8 recent monitoring events, as well as historical data from 1989 and 1993 are summarized in Table 5. The data did not show any obvious seasonal trends.

These data showed that each of the wells had at least one parameter that was above expected background concentrations. Of the ten wells sampled, four (MW-5A, MW-6, MW-7A, and MW-10A) had nitrate concentrations consistently at or near the GA standard of 10 mg/l. The GA classification is applied as a default to most groundwater in Connecticut and is intended to denote water that is suitable for use as drinking water without treatment. As detailed in Section 5.3, the Town has undertaken several efforts to reclassify the groundwater in Essex Village to reflect the fact that it is not used as a drinking water source and, therefore, may not need to meet these rigorous standards.

All of the wells exceeding the GA nitrate standard are located South of Main Street in Essex Village. A fifth well, MW-8 had an anomalous spike of 20.1 mg/l nitrate, but generally had concentrations less than 5 mg/l. This same well historically had ammonia concentrations above

TABLE 5
HISTORICAL GROUNDWATER QUALITY DATA
ESSEX WASTEWATER MANAGEMENT STUDY

		NITRATE	AMMONIA	COLIFORM
	STANDARD	10		Note (1)
WELL	DATE			
MW-2	08/29/89	ND<0.1	12.1	NS
	08/26/93	ND<0.1	8.7	ND<2
	10/04/94	ND<0.1	4.2	9
	1/31/95	ND<0.1	4.5	23
	5/1/95	0.16	5	2
	7/14/95	ND<0.1	6.8	1600
	10/23/95	ND<0.4	5.2	34
	1/22/96	ND<0.01	3.85	42
	4/15/96	ND<0.01	4.24	8
	7/10/96	0.02	3.93	500
MW-5	08/29/89	5.75	0.35	NS
Note (2)	08/26/93	7.7	0.13	8
	10/04/94	8.5	0.09	280
	1/31/95	7.7	0.09	>1600
	5/1/95	2.1	0.1	1600
	7/14/95	2.9	0.5	>1600
	10/23/95	0.11	ND<0.07	>1600
	1/22/96	2.16	0.70	>1600
	4/15/96	3.20	0.41	110
	7/10/96	5.77	0.29	23
MW-5A	1/22/96	13.2	2.61	300
	4/15/96	17.1	1.54	90
	7/10/96	10.7	0.30	90
MW-6	08/29/89	16	0.44	NS
	08/26/93	8.6	ND<0.05	ND<2
	10/04/94	16	ND<0.07	ND<10
	1/31/95	13	0.15	ND<2
	5/1/95	8.9	0.10	ND<2
	7/14/95	11	ND<0.07	80
	10/23/95	15	ND<0.07	50
	1/22/96	8.22	0.02	4
	4/15/96	8.43	0.10	ND<2
	7/10/96	8.58	0.03	11
MW-6A	1/22/96	0.55	0.12	>1600
	4/15/96	3.73	0.24	>1600
	7/10/96	1.58	0.13	170

WELL	DATE	NITRATE	AMMONIA	COLIFORM
MW-7	08/29/89	6.9	0.18	NS
	08/26/93	2.1	0.84	ND<2
	10/04/94	0.99	0.46	ND<2
	1/31/95	1.9	0.37	500
	5/1/95	1.9	0.24	11
	7/14/95	3	0.3	190
	10/23/95	5	1.1	23
	1/22/96	2.92	1.58	900
	4/15/96	1.42	0.73	>1600
	7/10/96	5.22	1.77	13
MW-7A	1/22/96	16.0	0.34	50
	4/15/96	11.1	0.11	30
	7/10/96	12.6	0.12	0
MW-8	08/29/89	0.2	49.4	NS
	08/26/93	ND<0.1	45	ND<2
	10/04/94	4.7	14	ND<2
	1/31/95	0.47	9.2	ND<2
	5/1/95	0.50	6.2	ND<2
	7/14/95	NS	NS	NS
	10/23/95	0.53	2.9	14
	1/22/96	20.1	4.35	23
	4/15/96	3.24	6.09	ND<2
	7/10/96	3.83	8.89	0
MW-9	08/29/89	3.9	0.44	NS
	08/26/93	5.2	ND<0.05	ND<2
	10/04/94	ND<0.1	ND<0.07	20
	1/31/95	3.9	ND<0.07	ND<2
	5/1/95	4	ND<0.07	ND<2
	7/14/95	4.6	ND<0.07	4
	10/23/95	4	0.14	80
	1/22/96	3.70	0.18	220
	4/15/96	3.95	ND<0.02	27
	7/10/96	4.75	0.06	0
MW-10A	1/22/96	8.00	0.06	300
	4/15/96	10.9	0.06	900
	7/10/96	12.6	0.09	23

NOTES:

(1) Not to exceed a monthly average of 1, or 4 in any single sample.

(2) Monitor well cover was missing until December 1995.

NO3 = Nitrate, mg/l

NH3 = Ammonia, mg/l

T.C. = Total Coliform, Colonies or MPN per 100 ml

ND = Not Detected

NS= Not Sampled

40 mg/l, but these did not recur during the 2 years of recent data. At least periodically, all of the wells had total coliform concentrations in excess of GA standards (which is only 1 colony per 100 ml).

Taken as a whole, these data may suggest impacts due to use of subsurface disposal systems. Groundwater quality is also impacted by the high percentage of impervious area and storm drainage system in the Village. Most of the stormwater does not infiltrate in this area to dilute nitrogen as it would in a less dense area. These facts were also used to support the request for groundwater reclassification.

It must be clearly understood that although the groundwater may be impacted in the area, the ramifications of this impact are very limited. The entire area has public water supply provided by the Connecticut Water Company. Thus, there is no public health concern about this water being used as a potable supply. The groundwater under the Village discharges to the surrounding surface waters (Connecticut River and Middle and South Coves) and is unlikely to cause any impact to attainment of surface water quality goals (Class SB). There are no nitrate or ammonia standards for SB waters in Connecticut. During simultaneous sampling in Essex Village and the surrounding surface water, coliform concentrations have been significantly higher in the Connecticut River than in groundwater beneath Essex Village.

5.2 Sewerage System Evaluation

At the request of the WPCA, Fuss & O'Neill evaluated a wide variety of sewerage system alternatives that could be installed in Essex. These ranged from constructing a small multi-user subsurface disposal system in Essex Village to sewering all of the study areas and building a new treatment plant or expanding the one in Deep River. These various systems were termed "Discussion Items" in recognition that some of these alternatives were not necessarily being seriously considered for implementation. Rather, they were evaluated in order to determine what the potential costs and impacts of various systems would be to the Town and its residents.

The "Discussion Item" material (including sketches and tables) presented below is essentially the same as that developed for public presentations during 1992. This material is being presented in order to document the evaluations undertaken on behalf of the WPCA. However, it should be understood that these concepts have evolved during the 5 years since they were developed.

In 1992, the costs the concept of equivalent dwelling units (EDUs) was used as a means of distributing wastewater management costs. This was done because it was likely that larger sewer dischargers would pay more than individual homeowners, and those served by the the sewerage system would pay more than those who were not. For each of the Discussion Items, some of the 2900 EDUs would be served by sewers; the rest would be served by an on-site wastewater management system. The cost (as estimated in 1992) of this on-site wastewater management system is represented in the annual O&M costs for the non-sewered area.

5.2.1 "Discussion Item A"

The first "discussion item" was construction of a small multi-user SSDS in the park on Main Street in Essex Village. This would serve the properties along Main Street and North Main Street with lots too small to make repairs on-site. The concept of acquiring groundwater rights was included in this alternative as a means of addressing concerns that the groundwater does not currently meet GA (drinking water) standards. As detailed further in the public information included in Appendix J, it was hoped each property owners would transfer their groundwater rights to the Town (for a nominal fee). This would enable the Town to control the groundwater plume under the Village's SSDS's until it is discharged to a Class B water body (the Connecticut River and its coves). The groundwater rights concept was not well supported by the Town Boards and the general public. Criticisms of this concept included the following:

- Obtaining groundwater rights does nothing to change groundwater quality and therefore is of no direct environmental benefit; and

- It impossible to predict the costs of obtaining groundwater rights because no one knows whether all Essex Village residents would be willing to transfer them for a nominal cost.

This alternative also included the concept of purchasing property in the "remote areas" (Comstock Avenue, Ivoryton Center, and South Charles Street) so that off-site repairs to one or two properties in each area could be made if necessary. These costs were included to make comparison with the larger sewer area options more reasonable.

The cost of an active on-site wastewater management program was included for the non-sewered areas of the Town.

A schematic map of the sewered area is provided in Sketch 1. A preliminary opinion of the costs associated with this alternative is provided in Table 6. This table also includes distribution of costs to sewered and non-sewered properties.

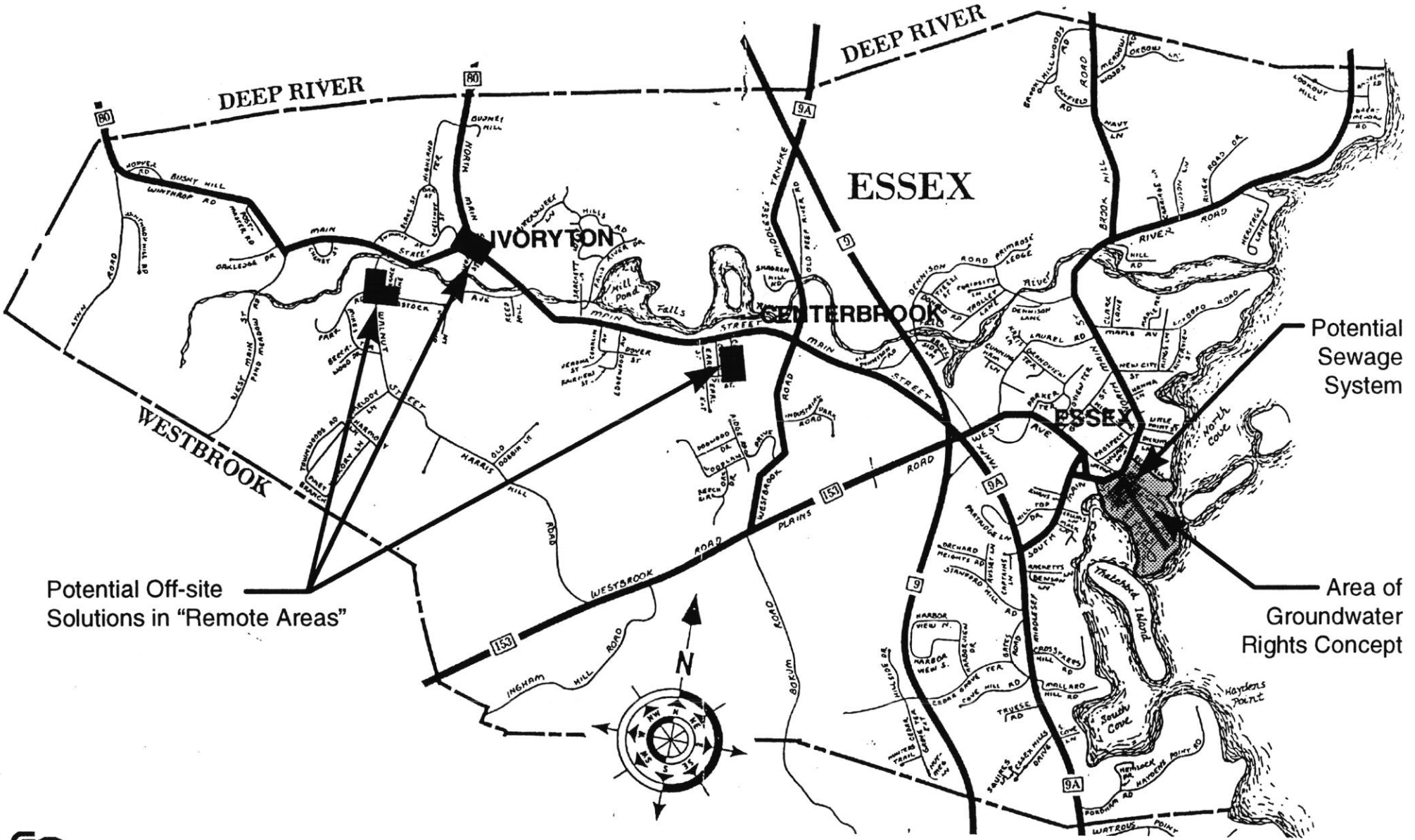
5.2.2 "Discussion Item B"

The second "discussion item" considered would include sewers for the entire Essex Village area. Construction of a wastewater treatment plant would be required. No site had been selected for such a facility, although it was clear from public discussion that siting this facility would be a controversial issue. Since the entire area would be sewered, and SSDS no longer used, obtaining groundwater rights would not need to be considered. This alternative was otherwise similar to Discussion Item A. A schematic map of the sewered area is provided in Sketch 2. A preliminary opinion of costs and distribution is included in Table 7.

5.2.3 "Discussion Item C"

"Discussion Item C" included sewers for all of Essex Village as well as sewers for the industrial park and part of Centerbrook. This concept was intended to provide infrastructure for industrial and commercial economic development. Wastewater would be treated at a new wastewater

Essex Wastewater Management Plan
Discussion Item A
1992 Sewerage System Evaluation



Fuss & O'Neill Inc. *Consulting Engineers*

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Sketch 1

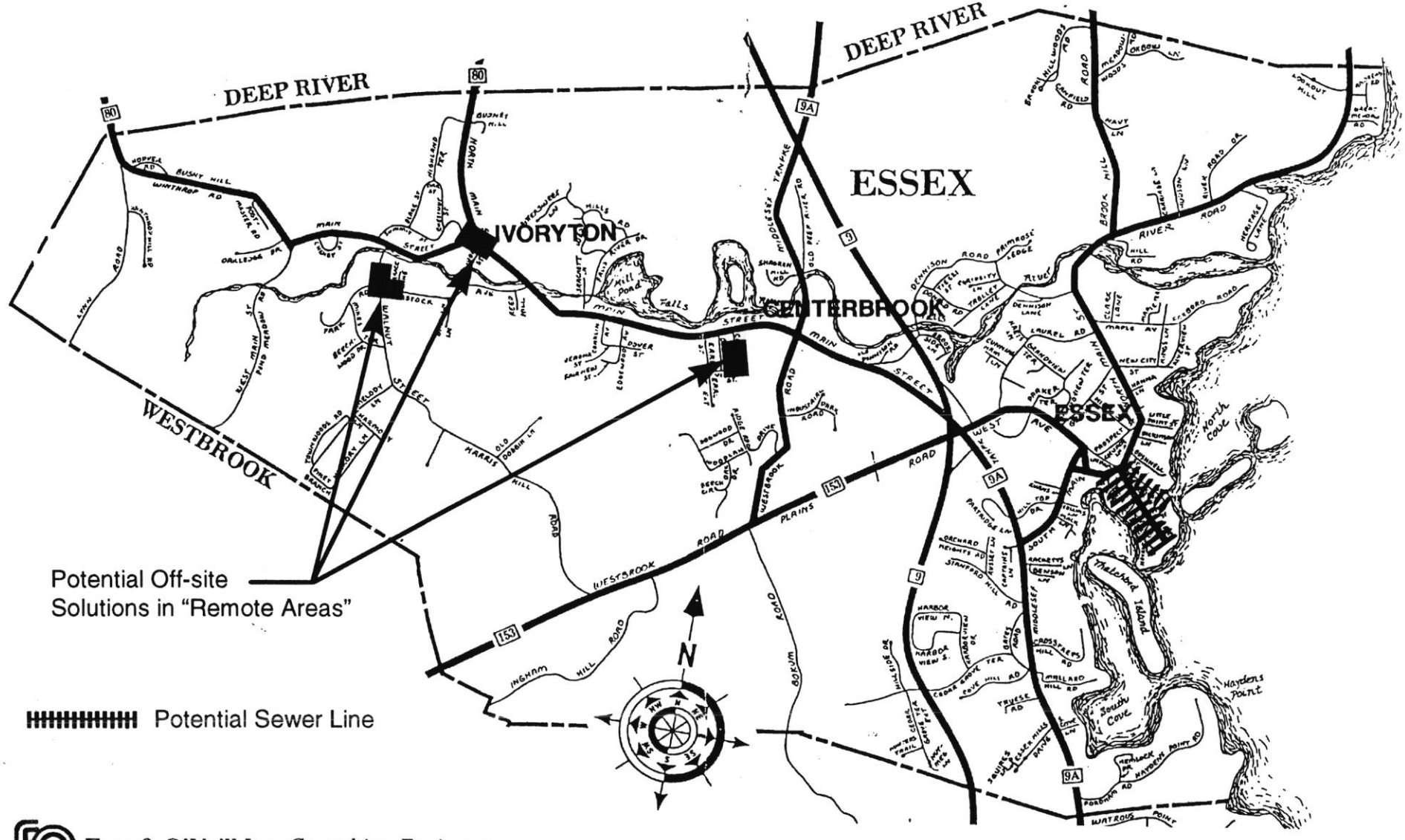
TABLE 6

PRELIMINARY OPINION OF COST
ESSEX WASTEWATER MANAGEMENT
DISCUSSION ITEM A
1992 SEWERAGE SYSTEM EVALUATION

Capital Costs:	
Village Collection System	$125,000
Village Community Septic System	$120,000
Satellite Community Septic	$200,000
Total Capital Cost (Not Including Legal)	$445,000
Capital Cost/Sewered EDU (23)	$ 19,300
Legal Costs:	
Legal-Groundwater Rights	$190,000
Legal Cost/Non-Sewered EDU (2877)	$ 66
Annual O&M Costs:	
For Sewerage System	$ 2,300
O&M Cost/Sewered EDU (23)	$ 100
For Non-Sewered Area	$80,000
O&M Cost/Non-Sewered EDU (2877)	$ 28

NOTE: All Costs in 1992 Dollars. Flow = 8,000 gpd.

Essex Wastewater Management Plan
Discussion Item B
1992 Sewerage System Evaluation



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Sketch 2

TABLE 7

PRELIMINARY OPINION OF COST
ESSEX WASTEWATER MANAGEMENT
DISCUSSION ITEM B
1992 SEWARAGE SYSTEM EVALUATION

Capital Costs:

Village Collection System	$1,750,000
Village Wastewater Treatment Plant (ex. land)	$1,100,000
Satellite Community Septic Systems	$ 200,000
Total Capital Cost	$3,050,000
Capital cost/Sewered EDU (153)	$ 19,900

Annual O&M Costs:

For Sewerage System	$ 45,900
O&M Cost/Sewered EDU (153)	$ 300
For Non-Sewered Area	$ 78,000
O&M Cost/Non-Sewered EDU (2747)	$ 28

NOTE: All Costs in 1992 Dollars. Flow = 40,000 gpd.

treatment plant (at an unspecified location) or at an upgraded Deep River plant. A schematic map of the sewered area is provided in Sketch 3. A preliminary opinion of costs and distribution is included in Table 8.

5.2.4 "Discussion Item D"

The final concept considered sewering all "study areas" shown on Figure 4. This was the maximum sewer area considered and would eliminate the possibility of future on-site repairs in all of the study areas. An on-site wastewater management program was included in this alternative as well, because even this large sewerage system would serve less than half of the properties in Essex. This alternative also would have taken maximum advantage of DEP funding while it was available. A schematic map of the sewered area is provided in Sketch 4. A preliminary opinion of costs and distribution is included in Table 9.

5.2.5 Conclusions Regarding "Discussion Items"

Pros and cons of the various sewerage concepts were developed and are presented in Table 10. During late 1992 and early 1993, these sewerage concepts, cost tables, and pros and cons were presented to the WPCA, other Town Boards, and the general public. Following these meetings, the WPCA rejected all four discussion items in order to more vigorously pursue on-site wastewater management. This is consistent with the conclusions of the 1991 draft wastewater management study which indicates that for the vast majority of properties in Essex, on-site wastewater management is a viable option.

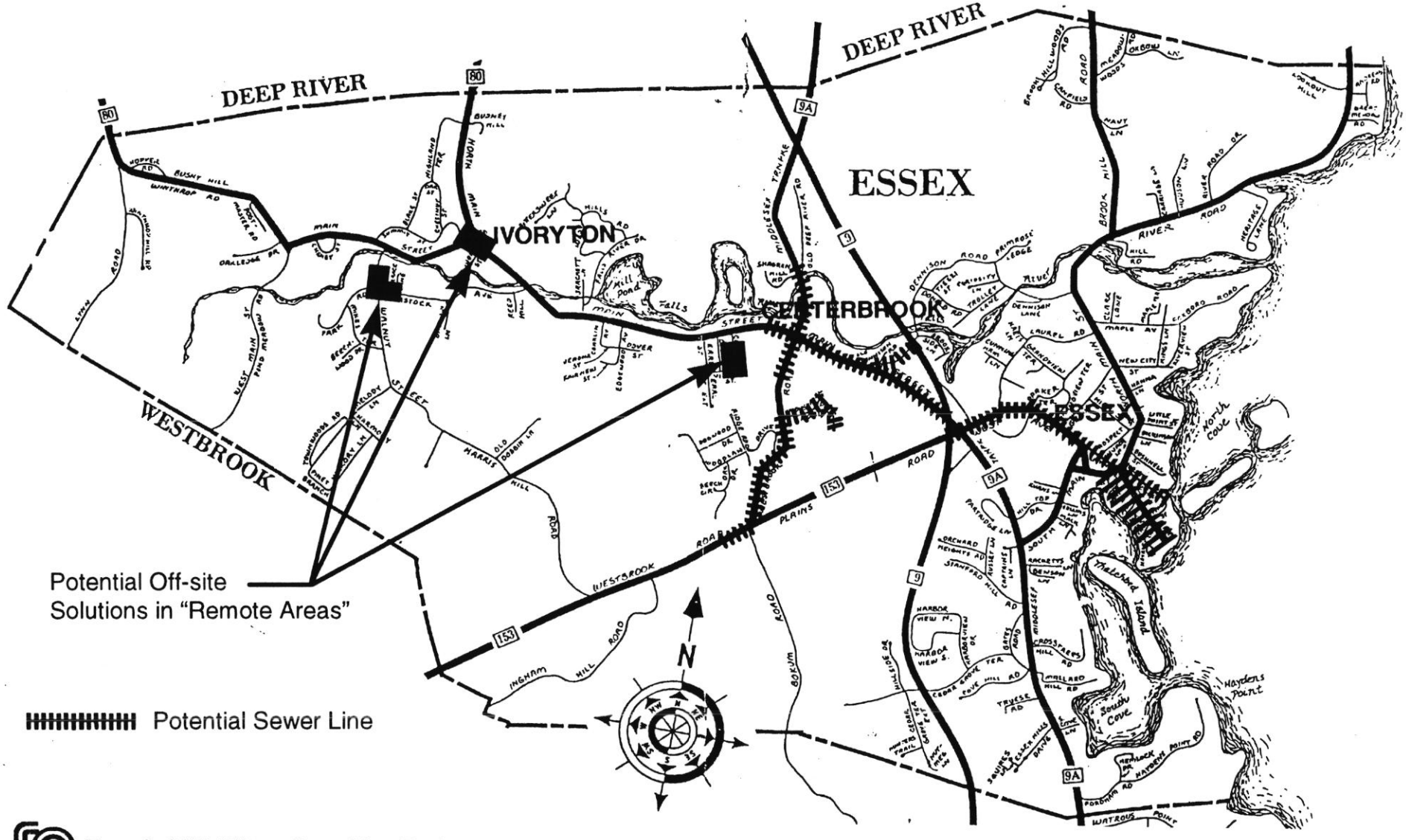
This On-Site Wastewater Management Program concept is the foundation upon which the recommended plan is built. The complete On-Site Wastewater Management Program has been detailed in Chapter 6 and will be active throughout Essex, Ivoryton, and Centerbrook.

5.3 Groundwater Reclassification

The Town and its consultant believe that Essex Village could reasonably be designated Class GB, without adverse impact to human health or the environment. Therefore, several attempts to reclassify the groundwater from GA to GB have been made. The initial request was made during Connecticut River Basin-wide reclassification hearings in 1991. As a result of this hearing, the CTDEP changed the groundwater classification under the Essex Village peninsula from GA to GB/GA. This change was made in recognition that the groundwater quality does not meet GA standards.

A second reclassification request was made during September 1992 as an alternative to obtaining groundwater rights. As detailed in correspondence contained in Appendix K, the Town felt that obtaining groundwater rights and reclassifying the groundwater could both achieve the same effect on the environment. This request addressed the economic and uncertainty issues associated with obtaining groundwater rights. Obtaining groundwater rights would be the single largest cost item associated with "Discussion Item A" detailed above. There was also considerable concern

Essex Wastewater Management Plan
Discussion Item C
1992 Sewerage System Evaluation



Fuss & O'Neill Inc. *Consulting Engineers*

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Sketch 3

TABLE 8

PRELIMINARY OPINION OF COST
ESSEX WASTEWATER MANAGEMENT
DISCUSSION ITEM C
1992 SEWERAGE SYSTEM EVALUATION

Capital Costs:

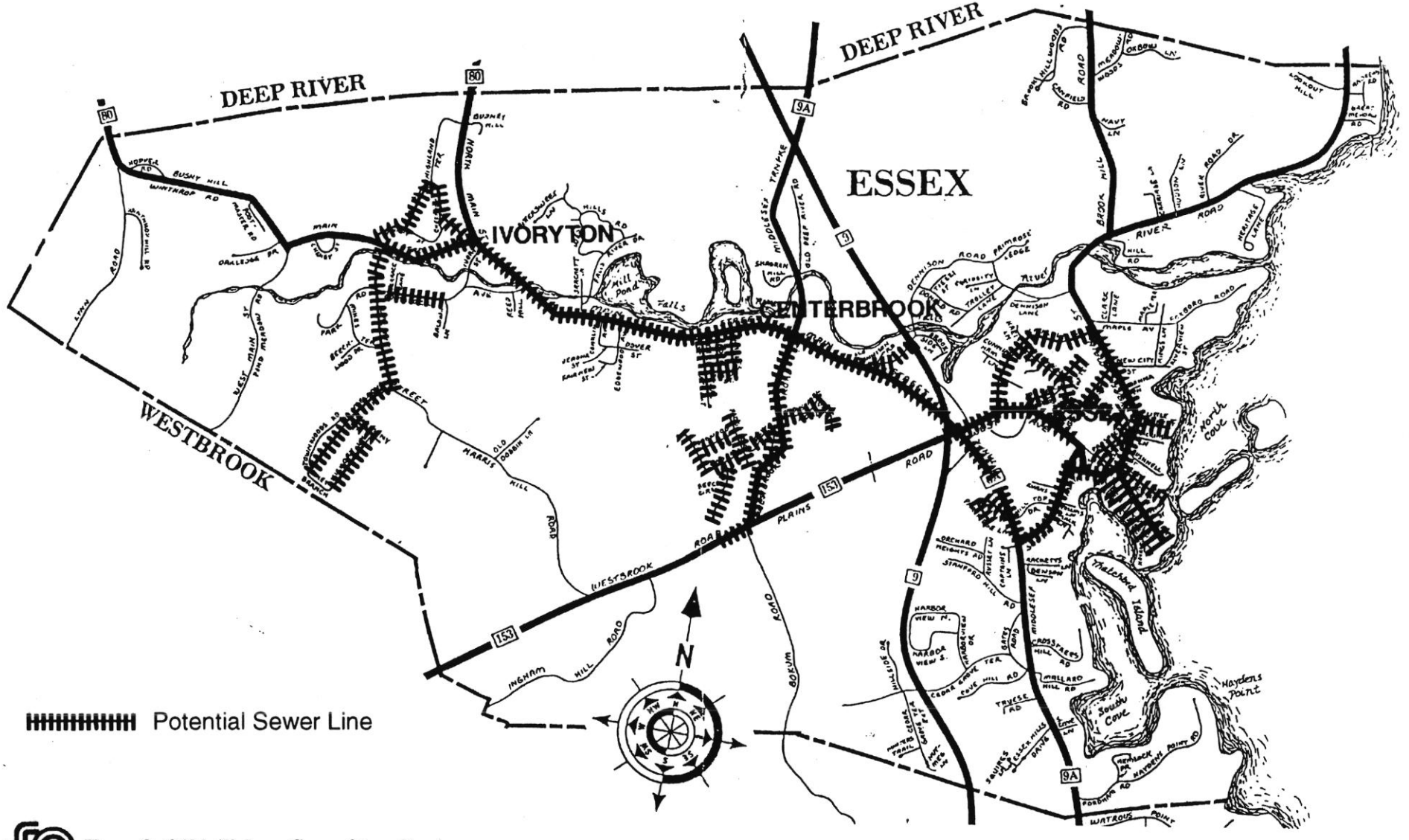
Collection System	$ 5,400,000
Force Main to Deep River	$ 2,200,000
Upgrade Deep River Wastewater Treatment Plant	$ 2,900,000
Satellite Community Septic Systems	$ 200,000
Total Capital Cost	$10,700,000
Capital Cost/Sewered EDU (458)	$ 23,400

Annual O&M costs:

For Sewerage System	$ 137,400
O&M Cost/Sewered EDU (458)	$ 300
For Non-Sewered Area	$ 70,000
O&M Cost/Non-Sewered EDU (2442)	$ 29

NOTE: All Costs in 1992 Dollars. Flow = 100,000 gpd.

Essex Wastewater Management Plan
Discussion Item D
1992 Sewerage System Evaluation



Fuss & O'Neill Inc. *Consulting Engineers*

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Sketch 4

TABLE 9

PRELIMINARY OPINION OF COST
ESSEX WASTEWATER MANAGEMENT
DISCUSSION ITEM D
1992 SEWERAGE SYSTEM EVALUATION

Capital Costs:

Collection System	$15,300,000
Force Main to Deep River	$ 2,300,000
Upgrade Deep River Wastewater Treatment Plant	$ 4,300,000
Total Capital Cost	$21,900,000
Capital Cost/Sewered EDU (1139)	$ 19,200

Annual O&M Costs:

For Sewerage System	$ 341,700
O&M Cost/Sewered EDU (1139)	$ 300
For Non-Sewered Area	$ 55,000
O&M Cost/Non-Sewered EDU (1761)	$ 31

NOTE: All Costs in 1992 Dollars. Flow = 240,000 gpd.

TABLE 5
HISTORICAL GROUNDWATER QUALITY DATA
ESSEX WASTEWATER MANAGEMENT STUDY

WELL	DATE	NITRATE	AMMONIA	COLIFORM
	STANDARD	10		Note (1)
MW-2	08/29/89	ND<0.1	12.1	NS
	08/26/93	ND<0.1	8.7	ND<2
	10/04/94	ND<0.1	4.2	9
	1/31/95	ND<0.1	4.5	23
	5/1/95	0.16	5	2
	7/14/95	ND<0.1	6.8	1600
	10/23/95	ND<0.4	5.2	34
	1/22/96	ND<0.01	3.85	42
	4/15/96	ND<0.01	4.24	8
	7/10/96	0.02	3.93	500
MW-5	08/29/89	5.75	0.35	NS
Note (2)	08/26/93	7.7	0.13	8
	10/04/94	8.5	0.09	280
	1/31/95	7.7	0.09	>1600
	5/1/95	2.1	0.1	1600
	7/14/95	2.9	0.5	>1600
	10/23/95	0.11	ND<0.07	>1600
	1/22/96	2.16	0.70	>1600
	4/15/96	3.20	0.41	110
	7/10/96	5.77	0.29	23
MW-5A	1/22/96	13.2	2.61	300
	4/15/96	17.1	1.54	90
	7/10/96	10.7	0.30	90
MW-6	08/29/89	16	0.44	NS
	08/26/93	8.6	ND<0.05	ND<2
	10/04/94	16	ND<0.07	ND<10
	1/31/95	13	0.15	ND<2
	5/1/95	8.9	0.10	ND<2
	7/14/95	11	ND<0.07	80
	10/23/95	15	ND<0.07	50
	1/22/96	8.22	0.02	4
	4/15/96	8.43	0.10	ND<2
	7/10/96	8.58	0.03	11
MW-6A	1/22/96	0.55	0.12	>1600
	4/15/96	3.73	0.24	>1600
	7/10/96	1.58	0.13	170

WELL	DATE	NITRATE	AMMONIA	COLIFORM
MW-7	08/29/89	6.9	0.18	NS
	08/26/93	2.1	0.84	ND<2
	10/04/94	0.99	0.46	ND<2
	1/31/95	1.9	0.37	500
	5/1/95	1.9	0.24	11
	7/14/95	3	0.3	190
	10/23/95	5	1.1	23
	1/22/96	2.92	1.58	900
	4/15/96	1.42	0.73	>1600
	7/10/96	5.22	1.77	13
MW-7A	1/22/96	16.0	0.34	50
	4/15/96	11.1	0.11	30
	7/10/96	12.6	0.12	0
MW-8	08/29/89	0.2	49.4	NS
	08/26/93	ND<0.1	45	ND<2
	10/04/94	4.7	14	ND<2
	1/31/95	0.47	9.2	ND<2
	5/1/95	0.50	6.2	ND<2
	7/14/95	NS	NS	NS
	10/23/95	0.53	2.9	14
	1/22/96	20.1	4.35	23
	4/15/96	3.24	6.09	ND<2
	7/10/96	3.83	8.89	0
MW-9	08/29/89	3.9	0.44	NS
	08/26/93	5.2	ND<0.05	ND<2
	10/04/94	ND<0.1	ND<0.07	20
	1/31/95	3.9	ND<0.07	ND<2
	5/1/95	4	ND<0.07	ND<2
	7/14/95	4.6	ND<0.07	4
	10/23/95	4	0.14	80
	1/22/96	3.70	0.18	220
	4/15/96	3.95	ND<0.02	27
	7/10/96	4.75	0.06	0
MW-10A	1/22/96	8.00	0.06	300
	4/15/96	10.9	0.06	900
	7/10/96	12.6	0.09	23

NOTES:

(1) Not to exceed a monthly average of 1, or 4 in any single sample.

(2) Monitor well cover was missing until December 1995.

NO3 = Nitrate, mg/l

NH3 = Ammonia, mg/l

T.C. = Total Coliform, Colonies or MPN per 100 ml

ND = Not Detected

NS= Not Sampled

TABLE 10
SUMMARY OF 1992 SEWERAGE SYSTEM EVALUATION

	Discussion Item A	Discussion Item B	Discussion Item C	Discussion Item D
DESCRIPTION	Community system for portion of Essex Village Obtain groundwater rights for Essex Village Purchase property for septic system repairs in Ivoryton and Centerbrook On-site wastewater management required for unsewered areas	Sewer of all Essex Village Build a conventional treatment plant on Essex village Purchase property for septic system repairs in Ivoryton and Centerbrook On-site wastewater management required for unsewered areas	Sewer all of Essex Village Sewer the industrial park and part of Centerbrook Upgrade Deep River treatment plant or build a new plant Purchase property for septic system repairs in Ivoryton and Centerbrook	Sewer all "Study Areas" upgrade Deep River treatment plant or build a new plant to serve these areas On-site wastewater management required for unsewered areas
PROS	Lowest capital cost Lowest operating cost Least disruption from construction Known treatment plant site location	No groundwater rights required	No groundwater rights required Provides infrastructure that can promote further flexibility in economic development (industrial and commercial) Treatment plant may not be needed Treatment plant site may not be needed Uses DEP money for maximum service area while it is still available Long term solution for "C" areas	No groundwater rights required Provides infrastructure that can promote further flexibility in economic development (industrial and commercial) Eliminates uncertainty of future repairs in all study areas
CONS	Groundwater rights concept is new for use by a municipality and has some risks: * No ability to expand * Limited improvement to groundwater quality in Essex Village Unknown public reaction to using park on Main Street for leaching field	Higher capital and operating cost than obtaining groundwater rights Requires finding a site for the treatment plant	Second highest capital and operating costs New treatment plant site may be required	Highest total capital and operating costs Services some areas which could continue to manage wastewater on-site Greatest disruption during construction New treatment plant site may be required
Properties/EDU's served	16/23	120/153	229/534	893/1139
Capital Cost	$635,000 (w/estimated legal costs)	$3.1 Million	$10.7 Million	$21.9 Million

about risk that some residents would fight the groundwater rights concept and raise the costs substantially. The CTDEP rejected this request and the associated economic feasibility arguments.

During early 1996, the Planning and Standards Division of the CTDEP Bureau of Water Management developed a guidance document containing five reclassification criteria that must be met for a change from GA to GB to be granted by the CTDEP. Since it is believed that the Essex Village Area meets all 5 of these criteria, a third request for reclassification was made. This request was rejected on the grounds there are practicable ways to remove the source of groundwater degradation in Essex Village. In reviewing this response, it seems that the CTDEP may not have considered economics in their definition of "practicable". The CTDEP further noted that changing the groundwater classification would not change the type of wastewater treatment that is required. This correspondence is also included in Appendix K.

5.4 Development of On-Site Wastewater Management Program

The Town has recently upgraded the position of Sanitarian from part-time to full-time and hired an individual experienced with aggressive on-site management. A crucial accomplishment of the Town Sanitarian and the WPCA has been the development of an on-site wastewater management program. This program is detailed as part of the "Recommended Plan" in Chapter 6. Briefly, it includes a Wastewater Management Ordinance to encourage good management of subsurface sewage disposal systems (SSDS). The on-site wastewater management program and ordinance address the following topics:

- Design and Construction Standards
- Land Use Controls
- Septic System Permitting
- Septage Management
- Walkovers
- Public Education
- Water Quality testing
- Enforcement, and
- Recordkeeping.

5.5 Status of Areas with Some On-Site Disposal Restrictions

In the 1991 Draft Wastewater Management Study, four areas had been noted as having some limitations for on-site disposal. These areas, as addressed in Sections 4.1.2-4.1.2.4, include South Charles Street, Hickory Lane/Melody Lane, Comstock Avenue, and Ivoryton Center. In 1991 it was recommended that these areas be closely monitored and repairs made as needed. Recent history has shown that these areas have not been the source of significant problems. There have not been an unusual number of repairs in these areas, and those that have occurred have been made successfully. According to the Town Sanitarian, most of the repairs that have been made were necessary due to the age of the system and not due to premature failure.

Drainage repairs that may improve storm water management and, as a result, subsurface disposal, have been made in Ivoryton Center and are ongoing on Comstock Avenue. As a water quality check, prior to making drainage repairs, water in a catch basin at the corner of Reed Street and Comstock Avenue was sampled and no sewage indicators were found.

Since wastewater management in these areas is similar to or better than it was in 1991, these areas will maintain the label of "B" indicating that they still have "some on-site disposal restrictions". Recommendations for wastewater management in these areas is addressed in Chapter 6.

5.6 Status of Areas of Concern for Continued Subsurface Disposal

As detailed in Section 4.1.3 to 4.1.3.3, in the 1991 Draft Study, it was recommended that on-site disposal be monitored closely in three areas including Essex Plaza, Bokum Center, and Essex Village. These areas had been given a designation of "C" indicating that they were areas of concern for continued subsurface disposal. An updated status of, and recommendations for, wastewater disposal for these three areas is provided below.

5.6.1 Essex Plaza

The owners of the Laundromat located in Essex Plaza have been working with the Sanitarian to perform maintenance to their SSDS. This maintenance will likely include repairs to or replacement of clogged galleries or may include piping the wastewater to a nearby property owned by the Laundromat owners. In either case, the Sanitarian's involvement will help ensure that appropriate repairs are made. Since this site is being actively monitored and addressed, it no longer needs the designation of "C" for area of concern. However, to ensure that it continues to maintain a priority status, it will be designated "B" to acknowledge that the site does have some on-site disposal restrictions.

5.6.2 Bokum Center

The repairs described in Section 4.1.3.2 have been completed and the SSDS in this area are reportedly performing adequately. Documentation of a recent repair at the Colonial Market is included in Appendix L. Since no further action is anticipated to be needed at this time, this area will also be changed from a designation of "C" to "B". Close monitoring of this area will continue.

5.6.3 Essex Village

As detailed in Section 4.1.3.3, wastewater disposal in Essex Village has been studied in detail. Although many of the lots in this area are small, the large depth of coarse unsaturated soils in this area are ideal for construction of SSDS using deep drywell systems, as is currently practiced. As detailed in the computations in Appendix M, at the time the Wastewater Management Study Report was originally prepared, 15 vertical feet of a 6' diameter drywell are needed to serve a 3 bedroom single family home. Each lot in this area has been analyzed to determine whether there is sufficient space to make repairs using deep dry wells. As detailed in Figure 6, it has previously been determined that repairs can be made to most of the properties in Essex Village. Low flow

fixtures or variances from separating distances would be required to make repairs on a few properties identified in Figure 6. Four properties were identified as having insufficient space for any reasonable repair.

Since 1989 when these computations were first prepared, the DPH Technical Standards have been revised, increasing the square feet of leaching area required for SSDS in Essex Village. This appears to have resulted from the consolidation of two ranges of percolation rates. Previously, properties with percolation rates of 1-5 minutes/inch were allowed lower leaching areas than those with percolation rates of 5-10 minutes/inch. In the current Standards (revised January 1, 1997), these two categories have been grouped together and the more conservative standards for 5-10 minutes/inch apply even to properties with faster (i.e., 1-5 minutes/inch) percolation rates. For Essex Village, which typically has faster percolation rates, this has increased the leaching area requirements by 25 to 32%. However, lots in existence prior to January 1, 1994 may use the effective areas corresponding to the rate of 1-5 minutes/inch if site conditions prohibit installations sized according to the rate of 1-10 minutes/inch. Although such a variance may apply in most of these cases, the more conservative standards have been used in this updated assessment.

As part of 1997 revisions to the Wastewater Management Study Report, the relatively small properties in the area bounded by Pratt Street, Main Street, and Cross Street were evaluated in accordance with these new standards. As documented by the Town Sanitarian in Appendix N, three of the small properties toward the western end of Main Street all have flows of 100 gpd or less. Therefore repairs to these systems, if needed, could likely be made on site. Each of the remaining 4 properties located near Cross Street were re-evaluated to determine whether repairs could be made. The results of this analysis, documented in Appendix O, indicate that such repairs would fit on these properties. However, variances to separating distances from property lines would be required for the property at the corner of Main Street and Cross Street.

In addition, the sampling results detailed in Section 5.1 indicated that groundwater continues to be impacted by use of SSDS. Due to concerns about the ability to make necessary repairs at a few properties and water quality impacts, Essex Village has remained an "area of concern for continued subsurface disposal" (designation "C" on Figure 4).

5.7 Harbor Management

A chapter addressing harbor management and wastewater generated on boats was included in the 1991 Draft Wastewater Management Study. To improve the flow of the current report, this section, formerly Chapter 6, has been relocated to Appendix P in its entirety. A few changes related to boats and harbor management have recently occurred. One marina has a private pump-out facility for use by its customers. Another marina and the Town are each considering adding a publicly accessible pump-out facility. Addition of pump-out facilities would have a positive influence on water quality in the Connecticut River and the Coves in Essex.

The WPCA is involved in planning pump-out facilities to help ensure that wastewater collected at these facilities is managed properly. Based on recommendations of a 1988 DEP memorandum regarding treatment of marine holding tank waste, wastewater from these pump-out

approved wastewater treatment plant.

Public restrooms are available at two locations in Essex Village. These restrooms are used by boaters and other tourists.

5.8 Aquifer Protection

As part of the CTDEP Order, the Town of Essex was required to focus on the interrelationship between the potential for onsite wastewater disposal and land use management of the aquifer recharge areas of Essex. This requirement was met through the following steps:

- Delineating significant aquifers in Essex and illustrating them on 1"=800' scale mapping;
- Coordinating with the Town's Planning Commission during the updating of the Town's Plan of Development during the early 1990's;
- Developing a non-residential land use summary noting activities of concern; and
- Suggesting a list of activities to prohibit in aquifer protection zones.

This effort was documented in the 1991 Draft Wastewater Management Study. To improve flow of the current report, this section, formerly Chapter 8, has been relocated to Appendix P in its entirety with no changes. The CTDEP is actively developing a statewide aquifer protection program that may fall under the purview of an agency other than the WPCA. The work already completed on aquifer protection may be of use when such a program is implemented.

Chapter 8 originally noted that the Connecticut Water Company planned to abandon the Brookside Lane well (which had not been used since the mid-1980's) due to its contamination with surfactants. Recent information from the Connecticut Water Company indicates that they are assessing the feasibility of returning this well to service. Correspondence from the Connecticut Water Company, including water quality data is included in Appendix R.

5.9 Septage Management

An evaluation of the existing septage disposal facility was included as part of the 1991 Draft Wastewater Management Study. In addition, four alternatives for future septage disposal were analyzed. The four alternatives are:

- Continued use of lagoons:
- Disposal out of town;
- Solar Aquatic septage treatment; and
- Septage dewatering and composting

Findings from these analyses and recommendations for improved existing facility operation are included in Appendix E. In 1991, recommendations for continuing the use of existing lagoons included regular lagoon cleaning, periodic water quality monitoring, better controls on sewage discharges to the lagoons and improvements to the facility. Improving the existing lagoons was determined to be the most cost-effective method of septage disposal.

The WPCA chose to continue use of their lagoons for residential septage disposal and has made recommended improvements to this facility. In 1997, the WPCA reported that all three lagoons were operational and performing well. All commercial and industrial waste from Essex is hauled to other sites.

6.0 RECOMMENDED PLAN

The recommended plan has been developed with the knowledge, understanding, and documented evidence that the new on-site wastewater management program detailed below will be used to ensure that SSDS usage is managed properly and that repairs and improvements are made as needed. This on-site wastewater management program is the foundation for the wastewater management strategy for the entire Town of Essex. The Town's proactive, comprehensive program for on-site management could serve as a model for other Connecticut towns.

6.1 On-Site Wastewater Management

A vital part of any wastewater management program that includes the use of on-site subsurface sewage disposal systems is management of the installation, use and maintenance of these systems. As a fundamental goal of the Essex WPCA is to minimize the need for off-site disposal, the WPCA has adopted a Wastewater Management Ordinance to encourage good SSDS management.

6.1.1 Purpose of the Wastewater Management Ordinance

The purpose of the Ordinance is to:

(a) Protect the public health and welfare of the Town through the prevention of public health nuisances and hazards and environmental degradation that may have a detrimental impact on the quality of the Town's surface and subsurface water resources.

(b) Affirm and declare that the State program and policy of sewer avoidance should be applied to the entire Town of Essex.

(c) Establish standards to ensure the continued viability of the Town's wastewater management program.

(d) Regulate and control the design, construction, operation and maintenance of septic systems in the Town, and require periodic maintenance and inspection of these systems.

The complete text of the Wastewater Management Ordinance is included in Appendix S.1. Key elements of the Ordinance and the overall Town wastewater management program are detailed below.

6.1.2 Design and Construction Standards

As detailed in the Ordinance, design of all subsurface disposal systems must be performed in accordance with the State Public Health Code. Prior to the issuance of a building permit for any new structure requiring a septic system, a design must be prepared by a licensed professional engineer and approved by the Town Director of Health or his agent, typically the Town Sanitarian. A sample Application to Construct a New Septic System is included in Appendix S.2. Plan requirements for engineered septic systems are included in Appendix S.3. Soil testing is

done by the engineer and Town Sanitarian prior to system design. A sample soil test application is included in Appendix S.4.

6.1.2.1 Building Conversions and Additions

Submission and approval of plans is also required for any building conversion, addition, or change in use that may increase total water usage. A sample Application for Plan Review is included in Appendix S.5. The plans must demonstrate that suitable area exists on the lot for installation of a subsurface disposal system that meets the requirements of the State Public Health Code (except for the requirement of 100% reserve leaching area). The Town Director of Health may require expansion of the existing SSDS, or installation of a new SSDS at the time of the conversion or addition.

Approval of the Town Health Department is also required for installation of pools, garages, decks, porches and patios, and other changes to the property that could affect area available for subsurface sewage disposal. The Application for Plan Review is also used for these purposes. Design plans must be submitted to demonstrate that adequate area exists for installation of a subsurface sewage disposal system that meets all the requirements of the Public Health Code and that required separation distances are maintained.

Once all approvals have been granted, the Town Sanitarian reviews and monitors SSDS construction. The Health Department must sign off on the Certificate of Occupancy before it is issued.

6.1.2.2 Other Land Use Controls

The Town has been working cooperatively to provide an integrated approach that supports on-site wastewater management. The Essex Planning Commission Subdivision Regulations also help ensure that adequate SSDS are provided. These regulations require that each proposed lot in a standard subdivision be able to accommodate an SSDS with capacity for a four bedroom house (minimum). A copy of the relevant regulations is included in Appendix S.6. When changes in use are brought before the Zoning Department, input from the Sanitarian is sought. The Application for Plan Review included in Appendix S.5 is used for these purposes. This close communication has prevented conversions from being made where inadequate SSDS capacity was available.

6.1.3 Management of Existing Subsurface Disposal Systems

Existing SSDS are managed through a variety of means including discharge permits, monitoring and recording septage pumpouts and inspections, tracking failures and repairs in a database, performing walkovers, and requiring repairs as necessary.

6.1.3.1 Permits to Discharge

A discharge permit is issued for a new building following an on-site inspection of the septic system by the Sanitarian, concurrent with the Certificate of Occupancy. A sample Permit to

Discharge is included in Appendix S.7. These permits have a 5-year life unless revoked sooner due to a malfunction documented by the Sanitarian. If the discharge permit is revoked-under these circumstances, it is reissued following a repair and inspection by the Town Sanitarian.

For properly functioning systems, the permit can be renewed by having the septic system pumped and inspected by a licensed septic pumper and the results reported to the WPCA.

6.1.3.2 Septic System Pumping/Septage Management

Septic systems must be pumped out at least once every 5 years so that the discharge permit can be reissued. Town residents are required to use only state-licensed septage pumpers. Pumpers may then discharge residential septage to the Essex septage lagoon or an out-of-town facility. Septage from commercial, industrial and other non-residential users must be discharged to an out-of-town facility.

The Town of Essex Septage Treatment and Disposal Policy (Appendix S.8) addresses septage disposal at sites in and outside of Essex. Discharge of septage to the Essex lagoon requires purchase of a Disposal Permit (Appendix S.9). Pumpouts are tracked through this system and recorded in a database. High frequency (more than once per year) pumpouts are noted and investigated by the Sanitarian to determine whether the SSDS is malfunctioning. The Deep River Water Pollution Control Facility (where a considerable amount of Essex septage is discharged) provides septage reports to the Sanitarian on a quarterly basis. A sample report is included in Appendix S.10. These Deep River reports will become part of the Essex data base.

6.1.3.3 Walkovers

Beginning in the summer of 1997, the Health Department hired a part-time technician (30 hours per week for approximately 10 weeks) to conduct walkovers of septic systems to determine whether SSDS appear to be functioning properly. The goal is for every system to be inspected every 5 years. This requires that approximately 460 walkovers be conducted per year. The Walkover Inspection Report included in Appendix S.11 is used to help ensure that complete walkover inspections are performed and recorded thoroughly and consistently. During these walkovers, attempts are made to contact the property owner and discuss operation and maintenance of their SSDS. The technician also helps educate homeowners in proper SSDS care.

During 1997, 452 walkovers were conducted in the Melody Lane/Hickory Lane area, Comstock Avenue, central Ivoryton, and the Summit Street Area. Five confirmed failures were identified during these walkovers. Another 11 locations will be rechecked next year because they had possible evidence of a problem observed by the technician or reported by a homeowner.

6.1.3.4 Public Education

In addition to discussions with property owners during walkovers, the Town Health Department is taking other steps to educate residents in proper septic system operation and maintenance. Letters containing recommendations to pump SSDS every 3 to 5 years and a brochure describing the basic design and operation of a septic system are sent to new homeowners in Essex. Similar

letters, as well as a copy of repair permits, as-built drawings, and the permit to discharge are sent to property owners after they make repairs or construct a new septic system. Sample letters, as well as DPH information, are included in Appendix S.12. Septic system information is available at the Sanitarian's office and the Town library. In addition, the Sanitarian has published articles on septic system maintenance in local newspapers as well as in the Fall 1996 Town Newsletter. A copy of this material, as well as other media coverage of wastewater management in Essex Village, is included in Appendix S.13.

6.1.3.5 Water Quality Testing

The Town Sanitarian's budget contains $1000 for fiscal year 1997 and $3000 for fiscal year 1998 to conduct water quality testing. The Town Sanitarian anticipates semi-annual sampling of 6 monitoring wells in Essex Village as well as shallow wells and/or surface waters at 4 to 6 other locations throughout Essex. Additional testing of wells and/or surface waters is done by the Health Department of SSDS failure or other pollution is suspected.

Potability testing results for newly installed wells and existing wells tested as a condition of real estate transfer are tracked by the Health Department. No exceedences of GA standards for coliform or nitrate were reported in the 52 wells tested in 1997. In addition, residents not served by the Connecticut Water Company System are advised to have their own well water tested every 3 to 5 years. Sample bottles can be obtained from the Sanitarian.

6.1.3.6 Repairs/Enforcement

The WPCA and Health Department work cooperatively with residents to ensure that SSDS repairs are made in a timely manner when they are needed. As a first step, the Sanitarian recommends that a repair be made and suggests that the property owner contact a septic system installer and/or a licensed professional engineer for assistance. Approval to modify or repair an existing septic system is required, and the form in Appendix S.14 is used. Typically, homeowners respond to repair suggestions, have appropriate repairs made, and no further action is required.

However, when necessary, the WPCA and Health Department may use a number of enforcement options to reinforce the need for timely SSDS repairs. Orders can be issued when necessary to further advise property owners that repairs MUST be made. An example of an Order requiring an immediate septic system repair in Essex Village is included in Appendix S.15. Orders are tracked by the Sanitarian on a data base. A sample report showing this information is included in Appendix S.16.

Other steps that may be taken by the Health Department include operational restrictions such as placing limits on water usage or imposing a mandatory pumpout schedule. Documentation of three recent examples of these creative enforcement actions are included in Appendix S.17. These examples are detailed to illustrate the types of actions that are now taken in Essex. In one case, a limit of four employees was placed on a commercial building located on a very small property in Essex Village. In a second case, a retail property owner in Essex Village was required to install low flow fixtures and limit average daily flow to 225 gallons per day. The Health Department has confirmed that these restrictions are being met. In the third case, as part of an

overall SSDS repair and maintenance plan, an apartment complex was ordered to remove washing machines and document that they are making repairs and inspections as well as following the mandatory pumpout schedule included in the Order. Numerous other similar steps have been taken in Essex to ensure the effectiveness of the On-Site Wastewater Management Program.

The Wastewater Management Ordinance allows the Town access to water company records. These can be used to ensure that flow limitations are met for those properties where they are necessary. In addition, the Health Department has, and will continue to require that flow meters be installed for private wells, as needed, to ensure that SSDS capacity is not exceeded. Concerns about flow limitations are most likely to occur at commercial properties such as restaurants and at properties where repairs requiring low flow fixtures or other flow restrictions have been made.

As a last resort, the discharge permit may be revoked if the property owner continues not to repair SSDS malfunctions. Although this step has been unnecessary in the recent past, it is one of the options available to the Town. The permit would be reissued once the repair is made and inspected.

6.1.3.7 Recordkeeping

A database is currently being developed to help document SSDS status throughout the Town of Essex. Information to be included in the database includes basic property information such as address, map-block-lot, and septic information, dates of SSDS installations, repairs (and reasons the repair was required), pumpouts, walkover results, orders, and permit expiration. Repairs are plotted on Town-wide mapping so that area trends can be observed, and potential problem areas spotted. Information from the data base will also be used to assist preparation of annual reports to the CTDEP. Annual Reports for 1996 and 1997 are included in Appendix S.18.

6.1.4 Wastewater Management Staffing and Budget

The Town recently (May 1, 1996) hired a new full-time Sanitarian to help implement the Wastewater Management Plan. The Sanitarian is assisted by a secretary and will have a technician to perform walkovers in the summer. The wastewater management budget, detailed in Appendix S.19, also includes money for water testing, computer hardware, software, and database programming, office and educational supplies, and transportation (during walkovers).

6.2 Areas with Some On-site Disposal Restrictions

Even with an aggressive on-site wastewater management program in place, further consideration is given to those areas with some on-site disposal restrictions. As detailed in Sections 5.5 and 5.6, a total of six areas (South Charles Street, Hickory Lane/Melody Lane, Comstock Avenue, Ivoryton Center, Bokum Center and Essex Plaza) are now considered to have some limitations for on-site disposal. As part of the Town-wide on-site wastewater management plan, properties with failures in these areas will be addressed as they arise. As is the case in the rest of Essex, the property owner would have responsibility for SSDS repairs.

In these six areas, a total of five lots (two each in Comstock Avenue and South Charles Street, and one in Ivoryton Center) have insufficient area for a conventional Department of Public Health (DPH) repair. Options available for repairs in these isolated properties include the following strategies that are currently used as needed in Essex:

- Variances to the State DPH Code for subsurface disposal systems could be sought. Typically such a variance would address separating distance from property lines, wells, or buildings.

- Some or all of the SSDS repair could be made in the adjacent Town road or neighboring lot. Such a repair would require that the homeowner obtain an easement from the Board of Selectmen or adjacent property owner and would also require State DPH approval.

- Low flow water fixtures could be used, thereby reducing the required leaching area. In such a case, the Town would restrict water usage through use of a Permit to Discharge (detailed in Section 6.1.3.1). A water meter could be installed at the property to ensure adherence to these flow limits. The Wastewater Management Ordinance authorizes the WPCA to obtain water consumption records from water companies.

- Alternative leaching structures could be used. These structures may allow greater infiltrative area per linear foot than conventional galleries. Similarly, leaching structures could be stacked to allow greater infiltration area from a given amount of land area.

Potential costs associated with these alternatives are summarized in Table 11. The costs of these alternatives were compared with the cost of making off-site repairs. A maximum of two properties per study area were found to have insufficient area for a conventional DPH repair. Ideally, these two properties would be served by a single multi-user subsurface disposal system. However, vacant lots of sufficient hydraulic capacity to accommodate wastewater flow from two properties were not conveniently located near the small properties in question. Costs were therefore estimated for each repair to be made on a separate vacant lot. A preliminary opinion of cost for a single off-site repair on a nearby vacant lot was in the range of $45,000 to $55,000 depending on piping distance and whether pumping would be required. Given these high costs, it is recommended that the alternatives detailed above be considered first. Since off-site repairs on other than Town property are not currently recommended, purchase of vacant property is not proposed.

Other considerations for individual areas are addressed below.

6.2.1 South Charles Street

Homes in this area are good candidates for the types of repairs described above. An added advantage is that Connecticut Water Company mains are located on adjacent streets. Therefore, extension of public water supply would be relatively easy in this area. With public water supply in place, a homeowner could discontinue use of the on-site well, thereby allowing more space (by eliminating the need for separating distance) for septic system repairs. If connection to public water supply were not made, water use could be restricted accordingly.

Table 11
Essex Wastewater Management Study
Wastewater Management Alternatives & Estimated Costs

Alternative	Capital Cost	Annual Operation & Maintenance Cost
Continued Use of On-Site Septic System	$0	$30-$50
Install Low Flow Plumbing Fixtures	$400-$700	$0
Repair Septic System On-Site		
Conventional System	$2,000-$8,000	$25-$45
Mounded System	$6,000-$17,000	$25-$45
Mounded System with Pumping	$8,000-$20,000	$45-$65
Holding Tank (with Alarm, Low Flow Fixtures)[1]	$4,000-$5,000	$3,000-$5,000

1. DEP does not accept usage of holding tanks except in extreme, scattered circumstances.

6.2.2 Hickory Lane/Melody Lane

As detailed in Section 4.1.2.1, this area has a shallow water table and severe soil conditions. Since most of the lots are more than ½ acre in area, mounded systems could be used for repairs. Our analyses and ongoing discussions with the Town Sanitarian indicate there is sufficient area on these lots to make these types of repairs successfully for the long term. As detailed in Table 11, the cost for mounded systems exceeds that of a traditional subsurface disposal system. However, these costs are considerably less than those estimated above in Section 6.2 for off-site repairs.

Drinking water supply in this area is provided by on-site wells which are reportedly at shallow depths in some cases. If the wells in this area were to become contaminated, bedrock wells could be installed by the property owners. If as part of the on-site wastewater management plan walkovers or review of data base indicates that frequent failures are occurring in this area, some of the water testing budget could be used to check the quality of the potable water in this area.

The Town Sanitarian has indicated that recent groundwater data has been obtained from an area downgradient of the Hickory Lane/Melody Lane area. Groundwater samples from bedrock wells located in a new subdivision downgradient of Hickory Lane/Melody Lane shows no evidence of contamination.

6.3 Essex Village

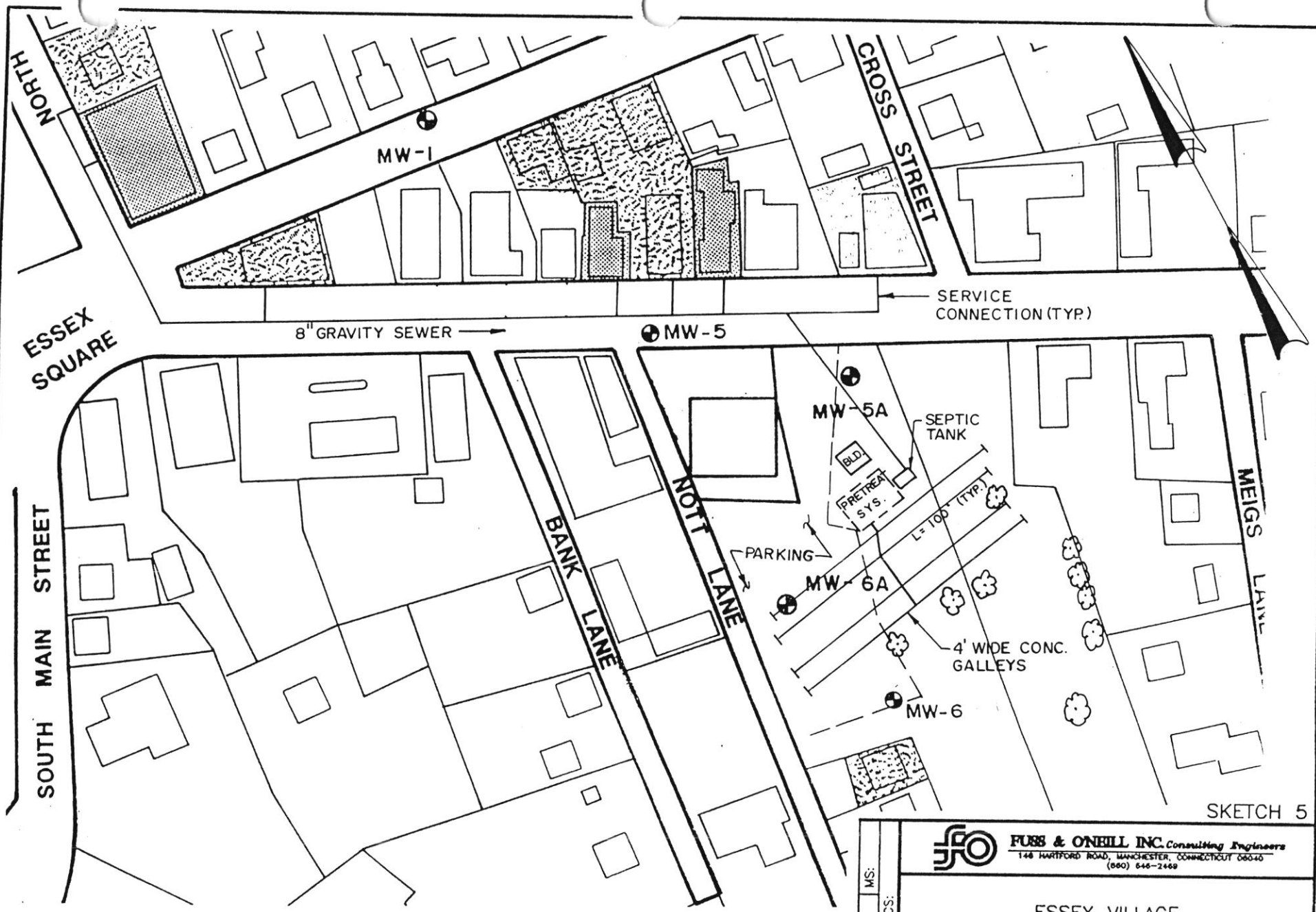
As detailed in Section 5.6.3, Essex Village is the only location that has remained an "Area of Concern for Continued Subsurface Disposal". Because there is the potential need for off-site disposal for a limited number of properties in the Village area, conceptual plans for a multi-user SSDS have been developed. This multi-user subsurface disposal system could serve the properties shown in Sketch 5. The Town Sanitarian has recently reviewed the usage of these properties and refined estimated wastewater flows for each of these 12 properties. These revised estimates are based on number of bedrooms in residential units and number of employees in commercial units. As detailed in Appendix N, the combined wastewater flow from this potential service area is approximately 5800 gallons per day.

6.3.1 Multi-user Subsurface Sewage Disposal System

The most suitable site for a small multi-user SSDS appears to be in the Town Park on Main Street. A conceptual design for such a system has been developed and is shown in Sketch 5. The following capacities were computed for this park parcel using various critical design parameters in CTDEP's technical design standards for larger (>5,000 gpd) SSDS's that DEP regulates:

- Hydraulic - 8000 gpd
- Bacterial travel time - 3700 gpd
- Nitrogen dilution - 2500 gpd

Since the hydraulic capacity of the parcel exceeds the anticipated flows from the service area,



SKETCH 5

NOTE:
LEACHING FIELD IS SIZED ACCORDING TO THE APPLICATION RATE FOR NO PRETREATMENT.

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(860) 646-2469

MS:
UCS:
FN:
PPP:

ESSEX VILLAGE

MULTI-USER SUBSURFACE DISPOSAL SYSTEM SCHEMATIC

ESSEX CONNECTICUT

PROJ. NO.: 88-057B1 DATE: APR. 1997 SCALE: 1"=100'

use of this site would be technically feasible. The downgradient discharge point for this SSDS would be Middle Cove. The treatment that the wastewater would receive would be consistent with meeting the Class B standards of this surface water body. However, the treated effluent plume could flow under parts of three properties located between the leaching system and Middle Cove which could potentially require that GA standards be met before the plume leaves the Town's parcel. Three potential ways of addressing this issue are listed below:

- If the groundwater were reclassified or if a waiver from meeting GA standards were obtained the system described above would meet required standards.

- Another alternative that could be considered is purchasing groundwater rights from these three properties. The concerns detailed in Section 5.2.1 about the feasibility of obtaining groundwater rights are diminished because only three properties would be involved.

- If the above concepts could not be implemented pretreatment, as described below, could be added when flows exceeded 2500 gpd (i.e., when it is projected that nitrate concentrations would no longer meet DEP standards, based on typical loadings and dilution computations). Since pretreatment is very costly, additional groundwater sampling in the area downgradient of the SSDS would likely be warranted to confirm that pretreatment is necessary.

The conceptual design of this multi-user system is based on collection of the wastewater using gravity sewers. Gravity sewers were selected because preliminary cost estimates indicated that a gravity system could be installed at less cost than a low pressure sewerage system using grinder pumps. The wastewater would flow to a septic tank for solids removal and then to a dosing tank located in the Town Park. From the dosing tank, wastewater would be distributed to the leaching field using 48" high concrete galleys. Preliminary opinions of cost for this system are included in Appendix T. The cost of $260,000 for the sewers and SSDS were developed based the following assumptions:

- The SSDS system would be designed for its full hydraulic capacity of 8000 gpd and may be constructed in phases depending on the properties to be serviced; and

- The leaching system design is based on the assumption that the wastewater would be pre-treated using only a septic tank. If additional pretreatment (i.e. for nitrogen removal and UV disinfection) were installed, a 30% reduction in leaching area could be realized.

A preliminary opinion of cost was also developed for pretreatment. Five different types of pre treatment systems were considered in this evaluation. These included sequencing batch reactors (SBR), FAST, Amphidrome, and Zenon systems. Conceptual design assumptions and costs for these four types of systems are detailed in Appendix T. The pretreatment system with the lowest cost was the Amphidrome system. Literature about the pretreatment system options is included in Appendix U. Pretreatment also includes use of ultraviolet (UV) disinfection for bacterial kill. The preliminary opinion of cost for the pretreatment system is $220,000. The addition of pretreatment nearly doubles the total cost of the multi-user system.

Another possibility would be use of a Solar Aquatics system, which treats wastewater in greenhouses. Since the proposed location for the pretreatment plant is a Town Park, a small pretreatment building is preferred. Therefore, the Solar Aquatic system, which requires relatively large greenhouses was not evaluated further for this application. It could be considered further if the site were to change or if building size became less of a concern. When and if a pretreatment system is required, alternative treatment systems will be evaluated further.

It should be noted that the service area for the multi-user SSDS described above does not include the area east of Cross Street.

Table 12 compares costs for the recommended multi-user SSDS to previously developed for 1992 Discussion Item costs. These costs must be compared very cautiously due to changes in wastewater management strategy that have evolved since 1992. These include:

- The 1992 Discussion Item costs do not include nitrogen removal. Since 1992, the Long Island Sound Program has increased concern about and requirements for nitrogen removal. If the discussion items were developed today, they would all increase due to costs for nitrogen removal.

- The 1992 Discussion Items included costs for off-site SSDS in the "remote areas" which are not included in the recommended plan.

6.3.2 Alternative Multi-user SSDS Sites

Hubbard Park has been evaluated as a possible alternative site for construction of a multi-user SSDS. As documented in Appendix V, conceptual design of a SSDS on this site indicated that it has the following capacities for the critical design parameters:

- Hydraulic - 18,000 gpd
- Bacterial Travel time - 18,000 gpd
- Nitrogen dilution - 4,400 gpd

The costs for construction of the sewers and SSDS for Hubbard Park have been estimated at approximately $1,000,000 excluding pretreatment, as detailed in Appendix V. Since these costs are significantly higher than those for the Town Park on Main Street, it is recommended that this alternative not be considered unless the Town Park site is found to be technically or politically unfeasible.

In addition, as a more creative approach to subsurface disposal, the hydraulic capacity of the Main Street right-of-way (ROW) was considered. In this analysis, it was assumed that approximately 1400' of the Main Street ROW could be used as a multi-user leaching field to treat wastewater from future failures in the Essex Village area. The pavement on Main Street would be removed, the leaching field would be constructed, and then the area would be repaved. For the purposes of this analysis, it was assumed that the water main in Main Street would have to be relocated to the edge of the road to provide separating distances from the leaching structures. Surface drainage may also need to be rerouted. This analysis showed that the ground under Main Street

TABLE 12

PRELIMINARY OPINIONS OF COST
1992 DISCUSSION ITEMS AND 1997 RECOMMENDED PLAN

	1992 Discussion Item A	1992 Discussion Item B	1992 Discussion Item C	1992 Discussion Item D	1997 Recommended Plan
Estimated Number of Hookups	16	120	229	893	9
Capital Costs[1]					
- Sewers and Conventional Treatment	$445,000	$3,050,000	$10,700,000	$21,900,000	$250,000
- Pre-treatment (Nitrogen Removal)[2]	N/A	N/A	N/A	N/A	$220,000
Annual Operating Costs	$2,300	$46,000	$140,000	$340,000	$2500/$5000[3]

NOTES:

1 Costs for Discusision Items A-D based on 1992 dollars; costs for Recommended Plan based on 1997 dollars.

2 The 1992 Discussion Item costs do not include nitrogen removal. These costs would need to be added if the discussion items were to be implemented.

3 $2500 operating costs without pretreatment; $5000 operating costs with pretreatment.

potentially had the hydraulic capacity for approximately 17,000 gpd of wastewater. This alternative should be considered further if the Town Park site were not used.

6.3.3 Groundwater Monitoring in Essex Village

In order to monitor the effectiveness of repairs over time, and long term water quality trends, the WPCA proposes to sample the ground and surface waters semi-annually as described in Section 6.1.3.5.

6.3.4 Recommended Implementation Plan for Essex Village

Since the hydraulic requirements for sewage disposal in Essex Village are currently being met, and there are no critical repair needs that cannot be made on-site, it is reasonable to continue to monitor this area until a structural solution is needed. If multiple failures occur that cannot be managed by the property owners, then design and construction of the multi-user SSDS should be considered. The system will be designed and constructed for the full hydraulic capacity of 8,000 gpd even if this capacity exceeds flows from the initial participating properties. This will allow capacity for future needs within the service area and could allow for the possibility of connection of properties outside the presently-defined service area.

It is recommended that one or both of the first two strategies described in Section 6.3.1 for reconciling this system's operation with present GA standards be implemented (reclassification or acquisition of groundwater rights from 3 properties). Installation of a pretreatment system would only be pursued should these strategies not be successful, especially given the high cost and questionable need for the pretreatment system, and only then would pretreatment need to be considered if/when flows to the multi-user system exceeded the 2,500 gpd nitrogen-dilution capacity.

7.0 ENVIRONMENTAL ASSESSMENT

7.1 Introduction

There are two major components of the Recommended Plan in Chapter 5:

- Immediate Implementation of the On-Site Management Program, and
- Potential Future Construction of a Multi-user SSDS in Essex Village.

Potential environmental impacts differ for each of these recommendations and are addressed separately below.

7.2 On-Site Management Program

The on-site wastewater management program detailed in Sections 6.1-6.1.4 will provide environmental benefit by improving management of on-site subsurface sewage disposal systems (SSDS). This program addresses installation, use and maintenance of SSDS.

7.2.1 SSDS Installation

The on-site wastewater management program addresses new construction, building use conversions, and existing systems. As part of the on-site wastewater management program, Sanitarian approval is required for all new septic systems, repairs, and modifications as well as for building conversions or additions that could change the amount of wastewater generated or could reduce the area available for future SSDS repairs. This additional scrutiny will be environmentally beneficial by helping to ensure that SSDS design and usage is appropriate for site conditions.

7.2.2 SSDS Use and Maintenance

The on-site wastewater management program addresses use and maintenance of SSDS through discharge permitting, requirements for septic system pumping, walkovers, public education, water quality testing, and enforcement of requirements for necessary repairs. Properly maintained SSDS are less likely to cause environmental degradation. Development of a database to track the above information will be useful for spotting SSDS trends and areas requiring further evaluation or action. This will enable the Town to identify subsurface disposal problems before they become serious public health or environmental pollution concerns.

7.3 Potential Future Construction of Multi-user SSDS

Essex Village is the only area in which concerns about the ability to make on-site repairs and water quality impacts led to conceptual development of a plan for limited future off-site wastewater disposal. Unlike the on-site wastewater management program, which is likely to result only in environmental benefit, construction of a multi-user SSDS has both environmentally positive and negative consequences.

7.3.1 Potential Benefits of Multi-user SSDS

If construction of a multi-user SSDS is necessary because no other means for making necessary individual SSDS repairs can be found, then it will be environmentally beneficial by increasing the degree of treatment of this wastewater before it reaches the groundwater. If such a system were needed due to surface breakouts of sewage, a potential risk to public health would be eliminated as well.

7.3.2 Potential Impacts and Mitigation Methods for Multi-user SSDS

Many of the impacts associated with the multi-user SSDS would be related to the construction process and would therefore be temporary in nature.

7.3.2.1 Sewer Installation

Installation of sewers would have a series of construction-related impacts in Essex Village. Essentially all the sewers are planned to be installed in existing roadways, thus minimizing the need for easements and disruption of wooded and other areas outside of commonly traveled ways. The expected impacts include:

7.3.2.1.1 Traffic

One of the most noticeable impacts of the sewer construction would be the disruption of traffic on Main Street, though maintenance of reasonable access to the businesses and homes along the route of the sewer would be provided. This would be of greatest concern if construction occurs during the summer months when Essex Village is often congested. It would be important to allow maximum access through the Village area during weekends when traffic is heaviest. Good communications with residents would be important, as would maintenance of driveways adjacent to sewer construction.

7.3.2.1.2 Noise

During the course of sewer installation, noise would be generated by the heavy equipment used in installing the sewers. This noise is unavoidable, but is of only a temporary nature and would be restricted to certain hours of the day.

7.3.2.1.3 Dust

A certain amount of dust would be generated by the sewer installation. Dust control through use of water and/or calcium chloride would be practiced wherever necessary. It is anticipated that the impact of dust generation would be negligible.

7.3.2.1.4 Erosion and Sedimentation

As with any significant construction project there exists a potential for erosion and for sediment to be washed into surface water courses. This concern would be minimized along the route of

these sewers by the fact that the sewers are planned to be installed either in or adjacent to existing roadways. Appropriate erosion and sediment control measures, such as haybales and silt fences, would be used wherever necessary to prevent the dispersion of sediments into wetlands and water courses. Disturbed vegetated areas would be loamed, seeded and mulched as soon as possible after installation of sewers so that vegetative cover would be re-established to prevent erosion.

7.3.2.1.5 Utilities

Another potential impact of the construction phase of a sewering project would be the temporary disruption of utilities such as water and natural gas. Coordination with utility companies would help to minimize these impacts.

7.3.2.2 Installation of Building Connections

There would be some disruption of each property served by the sewer system during the installation of the building connection from the buildings to the street. Temporary disturbance of lawns and some driveways would be expected.

7.3.2.3 Construction of Multi-user SSDS in Town Park

During the construction phase, a significant area of the Town Park on Main Street would be disturbed. Care would be taken in the design of the leaching field to minimize impacts to large trees in the park. The area above the leaching field would be loamed, seeded and mulched as soon as possible to restore the grass area. Once the grass was established, the leaching field would not expected to be noticeable.

7.3.3 Long-Term Impacts

7.3.3.1 Odors, Noise and Air Quality

The potential for odors exists if sewage is allowed to go anaerobic. The system proposed for Essex Village is a very limited sewer system that would have very little opportunity for these odors, as the sewage would not be in the sewers for long periods of time. The initial multi-user system is just a larger version of a septic system that would be found at an individual home. Since it is entirely underground, there would be little potential for odor provided it is properly maintained.

7.3.3.2 Traffic

Long-term traffic impacts of the wastewater management plan would be negligible.

7.3.3.3 Pretreatment System

If a pretreatment system were required, the associated impacts would be more significant, but with care could be managed. First, it would require construction of a permanent small building in the Town Park. This building would be designed to blend with the surroundings making it less

noticeable. The pretreatment system would also have to be equipped with positive means of controlling potential odors from the pretreatment facility.

7.4 Socio-economic Impacts

Some wastewater management strategies can have the potential for socio-economic impacts. As addressed below, the only socio-economic impacts are expected to be positive.

7.4.1 Property Values

The implementation of the on-site wastewater management program will have a positive effect on properties in Essex. Since SSDS failures are more likely to be promptly repaired with such a program in place, there could be a slightly positive effect on property values.

Should properties in Essex Village develop subsurface disposal system problems significant enough to warrant construction of a multi-user system, then these properties would benefit by connection to the sewer system, as nuisance problems and potential public health risks from these individual septic systems would be eliminated. These improvements should be reflected in a long-term increase in property values for the affected lots.

7.4.2 Growth Potential

The on-site wastewater management program allows controlled development in concert with the Town's Plan of Development. Therefore, it does not spur induced growth.

The potential multi-user system in Essex Village has been laid out to serve only existing development. Any new construction or conversions in use of existing buildings would have to be approved prior to construction. The very limited size of the service area makes the potential for induced growth insignificant and would have only a minor impact on the existing Town facilities and services.

7.5 Land Taking

No taking of land is expected for on-site management or for the potential Essex Village sewers, as the pipes will be located in road rights-of-way, and no pump stations are anticipated. The proposed site for the SSDS is on Town property so that no land taking would be necessary. Acquisition of groundwater rights for downgradient properties could be considered in the future.