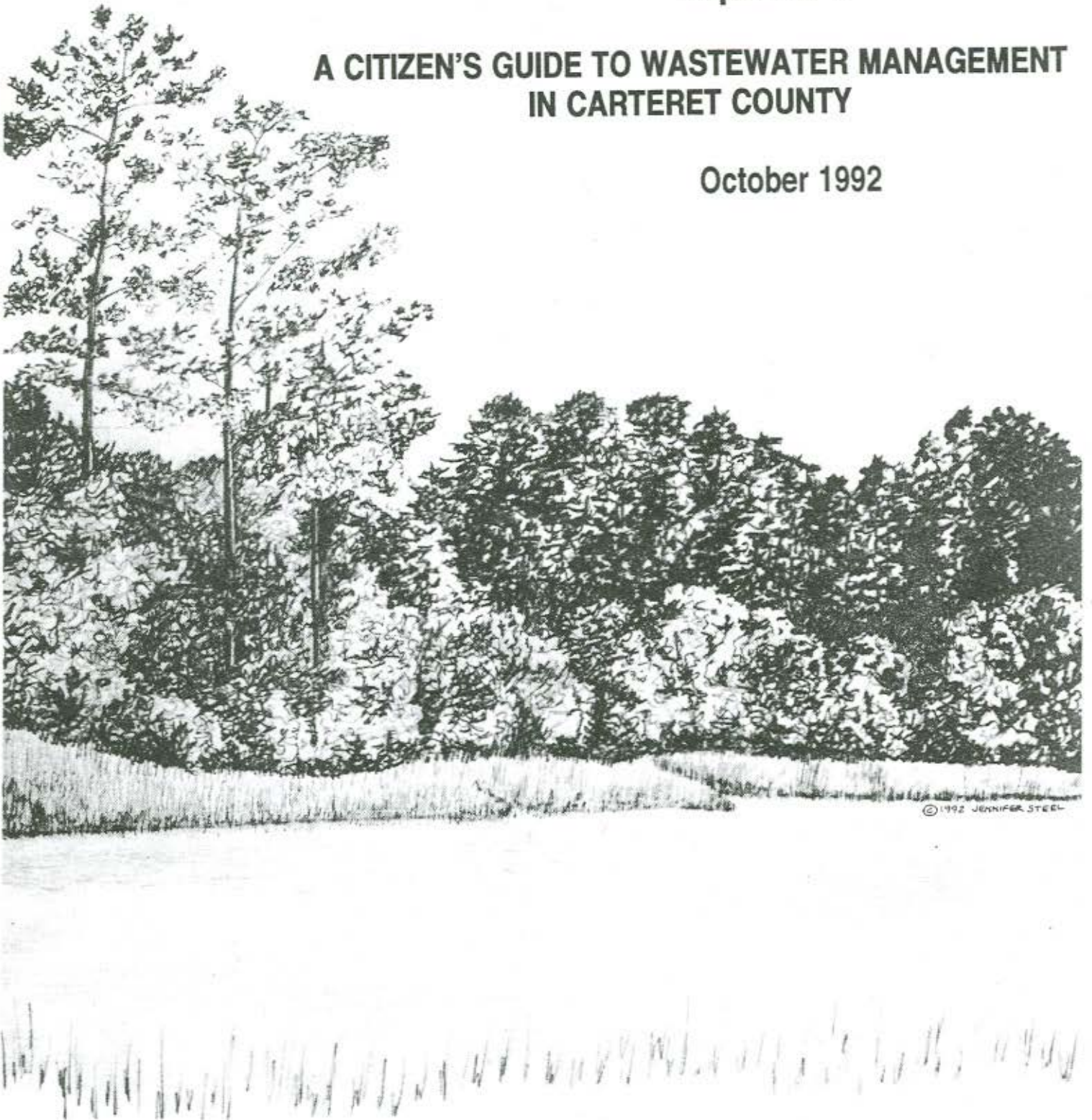


Report 92-17

**A CITIZEN'S GUIDE TO WASTEWATER MANAGEMENT
IN CARTERET COUNTY**

October 1992



**ALBEMARLE-PAMLICO
ESTUARINE STUDY**

NC Department of
Environment, Health,
and Natural Resources



Environmental
Protection Agency
National Estuary Program



A CITIZEN'S GUIDE TO WASTEWATER MANAGEMENT
IN CARTERET COUNTY

by

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This project was financed by the United States Environmental Protection Agency and the North Carolina Department of Environment, Health, and Natural Resources through the Albemarle-Pamlico Estuarine Study.

Contents of the publication do not necessarily reflect the views and policies of the United States Environmental Protection Agency, the North Carolina Department of Environment, Health, and Natural Resources, nor does mention of trade names or commercial products constitute their endorsement by the United States or North Carolina Government.

October, 1992

Acknowledgements

Many thanks to Dr. John Costlow and Lynn Phillips who have supported this project from its start and to Randy Waite and the Albemarle-Pamlico Estuarine Study for supporting the publication of this document. I am grateful to Dave Adkins, Ted Bisterfeld, Bruce Payne, Joe Ramus, Jennifer Steel, and several others who assisted me in this project.

Special thanks to Tom Buhrman for preparing the illustrations found on pages iii, 1, and 4, to the N.C. Center for Geographic Information for preparing the map on page 16, and to the Water Environment Federation for permitting the reprinting of the illustration on page 9.

Preface

Many residents in Carteret County are concerned about the future management of wastewater in the county. This issue is important because of its effects on the quality of life and the environment. Efforts are being made by the county and its communities to plan for the future management of wastewater. This guide was prepared to provide the citizens of Carteret County with information on this important issue. It describes how different types of wastewater systems work and the advantages and problems each type might have. Then, it describes how wastewater is treated and disposed of in Carteret county now and how the county is addressing its need to plan for future wastewater management. The guide ends with information on opportunities for involvement and additional resources for concerned citizens.



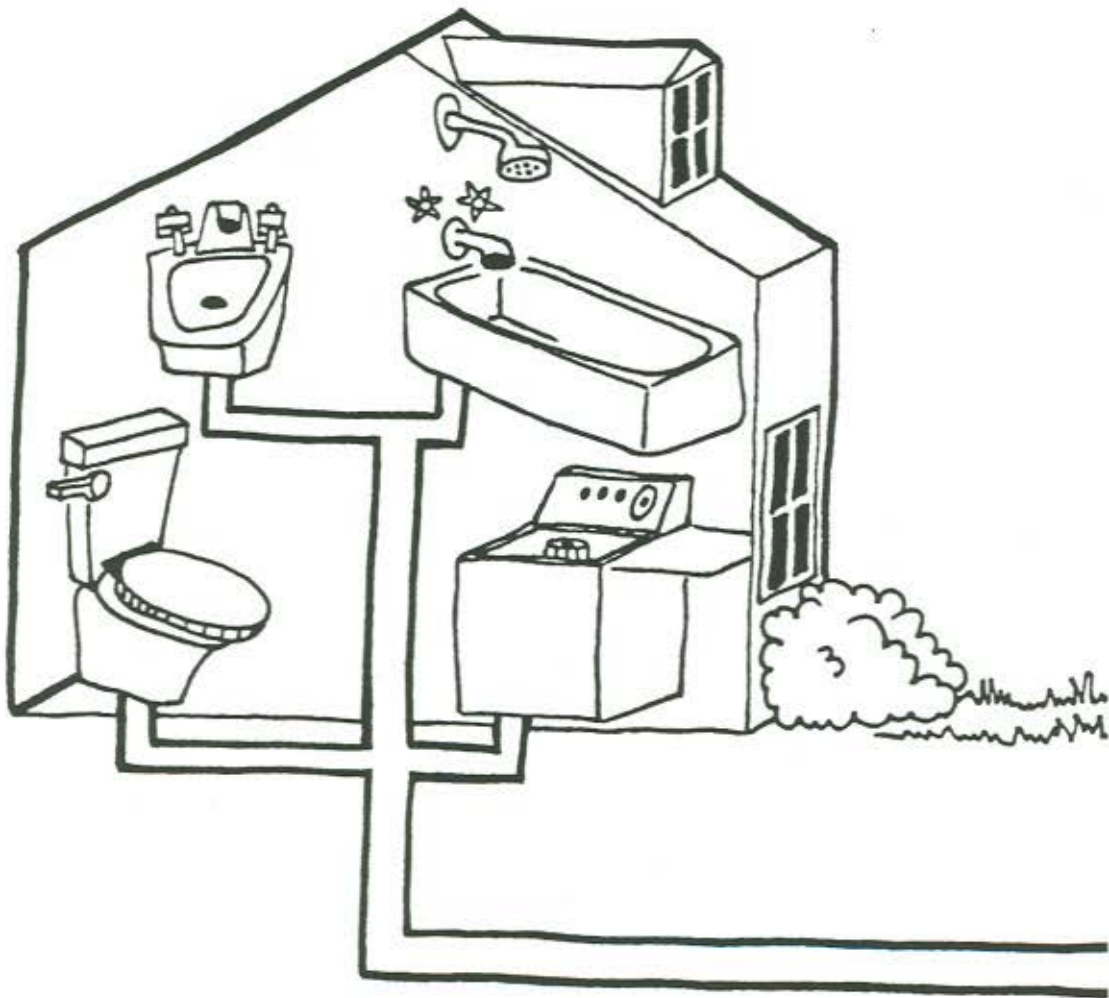
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Introduction

Wastewater is the water that leaves your home, restaurants, stores, and hotels through sink drains, bathtub drains, and toilets. It is also the water that leaves factories after it has been used in a manufacturing process. Wastewater is eventually disposed of into a body of water or on the land. Before disposal, however, wastewater must first be treated to remove pollutants in order to protect the environmental quality of the land or water that receives it. Treatment and disposal may be conducted at a household, factory, or a central, community-owned system treatment system. In this report, efforts to treat and dispose of wastewater are referred to as wastewater management.

All communities create wastewater, and as the population of a community grows, its capacity to manage wastewater must grow and change to handle increased wastewater flows. If wastewater is treated in systems which are designed to provide



an appropriate level of treatment, which are properly operated and maintained, and which have a large enough capacity to receive the incoming flows, then wastewater does not significantly threaten the quality of a community's environment.

Wastewater may create environmental problems, however, when treatment systems break down, cannot handle the volume of wastewater flows, or are inadequately operated and maintained. Untreated or inadequately treated wastewater may cause pollution of waters that receive it with deleterious substances such as heavy metals or organic compounds from domestic or industrial sources. Wastewater is rich in nutrients which may disrupt the balance of natural communities in the receiving waters. Inadequately managed wastewater may contaminate shellfish beds with bacteria and viruses and require the closure of shellfish beds to harvesting in order to protect public health. In other areas of the country, such contamination has required the closure of beaches to swimming. To protect the ecosystem's natural resources, management of wastewater must be carefully planned.

Management of wastewater is an important issue in Carteret County. Efforts are being made by the county and its municipalities to plan for future management of wastewater.

In Carteret County, the waters of the Neuse, Newport, and White Oak River systems flow to mix with the waters of the Atlantic Ocean, forming a rich and complex natural system known as an estuary. The waters of the estuary support the county's important commercial and recreational fishing industries and a small, but growing, aquaculture industry. These waters make Carteret County an attractive place to visit and draw hundreds of thousands of visitors every year. Residents and visitors to the county use the waters of the estuary for recreation, and others use it for research. Through these many uses of the estuary, the health of the county's economy is directly linked with the health of its natural resources.

One use of the estuary is for the disposal of wastewater. The county has over 50,000 permanent residents and a peak total population of over 117,000 residents during the tourist season. These residents create wastewater which must be treated and disposed of in a manner that does not harm the county's natural resources.

This guide is designed to provide information on wastewater management issues to the citizens of Carteret County. First, it describes methods of treating and disposing of wastewater to provide a general background to the technical aspects of this issue. Then, it describes the current state of wastewater management in Carteret County. Next, it explains the efforts being made to plan for future wastewater management by the county and its municipalities. Because this issue is important to the economic and environmental future of the county, many citizens are concerned, and they would like to learn more about and take an active role in this issue. This guide ends with information on additional resources and opportunities for involvement for concerned citizens.

A Primer of Wastewater Treatment and Disposal

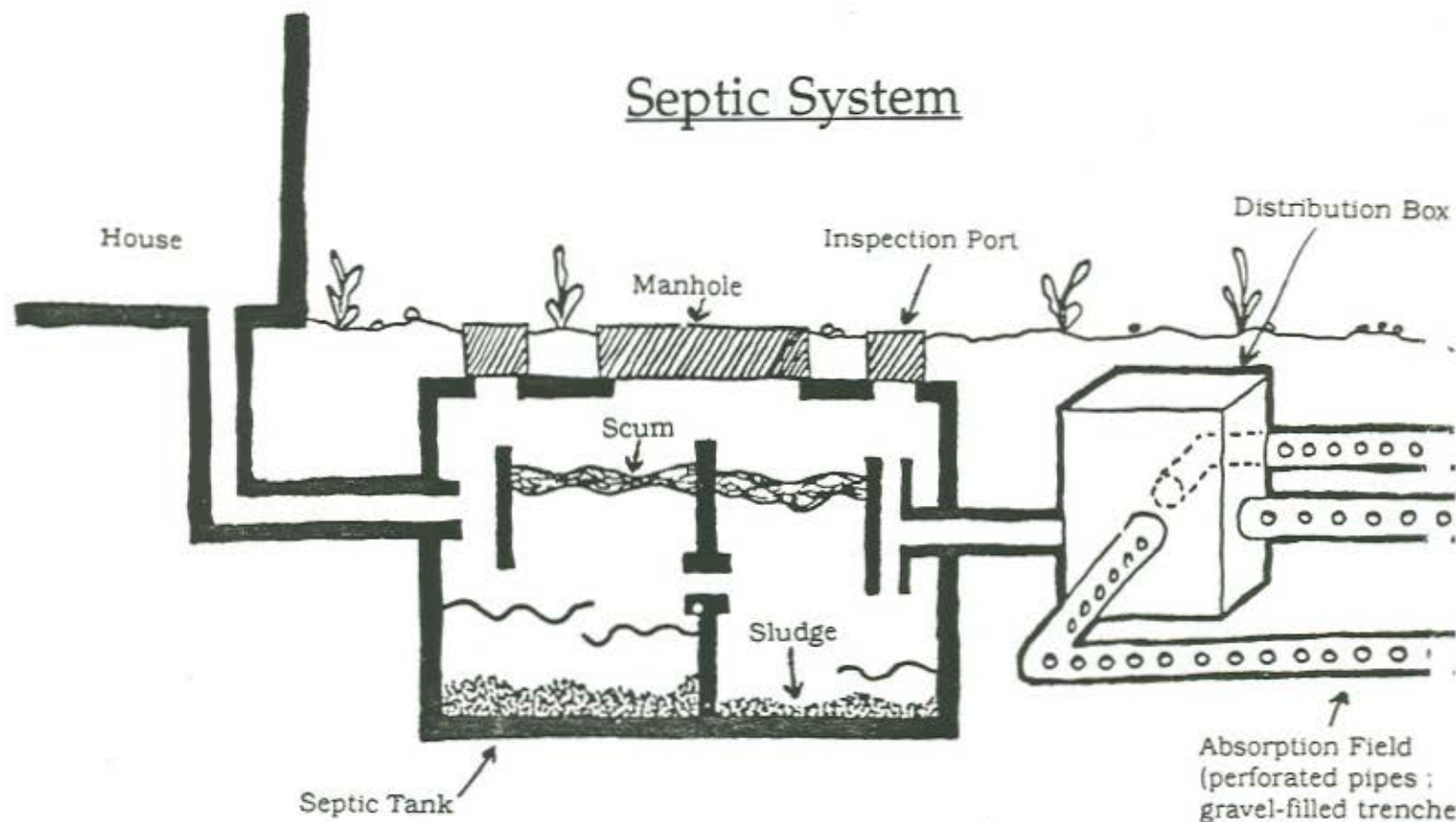
In the treatment process, wastewater is filtered and cleaned with physical, chemical, and biological agents. Then, treated wastewater is disposed of into the environment, either to the water or the soil. Wastewater may be treated and disposed of by small individual systems which serve one or more households or by larger central systems which collect wastewater in sewer systems for treatment and disposal at a central treatment plant. Several treatment methods, their disposal practices, and their advantages and problems are described below.

Septic Systems

Introduction: Septic systems usually serve single households, but larger systems may serve multiple residences, schools, or shopping centers. Septic systems are common in areas which do not have central sewer systems. Property owners must obtain permits from the county Department of Health to construct and operate septic systems or to expand existing systems. Permits are issued if the soils on a lot are determined to be suitable for the installation of a septic system. When buying property in an area where a septic system is needed, it is important to first check with the local health department about the suitability of the soils on the property to support a septic system.

Septic systems consist of three parts: the septic tank, absorption trenches, and the soil. The illustration below shows the design of a septic system. A septic tank is a concrete container which usually has a capacity of 900 to 1200 gallons. The septic tank receives wastewater from the house. In the tank, heavy solids in wastewater sink to the bottom and form a layer of sludge. Anaerobic bacteria, that is bacteria which live without oxygen, work to break up some of the solids. Grease and light particles float to the top of the tank to form a layer of scum. The accumulation of sludge and scum in the tank should be checked periodically and pumped, usually every four to five years, to prevent system backup and overflow.

After the separation of solids and initial biological treatment in the tank, the liquid component of the wastewater flows into the absorption trenches. The wastewater is carried into the trenches in pipes, usually four inch, plastic pipes which are perforated with holes through which the wastewater is distributed into the trenches. The trenches are usually two to three feet deep, two to three feet wide, and up to 100 feet long. They contain gravel and are covered with soil. The wastewater flows from the gravel into the surrounding soil. In the soil, bacteria and oxygen help to purify the liquid as it makes its way to the groundwater below.



To avoid causing environmental degradation, a septic system must keep untreated wastewater below the ground surface and purify wastewater before it reaches ground or surface water. Soils that are suitable for septic systems filter the wastewater to provide straining and biological treatment. To be suitable, soils must allow free passage of water while still providing adequate filtration. Sands can provide the necessary level of filtration, but may allow wastewater that has not been adequately treated to pass through and contaminate the groundwater. In some areas, groundwater is a drinking water supply, and therefore, the protection of its quality is important to public health. Clay, on the other hand, does not allow water to pass freely and may allow wastewater to accumulate and rise to the surface.

The soil must also contain air in its pores to support aerobic (oxygen-requiring) bacteria which treat the wastewater in the soil. When the water table is high, water may replace air in the soil pores and cause the aerobic bacteria to fail to function. Also in areas where the water table is high, or where rainfall frequently raises the water table to a high level, untreated wastewater in the septic system may rise to the surface, and at the surface, untreated wastewater may flow over land and pollute nearby waters.

Some modifications can be made to the conventional septic system design to improve system performance where soil and water table conditions are not fully suitable. For example, in fine shallow soils or an area with high water table, the absorption field can be placed in a mound of fill material. This method, known as a mound system, increases the vertical distance in the soil for treatment of wastewater. These systems also often dispose of wastewater to the mound absorption field in a dosing and resting cycle to prevent overloading the soil with wastewater. Another modified system is a low pressure pipe system which is suitable for areas with heavy clay soils, high water tables, or soils with rock near the surface. The low pressure system has more shallow absorption field than a conventional system, uses a dosing and resting cycle like the mound system, and distributes the wastewater more uniformly in the absorption area than a conventional system. Modified systems such as these are usually slightly more expensive and require more maintenance than conventional systems, but they provide better performance in areas where soil conditions cannot support a conventional septic system.

Advantages: Septic tanks provide a method of wastewater treatment and disposal where only low density development is planned and where central sewers and treatment are unavailable. Small wastewater systems such as septic tanks usually provide small communities with the most economical method of wastewater treatment and disposal. Central wastewater systems are expensive to construct and require many users to share the costs in order to make them economical. If sited in suitable soils and properly designed, installed, and maintained, septic tanks treat and dispose of wastewater in a manner that will not create environmental problems.

Problems: Inadequate maintenance and a lack of routine pumping may result in a septic tank becoming clogged or failing to drain properly, possibly creating pollution hazards. Wastewater that contains small amounts of hazardous and toxic chemicals from household products can destroy the biological digestion processes in the tank and possibly contaminate the groundwater. A system will not function properly if it becomes clogged with paper towels, plastics, cat box litter, grease, fats, and other solids. If a septic system is located in unsuitable soils or an area with a high water table, it may cause pollution of ground or surface waters and cause objectionable odors.

Package Plants

Introduction: These systems usually serve several households. In Carteret County, they are common in condominium and motel developments on Bogue Banks. Package plants treat the wastewater with mechanical filtering and biological treatment. The wastewater is then disposed of on or below the surface of the land. As with septic systems, when disposed of in the ground, the wastewater is filtered and treated by the bacteria and oxygen in the soil.

Package plants owners must have a permit from either the North Carolina Division of Environmental Management or the county Health Department. The Division of Environmental Management is responsible for the permitting of package plants which discharge to the ground surface, and local Health Departments are responsible for the permitting of package plants which discharge below the ground surface. Permits for package plants specify requirements concerning plant operations and maintenance.

Advantages: Similar to septic tanks, package plants provide a method of wastewater treatment and disposal where central sewers and treatment are unavailable. In small communities, small wastewater systems are usually the most economical method of wastewater treatment and disposal. If properly operated and maintained by skilled operators and sited in suitable soils, package plants treat wastewater adequately and do not create environmental problems.

Problems: Most package plants can treat wastewater as effectively as larger, central treatment plants. Usually, however, they are owned by private homeowners' organizations which lack the resources to support the level of oversight by skilled operators that larger, central treatment plants have. The major reason for problems with package plant systems is the inadequate management of the system's operation and maintenance. Inadequately managed package plants may malfunction and discharge untreated wastewater or may fail to disperse the treated wastewater in a manner that facilitates its absorption into the disposal field soils.

Problems may also occur at package plants when a plant's capacity is exceeded by incoming flows. When a package plant is designed, its capacity will often be determined by the cost of construction, and it may not be large enough to handle a wastewater flow of the size that will be produced by a condominium packed with visitors on a summer weekend or holiday. If a plant's capacity is overloaded by incoming flows, it could malfunction, possibly causing the discharge of untreated or inadequately treated wastewater. The wastewater may overload the disposal fields causing inadequate treatment by the soils or possible runoff over the land.

As of July, 1992, North Carolina state regulations require that all package plant operators visit each plant they operate once each weekday. This regulation will improve the management of operations and maintenance at package plants. The most critical time, however, for oversight of these plants by skilled operators is on busy weekends and holidays when peak flows occur. The new regulations do not require operators to be present on weekends.

Also as of July, 1992, package plant systems under the jurisdiction of local health departments are required to have a "public management entity", such as a county government or public utility, as the agent responsible for the management of the plant. Package plant owners will have contracts with the "public management

entity" that will spell out responsibilities for regular maintenance and inspections. This new change of policy will address problems of inadequate management by private owners of package plants.

Central Sewer and Treatment Systems

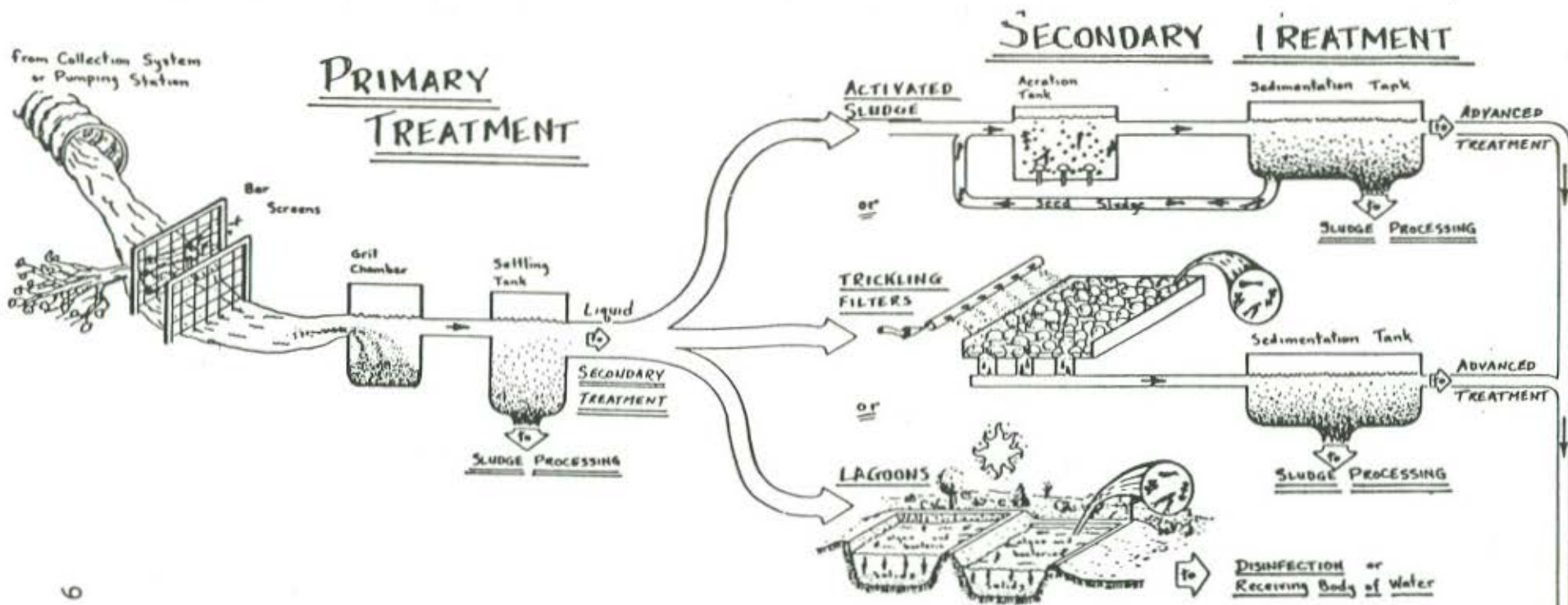
Introduction: Large communities often have central sewer systems to collect wastewater for treatment and disposal at a central wastewater treatment plant. These systems are usually municipally owned.

In many areas of the country, central sewer systems have been built to collect both wastewater and stormwater in an effort to reduce costs. After heavy rain, flows in these sewers increase substantially as a result of the inflow of stormwater. The treatment plant which receives the flow from the sewer must have the capacity to treat the increased flow, or the increased flow will have to bypass the treatment plant and be disposed of untreated.

In North Carolina, there are no combined stormwater and wastewater sewer lines. Wastewater flows may be increased, however, through infiltration of stormwater into old sewer lines which are cracked or have leaky joints.

The treatment process at a central treatment plant may consist of several levels: primary, secondary, and tertiary or advanced treatment. The illustration on the next page diagrams the treatment process from primary through advanced treatment. Table 1 describes each level of treatment. Each stage adds more expense to the process, but produces a cleaner effluent (discharge). Tertiary or advanced treatment is less common and has much higher construction and operation costs than secondary treatment. Prior to disposal, the last step in wastewater treatment is usually disinfection to remove water coloration and kill disease-carrying bacteria and some viruses. For comparison, septic tanks provide about the equivalent of primary treatment or better, and package plants provide secondary treatment or better.

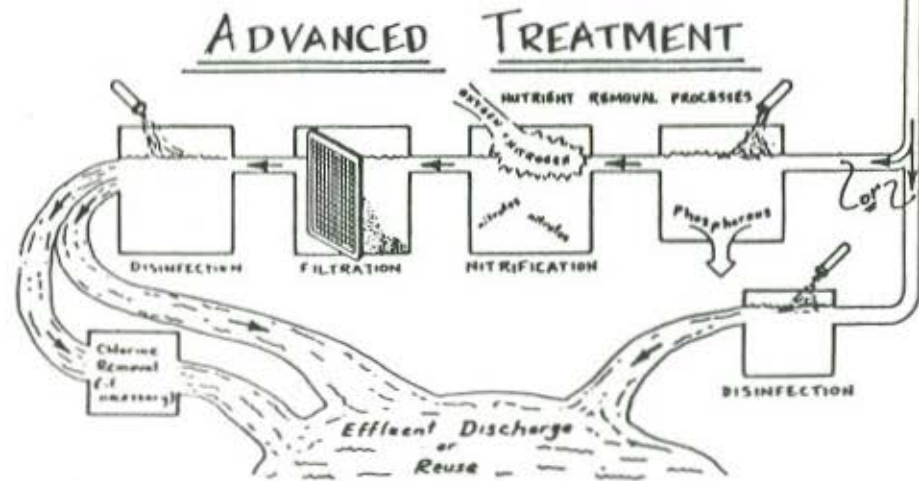
After wastewater is treated in the plant, it is discharged by one of three methods: discharge to an inshore water body, land application, or ocean discharge. Each of these disposal methods is discussed in the following sections.



Wastewater Treatment

This diagram shows the process of wastewater treatment from primary through advanced treatment.

In Carteret County, wastewater treatment plants provide through secondary treatment before discharging.



This illustration has been reprinted with permission from the Water Environment Federation

TABLE 1: Levels of Wastewater Treatment

Primary	Utilizes filtering and settling to remove organic and inorganic solids.
Secondary	Utilizes bacteria in biological treatment to breakdown biodegradable, organic wastes.
Tertiary/Advanced	Uses specialized chemical and physical processes to remove specific pollutants which may remain following primary and secondary treatment. Type of treatment varies with what specific pollutants are of concern in a particular wastewater flow.

Source: Miller, G. Tyler. Environmental Science. 2nd edition. Belmont, CA: Wadsworth Publishing Company. 1988.

Disposal of the treated wastewater to a water body, such as a bay, stream, or river, is the method used at the three treatment plants in Carteret County. Because these plants discharge to the waters of the estuary, their disposal method is called **estuarine discharge**. A wastewater treatment plant that discharges to a water body must have a federal National Pollution Discharge Elimination System (NPDES) permit. These permits are normally issued by state environmental management agencies, but the Environmental Protection Agency (EPA) oversees these permits and may intervene in the state agency's permit decisions. An NPDES permit has requirements that are designed to preserve water quality in water that receives a discharge at the level that prevailed before the discharge. The Federal Clean Water Act requires that all treatment plants discharging to surface waters provide a minimum of secondary treatment.

The volume of wastewater that a plant discharges may affect the environmental impact that the discharge will cause. Although secondary treatment produces an effluent with low levels of pollutants, if the total amount of effluent

discharged is large, the total amount of pollutants discharged is likely to be relatively large. The size of the discharge affects the degree of treatment necessary to protect the quality of the water that receives the discharge. The amount of pollutants or nutrients that a body of water can receive without significant degradation is called its assimilative capacity. If the total load of pollutants being discharged exceeds the assimilative capacity of the water that receives it, the quality of the water will be degraded. If the amount of wastewater treated and disposed of by a plant increases, the plant may have to provide higher levels of treatment to keep the overall quality of its discharge within the assimilative capacity of the receiving body of water.

Treated wastewater may also be disposed of by **land application**. In this disposal method, wastewater is disposed of on the land. The soil provides further treatment of the wastewater by filtering bacteria, viruses, and organic matter. The nutrients in the wastewater act as fertilizer for plants growing in the soil. Some land application sites are not located at a treatment plant, and therefore, treated wastewater must be pumped to the site. Land application can be used to irrigate and fertilize woodlands, golf courses, roadway shoulders, and agricultural fields (with crops not grown for human consumption).

In North Carolina, prior to disposal by land application, the wastewater must have received a minimum of primary treatment, and for some types of land application, depending of the type of soil and the rate of application of wastewater, a minimum of secondary treatment is required. Spray irrigation systems, such as that proposed for Atlantic Beach, are required to have secondary treatment and disinfection. In coastal areas, land application systems which do not use spray irrigation are required to provide tertiary treatment. Land application requires a non-discharge permit for subsurface disposal which is issued by the North Carolina Division of Environmental Management.

In coastal North Carolina, land application systems are in use in the towns of Edenton, Ahoskie, Winton, and other municipalities in the Chowan River basin and in Surf City, Shalotte, and Calabash. Land application systems are proposed for Atlantic Beach and Jacksonville. At the system in Calabash, treated wastewater is "reused" through land application to irrigate a golf course. A similar, but larger, land application system has been proposed to irrigate several golf courses in southern, coastal North Carolina.

Another method for disposal of treated wastewater is discharge in the ocean, commonly known as **ocean outfall**. The wastewater is disposed of in the ocean through a long, underwater, outfall pipeline which usually extends one to three miles from the land. At the end of the pipeline, a diffuser discharges the treated wastewater in many directions for rapid dispersal. At this time, regulations do not specify the minimum level of treatment that should be provided for disposal by ocean outfall. The Environmental Protection Agency recommends a minimum of primary treatment. Like an estuarine discharge, ocean outfall disposal requires an NPDES discharge permit.

Advantages: Central sewer and treatment can provide adequate treatment of wastewater to large and highly developed communities. In some communities, the lack of a central sewer and treatment system is considered an impediment to economic growth because it is difficult to accommodate concentrated development with small wastewater systems, especially in areas with soil conditions that are inadequate for septic systems.

Environmental and maintenance problems associated with small systems can be avoided by centralizing wastewater treatment and disposal. North Carolina requires that all treatment plants have certified operators who are technically trained to oversee the operations of a treatment plant. Central sewer and treatment plants are usually staffed by full-time certified operators who maintain the equipment and address any problems.

Problems: Central sewer systems must be planned with careful attention to their potential impacts. A central wastewater system collects large quantities of wastewater in one place. As a result, finding a location suitable to receive the treatment plant's discharge may be difficult. The discharge siting decision must be made with careful attention to potential impacts on an area's natural resources. Furthermore, providing sewer systems removes a constraint to high density development. Some areas are unsuitable for dense development due to their environmental sensitivity or vulnerability to severe storm damage.

Operating within its permit specifications, a wastewater treatment plant with estuarine discharge may have negative effects on the environment. In the discharge area, shellfish harvesting is prohibited because contamination of shellfish with human

pathogenic bacteria and viruses is likely. After secondary treatment, wastewater still has 50-70% of the nutrients it had before treatment; therefore, treated effluent can overload nutrient conditions in the receiving water and disrupt the water's natural balance. Furthermore, after secondary treatment, wastewater typically still has 30% of the toxic metal compounds and synthetic organic chemicals it had before treatment. In Carteret County, however, metal compounds and synthetic organic chemicals do not occur in significant amounts in the waste stream and are not a problem at this time.

If a treatment plant fails or is overloaded, untreated wastewater may be discharged to the estuary causing severe contamination. In central systems with combined stormwater and wastewater collection or with infiltration problems, increased flows after a rain storm may overload a system's capacity. Infiltration into cracks in the sewer system in Morehead City has caused the treatment plant capacity to be exceeded several times in the past. When this overloading occurred, much of the wastewater had to be passed by the treatment system and directly discharged without treatment. This problem has been addressed in the past few years with a plant expansion and sewer system improvements.

Environmental problems may also result from disposal by land application. Soils may fail to absorb all of the wastewater, and runoff containing high levels of nutrients and contaminants may pollute nearby waters. This type of problem would most likely occur during wet times of the year. In areas with high water tables, disposed wastewater may contaminate the groundwater. Where groundwater is at or near the surface, wastewater may be discharged onto the ground surface. These problems with land application systems, however, can be addressed through careful site selection, system design, and system maintenance.

Disposal by ocean outfall has the advantages of large volume, depth, and currents in the ocean which help to disperse and dilute the wastewater discharge. The environmental impacts of ocean outfalls, however, have not been thoroughly assessed. Many ocean outfall systems are in operation in the nation's coastal areas. In some areas, they have not caused noticeable environmental disturbance, but in other areas, problems have occurred. In New Jersey, for example, outfalls have been required to expand pipeline lengths because it was suggested that the outfalls were contributing to shoreline contamination. More information is needed on the

environmental effects of outfalls, but with careful design, ocean outfall may provide a viable alternative for disposal in the future. At the present time, it is not likely that permits for ocean outfalls in the Southeast will be approved because the Environmental Protection Agency currently has a policy which sets a preference for land application and wastewater reuse methods over ocean outfalls.

Central wastewater systems with estuarine discharge, land application, and ocean outfall are expensive to construct, and the costs are affordable only to large municipalities or when shared by several communities. Estuarine discharge systems are likely to require expensive improvements to comply with environmental regulations which are expected to become increasingly more strict for this type of discharge. Ocean outfall systems are very expensive to construct, and because information is lacking on their environmental effects, the environmental plans that would be required before an ocean outfall could be constructed would be very expensive as well. Land application disposal systems may be the most economical systems to construct. The costs for land application systems, however, vary widely and depend on the site. If land must be purchased for the disposal site and if a pipeline must be constructed to the disposal site, the cost of a land application project may be as expensive as the other methods of disposal.

In considering the environmental impacts of each of these disposal methods, it is important to remember that the wastewater being disposed of, whether to the estuary, the land, or the ocean, has already been treated to remove most of its pollutants. Environmental problems associated with wastewater systems are most severe when the systems are not properly located or have not been adequately maintained.

In summary, septic systems, package plants, and municipal treatment plants with estuarine disposal, land application, or ocean outfall are possible methods of wastewater treatment and disposal for Carteret County. All of these methods may present some public health and environmental problems; therefore, the wastewater management planning process must give careful consideration to each alternative. Through careful planning, site selection, and maintenance, the improvement of wastewater management can address environmental problems and improve the quality of life and the environment in Carteret County.

The State of Wastewater Treatment and Disposal in Carteret County

Carteret County has a permanent population of over 50,000 residents and a peak seasonal population of over 117,000 permanent and seasonal residents combined. This population is served by septic systems, package plants, and municipal treatment plants as described below.

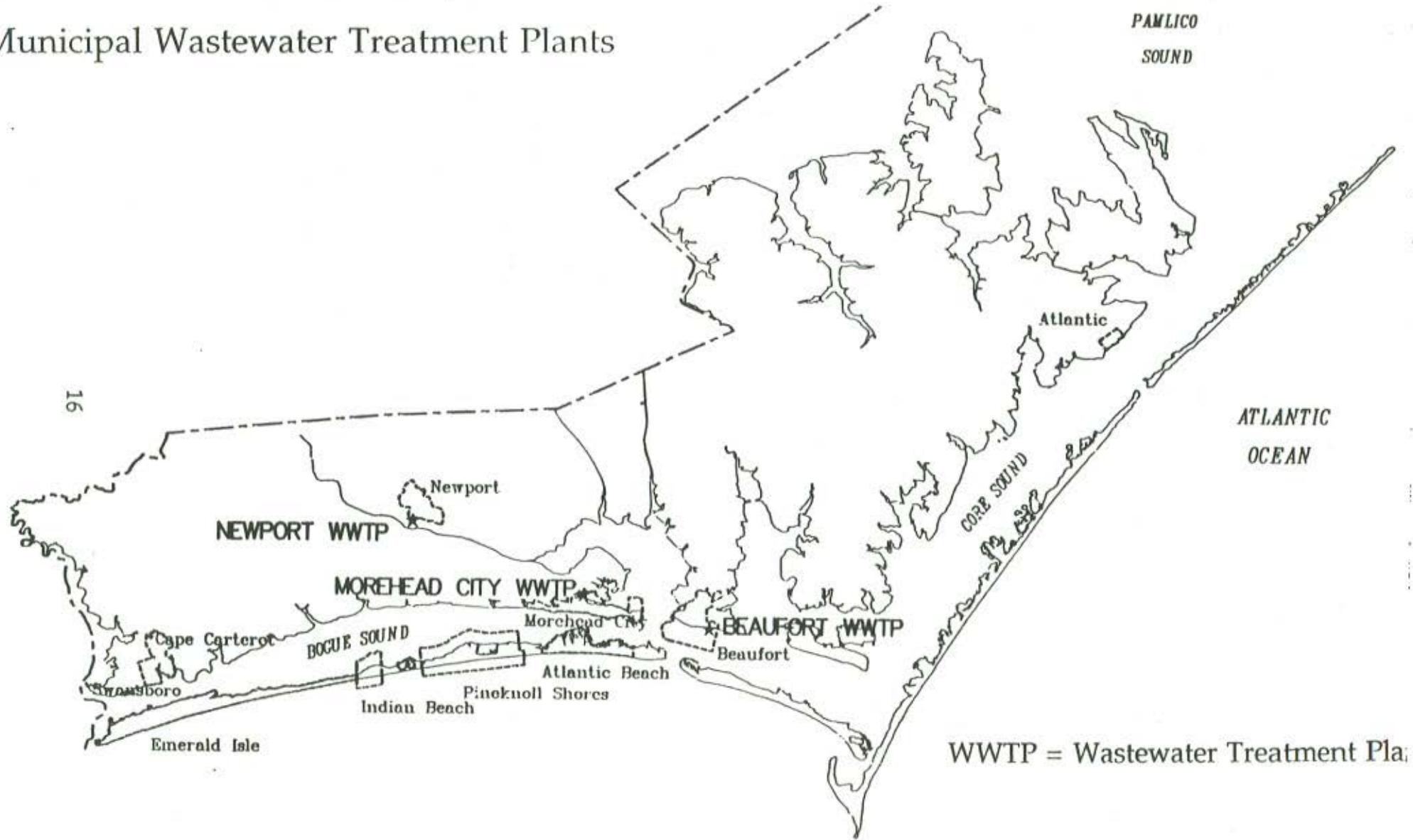
Septic systems: Approximately 2/3 to 3/4 of the population in Carteret County is served by septic systems. The soils of Carteret County have been rated for their suitability of use with septic systems in a soil survey by the U.S. Soil Conservation Service. The survey scale ranks the soils as good, moderate, slight, or severe. Of the 52 soil types that are present in the county, 47 were rated as severe, and these soil types account for 97.9% of the land in the county. The soil survey ratings indicate that extreme care must be taken when siting and constructing septic systems in Carteret County. The county Health Department often requires modification of a site before it will approve a permit request for a septic system, but with site modifications, most permit requests are approved.

Package plants: Carteret County has over 40 package plants. Most serve condominium and motel developments on Bogue Banks, and as such, many plants serve tourists. In the past, many plants have experienced malfunctions and failures as a result of a lack of effective management, but better management has improved their performance in the recent past. New requirements for certified operators and intensified management of package plants have been established by the "public management entity" regulations which were described on page seven in the previous section. The requirements should contribute to continued improvement in package plant operation and maintenance.

Municipal Treatment Plants with Estuarine Discharge: In Carteret County, the municipalities of Beaufort, Morehead City, and Newport each have a central sewer and treatment plant system with estuarine discharge. All three plants provide secondary treatment of the wastewater prior to disposal. The map on the next page shows the locations of the discharges of these three plants. The plant in Beaufort serves approximately 4600 permanent residents and discharges effluent into Taylor's Creek. The Morehead City plant serves approximately 6800 permanent residents and discharges into Calico Creek. The Newport plant serves approximately 2600

Carteret County

Municipal Wastewater Treatment Plants



WWTP = Wastewater Treatment Plant

SCALE 1:375,000

--- County Boundary
... Municipal ...

North Carolina Center for...

permanent residents and discharges into the Newport River. In total, 27.6% of the county's permanent residents are served by central sewer and treatment plant systems.

Each of these plants was expanded recently, and since the expansions, the plants have operated in compliance with their NPDES permits. In Morehead City, the treatment plant's capacity was doubled in 1990 to meet the town's treatment capacity needs, especially after rainfall which frequently overloaded the system. While the treatment capacity was increased, the size of the plant's discharge did not change. To maintain the pre-expansion level of discharge, in periods of high flow, treated wastewater can be held at the plant for later disposal during low flow periods.

The degree of treatment provided at the county's three central wastewater plants may have to be increased if the Newport River continues to be threatened with eutrophication, an environmental condition in which large growths of algae occur in response to high levels of nutrients. Eutrophication causes a disruption of the balance of the water body's natural community, possibly causing the death of fish, shellfish, and other organisms. Wastewater treated with secondary treatment has high levels of nutrients and may contribute to eutrophication. If high levels of nutrient loading increasingly threaten the river system with eutrophication, the state may classify the Newport River as nutrient sensitive and so require that discharges to the Newport River system be treated with advanced treatment for nutrient removal. This classification would affect all three treatment plants because the town of Newport discharges directly to the Newport River, and Taylor's Creek and Calico Creek, which receive the discharges of Beaufort and Morehead City, both flow into the Newport River.

In assessing the state of wastewater management in the county, an important factor to consider is expected population growth. Increases in population, both permanent and seasonal, cause increases in the amount of wastewater produced. Between 1980 and 1987, the county's permanent population increased by 22.9%, and the peak seasonal population (permanent and seasonal residents combined) increased by 56.2%. During the same period, the number of housing units in the county increased by 33.0% for year-round residences and by 71.3% for seasonal residences. The large growth in housing units reflects growth in vacation homes, condominiums,

hotels, and other units occupied by tourists in the county. Between 1987 and 2000, the permanent population of the county is expected to grow 32%, and the seasonal population is expected to grow 104%. During the same period, the number of year-round occupied housing units is expected to grow 37%, and the number of seasonally occupied housing units is expected to grow by 104%. This growth will cause wastewater flow increases on a similar scale.

Table 2 presents projected wastewater flows for the county in 2000 and 2010. These projections reflect the expected growth in the permanent and seasonal populations in the county. The wastewater flows are given in millions of gallons per day (MGD). Separate projections are made for the summer and for the fall through the spring because of the greater number of tourists in the summer.

To maintain the present quality of life and the environment in Carteret County, wastewater treatment and disposal practices must be able to accommodate this growth in wastewater flows. Even if growth occurs more slowly than projected,

TABLE 2: Wastewater Flow Projections for Carteret County

	1986 (MGD)	2000 (MGD)	2010 (MGD)
Fall - Spring	4.392	6.299	7.661
Summer	6.572	9.425	11.463

% increases in fall - spring wastewater flows:	% increases in summer wastewater flows:
1986 - 2000: 46%	1986 - 2000: 43%
1986 - 2010: 74%	1986 - 2010: 74%

Source: Carteret County Wastewater Treatment and Disposal Environmental Assessment. Prepared by McDavid Associates, October 1989.

it will occur, and the present state of wastewater management is inadequate to serve significantly higher levels of flow. The county and its municipalities must give careful consideration to how wastewater will be treated and disposed of in the future.

Carteret County residents have a variety of feelings about growth. Growth is favored by some for its economic benefits. On the other hand, growth is opposed by some because it creates secondary environmental impacts by increasing stress on the area's natural resources. Growth is opposed by others because they do not wish to see their community change.

Central sewer and wastewater treatment systems can support growth positively. Areas without central sewers, on the other hand, are considered to be limited for growth. Significant growth has occurred, however, over the past 20 years in communities which do not have central wastewater systems. Limiting the availability of wastewater systems in an effort to control growth may worsen existing problems with septic tanks and package plants without limiting growth.

Although central wastewater systems may lead to population increases, growth can be controlled by means other than avoiding the construction of a central wastewater system. If designed properly and strictly enforced, land use planning, zoning, and density controls can effectively manage growth and its secondary effects.

Inadequate management of existing wastewater systems and, if inadequately controlled, growth associated with the construction of new, central wastewater systems both can have negative impacts on a community's environmental resources. In planning for wastewater management, careful consideration should be given to the protection of natural resources in the face of population growth.

Planning for Future Wastewater Management in Carteret County

To accommodate future growth in its wastewater flows, Carteret County has begun the process of making long-term plans for its wastewater management. The process began in 1986, when county officials commissioned the *Carteret County Water and Sewer Study*. This report identifies the county's water and sewer capacity needs

and makes recommendations for meeting these needs. The study recommends that both the water supply and wastewater needs of the county be addressed with county-wide systems. It also recommends that the county conduct a referendum for approval or rejection of a bond issue to finance improvements to the county's water and wastewater systems.

In February 1987, county residents voted to reject the bond issue by a margin of 2.5 to 1. The defeat of the bond issue has been attributed to the expected increased costs of water and wastewater improvements to the taxpayers, a lack of understanding of the issue, and opposition to growth that may result from improved water and sewer systems. The rural areas of the county were especially opposed to the bond issue.

The defeat of the bond issue, however, was not the final word on wastewater planning for the county. Over the past several years, many reports have addressed the issue. (Several such reports are listed in Appendix 1 of this guide.) In 1988, the county established a Water and Sewer Task Force to address the need for long-term planning for wastewater management. Some communities in the county have been addressing the wastewater issue on their own. Beaufort, Morehead City, and Newport each have recently completed treatment plant expansions to meet requirements for their NPDES permits. Atlantic Beach and Harkers Island have given consideration to constructing central wastewater collection, treatment, and disposal systems, and Atlantic Beach has initiated planning for a central system. Despite the defeat of the bond issue, wastewater planning efforts have not waned, but became more prevalent.

In Atlantic Beach, wastewater is managed with package plants and septic systems. Development is dense, particularly with vacation homes and condominiums. Problems with septic tank and package plant failures have been common. To address the community's need for improved management of its wastewater, plans for a central sewer system have been under consideration for several years.

The issue of a central wastewater system in Atlantic Beach has been quite controversial. In April 1988, although the town had no specific proposal or permit application, the North Carolina Division of Environmental Management decided to

require the preparation of an environmental assessment type document for any proposal from Atlantic Beach.

This type of document analyzes the environmental effects of a proposed project and reviews alternatives to the project and the environmental effects of those alternatives. Environmental assessments and environmental impact statements (EIS) are two types of environmental assessment documents. An environmental impact statement is often required by federal, state, or local regulations for major development projects. With such documents, government agencies can determine whether a project will meet the requirements of environmental regulations and avoid causing degradation of the environment and whether an alternative to the project would be preferable.

A public meeting was held to determine what should be included in any Atlantic Beach environmental document. After this meeting, the Division of Environmental Management decided that comprehensive, county-wide, wastewater management planning should precede the approval of any new or expanded municipal wastewater discharges in Carteret County. The director of the Division of Environmental Management ordered the county to prepare a long-range, county-wide, wastewater management plan. Until the plan was completed, no permits for new or expanded wastewater discharges would be approved for Atlantic Beach or any other entity in Carteret County.

Having just created the Water and Sewer Task Force a few months before this order from the state, Carteret County already had a forum for the establishment of a long-term plan, and now had an extra incentive to begin work on the planning process as rapidly as possible.

The Carteret County Wastewater Plan

It was decided that the required long-term wastewater plan for Carteret County would be developed in the form of an environmental assessment. The document would not address a specific project, but provide a general overview of all of the wastewater management options available to the county for both the short- and long-term. (Note: The Carteret County wastewater plan is commonly referred to

as an environmental impact statement, or EIS, but is not officially considered an environmental impact statement. Here, the document is referred to as the county's wastewater management plan and an environmental assessment.)

In August 1988, the Division of Environmental Management issued a scoping report that outlined what the environmental assessment should include. An engineering firm, McDavid Associates, Inc., was chosen by the county to prepare the document. The cost to the county for preparation of the document was \$15,000, very inexpensive for an analysis of this kind. The costs were shared by the county and several of its municipalities. The completed draft document was submitted to the Division of Environmental Management in October 1989.

Following the submission of the draft, the Division of Environmental Management circulated the document for review by government agencies, and in September 1990, the Division held a public hearing to gather citizen input. The hearing was well attended, and many viewpoints were expressed. The Division asked McDavid Associates to make several additions and revisions in response to concerns that arose in the review process. After final revisions were completed, the environmental assessment was adopted as final in late 1991 by the state government as Carteret County's long-term wastewater plan.

From the evaluations in the environmental assessment of the short- and long-term wastewater management alternatives for Carteret County, the environmental assessment makes the recommendations listed in Table 3.

After the draft environmental assessment was submitted in late 1989, the Carteret County Water and Sewer Task Force prepared a resolution that made recommendations for the future management of wastewater disposal in the county. The recommendations were based on the task force's acceptance and interpretation of the conclusions made in the environmental assessment. A copy of the resolution appears in Appendix 2.

The resolution states that no permits should be issued for new or expanded estuarine discharge disposal systems. It establishes a goal that all estuarine discharge systems in the county be eliminated within the next 20 years. For wastewater disposal during the next 15 years, the resolution recommends that communities use

Table 3: Recommendations of the Carteret County Wastewater Plan

- 1) **Short-term Strategy:** Until a long-term strategy is implemented, communities which have immediate needs for central wastewater systems should use land application as their method of disposal. Atlantic Beach has already begun pursuing this option.
- 2) **Long-term Strategy:** Communities in the county should participate in a land application system which serves the entire county, part of the county, or individual communities within the county, or they should participate in a county-wide ocean outfall system.
- 3) A cooperative, county-wide effort should be made to eliminate wastewater discharges to the waters of the estuary.
- 4) A county wastewater task force should oversee efforts to improve wastewater management in the county. This task force would be responsible for:
 - overseeing the efforts in individual communities to establish land application systems;
 - coordinating efforts among the various government agencies involved in the establishment of a central system with land application or ocean outfall disposal for all or part of the county;
 - overseeing the choice of locations for systems and environmental studies of potential wastewater projects; and
 - providing community education on wastewater management in the county.
- 5) The wastewater task force should hire one full-time employee to oversee the implementation of wastewater plans and coordination of the efforts of the task force to meet the responsibilities described above. Costs should be shared by the county and its municipalities to finance the implementation of the efforts that are recommended.

land application. For the long-term, the resolution recommends that an ocean outfall system be pursued.

The resolution lists environmental protection criteria that should be used in determining the suitability of land application sites. It states that growth is a likely consequence of any centralized wastewater system and that land use planning should be used to manage this growth. The resolution commits the county to funding an engineer to implement the county's wastewater plans. It also commits the county to the continuation of a permanent Water and Sewer Advisory Board. Finally, it states that management of the county's wastewater will require cooperation and the sharing of responsibility by the county and its municipalities.

The county commissioners have adopted this resolution, and several municipalities have responded to the resolution and to the environmental assessment with support. The municipalities of Newport, Atlantic Beach, Pine Knoll Shores, Indian Beach, Cape Carteret, and Morehead City have adopted similar resolutions. The Carteret County Chamber of Commerce also supports the resolution.

In Morehead City, a resolution similar to that of the county has been adopted, but the Morehead City resolution points out that problems may arise through the use of either land application or ocean outfall. The resolution reflects concern over technical uncertainty about the feasibility of large scale land application systems and political uncertainty of the approval of ocean outfall disposal.

A resolution adopted by Indian Beach urges caution in the design of an ocean outfall system, and it states that preservation of environmental resources should take precedence over economic growth and other concerns. The Emerald Isle resolution states a specific objection to the cost sharing plans suggested in the environmental assessment. In general, however, these communities support the county's resolution and the adoption of the document.

On the other hand, the town of Beaufort has expressed several objections to the environmental assessment and the county's resolution. In their comments submitted to the Division of Environmental Management, the Beaufort commissioners oppose the prohibition of expanded estuarine discharges in the county resolution because the cost of wastewater disposal in Beaufort is already high. Complying with

the resolution by building a short-term land application system and participating in a long-term ocean outfall project would not be economically feasible for Beaufort. The commissioners of Beaufort felt that the environmental assessment was biased against ocean outfall, and furthermore, they felt that McDavid Associates did not adequately explain its method of evaluating the alternative wastewater management strategies.

The Friends of the Newport River also have expressed some objections to the environmental assessment. Like Beaufort, they felt that the document was biased against ocean outfall and that it overlooked potential problems with land application disposal. They believe that wastewater flow projections given in the document are underestimated. Furthermore, they state that the document does not address all of the issues that the Division of Environmental Management suggested should be included. The Friends of the Newport River oppose the recommendation for short-term land application, but support the recommendation for long-term ocean outfall.

The North Carolina Coastal Federation also has objections to the environmental assessment. They believe that a county-wide ocean outfall or land application system would induce uncontrolled, rapid growth which would have severe environmental impacts. Therefore, the Coastal Federation disagrees with the environmental assessment's conclusions and supports an alternative approach of intensified, community management of the county's existing wastewater management systems.

Support for land application and ocean outfall in the environmental assessment and the county resolution is a source of controversy. For land application, confusion over technical aspects of its operation has caused several different interpretations of its possible impacts. Some people believe that there is not enough suitable land in the county for a regional land application system. Others believe that wastewater will runoff from these systems and possibly contaminate nearby waters. Some believe that applied water will flow to drainage ditches from which it will discharge to nearby waters; therefore, they contend that these systems should be required to obtain a more restrictive discharge permit. Others believe there is a risk of groundwater contamination. Many people believe, however, that land application will not have negative impacts. While many different predictions of impacts exist, an accurate assessment of possible impacts will come about only in site specific studies.

On the other hand, ocean outfall disposal is well supported in the county, but environmental impact evaluation requirements and the EPA preference for land application systems will make following through with the recommendation for an ocean outfall system long, costly, and possibly infeasible.

After the Wastewater Management Plan: Atlantic Beach and Beyond

Now that the county's long-term wastewater management plan has been adopted, the town of Atlantic Beach is moving ahead with its wastewater plans. Facing problems with failing septic systems and package plants, Atlantic Beach has the most immediate need in the county to address wastewater problems. The town would like to construct a central sewer and treatment system to address environmental problems caused by its package plants and septic tanks.

The town's plans to pursue construction of a central system were put on hold by the Division of Environmental Management's decision to put on hold any applications for permits for new or expanded wastewater discharges in the county until a comprehensive county-wide wastewater plan was developed. Now that the county has created a long-term wastewater plan, Atlantic Beach may move forward with its application for a permit to construct a central wastewater system.

Atlantic Beach is proposing to develop a land application system. The town's wastewater would be collected in a sewer system and treated at a treatment plant in the town. Currently the town proposes to dispose of the treated wastewater by land applying it on a section of Open Grounds Farm, a 44,000 acre farm in the northeastern part of the county. The wastewater would be pumped several miles through a pipeline to the farm, and there, the treated wastewater would be disposed of through a spray irrigation system. Holding ponds would be constructed at both ends of the pipeline to provide storage capacity during periods of high flow. The irrigation of the treated wastewater would be conducted on a 1000-acre plot that Atlantic Beach would lease from the farm. The treated wastewater would provide nutrients to fertilize vegetation that grows on this plot. The land disposal plot would be used to grow animal fodder, not food for human consumption.

The system which Atlantic Beach plans to build will not have much extra capacity with which to accommodate high levels of growth. The town plans to coordinate the management of its growth with its wastewater plans. It plans to use land use planning and zoning to maintain its wastewater flows within the new system's capacity.

Atlantic Beach currently has a permanent population of only about 1950, but its seasonal population has a peak of approximately 35,000. It is estimated that the proposed system will cost the town of Atlantic Beach approximately \$17 million. Of this amount, \$9.9 million will be provided through a bond referendum approved by the voters of Atlantic Beach in 1989. Another \$6 million will come in the form of low interest loans from the state. The town approached other communities in the county about constructing a larger system together and saving costs. No other part of the county, however, had such an immediate need for a new central wastewater system to pursue a proposal of such high expense.

The Atlantic Beach proposal has been controversial in Carteret County. Many residents from the eastern part of the county are opposed to land application at Open Grounds Farm because they feel it will threaten water quality in their area. To address concerns about the proposed system's impacts on water quality and other environmental resources, an environmental impact statement has been prepared.

During the development of the proposal and environmental impact statement for the Open Grounds Farm land application system, the state adopted more restrictive regulations for land application systems. The new regulations require a 100 foot setback of land application operations from waterways. This setback requirement would make land application at Open Grounds Farm infeasible because drainage ditches are spaced in a grid of 360 foot squares. To comply with the setback, only a small portion of each square could be used for land application irrigation. A much larger area than the 1000 acres originally proposed would be required to dispose of all of the effluent, and costs for the system would be prohibitively higher. The draft environmental impact statement did not address this restriction, and the issue is being reconsidered.

The issue of the adequate width for a setback is a complex, technical question. Because of the low slope of land in coastal areas, a 25 foot setback may be adequate

to prevent direct runoff of the wastewater into the surrounding waterways. However, soil and water table conditions in Carteret County may require a minimum 100 foot setback to protect the quality of the surrounding waters. This issue is currently under consideration by the Division of Environmental Management.

It is possible that the town of Atlantic Beach may request a variance to use a smaller setback width than that required by the current regulation. It is also possible that the setback regulation may again soon be changed. In March, 1992, the Environmental Management Commission (EMC), which approves water quality regulations for the state, sent to public hearing a proposal to change the minimum setback from 100 to 25 feet. The final decision on this setback regulation is expected in the fall of 1992.

Atlantic Beach has been working on its plans for a central wastewater system for several years. Having prepared an environmental impact statement, the town is applying for a permit for the proposed system. In the near future, the permitting process will include a public hearing for citizens to make statements on their support for or opposition to the proposed wastewater system. Concerns like those discussed above will be expressed at the hearing. Citizens who have concerns about the Atlantic Beach wastewater plans need to be informed and active in the issue. Citizens can take part in this issue by becoming more informed through resources such as those listed in Appendix 1, by taking part in the hearing, and by expressing their opinions in writing to public officials at the county and state levels.

While Atlantic Beach works toward addressing its wastewater management concerns, the county is moving forward with its wastewater plans. In the late summer of 1991, the county hired an engineer whose responsibilities include coordinating the implementation of Carteret County's wastewater plans. In addition, Carteret County officials have participated in discussions concerning regional wastewater plans with adjacent counties and the Marine Corps Air Station at Cherry Point through the Neuse River Council of Governments. Coordination of wastewater plans at this multi-county regional level could lead to consideration of a large ocean outfall system to serve the region.

Wastewater management is an important issue in Carteret County because of its effects on the quality of life and the environment. All of the available wastewater

management options have some negative impacts. In the planning process, considering and weighing the alternatives will require careful analysis. The planning process will require great amounts of time and money. Many different opinions of what is best for the county will create a complex political situation.

Interested citizens can get more information on this issue from resources such as those listed in Appendix 1 of this guide. Citizens can attend public hearings on the county's wastewater issues and express their opinions to public officials. Informed and active citizens can help set the path for Carteret County's future wastewater strategies.

Appendix 1: Information Resources for Citizens

Citizens who would like more information on wastewater issues in Carteret County can make use of the following resources.

Local newspapers

The Carteret County News Times will have current information on wastewater issues in the county including the actions of the Water and Sewer Task Force, actions within municipalities such as Atlantic Beach as they move forward with community wastewater plans, and announcements of public hearings on proposed wastewater management projects.

Government agencies

Local governments:

County of Carteret	728-8400
Atlantic Beach	726-2121
Beaufort	728-2141
Indian Beach	247-3344
Morehead City	726-3131
Pine Knoll Shores	247-4353
Newport	223-4749
Emerald Isle	354-3424
Cape Carteret	393-8483

State government:

Division of Environmental Management
(in the Department of Environmental, Health, and Natural Resources)

Headquarters:

P.O. Box 29535
Raleigh, NC 27626-0535
(919) 733-7015

Regional office:

127 Cardinal Drive Extension
Wilmington, NC 28405
(919) 395-3900

Shellfish Sanitation Branch
North Carolina Division of Health Services
P.O. Box 769
Morehead City, NC 28557
726-6827

Albemarle-Pamlico Estuarine Study
NC Department of Environmental, Health, and Natural Resources
P.O. Box 27687
Raleigh, NC 27611
(919) 733-0314

Other Organizations to Contact:

Albemarle-Pamlico Citizen Water Quality Monitoring Program
Institute for Coastal and Marine Resources
East Carolina University
Greenville, NC 27858
(919) 757-6220

Carteret County Chamber of Commerce
3401 Arendell Street
Morehead City, NC 28557
726-6831

Carteret County Crossroads
P.O. Box 155
Beaufort, NC 28516

Carteret County Economic Development Council
P.O. Box 825
Morehead City, NC 28557
726-7822

Carteret County Watermen's Association
P.O. Box 263
Beaufort, NC 28516

Friends of the Newport River
Route 4, Box 371
Newport, NC 28570

North Carolina Coastal Federation
Hadnot Creek Farm
3223-4 Highway 58
Swansboro, NC 28584
(919) 393-8185

Reports about Wastewater Management:

These reports may be available through government agencies, libraries, environmental organizations, or universities.

Carteret County Water and Sewer Study. Prepared for the county by McDavid Associates. June 1986.

Carteret County Wastewater Treatment and Disposal Environmental Assessment. Prepared for the county by McDavid Associates. October 1989.

"Cost Benefit Analysis of Alternative Sewage Treatment Projects for Carteret County." By Pauline Vaas, Duke University Institute of Policy Sciences and Public Affairs. December 1986.

"Hydrologic Analysis of Land Application of Treated Municipal Wastewater for Carteret County, NC." By R.W. Skaggs and R.O Evans, Department of Biological and Agricultural Engineering, NCSU, Raleigh, NC. October 1989.

North Carolina Barrier Islands - Wastewater Management - Environmental Impact Statement. U.S. EPA, Region IV. December 1983.

"Public Opinion about Wastewater Management in Carteret County." By Thomas J. Hoban, Extension Sociologist Specialist, NC Agricultural Extension Service. Submitted to the Carteret County Water and Sewer Task Force. August 1989.

"Sewage Treatment Options for Atlantic Beach, NC." By Clifford S. Duke, Duke University Institute of Policy Sciences and Public Affairs. Submitted to Carteret County Crossroads. August 1986.

"Wastewater Disposal in Carteret County: Public Opinions and Alternatives." By Neil Armingeon et al., Bradley Fellowship Program, Duke University School of Forestry and Environmental Studies, Duke University Marine Laboratory. May 1989.

General Information on Coastal Environmental Resources:

Blueprint for Action: The Albemarle and Pamlico Citizens' Advisory Committees Resource Management Recommendations for the Albemarle-Pamlico Estuarine Study. Edited by Neil Armingeon. Published by the Albemarle-Pamlico Estuarine Study. December 1990.

A Citizen's Guide to Coastal Resource Management Through Local Government. Published by the North Carolina Coastal Federation. Winter 1990.

A Citizen's Guide to Coastal Water Resource Management. Written by the North Carolina Coastal Federation. Produced by University of North Carolina Sea Grant College Program and the Albemarle-Pamlico Estuarine Study. Spring 1988.

Evaluation of State Environmental Management and Resource Protection Programs in the Albemarle-Pamlico Region. By Robert C. Nichols et al. Published by the Albemarle-Pamlico Estuarine Study. Report no. 90-02. April 1990.

A Guide to Estuaries of the Albemarle-Pamlico Region. Written by Judith A. Gale. Published by the Albemarle-Pamlico Estuarine Study. 1989.

A Guide to Protecting Coastal Waters through Local Planning. Published by the NC Division of Coastal Management. May 1986.

Public Attitudes Toward Water Quality and Management Alternatives in the Albemarle-Pamlico Estuarine System. (Phase I Report). Written by Thomas Hoban and William Clifford. Published by the Albemarle-Pamlico Estuarine Study. April 1991.

A River of Opportunity. Edited by David McNaught. Published by the Pamlico-Tar River Foundation. April 1991.

Troubled Waters. By Glenn Lawson. Hadnot Creek Publishing Company, Swansboro, NC. 1990.

Where the Rivers Meet the Sea. Written by Frank Tursi. Published by the Albemarle-Pamlico Estuarine Study. Report no. 89-12. 1989.

Appendix 2: Carteret County Resolution on Wastewater Disposal

RESOLUTION
CONCERNING WASTEWATER DISPOSAL
AND ITS RELATION TO THE ECONOMIC
AND ENVIRONMENTAL WELL-BEING
OF CARTERET COUNTY

WHEREAS, future permits for wastewater discharge in Carteret County are being withheld upon the completion and review of the Environmental Impact Statement; and

WHEREAS, long-term and short-term issues must adequately be addressed; and

WHEREAS, a Task Force was appointed and charged with working with the consultants to prepare and review the EIS;

NOW, THEREFORE, THE CARTERET COUNTY BOARD OF COMMISSIONERS DOES MAKE THE FOLLOWING FINDINGS AND RECOMMENDS THE FOLLOWING POLICIES:

1. No permits should be granted for new or expanded discharges of wastewater into rivers and estuaries.
2. It is recommended that existing estuarine discharge be eliminated within 20 years, with a goal of all discharge going to an ocean outfall on or before that date.
3. The long-term needs of the county are best served by a regional ocean outfall.
4. Short-term needs (less than 15 years) are best served by land application.
5. The fulfillment of a long-term solution will require the cooperation and shared responsibility of the County and every municipality in planning, funding, and implementation. The County will agree to immediately begin investigating the funding of an engineer for fiscal year 1990-91 to help coordinate the wastewater needs of our towns and communities. A consistent strategy for developing a long-term wastewater solution must be maintained. A Water and Sewer Advisory Board will be organized on a permanent basis for municipal and community input.
6. Any form of centralized wastewater system, public or private, will induce growth provided the conditions are right in the marketplace. The County will utilize proper land use planning to direct this growth.
7. The County-funded report prepared by Drs. Skaggs and Evans of N.C. State University, concerning fresh-water runoff on land application sites should be an addendum to the EIS.

8. The following criteria should be used to judge the suitability of land application sites:
 - a. The watershed contributing to the point of discharge must be large relative to the area irrigated.
 - b. The site should be as far from an estuary as possible, and the fishery value of potential receiving streams should be taken into account.
 - c. Cover crops should be selected to maximize nutrient uptake and water retention at the site.
 - d. Setbacks of irrigated areas from ditches should be maximized to limit runoff from the sites.
 - e. Sites should be as far from human habitation as possible to minimize impacts on the quality of life and values of adjacent properties.

(This resolution was adopted by the Carteret County Board of Commissioners on March 5, 1990.)

