Coastal Zone Management Program

RURAL WASTEWATER MANAGEMENT
STUDY
FINAL REPORT

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Final Report

Rural Wastewater Management Study

Prepared For
Delaware Department of Natural Resources
and
Environmental Control
Division of Environmental Control
Planning Branch

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PREFACE

A large portion of Delaware's population relies on individual on-lot sewage disposal systems. When properly designed, and built on good soils these systems are generally very reliable, and can be expected to last thirty years or more. However, septic system failures continue to occur, both in isolated cases involving single homes, and in subdivisions or small communities where a number of systems experience chronic operational problems. A review of DNREC's emergency permit file bears out the fact that such problems exist.

The purpose of this study was not to document the extent of these problems, but rather was to address the various causes of system failure, and suggest a regulatory approach to preventing such problems and mitigating their environmental and socio-economic impacts. It is important that the state be better prepared to regulate individual wastewater disposal systems since future development in rural areas will rely heavily on the use of such systems. It is becoming more and more obvious that the traditional approach to wastewater management (i.e. "sewers) does not apply in these rural areas. This study is aimed at developing a new approach to rural wastewater management which provides for, and encourages, the use of innovative and alternative on-site and small community sewage disposal systems.

This final report culminates over one year's efforts devoted to the analysis of rural wastewater management issues in Delaware. In response to a request for proposals issued by the Projects and Planning Section of the Department of Natural Resources and Environmental Control in October 1979, this study was undertaken to address several technical issues related to the use of on-site and small community wastewater systems in the State. The major objective of this work was to develop specific recommendations for improving the administration of certain State regulatory programs in order to assure the proper application and use of such systems.

Over the course of this study, it became evident that, in fact, there was no comprehensive wastewater management program in Delaware, but rather, several independent administrative and regulatory programs dealing with different aspects of rural wastewater management. Although these programs incorporate many of the basic mechanisms for regulating the use of on-site and small community wastewater systems, they have not been completely successful in assuring the proper use of individual sewage disposal systems.

The first step toward implementing a more effective rural wastewater management program is to develop an overall strategy for carrying out appropriate program changes. To assist DNREC in formulating such a strategy, much of the effort expended in this study was directed at identifying specific program areas where administrative and/or regulatory changes should be considered.

Much effort was also spent on investigating the actual performance of individual disposal systems in several typical rural communities. These investigations pointed out that on-site system failures can not be attributed to one or two common causes, but rather are the result of a combination of factors. Although system failure is generally caused by some physical limitation, it is often difficult to predict these limitations when reviewing a permit application under current review procedures.

The recommendations offered herein suggest ways to identify and avoid potential on-site system problems through permit review and subdivision review. These recommendations reflect the long term objective of developing a comprehensive rural wastewater management program for Delaware. The changes suggested are significant, and will take time to implement. It is hoped that this report sufficiently outlines the overall scope of the program changes being recommended so that DNREC administrators can weigh the merits of the recommendations, and take appropriate actions to implement the changes they feel are warranted.

EXECUTIVE SUMMARY

This report presents several recommendations to the Department of Natural Resources and Environmental Control relating to the development of a rural wastewater management program for Delaware. These recommendations suggest changes in state legislation and administrative policies which should improve upon the current septic system permit program in terms of assuring the proper use of individual on-site wastewater disposal systems. Also addressed, are certain additional requirements relating to DNREC review of subdivision proposals.

These recommendations are offered with several goals in mind, including the following:

- Assure the proper application of wastewater systems in new subdivisions.
- Assure that individual (on-site) sewage disposal systems are properly designed and installed.
- Assure that all feasible alternative solutions are considered in reviewing emergency permits.
- Assure that on-site systems are properly operated and maintained.
- Assure that the density of individual on-site systems does not threaten groundwater quality.
- Assure that the long range wastewater management needs of rural areas be considered in facility planning studies.
- Assure that all persons involved in on-site system design, installation, and maintenance be technically qualified and well informed.

Twelve specific implementation tasks are presented in Chapter Three of this report. These tasks fall into eight basic categories:

1. Amend legislation pertaining to the regulation and management of on-site and small community wastewater systems.

2. Amend existing "Guidelines for Septic Tank Systems", and prepare other guideline documents pertaining to on-site system repairs; small community system design, and the preparation of subdivision wastewater management plans.

3. Modify administrative policies and procedures relating to DNREC review and approval of subdivision plats, requiring more formal approval of subdivision wastewater management plan before recording plat.

4. Modify administrative policies and procedures relating to the issuance of individual sewage disposal system permits and emergency system (i.e. system repair) permits, placing more emphasis on site evaluation to assure the proper application of on-site systems.

5. Establish training and licensing program in order to certify and register persons performing site evaluations.

6. Establish public education and technical assistance programs aimed at homeowners, property owners, developers, private contractors, and DNREC staff to increase awareness of on-site system design and operation requirements.

7. Conduct pilot studies, demonstration projects, and further research studies to support the technical recommendations offered herein.

8. Hire additional staff, as required to implement the program changes being recommended.

For each implementation task presented in Chapter Three, several activities are suggested to carry out various program changes. In general, the changes proposed call for more thorough review of subdivision and septic system permit applications, including a more extensive evaluation of soil condition and other site limitations. Public education and training programs are also proposed to supplement and support the changes in the regulatory program.

CHAPTER ONE

INTRODUCTION AND BACKGROUND

The topic of septic system performance and associated environmental health impacts is receiving considerable attention in Delaware and the Nation. The New Castle County 208 Program, for example, has completed a number of studies addressing both physical and fiscal aspects of septic tank system usage in that County. The Coastal Sussex 208 Study conducted an extensive groundwater sampling study, coupled with analyses of soil suitability, technical wastewater system alternatives, and regulatory programs, for on-site wastewater systems management. The Kent/Sussex Water Quality Program Report No. 8 Rural Wastewater Management emphasized the need for developing preventative solutions to water quality problems associated with septic systems through detailed consideration of technical and institutional alternatives. A recently completed Kent/Sussex Water Quality Program Report No. 10 Septic System Program Analysis and Recommendations contains a detailed discussion of problems and solutions related to septic system program management in Southern Delaware.

The findings and conclusions of these studies, and similar efforts across the country, suggest:

1. The effluent from individual septic systems is a major source of groundwater recharge in some areas; and if on-site systems are improperly designed, installed or maintained they can be a threat to groundwater and surface water quality.

2. The design of septic tank-drain field systems must recognize soil suitability, considering hydraulic capacity, renovative characteristics of the soil, the density of development, and waste loading factors in order for such systems to perform properly.

3. Dense concentrations of individual subsurface disposal systems represent a very serious potential for groundwater pollution, dependent to some degree on local soil characteristics and geology.

4. Although water quality problems associated with on-site systems have been identified by previous studies in Delaware and nationwide, there has been relatively little done to document the specific conditions under which septic systems do fail.

This current study was intended to expand on these basic observations by: (1) investigating the reasons for septic system failure (2) considering changes to the regulations governing the siting, design, operation, and maintenance of on-site systems, (3) evaluating the administrative procedures for reviewing and approving development plans using on-site and small community systems, and (4) commenting on relationships between wastewater facility planning and land use decisions at the state and local levels.

Purpose

The purpose of this study (as stated in the Kent/Sussex Water Quality Program Report No. 10) are to:

1. To analyze the present causes of septic system malfunction and groundwater pollution (as related, for example, to soil type, water table depth, construction practices and housing density) and to determine how present zoning, subdivision, and septic system regulatory programs contribute to these problems;

2. To develop septic system suitability maps and criteria which can be used to avoid building systems in unsuitable areas;

3. To analyze cost effective, alternative means of dealing with semi-rural and small community sewage treatment problems;

4. To recommend the best methods to manage and operate these alternative systems; and

5. To recommend changes to the Water Pollution Control Regulations to assure that new septic systems will operate properly.

This report presents a summary of study findings and recommendations.

Study Approach

The overall project involved four (4) basic tasks. These are:

1. Problem Assessment - investigation of conditions under which septic systems fail.

2. Management Needs Identification - examination and analysis of current administrative practices and legislation affecting the siting, design, and operation of septic systems in Kent and Sussex Counties.

3. Technical and Management Solutions Development - review technical alternatives for wastewater collection, treatment and disposal, and evaluation of options for managing the design, installation and operation of on-site systems.

4. Recommendations - formulation of near-term and long-term program recommendations for DNREC consideration.

Documentation of the results of these tasks are contained in a series of working papers (technical reports and program evaluation reports) organized according to specific topic areas. The highlights of the problem assessment are summarized in this chapter. The results of the remaining study tasks are discussed in terms of Program Management Goals and Objectives (Chapter 2) and Implementation Tasks (Chapter 3) which relate to management needs, technical and management solutions, and final Recommendations. Suggestions for prioritizing the implementation of these recommendations are offered in Chapter 4.

Summary of Problem Assessment

The overall purpose of the problem assessment task is to assess the operational performance of septic systems in the two county area and to investigate conditions under which septic systems fail. This analysis serves as a background for developing technical, administrative and regulatory approaches to solving existing problems with failing septic systems, and preventing future problems. Specific recommendations for improvements in the existing septic system regulatory and administrative programs and regulations (based on the findings of this analysis) are presented in Chapters 2 and 3 of this document.

There are essentially two forms of septic system failure which are of major concern to the analysis of system performance. They are:

1. "Operational failures" that are noticeable or obvious to the homeowner, such as a back-up of sewage into the home or a breakout of effluent onto the surface, and

2. "Water quality" failures that are less obvious (and often go undetected), which result in surface water or groundwater contamination.

Operational failures can generally be attributed to one of three basic problems:

1. A mechanical breakdown or malfunction affecting the septic tank, pipe, distribution box or drain lines (e.g. broken pipes, clogged tank, etc.). This can be caused by improper installation, movement due to settling, inappropriate use of heavy equipment, and the accumulation of solids and grease over time.

2. A reduction in the ability of the drainfield to transmit effluent due to the formation of a film or clogging mat at the interface between the drainfield and the surrounding soils. This can be due to the natural process whereby an organic mat builds up over time, or it can be caused by an overflow of solids or grease from the septic tank. The clogging of the infiltrative surface may be accelerated by overloading the system. This increases the likelihood of solids carry-over from the septic tank, and also prevents the oxidation of the organic clogging mat as long as the drainfield is saturated.

3. An inability of the surrounding soils to carry away the effluent from the drainfield, due to slow permeability, impermeable soil layers or high groundwater.

Water quality failures affecting groundwater quality are generally related to the ineffectiveness of certain soils in providing adequate renovation of wastewater effluent. This type of failure can occur in sandy, excessively well drained soils (which are inherently less chemically active, and do not provide sufficient filtering action to remove bacteriological and chemical constituents in the effluent) or in poorly drained soils with high groundwater (where the effluent is discharged directly to groundwater without passing through a sufficient depth of suitable soil). Another form of water quality failure is the direct discharge of raw or partially treated sewage to a surface water or drainage channel. This results when existing on-site systems are bypassed to correct an operational problem.

The major emphasis of our investigations was on operational failures, in particular those resulting in surface breakouts. Such failures were detected using aerial photographic techniques, and verified by field checking. Household surveys were conducted to document other forms of septic system failure such as sewage back-ups, and slow flushing toilets.

In addition to our analysis, the University of Delaware conducted a groundwater sampling program. Although the data collected does not in itself conclusively establish the presence of groundwater contamination related to on-site sewage systems, many of the samples showed very high nitrate levels. In a few cases the combination of high nitrates and high chloride concentrations strongly suggest contamination by septic tanks. Analysis of the existing data by the University of Delaware indicates that there may be a correlation between septic systems and groundwater contamination. Preliminary results show that "except in isolated cases, bacterial contamination of the groundwater is low. The potential for nitrate contamination from septic tanks, however, may be as great as that from poultry manure or leaching of inorganic fertilizers. There is widespread nitrate contamination of the groundwater table aquifer in Sussex County. In certain areas, septic tanks appear to be the major cause of this contamination."

It is very difficult to address "water quality" type on-site system failures without more specific documentation. Further groundwater monitoring and hydrogeological studies will be required to clarify the link between the use of on-site systems and groundwater quality.

Methodology

The initial step in this investigation was selection of study areas. The following factors were considered in selecting the study areas:

- Existing unsewered residential development
- Soil suitability for septic systems
- History of septic system problems (determined from emergency permits issued)
- Age of housing
- Housing Density
- Occupancy characteristics (i.e. year-round and seasonal dwellings)

Through discussions with the DNREC staff and Technical Advisory Committee (TAC) and field investigations of candidate sites, ten case study sites were selected for analysis. The study areas displayed in Figure 1 represent a mix of residential development settings located on various soil types, and include areas known to have had septic system problems as well as areas not experiencing problems.

The study areas analyzed included the following:

Coastal

1. Pot Nets/White House (Sussex County)
2. Lynn Lee and surrounding area (Sussex County)
3. North Millville (Sussex County)

Non-Coastal

4. Frankford and Dagsboro* (Sussex County)
5. North Shores/Nanticoke Acres/Concord (Sussex County)
6. Hartly (Kent County)
7. Eastman Heights (Kent County)
8. Haven Lake (Kent and Sussex Counties)
9. Houston (Kent County)
10. Felton (Kent County)

Approximately 4,000 individual homes are represented by these ten study areas. Several techniques were applied in the evaluation of system performance in these study areas. They included the following:

- Infrared Aerial Photography
- Homeowner Surveys
- Agency Interviews/Review of Permit Files
- Soil Suitability Analysis
- Detailed Septic System Analyses

1. Infrared aerial photography. The use of infrared aerial photography proved to be an efficient and effective tool for identifying septic system

*Subject of special Pilot Wastewater Management Study

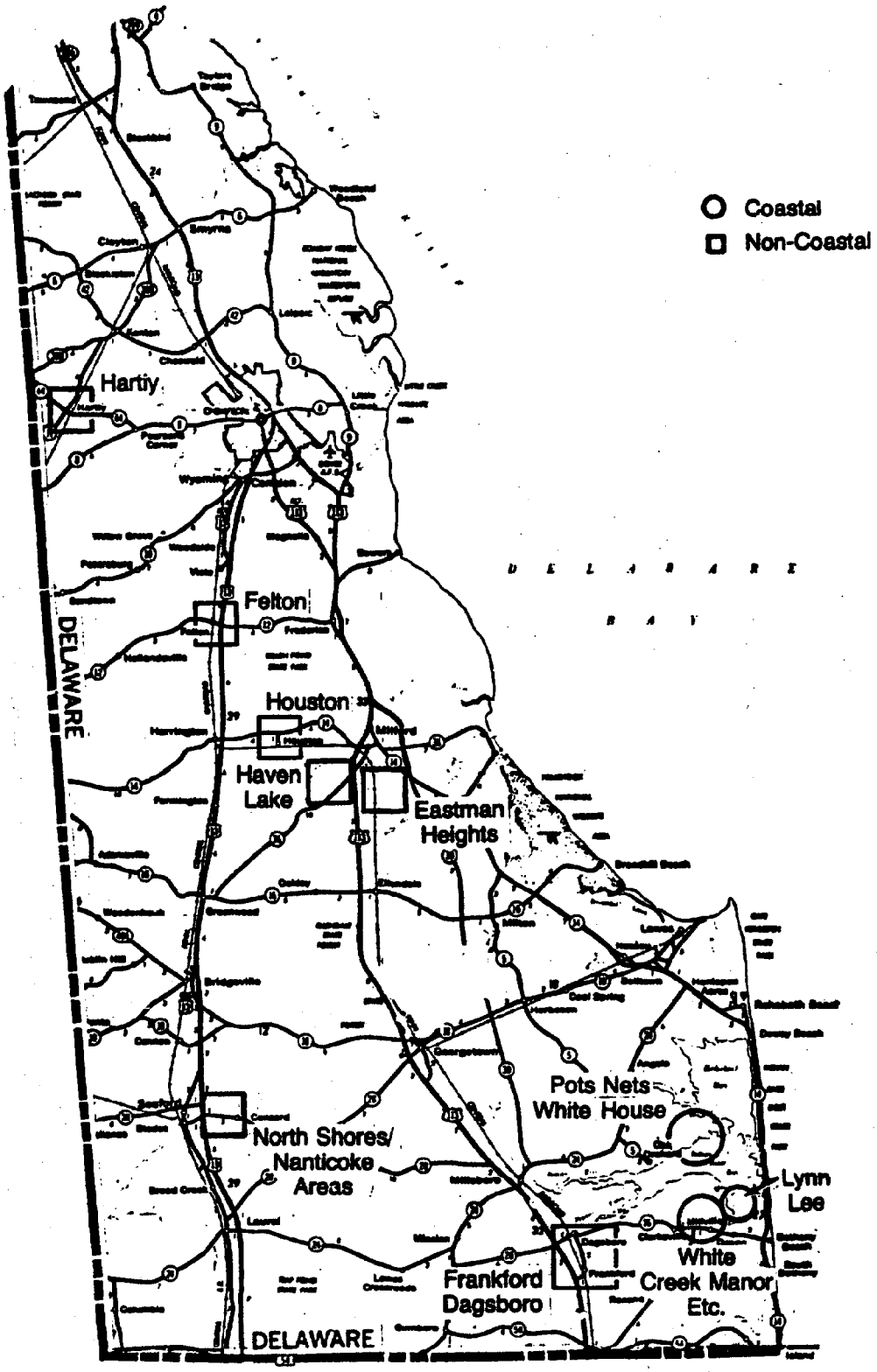


FIGURE I SELECTED STUDY AREAS

(surface) malfunctions. Through this technique, Weston and DSI (subcontractor) were able to identify isolated septic system failures and problem areas (i.e. pockets or groups of individual surface failures). The aerial surveys were done at two different times, in late Spring, 1980 for the Noncoastal areas, and late Summer 1980 for the Coastal Areas. This allowed DSI to analyze septic system failures associated with peak seasonal usage in the coastal areas.

Only those malfunctions that are noticeable on the ground surface can be detected with the aerial photography technique. Therefore, septic system problems in the form of sewage back-up into the home, straight pipe discharges to concealed areas, slow flushing toilets, or water table contamination cannot be detected with this technique. In the photo interpretation procedure, the aerial film was analyzed to identify those manifestations which might be associated with malfunctioning septic systems, such as

- Lush vegetation
- Dead Vegetation
- Standing wastewater or seepage
- Very dark soil

Septic system malfunctions were classified as one of two types: overt failures or marginal failures. Those systems designated as overt failures were having problems with wastewater coming to the surface at the time of field inspection. Those systems designated as marginal failures were not necessarily failing at the time of the inspection, but did exhibit signs of having failed in the past, or having the potential for malfunctioning during periods of excessive use or moderate to heavy rainfall. In addition, several homes were identified as discharging wash water directly into an open ditch. The infrared aerial photography technique was utilized for each of the study areas. The analysis is documented in Technical Report 6 (DSI Subcontractor Reports).

2. Literature Survey. In support of the field work, a survey of studies addressing the incidence of septic system failures, likely causes, and technical and institutional mitigative measures was conducted. The purpose of the literative survey was to help in various phases of the field work and follow-up activities namely:

   - the development of the field work methodology
   - the design and use of a household survey questionnaire
   - the formulation of a system inspection methodology
   - The assessment of technical and institutional options for solving problems with existing failing systems

   A supplemental use of the literature was to compare the results from this analysis in order to evaluate the significance of the findings.

3. Homeowners Survey. Door-to-door surveys of households in six of the ten study areas; Felton, Hartly, Houston, North Millville, Haven Lake and Frankford/Dagsboro, were conducted between July and December, 1980. Questions regarding the age, and type of the homeowner's septic system, maintenance practices and past operational performance of the system were posed in the household surveys. A stratified random sample procedure was applied. First, problem areas identified through the aerial photography and soil suitability analyses were noted. Then, homes having emergency permits were located on a map. The survey procedure itself involved the participation of several survey teams, each made up or one or two people, going door-to-door, within the identified problem areas as well as in residential areas not exhibiting septic system problems. The major problem encountered in performing the surveys in this way was that many of the homeowners were not at home during the day. It was felt, however, that the homeowner and septic system performance characteristics identified

through the survey were representative of the two-county area. Approximately 100 households were surveyed in the five study areas, (excluding Frankford and Dagsboro), using the above described procedure. An additional 159 homes were surveyed in Frankford and Dagsboro as part of the Pilot Wastewater Management Study.

4. Agency Interviews/Review of Permit Files. Interviews with key administrative and enforcement personnel were conducted to better understand their authority, roles and procedures in permitting new septic system installations, responding to complaints of septic system problems, and permitting replacement systems. Several members of the DNREC, Division of Environmental Control were interviewed by Weston. In the Water Resources Section, the Section Manager, the Water Pollution Branch Chief, the State permits Group Leader, and County unit personnel in Kent and Sussex Counties were interviewed. The Enforcement Section manager and Sussex County Environmental Protection Officer were also interviewed. The interviews took place in the early phases of the problem assesment activities, to acquaint enforcement agency personnel with the study objectives and to gain input into the various field work activities.

   Records of emergency permits issued and new system installations within the ten study areas were also reviewed. It should be pointed out, however, that certain limitations were placed on the use of this data. First, the septic systems that have been corrected through the emergency permit process represent only part of the total number of problems with septic systems. Many failing systems have not been corrected and some may have been repaired without obtaining an emergency permit. Also, it is often difficult to locate the applicant's home for follow-up survey.

5. Soil Suitability Analysis. Each of the soils in the two counties was classified as to its suitability for on-site wastewater disposal applications. The process of determining soil

suitability for septic systems involved the interpretation of soils information from the Soil Conservation Service, supplemented with field verifications of soil characteristics at specific sites. A Weston soil scientist (accompanied by soil scientists from the Soil Conversation Service in some cases), analyzed soils characteristics in the field on a site-by-site basis and compared the results with the Soil Conservation Service data to verify the generalized soils data, and to further help to analyze the relationship of soils characteristics to septic system performance.

The soils analysis, itself, was performed through a series of soil borings (using a bucket auger) to a depth of five feet, usually in the vicinity of the septic system drainfield. Detailed notes on soil properties such as soil texture, color, drainage, mottling, and anaerobic conditions were taken at each auger boring site. Approximately, 55 soil borings were taken at 36 locations in Frankford and Dagsboro. Additional soil borings were done at 30 homes (one or two borings per home) in the Hartly, Felton, Haven Lake and North Millville study areas.

The field sampling generally confirmed soil survey data, but also provided additional information on actual soil characteristics (e.g. depth to mottling) which helped classify suitability for on-site systems.

Table 1 categorizes soil types according to soil suitability classes. The soils were classified according to their drainage class, depth to water table, permeability, texture, and depth to mottling. (Mottling is an indicator of drainage problems related to seasonal high water table). Soils in the unsuitable category exhibit characteristics of very poor and poor drainage classes, depth to the water table of 0 to about 2 feet, and generally a moderate permeability. The marginal category include soils moderately well drained, with a depth to the water table of 2 to 5 feet, and a moderate to slow permeability.

Table 1
Soil Suitability for On-Site Wastewater Disposal

Unsuitable	Marginal	Suitable
Bayboro (K)	o Depth to Water Problem	*Evesboro
Berryland (S)	Klej	Kalmia (S)
Elkton (S)	Woodstown	Kenansville (S)
Fallsington		*Rumford
Johnston	o Slow Permeability	Sassafrass
Osier (S)	Keyport	
Othello (K)	Matawan (S)	
Plummer (K)	Mattapex (K)	
Pocomoke	Matapeake (K)	
Portsmouth (S)		
Rutledge (S)		

(K) Kent County Only

(S) Sussex County Only

*These soils are highly permeable and therefore, have a potential for groundwater contamination.

The suitable category includes well and somewhat excessively drained soils, having depths to water table of greater than 5 feet and moderate to high permeability.

The suitable category although exhibiting favorable drainage and depth to water table characteristics, does have the potential for groundwater contamination due to the high permeability of the soils. High permeability in a soil may not allow for a complete renovation of the septic effluent before it reaches the groundwater.

Another common problem with Delaware soils is the shallow depth to water table which contributes to poor drainage. A high water table on a site precludes the filtering action of the soil, and could possibly cause effluent to backup into the system or break out on the surface. The ideal soil for wastewater treatment would exhibit characteristics of being well drained, have moderate permeability, a depth to the water table of greater than 5 to 6 feet, and a medium soil texture. These characteristics should provide acceptable renovation of the effluent.

6. Detailed Septic System Analyses. In conjunction with the field analysis of soils suitability (i.e. the soil borings), and the aerial photography results, detailed inspections of individual septic systems were conducted. The purpose of this final phase of performance analysis was to help gain a better understanding of operating characteristics of both satisfactory and failing septic systems. It was hoped that these investigations would provide sufficient information to determine:

   - the cause of failure (for problem systems)
   - the circumstances that support satisfactory system performance
   - the mitigation measures that would be required to correct problem systems

- the effectiveness and feasibility of periodic on-site system inspections with regulated pumping to improve the operational efficiency of existing systems.

A total of sixteen (16) detailed system inspections were conducted. Thirteen (13) of these were located in Frankford-Dagsboro. The remaining three (3) were located in other parts of Sussex and Kent County. The septic system inspections in Frankford-Dagsboro typically involved the following activities:

- determining the type and age of wastewater system
- locating the components of the system (i.e. the tank, drainfield, etc)
- determining the water use habits and septic system maintenance practices of the household (through the household survey guestionnaire).
- uncovering the septic tank, estimating the amount of the sludge accumulation, tank condition and performance.
- analyzing soil characteristics in the vicinity of the drainfield (via soil borings).
- testing the performance of the drainfield by surcharging the system with water (for about 15-20 minutes) and checking for sluggish flows from the tank to the drainfield, surface breakouts in the drainfield area, and straight-pipe discharges.
- determining (where appropriate) the feasibility of various mitigative measures, such as septage pumping, system repair or replacement.

The Frankford-Dagsboro experience provided a better understanding of system performance characteristics and system improvement feasibility. These investigations also raised certain questions which could not be answered, namely:

- What causes some systems to fail, while others with identical characteristics appear to be functioning adequately?

- How does septic tank effluent migrate in the drainfield and drainfield/soil interfaces?

- Does the pattern of effluent migration vary by soil texture, soil drainage class, or leachfield age or design?

- What impact would water conservation measures or wastewater evaporation, or increased septage pumping frequency have on a system's operational reliability?

More intensive on-site system investigations were conducted in an attempt to address some of these unanswered questions. Three (3) failing septic systems were investigated; one in Voshell's Cove (Kent County), one near Camden (Kent County) and another in the North Millville area (Sussex County). A variety of septic system problems and soil characteristics were represented, but it is still not possible to answer all the questions raised earlier based on only three inspections.

The system investigation process applied in these three cases was more comprehensive than the methods used in the Frankford-Dagsboro system inspections.

- Each system component was located and staked out.

- Several soil borings were done in and around the drainfield.

- The condition of the septic tank was checked, and sludge accumulations were measured.

- The household tap water was analyzed for bacterial contamination.

- Deep excavations near the drainfield were dug (using a back-hoe) to observe soil characteristics, and detect signs of effluent migrating outward from the drainfield.

This final series of system investigations also provided an effective forum for discussing the actual application of design theory and soil dynamics among the homeowners, State administrative and regulatory personnel, and project team members (i.e. WESTON technical staff). The system investigations also helped to demonstrate the need for performing more inspections of this

type in order to better define the causes of different on-site system problems, and to develop preventive and corrective solutions.

Findings

From the assessment of septic system performance in the ten study areas, the following conditions were found to be common:

1. Many septic systems have been installed in soils that are classified as "unsuitable" for septic systems. We have found, for example, that many subdivisions have "pockets" of poorer soils interspersed among suitable and marginal soil types. In most cases, no attempt is made to avoid these unsuitable areas in laying out subdivisions. This problem is compounded by the fact that percolation test results appear to be misrepresented in some cases.

2. Many septic system drainfields appear to be underdesigned or too small to handle the wasteloads. The problem of underdesigned systems is most prevalent in areas where seasonal homes predominate. A septic system may be adequate for transient use during the summer months, but can become overloaded when used on a permanent basis. The continued conversion of homes from seasonal to permanent use will most likely contribute to an increasing number of system malfunctions and straightpipe discharges to streams, canals, and dikes.

   Another condition that results in an underdesigned system is where a builder applies for a septic system permit for a small home (e.g. two-bedroom house), but builds a larger home (e.g. three or four bedroom house). Since the size of the drainfield is a function of the number of bedrooms, a small system could be installed to serve a large home.

   A related problem is when a small home is occupied by a large family. Here, again, the number of bedrooms serves as an approximation of expected wasteloads, but as home ownership is transferred from one family to another, additional living space can be added to the home without increasing the capacity of the septic system.

The falsification of percolation test data can also result in undersized systems, since absorption area is a function of percolation rate according to existing regulations.

3. There are many substandard systems currently in use, which have the potential for malfunctioning. A substandard system is a privy or a cesspool, which cannot be installed under current regulations. Therefore, where cesspools or privies are in use, they have either been installed prior to the passage of the regulation or have been installed without a permit. Many of the older homes have cesspools, and once the system begins to fail, a straight pipe to a nearby ditch is a common solution.

4. Septic systems on small lots are common. While most systems appear to be operating without surface breakouts, there exists a significant potential for contamination due to the loading of septic effluent from a large number of septic systems in densely populated areas. Small lot sizes also limit the availability of sufficient replacement areas on-site, if and when the system fails.

5. Existing regulations and administrative procedures do not place appropriate emphasis on site evaluation. The present septic system regulations and administrative procedures do not allow for sufficient analysis of soil characteristics in determining the suitability of a site for a septic system. Relying on the percolation test, in itself, does not provide sufficient information to determine site suitability. Analyses of soil texture, drainage class and depth to mottling through soil borings or observation pits is necessary to make a proper determination of site suitability and select an appropriate system.

6. The regulation of septic systems does not consider groundwater management concerns. The emphasis in assessing rural wastewater problems and mitigative measures should begin to shift from the analysis of septic system performance

(which was the main focus of this study) to the evaluation of the incidence of groundwater contamination from septic systems and the evaluation of groundwater quality protection and enforcement methods. Certain key decisions about minimum lot sizes, water supply and wastewater service needs, and the use of alternative septic system need to be tied to groundwater quality management policies, as well as public health concerns. The data available at this time does not allow a complete assessment of groundwater quality implications related to the use of on-site wastewater systems.

The results of this study have documented the existence of several different types of on-site system problems in Delaware, specifically in Kent and Sussex Counties. These problems relate not only to deficiencies in septic system design and installation by individual homeowners and private contractors, but also to the failure of DNREC to fully enforce existing regulations and standards governing on-site systems. Recommendations for improving the current regulations and administrative practices are outlined in the two chapters that follow.

CHAPTER TWO

GOALS AND OBJECTIVES OF THE DELAWARE RURAL WASTEWATER MANAGEMENT PROGRAM

The previous discussion of findings suggests various goals and objectives for the Delaware Rural Wastewater Management Program. These program goals and objectives encompass a broad spectrum of regulatory and administrative requirements for managing rural wastewater systems. A total of seven (7) program goals have been formulated; each having several specific objectives. Each goal addresses a major aspect or component of the rural wastewater management program. Objectives are action items, which when accomplished, represent specific steps toward achieving the desired end point or goal.

The remainder of this chapter describes the goal statements and lists specific objectives associated with each. The next chapter will identify how each objective should be carried out.

GOAL 1:

TO ASSURE THE PROPER APPLICATION OF WASTEWATER SYSTEMS IN NEW SUBDIVISIONS.

A common problem identified through the problem assessment and in DNREC 208 Report No. 10 is that the preparation of subdivision plats does not sufficiently address the suitability of soils for various types of wastewater systems. Consequently individual lots are platted without sufficient regard for their ability to satisfy physical requirements (i.e. soils, water table conditions, etc.) for on-site system locations, design and performance. In many cases the individual lots are sold to private owners before the septic system permit is applied for. At this point it is too late to adjust lot lines, if necessary to provide an area with suitable soils for the on-site system. The intent of this program goal is to give adequate consideration to the suitability of various wastewater systems (in concert with local development standards) during the subdivision review process, in order to avoid a potentially difficult regulatory situation, in cases where an individual lot within a platted subdivision is determined to be unsuitable for on-site sewage disposal systems.

The specific objectives of this program goal include;

OBJECTIVE 1: Review Wastewater Management Plans for all subdivision proposals.

OBJECTIVE 2: Improve the procedure for conducting site evaluations for new developments by emphasizing the role of on-site soils evaluation in conducting suitability determinations, using the soil suitability maps to screen subdivision applications for potential problems.

OBJECTIVE 3: Encourage the use of appropriate alternative wastewater systems based upon the results of adequate site evaluations.

OBJECTIVE 4: Require that no subdivision be platted without a DNREC approved Wastewater Management Plan.

OBJECTIVE 5: Coordinate subdivision review procedures and analyses conducted during the subdivision review process with developers, subdividers, local planning and zoning commission, local governing bodies, and other concerned agencies.

OBJECTIVE 6: Develop uniform design criteria and evaluation procedures for conducting subdivision feasibility studies.

OBJECTIVE 7: Review all platted, but unbuilt subdivisions, and notify lot owners, developers and subdividers of potential problems in obtaining individual septic system permits (due to small lot size or unsuitable soils).

GOAL 2:

TO ASSURE THAT NEW INDIVIDUAL (ON-SITE) SYSTEMS ARE PROPERLY DESIGNED AND INSTALLED.

Promoting the long-term use of on-site systems requires careful consideration of site evaluation, system design and system installation activities. It is very important that adequate site evaluation criteria and design standards, based upon soil properties, hydrology and expected wastewater use, be adopted.

It is equally important that proper site evaluation and system installation practices be encouraged.

In response to this major program directive, the following objectives offer suggestions for placing greater emphasis on soils evaluations and complementary supervisory actions related to system design and installation:

OBJECTIVE 1: Modify the current procedure for conducting site evaluations by: (1) certifying soil evaluators, and (2) performing a more thorough assessment of soil suitability as a basis for system design, (3) abandoning the use of the percolation test as the principal indicator of site suitability for septic systems, and (4) prohibiting lot owners from performing their own site tests.

OBJECTIVE 2: Evaluate, select, and design alternative wastewater systems based on the results of adequate site evaluations.

OBJECTIVE 3: Establish design standards and criteria for encouraging uniform application of alternative wastewater for individual lots.

OBJECTIVE 4: Provide for more thorough inspection of system installations and issue an occupancy permit as a final approval.

GOAL 3:

TO CONSIDER ALTERNATIVE SOLUTIONS IN THE EMERGENCY PERMITTING PROCESS.

A failing septic system can be the result of several circumstances; including unsuitable soils, improper installation, substandard or inadequate design, excess water use or lack of maintenance. The process of issuing an emergency permit to correct a failing system should attempt to identify the particular cause of system failure, and prescribe an appropriate solution to correct the problem. In many instances it will be necessary to examine alternative wastewater systems to overcome restrictive site limitations (such as small lot size or marginal soils). In any case, cooperation from the homeowner is necessary to ensure that an acceptible and reliable remedy is found. The objectives that are listed below address these administrative and technical concerns in correcting failing septic systems:

OBJECTIVE 1: Encourage voluntary compliance (i.e. correction of problem) through a one-to-one interaction between DNREC County Unit staff and the homeowner.

OBJECTIVE 2: Consider alternative technologies in correcting failing systems through the involvement of the DNREC County Units and the State Permit Group.

OBJECTIVE 3: Perform thorough site inspection, including soils evaluation and system inspection, to determine cause of failure.

OBJECTIVE 4: Require pre-construction and pre-cover-up inspections (at a minimum) for all emergency permit applications to assure proper installation.

OBJECTIVE 5: Modify the role of the EPO in the emergency permit program. The EPO should be called upon to enforce a pollution abatement actions only after all efforts at voluntary compliance have been exhausted.

GOAL 4:

ENCOURAGE THE PROPER OPERATION AND MAINTENANCE OF NEW AND EXISTING ON-SITE WASTEWATER SYSTEMS.

In addition to procedures for ensuring proper site evaluation design and installation, it is necessary to provide a means for proper system operation and maintenance. It is recognized by many experts in the field of septic systems management that, through proper maintenance, septic systems can operate satisfactorily for up to 30 to 50 years. Providing adequate operation and maintenance for septic systems requires the involvement and cooperation of individual homeowners.

The following objectives highlight the legislative, administrative and educational requirements of developing an adequate operation and maintenance program.

OBJECTIVE 1: Provide information for homeowners on recommended procedures for operating and maintaining rural wastewater systems.

OBJECTIVE 2: Identify acceptable public and private entities which can provide wastewater system operation and maintenance services in Delaware, and determine if these entities have adequate legal authority to provide these services.

OBJECTIVE 3: Provide technical assistance and guidance in establishing rural wastewater management districts.

OBJECTIVE 4: Consider methods for mandatory wastewater system maintenance (e.g. maintenance or occupancy permits, presale inspections, or formal system maintenance programs for individual and community systems).

GOAL 5:

TO PROVIDE A MECHANISM FOR ASSURING A SAFE HOUSING DENSITY WHERE INDIVIDUAL SUBSURFACE WASTEWATER DISPOSAL SYSTEMS ARE APPLIED.

The density of on-site systems is an issue that deserves special attention in this rural wastewater management study, as well as in more comprehensive studies of groundwater management. As indicated in the DNREC 208 Report No. 10, and in recent EPA publications on groundwater management, the density of housing (as well as proper septic system siting, design, installation and maintenance) is an important consideration in protecting groundwater resources from contamination by septic system effluent. Even a properly operating septic system may pollute groundwater, since soils remove only part of the contaminants found in septic tank effluent. While it is recognized that septic system density is an important topic, there are only a few state or local entities in the nation that have instituted regulations and programs to protect groundwater quality by controlling septic system density. To do so requires quantitative analysis of the complex relationship between hydrology, soils, geology and land use, which is difficult to perform given the current state-of-the-art in impact assessment technology.

The following objectives outline a suggested approach to assuring reasonable housing density as a means of protecting groundwater quality:

OBJECTIVE 1: Require that every lot in proposed subdivisions (to be served by on-site systems) and individual lot applications include a set-aside area providing for the disposal area, replacement area and buffer zone.

OBJECTIVE 2: Groundwater management studies should be initiated to identify priority groundwater management protection areas and further develop appropriate minimum density standards.

OBJECTIVE 3: Consider requiring cumulative impact studies be prepared for any proposed large subdivision relying on individual subsurface disposal systems.

GOAL 6:

TO PROVIDE A MEANS FOR PREPARING AREAWIDE RURAL WASTEWATER MANAGEMENT PLANS TO DETERMINE THE BEST METHODS FOR CORRECTING EXISTING WASTEWATER DISPOSAL PROBLEMS AND AVOIDING RELATED PROBLEMS IN THE FUTURE.

Correcting septic system problems on an areawide (i. e. community) basis has traditionally been accomplished through 201 Facility Plans, financed by the EPA Construction Grant Program. Sponsors for such studies in Southern Delaware have been incorporated towns and counties (on behalf of incorporated and unincorporated areas). Areas that have not yet had plans of this type prepared include the less-populated incorporated areas and the rural unincorporated areas. The State of Delaware, unlike some of its neighboring states, does not have a mechanism for requiring incorporated municipalities and counties to conduct facility planning studies where there appears to be a need for improved wastewater service. In Delaware, the local municipality must voluntarily apply for "201" grant before such planning can begin.

Existing mechanisms for initiating a wastewater facility planning study to investigate methods of correcting septic system related problems and/or to develop strategies to avoid such problems in the future are limited to the designation of sanitary sewer districts in each county. Planning areas designated through this procedure are largely a result of local initiative, and concern over an existing or potential pollution problem. Relying on local initiative alone in the future may not be sufficient to properly address areawide septic system problems.

Program objectives formulated to address the need for areawide facility planning include:

OBJECTIVE 1: Conduct areawide sanitary surveys (i.e. community surveys) to determine the need for facility planning.

OBJECTIVE 2: Develop a method for establishing facility planning boundaries that recognizes the extent of problem areas and the logical service area requirements for wastewater systems management.

OBJECTIVE 3: Establish the necessary legal authority, administrative procedures and financial and technical assistance necessary to carry out wastewater management plans in areas of need.

OBJECTIVE 4: Incorporate rural wastewater management concerns and related non-point source pollution concerns into comprehensive groundwater management and septage management strategies.

GOAL 7:

TO ASSURE THAT ALL PERSONS INVOLVED IN WASTEWATER SYSTEM EVALUATION, DESIGN, INSTALLATION AND MAINTENANCE ARE TECHNICALLY QUALIFIED AND CAPABLE OF PERFORMING THESE TASKS.

Septic system installers, soil evaluators, septage pumpers, state agency personnel and the individual homeowner must be made aware of proper management practices for siting, designing, installing and maintaining septic systems. For some of these persons, particularly the soil evaluators and agency personnel, training and certification programs may be necessary to fully ensure competence in making critical judgements regarding site suitability and appropriate technology. Most homeowners are not familiar with septic system management requirements, especially site suitability and maintenance needs. As pointed out in DNREC Report No. 10, this lack of information can result in the purchase of property unsuitable for septic system operation; or it can result in neglect or abuse of the septic system. The homeowner can be left with a serious malfunction problem which can be costly to repair. More importantly, the regulatory agencies and the private sector may not be equipped with the essential information and technical knowledge necessary to solve many of the septic system problems or overcome restrictive site conditions.

The intent of this final program goal, therefore, is to provide the necessary information to all persons involved in septic system management through carrying out the following objectives:

OBJECTIVE 1: Establish a training program to educate DNREC personnel in soil interpretations for septic systems, septic system design practices, and the application of alternative wastewater systems.

OBJECTIVE 2: Establish a training and licensing program for private individuals involved in soil investigations (i. e. Certified Soil Evaluators). Provide for periodic re-examination, license revocations and fines.

OBJECTIVE 3: Establish a training and educational program for wastewater system installers and septage hauling.

OBJECTIVE 4: Prepare easily understood guidelines to describe steps and procedures developers and system designers should follow in evaluating and selecting wastewater systems.

OBJECTIVE 5: Develop a brochure presenting common information and advice on wastewater system operation and maintenance aimed at the homeowner and potential property buyer.

OBJECTIVE 6: Encourage (or require) all potential lot owners to investigate site suitability before they buy.

OBJECTIVE 7: Keep all concerned governmental agencies, realtors, developers, soil evaluators, installers, etc. informed of changes in guidelines and policies.

OBJECTIVE 8: Make soils maps and soil interpretations available to all individual system and subdivision plat applicants.

CHAPTER THREE

IMPLEMENTATION TASKS

This chapter of the report outlines the steps necessary to achieve the program goals and objectives described in the previous chapter. The presentation of implementation tasks consists of a discussion of the legislative, technical and administrative actions and activities that would be required to implement an improved rural wastewater management program. The program changes recommended involve the following major implementation tasks:

1. Amend Legislation Pertaining to the Regulation of On-Site and Small Community Wastewater Systems.

2. Amend Guidelines for Septic Tank Systems.

3. Prepare Guidelines for the Repair or Alteration of On-Site Systems.

4. Prepare Guidelines for Small Community System Design.

5. Prepare Guidelines for Subdivision Wastewater Management Plans.

6. Modify Administrative Procedures Relating to Subdivision Review.

7. Modify Administrative Procedures Relating to Individual System Permitting.

8. Modify Administrative Procedures Relating to Emergency System Permitting.

9. Establish Training and Licensing Program for Soil Evaluators.

10. Establish Public Education and Technical Assistance Programs.

11. Conduct Pilot Studies, Further Research etc..

12. Hire Additional Staff.

The following discussion of specific recommendations is organized according to these major tasks.

TASK 1: AMEND LEGISLATION

The recommendations made in this section specify modifications to Water Pollution Control Regulation No. 2, which governs the installation and operation of septic tank disposal systems, and or amendments to the State Code.

1.1 Require DNREC approval of wastewater management plan before a subdivision can be platted (goal 1, objective 4).

Current state legislation does not require a DNREC-approved wastewater management concept plan before final plat recording. As a result, subdivisions can be approved and recorded even though DNREC has recognized that site limitations may exist.

It is recommended that DNREC review and approval of wastewater management plans be required as a prerequisite to final approval of subdivision plats by the local government. This requirement is compatible, in concept, with current subdivision ordinance provisions in Kent County. Implementation of this recommendation may necessitate enactment of special local legislation (i.e. ordinance or resolution). Even without such local laws DNREC could enforce such a policy by requiring an approval subdivision wastewater management plan be on file before issuing individual permits.

1.2 Eliminate the requirement for at least one percolation test for individual lot applications, and require that permeability be determined through soil texture evaluations (goal 2, objective 1).

The current state regulations rely on the percolation test and a single soil profile for determining site suitability for individual systems. This method is not sufficient in itself to adequately determine soils suitability for a septic system. The validity of percolation test results are often suspect due to non-uniform testing procedures and falsification of data. It is recommended that the procedure for determining site suitability be based on a soils evaluation performed at the site in question by a soils scientist or certified soils evaluator (see Implementation Task No. 9). In most cases, this would require several hand auger borings, with test pits being optional. This recommended procedure is described more fully in Implementation Task No. 7; Modify Administrative Procedures relating to Individual System Permitting.

1.3 Prohibit property owners from performing site evaluations (goal 2, objective 1).

Section 205 of Water Pollution Control Regulation #2 requires the "seal and signature of a professional Engineer on a plans, specifications and percolation tests submitted on a septic system permit application". It also states, however, that this requirement may be "waived for a single or two (2) family home if the property owner submitting plans can demonstrate proficiency in conducting percolation tests".

It is recommended that site evaluations be performed only by certified soil evaluators. These activities should be done by trained individuals; soil evaluators. These are persons with training in soils science, geology, engineering, and related environmental descriptives whom have satisfactorily passed a certification exam and training course offered by DNREC (see Implementation Task 9). The role of the soil evaluator is further explained in Implementation Task 7.

1.4 Prepare enabling legislation for on-site system management agencies (goal 4, objective 2).

In the State of Delaware, sanitary sewer districts, sewer authorities incorporated towns, and county governments have adequate authority to manage conventional and alternative sewerage collection systems. The authority for the management of individual onsite systems in this state is not well defined. It is recommended that specific legislation be adopted to either (1) allow existing sewerage management agencies to assume on-site management duties, or (2) create a new management entity with adequate authority to set up and operate an on-site management program for a town or unincorporated area. Such legislation will help to promote the implementation of local on-site management programs.

1.5 Provide for occupancy permit tied to final inspections of on-site sewage disposal system (goal 4, objective 4).

According to Section 208 of Water Pollution Control Regulation #2, "after the issuance of the certificate of approval and the construction or alteration of the system, the septic tank sewage disposal system shall not be covered with back fill until the installation is inspected and approved (by DNREC)." In many cases systems are covered without a DNREC inspection. The occupancy permit would represent the necessary final approval that a property owner must have to occupy the home. This requirement would help to strengthen the permitting process, since the final approval would signify that all procedures have been properly

complied with, and that the installed system meets all DNREC standards for site evaluation, system design, system location and system installations.

1.6 Require site suitability analysis prior to land purchase, (goal 8, objective 6).

Many existing and potential land owners will find themselves in a frustrating situation when they realize their lot is unsuitable for septic systems. They may be told they cannot build or they may be advised that an expensive alternative system is necessary.

It is recommended that Subchapter II, Chapter 60, Title 7, Delaware Code be amended by adding a new section 6033 to prevent the sale of undeveloped lots unless satisfactory soil conditions are documented whenever individual subsurface disposal systems are to be used.

It is further recommended that the soil conditions of the lot satisfy the "standards" proposed in this report (as discussed under Implementation Task 2) rather than current minimum standards.

1.7 Provide specific authority for DNREC to require counties and incorporated towns to correct widespread problems with existing on-site systems (goal 6, objective 3).

The DNREC currently has legal authority to force individual homeowners to correct individual septic system problems. However, there does not exist any specific legal authority for DNREC to require municipality (i.e. a county or incorporated town) to prepare a plan and implement appropriate actions to solve existing pollution problems. The state should investigate the applicability and feasibility of adopting various legal methods such as cease and desist orders, orders to form sanitary districts, and directives to initiate facilities planning in order to place the responsibility of correcting septic system problems on the "town" or "county" (i.e. the responsible local level of government); and not on the individual homeowner.

1.8 Eliminate the 1250 gal/acre/day density limitation. Until specific criteria are developed under a groundwater management program (see Implementation Task II) require that an adequate disposal area be set-aside for individual lots (goal 5, objective 1).

The current method of determining lot size is ambigious and susceptible to various interpretations. The lack of certainty and definition of precise methodology creates confusion among applicants and DNREC personnel in applying the rule. In researching this density issue, documentation of the technical basis for the 1250 gal/acre/day rule could not be found, and specific guidelines for applying the rule for residential and commercial applications do not exist.

It is therefore recommended that the regulations be amended to eliminate the specific requirement for the 1250 gal/acre/day density limitation. In its place, a buffer area or set-aside requirement for individual lots should be adopted. This could be modelled after the State of Maryland "minimum ownership" requirement. The Maryland regulation requires a minimum area of either 10,000 square feet or 20,000 square feet (depending on percolation rate) to be set aside for the septic system and replacement area. According to Maryland regulations, minimum areas should be free of buildings, other impervious surfaces or permanent or physical objects that may inhibit septic system performance. Distances to water supplies, and streams are also specified in the regulations.

While the concept of minimum area set-aside may be admininistratively easy to implement, it does not directly respond to the water quality implications of long-term septic system use. It does, however, offer an indirect method of controlling system density without specifying a minimum lot size. Further studies of groundwater management will be necessary to develop a more effective method of protecting groundwater resources and assuring septic system performance through controlling housing density. Without the technical justification such studies would provide, DNREC should not attempt to directly regulate housing density (i.e. lot size) since this conflicts with local land use planning authority.

TASK 2: AMEND GUIDELINES FOR SEPTIC TANK SYSTEMS

The recommendations made in this section address changes to "Guidelines for Septic Tank Systems", prepared by the Water and Air Resources Commission, State of Delaware (circa 1967).

2.1 Change title to "Guidelines for On-site System Design".

It is suggested herein that the guidelines should be modified to provide design guidance on the use of various "alternative" systems, as well as for the standard septic tank system. The title should therefore refer to "On-Site Systems" in general rather than to "Septic Tank Systems".

2.2 Specify site evaluation procedures (goal 2, objective 1).

The proposed procedure for conducting site evaluations to determine septic system suitability places greater emphasis on soils analysis. It is further proposed that certified soil evaluators conduct site suitability evaluations (see Implementation Task 7).

The soils investigation, which should be described in the amended guidelines, should result in a complete description of the soil profile including the following information:

1. Identification of soil horizons with vertical measurements of depth and thickness.

2. Description of soil texture, structure and color properties for each horizon.

3. Indications of disturbed soils.

4. Indications of seasonal high groundwater (i. e. mottling) with vertical measurement of depth and description of coloration.

5. Depth to existing water table.

6. Indications of fragipan, clay layer, or other conditions that may restrict downward movement of water.

Figure 2 displays the general procedure for performing the site suitability analyses. This procedure should be included in the revised guidelines.

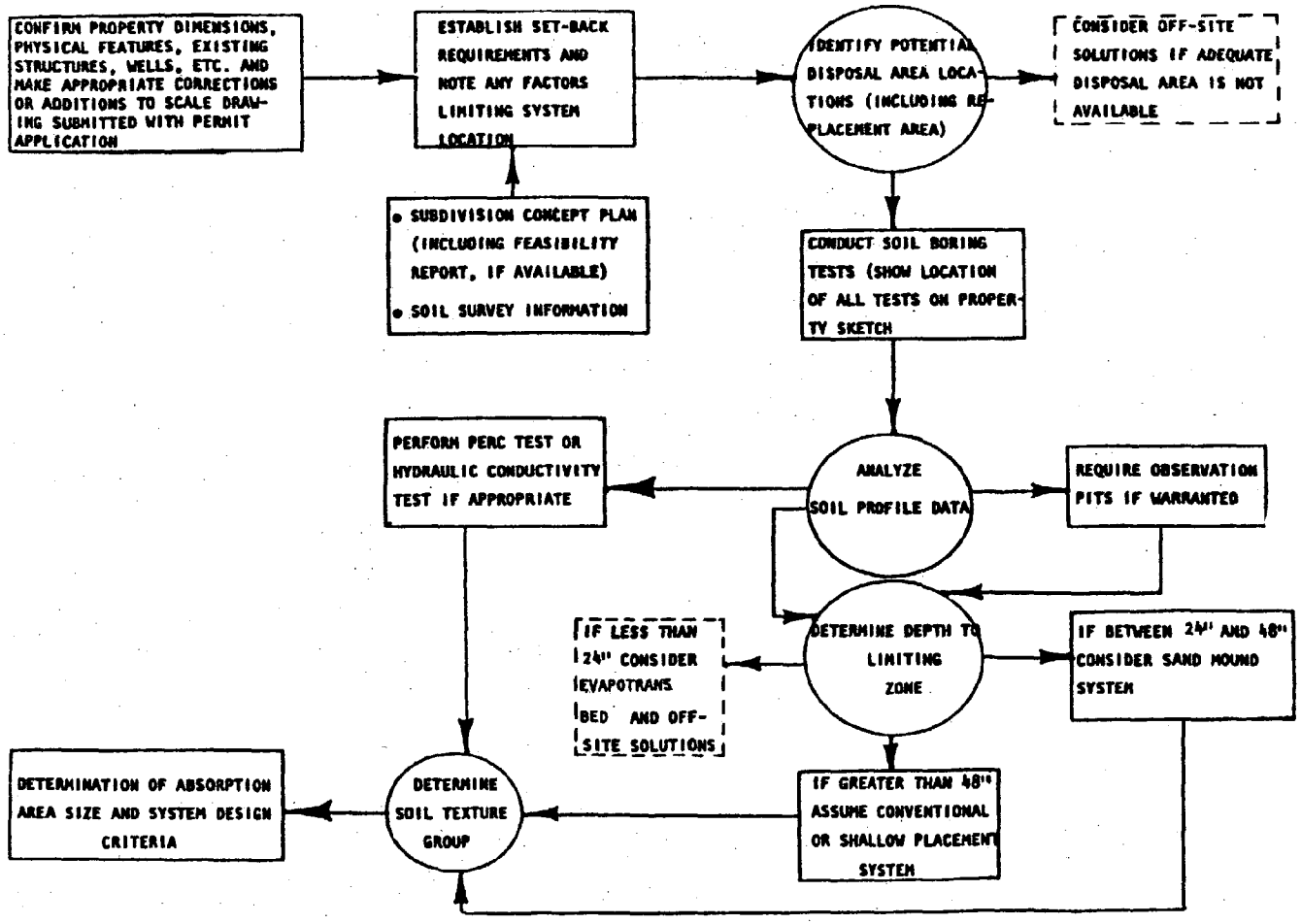


FIGURE 2 - SITE EVALUATION PROCEDURE

DETERMINATION OF SITE SUITABILITY AND SYSTEM DESIGN PARAMETERS

2.3 Provide guidance on selection of appropriate wastewater systems (Goal 2, Objective 2).

The interpretation of soils characteristics for site evaluation (just discussed in Task 2.2) provides a more direct method for selecting appropriate wastewater systems for a given site. As shown in Figure 2, soil texture and depth to limiting zone are major parameters for selecting and designing a system. A limiting zone is any condition (e.g. seasonal high groundwater or impermeable soil layer) that prevents or severely restricts the downward movement of effluent. Soil texture refers to the relative proportion of sand, silt and clay found in a given soil sample. Soil permeability and its capacity for accepting effluent can be defined on the basis of soil texture. Table 2 shows the basic types of alternative wastewater systems recommended under various limiting zone conditions. Table 3 shows the appropriate technology associated with soil texture groups. These illustrations in conjunction with Figure 2 represent the type of technical information that should appear in the amended guidelines.

2.4 Suggest design criteria and design examples for alternative systems (Goal 2, Object 3).

Field interpretations of soil texture and limiting zone conditions should also be relied on to establish system design parameters. By assigning typical permeability ranges to soil texture groups, as shown in Table 4, certain design parameters such as absorption area size can be established. This information along with the sizing factors by soil texture group, in Table 5, yield absorption area requirements for a particular soil texture groups, under different household size classifications.

Aside from basic design criteria (i. e. minimum depth to limiting zone, absorption area requirements, etc.), the Guidelines should include standard or minimum specifications for at least the following design parameters:

- material specifications for pipe, sand fill, gravel, etc.
- construction standards (e.g. thickness of septic tank walls)
- trench and bed dimensions
- required depth of gravel and/or sand fill

TABLE 2

Depth to Limiting Zone	Conventional Bed or Trench	Shallow Placement	Elevated Mound	ET-Bed or Off-Site Treatment
0" - 24"	N/A	N/A	N/A	OK
24" - 48"	N/A	N/A	OK	OK
48" - 60"	N/A	OK	N/A	OK
60" +	OK	OK	N/A	OK

NA - Not Appropriate

OK - Acceptable

TABLE 3

Texture Group	Appropriate Technology	Special Requirements
I	SLT or SLB, AT, DNIT, DISINF	Possible density limit, lot size restriction, or buffer area requirement
II	CONV. SYS., ALTBED, DOSING	-----
III	CONV. SYS, ALT BED, DOSING	Special construction practices to avoid compaction and smearing
IV	ET, WS, HT, OFF-SITE	Special technical review of all proposed designs

CONV. SYS - Conventional System
SLT/SLB - Sand lined trench or bed
AT - Aerobic Treatment unit
DNIT - Denitrification
DISINF - Disinfection
ALT BED - Alternating drainfields allowing periodic resting
DOSING - distribution system using siphon or pressure dosing
ET - Evapotranspiration system with sealed botton (i.e. no subsurface discharge)
WS - Waste separation (i.e. blackwater-greywater systems)
HT - Holding tanks
OFFSITE- Off-site treatment (e.g. small community systems)
ALT BED - UNDERLINING SIGNIFIES STRONG RECOMMENDATION

TABLE 4

SOIL TEXTURE GROUPS

TEXTURE GROUP	DESCRIPTION	USDA SOIL TEXTURE CLASSES INCLUDED	TYPICAL PERMEABILITY RANGE (MPI)	
I	Sandy Soils	Sand Loamy Sand	Less than 15	Most Permeable
II	Sandy Loam/ Loam Soils	Sandy Loam Loam	15 - 45	↑
III	Silt Loam/ Clay Loam Soils	Sandy Clay Loam Silt Loam Silt Silty Clay Loam Clay Loam	45 - 100	↑
IV	Clay Coils	Sandy Clay Silty Clay Clay	100+	Least Permeable

TABLE 5

Texture Group	Permeability Range (MPI)	Loading Rate Suggested by U.S.EPA Manual gpd/ft^2	Existing DNREC Requirement	Recommended Loading Rate	Recommended Sizing Factor ft^2/gpd
I Sandy Soils	15	1.2	.8-2.2	1.0	1.00
II Sandy Loam/Loam Soils	15 - 45	.5 - .6	.5- .8	.6	1.66
III Silt Loam/Clay Loam Soils	45 - 100	.2 -.45	NS	.4	2.50
IV Clay Soils	100+	.2	NS	NS	NS

- pipe diameter and installed gradient (slope of pipe)
- pump type, operating pressures, etc. for pump systems
- layout design for distribution pipe systems (conventional and pressurized)
- dosing volumes
- site preparation procedures

This information might be presented in the form of standard design examples (i. e. sketches and design drawings) for the different types of alternative systems. It is important to design the Guidelines so that the technical information is presented clearly in a form that can be readily used by the system designer.

Special design requirements and/or guidance for system installations should also be specified in the amended Guidelines. For example, as shown in Table 3, special emphasis should be placed on proper construction practices in the Soil Texture Group III, since these are susceptible to smearing and compaction.

2.5 Modify requirements for installation inspections (Goal 2, Objective 3).

In conjunction with the proposed legislative changes (i. e. the occupancy permit requirement suggested in Task 1.5), any changes affecting property owner responsibilities for notifying DNREC staff for pre-cover-up inspections should also be specified in the amended Guidelines. DNREC should also consider requiring more than just the pre-cover-up inspection in order to assure proper installation at critical phases of construction (i. e. site preparation/excavation, absorption area construction, piping system/distribution system installation, and system hookup).

2.6 Require set-aside areas for drainfield replacement area and buffer zone (Goal 5, Objective 1).

As mentioned in the discussion of Task 1.8, relating to modification of the density restriction, the adopted set-aside rule should be explained as it pertains to new system installations in the amended Guidelines.

TASK 3: PREPARE GUIDELINES FOR THE REPAIR OR ALTERATION OF ON-SITE SYSTEMS

These recommendations involve the preparation of a new set of guidelines concerned solely with the alteration or repair of on-site systems. It is recommended that these guidelines be prepared separately from the On-Site System Design Guidelines.

3.1 Outline emergency permit application requirements (Goal 4, Objective 1).

Emergency permits are issued to homeowners to correct a failing septic system. These new guidelines should describe the basic requirements for site evaluation, system design and installation, which the homeowner, system installer and soil evaluator must follow. These guidelines should make clear each individual's role and responsibilities, and identify required information to be provided.

3.2 Present technical options (i. e. alternative technologies) with design criteria as appropriate (Goal 3, Objective 2).

Table 6 presents technical solutions to common on-site problems. The range of technical solutions should be discussed and explained in the new guidelines. Specific design requirements should be specified (e. g. depth to limiting zone, land requirements, etc.) with reference to the On-Site System Design Guidelines as appropriate.

3.3 Require more extensive site investigation to determine cause of problems, and require better documentation in permit files (Goal 3, Objective 2).

An analysis of information contained in the emergency permit files was conducted as part of this study. It was determined from a review of permit data that insufficient information was shown on the permit application to identify the reasons for the septic system malfunction, the age of the system, household characteristics, etc. The new technical guidelines should describe the type of information to be collected in investigating the cause of a septic system problem. The discussion under Implementation Task 8, Modify Administrative Procedures, contains

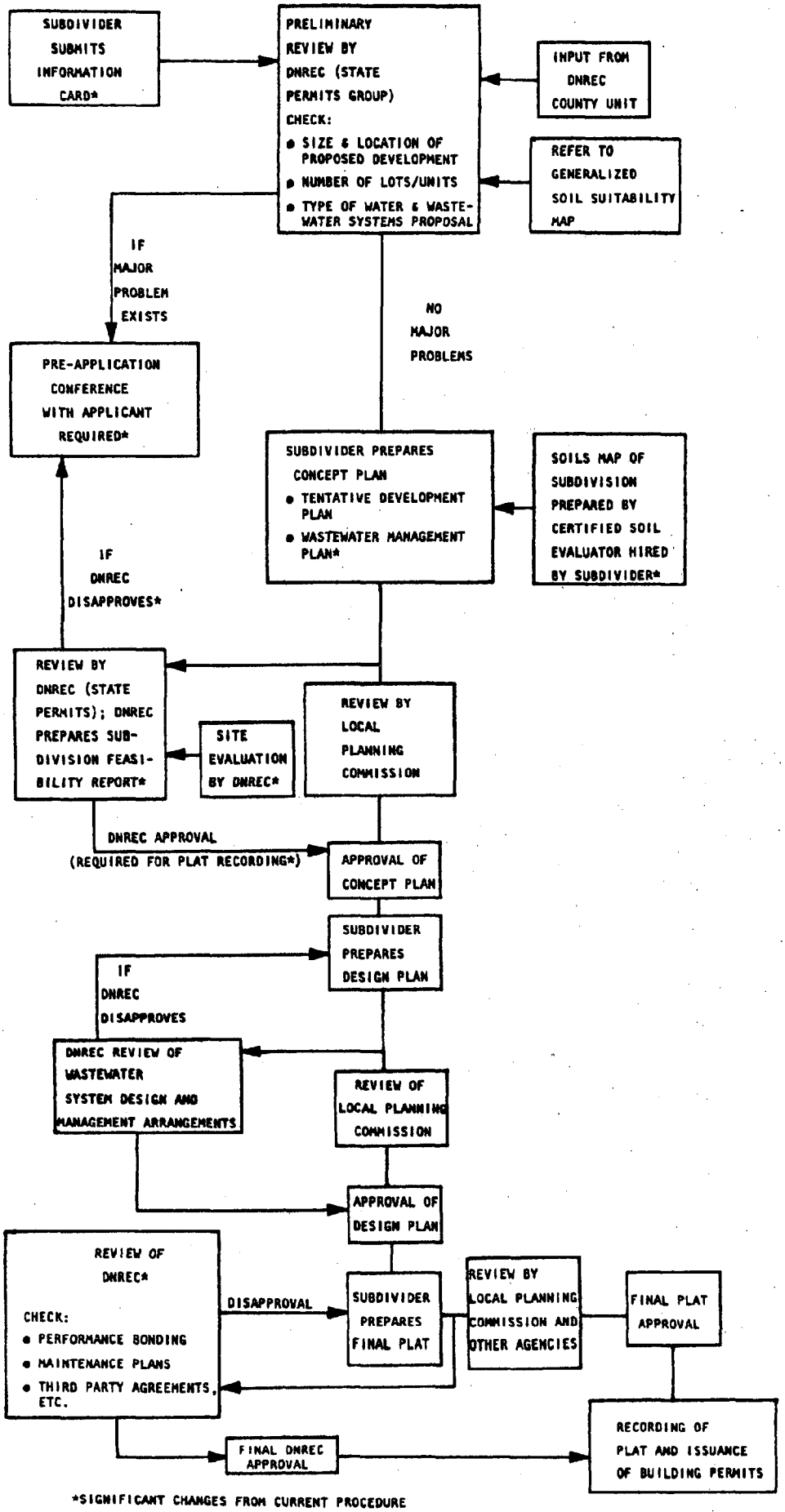
TABLE 6

TECHNICAL SOLUTIONS
TO COMMON ON-SITE PROBLEMS

PROBLEM	SOLUTION
Accumulation of Sludge/Scum in Septic Tank	Pump out tank
Clogged pipe, tank inlet, or tank outlet	Remove obstruction
Misaligned or broken tank, pipes, drain lines, etc.	Remove and replace affected component
Undersized Absorption Area	Expand drainfield, or add additional field using diversion valve or dosing device
Clogged Interface Due to Soil Texture Properties	Reconstruct drainfield taking precautions against compaction and smearing of soil; in certain soils premature clogging may be unavoidable
Clogged interface due to organic clogging mat	Oxidize mat using hydrogen peroxide or similar treatment
Clogged interface due to overflow of solids or grease from septic tank	Hydrogen peroxide treatment may be effective, if not new drainfield must be installed
High groundwater or limiting zone	Elevated sand mound, or shallow placement systems
Slowly Drained soils	Water Conservation Devices
Excessively well drained soils	Sand filter systems, sand lined trenches, nitrification-denitrification systems
Unsuitable soils	Off-site treatment

FIGURE 3

PROPOSED SUBDIVISION REVIEW PROCEDURE



*SIGNIFICANT CHANGES FROM CURRENT PROCEDURE

a more specific discussion of the administrative procedure for preparing an emergency permit application.

3.4 Place special emphasis on requirements for installation inspections (Goal 2, Objective 3).

Ensuring the proper installation of a replacement or repair system is probably the most critical phase of the emergency permitting process. Usually after installation of a replacement system the options for further replacement or alternation are limited. It is, therefore, important that specific requirements for installation inspections be included in the new guidelines. More frequent inspections should be required in addition to the pre-cover-up inspection, and DNREC should have the perogative to call for construction supervision by DNREC personnel in critical cases.

TASK 4: PREPARE GUIDELINES FOR SMALL COMMUNITY SYSTEM DESIGN.

New guidelines also need to be prepared to provide assistance in the design of small community wastewater systems. Design guidelines for this purpose do not currently exist in the state. These guidelines should provide general guidance regarding the basic collection and treatment options available, pointing out the operational advantages and disadvantages of various systems. It would not be necessary to provide specific design criteria at this point in time. However, as more of those types of systems are proposed by applicants, uniform design standards should be developed.

4.1 Outline permit application and regulatory review procedures (Goal 1, Objective 3).

The new guidelines should describe the permit application review and approval procedures to be applied by DNREC. The relationship between the permitting procedures for small community wastewater systems and small community water systems should also be specified in the guidelines.

4.2 Present technical options (i. e. alternative technologies) with design criteria as appropriate (Goal 1, Objective 6).

The guidelines should identify acceptable technologies and the applicability to Delaware for wastewater collection, treatment and disposal. Table 7 lists various alternative technologies that can be applied in typical rural subdivision and small community settings.

TABLE 7

SMALL COMMUNITY WASTEWATER SYSTEM
ALTERNATIVES

COLLECTION OPTIONS

Conventional gravity sewers

Small diameter (4") gravity sewers (with individual septic tanks)

Low pressure sewer systems (with individual grinder pumps or septic tank effluent pumps)

Vacuum sewer systems

Holding tanks and tank trucks

TREATMENT OPTIONS

Conventional treatment plant (i.e. package plant)

Innovative treatment technology (e.g. oxidation ditch)

Lagoon (i.e. wastewater stabilization pond)

DISPOSAL OPTIONS

Stream discharge

Land application (i.e. spray irrigation or overland flow)

Subsurface community drainfield

Marsh pond or wetland

4.3 Specify site evaluation and installation inspection requirements.

The new guidelines should also describe the administrative and technical procedures that should be applied in evaluating site suitability for various small community wastewater systems, and supervising their installation.

4.4 Specify management requirements.

Small community systems, due to their design and application, require a certain degree of maintenance and operational supervision. The guidelines should describe "what" maintenance activities need to be performed; "when", and by "whom". Requirements for performance bonding, third-party agreements, liability provisions, and ownership arrangements should also be specified in the guidelines.

TASK 5: PREPARE GUIDELINES FOR SUBDIVISION WASTEWATER MANAGEMENT PLANS.

These guidelines should be oriented to assist members of the building industry, system installers, soil evaluators, land owners and subdividers in understanding wastewater management considerations related to the subdivision development process. The guidelines should explain the wastewater management alternatives available to a subdivider, developer, etc. in preparing a subdivision plan for eventual plat recording. Procedural steps required to obtain the necessary approvals should also be described in these guidelines.

5.1 Outline administrative and regulatory review procedures (Goal 8, Objective 4).

The guidelines for preparing subdivision wastewater management plans could be expanded to portray a "guide to the land development process". In this context, the subdivision wastewater plan guidelines could be one component of an overall land development guidebook. In any case, the guidelines should identify the procedures and sequence of steps a builder, developer or subdivider must follow in preparing a wastewater management plan for a subdivision.

5.2 Provide guidance on selecting appropriate wastewater management technology (Goal 1, Objective 2).

The guidelines should identify appropriate technology described in the on-site system and small community system guidelines and suggest a methodology to follow in selecting technology for a specific situation. This should be consistent with basic design requirements (i. e. depth to limiting zone, etc.) specified in the "on-site systems" and "small community systems" guidelines.

5.3 Reference design criteria offered in "On-Site Systems" and "Small Community Systems" guidance documents.

Specific design criteria and design examples contained in the other guidance documents proposed under Task 2 and Task 4 should be referenced or included in this set of guidelines.

TASK 6: MODIFY ADMINISTRATIVE PROCEDURES RELATING TO SUBDIVISION REVIEW.

The previous discussion of guidelines for preparation of subdivision wastewater management plans (Task 5), contained reference to administrative procedures to be followed in reviewing and approving wastewater management plans for subdivisions. An explanation of the review procedure for subdivision is presented in the following task descriptions.

6.1 Perform comprehensive technical review of wastewater management plans for all subdivision proposals (Goal 1 Objective 1).

As stated in the Task 1 (amend legislation) discussion, it is recommended that all wastewater management plans for subdivisions should be reviewed and approved by DNREC before recording by local government. Under this arrangement, DNREC, particularly the State Permits Group, would be more formally involved in the subdivision review process. The difference between what is presently done and what is being recommended is that (1) the review would be a prerequisite of plat approval, (2) on-site soils evaluation (at least hand auger borings) would be required, and (3) the DNREC would prepare a formal subdivision feasibility report for each review.

6.2 Use soil suitability maps to screen subdivision applications and require soil testing to confirm actual soil characteristics (Goal 1, Objective 2).

The following is a recommended procedure for preparing, reviewing and approving wastewater management plans for subdivisions showing how soils evaluations are considered (see Figure 3 for a

graphic display of these steps):

1. The subdivider (or developer) would fill out an information card and send to DNREC for preliminary review. The information on the card would include:

   - o location of proposed development site (rough map showing major roads, etc.)
   - o number of acres in the development
   - o proposed number and size of lots
   - o type of wastewater system proposed
   - o type of water system proposed
   - o number and type of dwelling units (e. g. single family detached, multiple family, mobile homes, etc.)

   The subdivider would be encouraged to send this information to DNREC before developing a concept plan. (The information card could be obtained at the county planning commission offices or at the DNREC County Unit Offices. A completed card would be sent to the State Permits Group Office.)

2. The DNREC State Permits Group (with input from the County Units) would review the information on the card using the soils suitability map to identify potential problems that the subdivider should be aware of. If a major problem appears (for example, on-site systems proposed in unsuitable soils), a pre-application conference with the subdivider should be scheduled to review alternative wastewater systems. If only minor problems (or no problems) appear, then DNREC (through a simple form letter) can prescribe a suggested course of action and the subdivider can proceed to the next step.

3. The subdivider would prepare a concept plan (i.e. a tentative development plan and wastewater management plan) showing the proposed lot configuration and the intended method of

wastewater disposal. A soils map (similar in level of detail to an SCS soil survey map) with the lot configuration superimposed should accompany the concept plan. This soils map should be prepared by a certified soil evaluator. Random soil borings may be performed (applicant's option) to verify the soils map information. The completed concept plan would then be submitted to the local planning commission office and forwarded to DNREC for its review.

4. The DNREC State Permits Group would prepare a Subdivision Feasibility Report as a product of its review. The report would be submitted to the applicable local planning commission as an official DNREC statement of plan approval or disapproval. Plan approval will allow the subdivider to complete the remaining requirements of the local subdivision ordinance. (DNREC approval of a concept plan should be required before recording the Final Plat.) Plan disapproval would require a pre-application-type conference and a resubmitted concept plan reflecting necessary modifications to the wastewater management plan.

   In preparing the feasibility report, the DNREC soils scientist should visit the development site and take soil borings where appropriate (a general rule of thumb of at least 2 borings per lot is proposed). This site evaluation information would provide the technical basis for the DNREC Feasibility Report.

5. If a small community wastewater system is proposed, the subdivider must submit a Design Plan for DNREC review. DNREC approval of the Design Plan would be necessary for final platting.

6. The subdivider can then complete the local subdivision ordinance requirements by preparing a Final Plat, which represents the final documentation of the proposed development plan (and wastewater management plan).

7. DNREC should review the Final Plat to assure that previously approved wastewater plans are

properly incorporated into final plan documentation. All legal and fiscal requirements for wastewater system ownership and maintenance (e. g. performance bonding, maintenance plans, third party agreements, etc.) should also be reviewed. A final DNREC approval/disapproval should be issued. Final plan approval will allow the subdivider to proceed to the next step. Plan disapproval would require that the final plan be modified.

8. Final platting of the subdivision would be done by the local governing entity, once all agency approvals have been submitted.

6.3 Encourage involvement of applicant, local planning agency, local governing bodies, and other interested agencies in the technical review process (Goal 1, Objective 5).

The Development Advisory Committees established at the county level should remain intact, with continued DNREC participation. Wherever possible, the DNREC should encourage pre-application conferences with subdividers and realtors to explain the agency review procedures and to familiarize applicants with accepted development practices.

TASK 7: MODIFY ADMINISTRATIVE PROCEDURES RELATING TO ON-SITE SYSTEM PERMITTING

Current administrative procedures for reviewing and approving on-site system applications also need to be amended to account for the greater emphasis being place on soils investigations. In this discussion references are made to a revised permit form. The permit application consists of four (4) parts:

Part I contains owner information (lot location, area and applicant's name). This section is completed and signed by the owner of the property.

Part II is the site evaluation section and is prepared and signed by the soil evaluator.

Part III is the system design section and is completed and signed by the soil evaluator or professional engineer.

Part IV is the system installation section. It is completed and signed by the system installer.

The suggested changes in permit administration procedures are outlined below.

7.1 Require more detailed on-site soil evaluations as a basis of system design (goal 2, objective 2).

The recommended procedure of conducting a soil evaluation requires a series of hand auger soil borings (supplemented with observation holes where necessary) to identify limiting zone conditions and soil texture characteristics. This procedure is significantly different from the present procedure. Figure 4 displays the modified procedure. The responsibility of the property owner (i.e. applicant), the DNREC County Units, and soil evaluators are described accordingly.

1. The applicant would obtain zoning approval from the local planning commission (i.e. a zoning certificate).

2. The applicant would obtain a copy of a (revised) permit application form, and (amended) guidelines from the DNREC County Unit. A preliminary

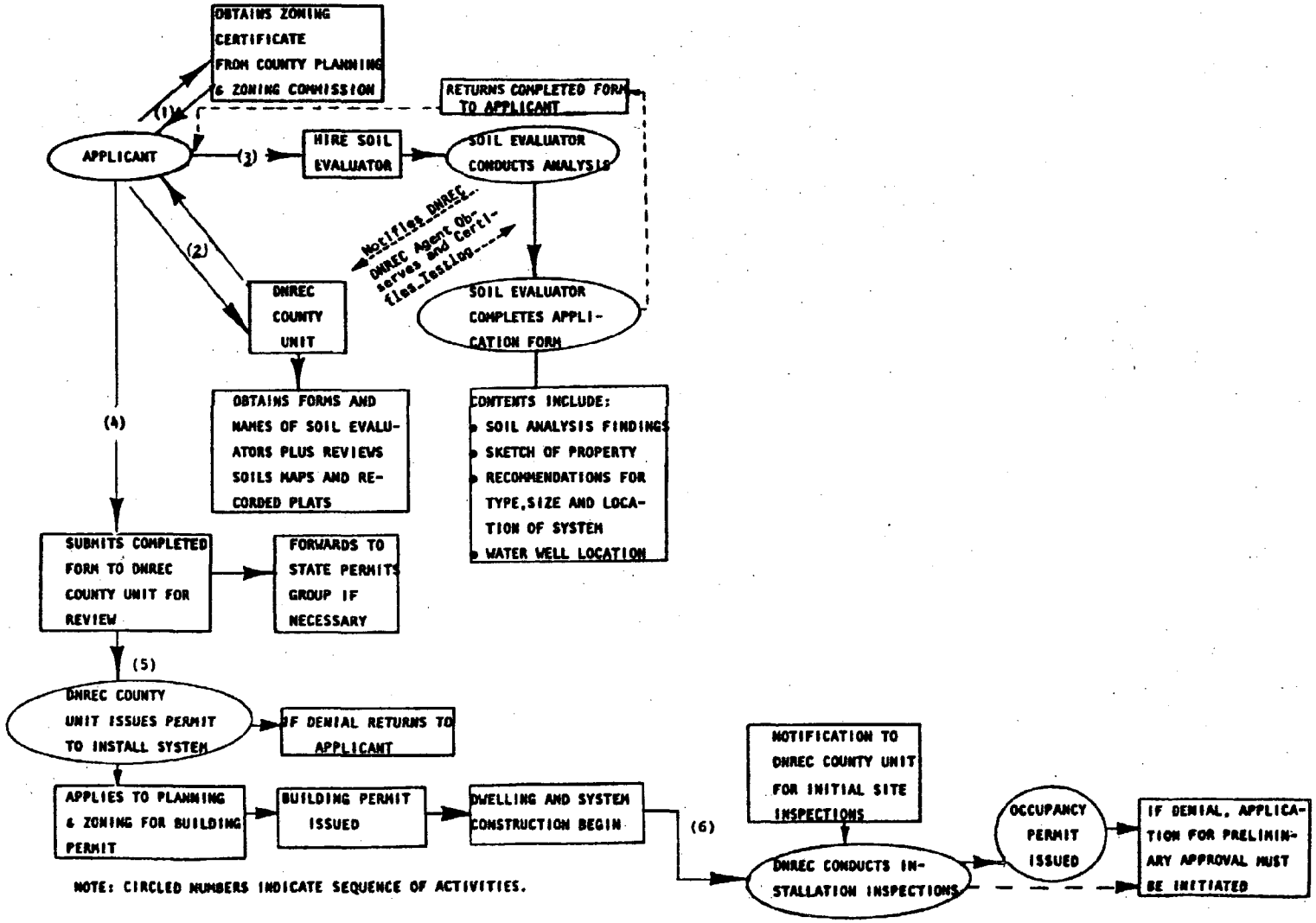


FIGURE 4 RECOMMENDED PERMIT PROCEDURE

assessment of potential problems can be made at this point by simply locating the development site on the soil suitability map and checking a copy of the DNREC subdivision feasibility report if one was prepared. The County DNREC Unit may also wish to check its records on failing systems (i.e. emergency permit files) to see if septic system failures have been common in that area. If there appears to be a potential problem, the DNREC Unit can request the applicant to notify the Unit when site tests will be done. A DNREC County Unit staff person would witness the site tests in this event.

3. The applicant would hire a soil evaluator to conduct a site evaluation. The soil evaluator would complete the first part of the permit form; discuss soil texture and limiting zone characteristics, prepare a sketch of the property to show the presence of other physical or permanent conditions that may affect septic system performance; and recommend a location, size and type of wastewater system, and acceptable well location.

   The site evaluation procedure should consist of a series of soil borings, and if necessary, an observation pit and percolation tests. At least two and generally no more than five soil borings will be necessary to determine soil characteristics and to identify an acceptable location for a subsurface disposal system. The holes should be situated so that they represent the entire absorption area. More borings will be required where soil type variations are suspected. (A similar procedure should be carried out to locate a suitable reserve disposal area.) The general perimeter of the absorption area (and reserve area) should be staked out at this time.

   An observation pit would be required (to supplement soil borings) in the following situations:

   - Soil characteristics vary significantly among the borings.

   - Observation of soil characteristics at depths greater than 5 feet is necessary (e.g. to

determine if adequate soils are present within prescribed vertical distance of trench or bed bottom).

- o Perched water table is suspected from boring hole data. (e.g. in cases where fragipan or clay layer is suspected but cannot be confirmed).

- o Seasonal high groundwater is suspected but cannot be confirmed by boring hole data alone.

- o Soil profile exhibits unusual or atypical characteristics for a given soil type.

Should a difference of opinion between DNREC and the soil evaluator (and/or the applicant) arise as to the suitability determination for the site, an SCS representative can be called upon to perform percolation tests or to conduct similar soils tests as outlined above and offer an independent assessment. In any event, DNREC would reserve the final authority to approve or disapprove the application based on these evaluations.

4. The applicant would submit the completed first, second, and third sections of the permit form to the DNREC County Unit for their review. The DNREC County Unit would determine whether all information is correctly shown, and decide whether the applicant can proceed with system installation. The State Permits Group would be called upon to assist in reviews of alternative systems. As described in Step 3, in the event of a difference of opinion between the DNREC and soil evaluator, an SCS soils scientist can be called upon to conduct an independent evaluation.

5. After DNREC approval of the site evaluation and system design, an authorization to install the system is issued. An application for a building permit can then be submitted.

6. The system installer will notify the DNREC County Unit to conduct a pre-coverup inspection. (Additional inspections are desireable; however

this will require that the guidelines be changed as suggested in Task 2.5.) If the design, location and and installation is acceptable, an occupancy permit is issued.

In accordance with the proposed regulation change, no dwelling unit or facility served by an on-site sewage system could be occupied or used until Parts I, II, III and IV of the permit have been properly submitted and approved. DNREC should investigate the possibility of coordinating such a requirement with the issuance of occupancy permits by municipalities.

7.2 Encourage applicants to consider alternative technologies if appropriate (goal 2, objective 2).

Steps 1 and 4 of the procedure just described enable the DNREC to suggest alternative technologies on the basis of the site evaluation. It is important that the soil evaluator understand the applicability of alternative systems to specific site constraints. DNREC staff (in the State Permits Group and County Units) need to work with applicants and system designers, and make them more aware of the technical options.

7.3 Perform more comprehensive (and preferably more frequent) installation inspections (goal 2, objective 4).

In the procedure described in Task 7.1 the DNREC County Unit staffperson should visit the site at least twice; once to confirm the approved drainfield area location prior to construction, and another to inspect the pre-coverup installation. DNREC should consult with local government agencies to see if local building inspectors can witness system installations as part of their normal duties.

TASK 8 MODIFY ADMINISTRATIVE PROCEDURES RELATING TO EMERGENCY SYSTEM PERMITTING

A major administrative problem encountered in responding to system failures and correcting them, under the current program, is the division of responsibility for problem investigation/ enforcement and system replacement permitting within DNREC. Under the present arrangement information on septic system performance is not being properly "fed-back" into the permitting system. Thus, the permit program is not getting input that might help explain why systems fail. The recommended administrative procedure for emergency system permitting attempts to deal with

this problem through a redefinition of roles and responsibilities of the DNREC County Unit and the DNREC enforcement section.

8.1 Encourage voluntary compliance by involving County Unit Staff (rather than the EPO) to investigate system problem complaints (goal 3, objective 1).

The emergency system permitting process is initiated when an application for such a permit is requested by the homeowner. A permit application can be obtained from the DNREC County Unit. The applicant can be referred to the County Unit Office by an installer, septage hauler, DNREC Environmental Protection Officer (EPO), a County Unit Staffperson, or State Health Department representative. The recommended process for completing the application and issuing the permit is displayed in Figure 6 and described as follows:

1. As mentioned above, a complaint or problem with a failing septic system can be reported to the DNREC County Unit by the homeowner, his/her neighbor, or anyone else. When a problem is reported to the DNREC County Unit, a sanitarian (operating out of the DNREC County Unit) is dispatched to investigate the problem and recommend a course of action. In making this determination, the sanitarian would complete a brief homeowner interview form, noting the system age, estimated water use, failure frequency, homeowner maintenance practices, etc. Based on a visual inspection of the problem, the sanitarian would outline the following options for the homeowner to follow:

   - If the problem can be solved by a simple task (e.g. tank pumping or clogged line repair, etc), no permit would be necessary. The homeowner would contract with a septage hauler or septic system installer to pump the tank or repair the system. Proof of repair or tank pumping (e.g. copy of invoice) should be sent to the DNREC County Unit office.

   - If a detailed inspection of the system is necessary to properly diagnose the problem, a permit application would be necessary. The sanitarian and homeowner would discuss what needs to be done in the inspection, how it should be done and who should do it.

(It is recommended that the sanitarian do as much field investigation work as possible to assist the homeowner in problem identification, after a permit application has been obtained.)

- If the failing system is in non-compliance (e.g. a cesspool) or if rehabilitating the existing system is not feasible, then the system should be replaced. A permit application would be necessary.

3. Assuming the third course of action is followed (i.e. the system would need to be replaced or major alterations would be necessary), a similar procedure to that for new on-site system installation would be followed (see Task 7). The homeowner would hire a soil evaluator to conduct a site analysis and recommend a system design. The DNREC County Unit (and State Permits Group if necessary) would review the results of the site analysis and design recommendations. If satisfactory, the homeowner would then contract with an installer to install the system.

4. It would be desireable for a DNREC County Unit staffperson to inspect system repair and replacement work at various stages in construction, and possibly supervise certain critical construction activities. This however, will require changes in the guidelines as suggested in Task 3.4.

5. The homeowner would then be instructed by the sanitarian on proper maintenance practices. (This discussion would take place at the time of the pre-coverup inspection.) This procedure utilizes the sanitarian in an advisory/consultant role. The success of this sanitarian-homeowner relationship will depend on the extent of cooperation that exists throughout this procedure. If the homeowner is not willing to work with the sanitarian on a cooperative basis, the EPO would be called upon to enforce the regulations through the legal procedures provided under state code. Thus, in this approach the EPO would serve primarily in an enforcement role, after all avenues of voluntary participation have been pursued through the County Unit.

8.2 Provide technical assistance to the homeowner through County Unit Staff so that the most appropriate solution is applied (goal 3, objective 2).

As discussed in 8.1, the sanitarian assumes a technical assistance/advisory role with the homeowner. It is important that the County Units have capable sanitarians to provide this one-to-one interaction with homeowners with failing systems. Many of the existing failing systems could probably be easily corrected if the DNREC County Units adopted such a procedure of voluntary compliance and technical assistance. It should be reiterated, however, that the participation of the EPO will help to ensure that an expeditious approach to the problem can be achieved, if voluntary compliance is not effective.

TASK 9: ESTABLISH A TRAINING AND LICENSING PROGRAM FOR SOIL EVALUATORS

The soil evaluators are key participants in the proposed rural wastewater management program. They become involved in conducting site investigations to determine septic system suitability and recommend system designs to the DNREC. Soil evaluators are private-sector individuals educated in soils, geology, engineering, or related disciplines. They would provide site evaluations and system designs on a contractual basis to property owners, subdividers or developers.

9.1 Administer initial licensing and recertification program.

The DNREC State Permits Group should assume a lead role in organizing a training and licensing program for soil evaluators. The DNREC soils scientist, with assistance from SCS soil scientists and other sections of DNREC would organize and conduct the training sessions and develop a certification exam. The soil evaluators should be required to attend the training sessions, and complete and pass written and field examinations.

A program for re-certification should also be established, as well as, a procedure for revoking the licenses of evaluators found to be conducting substandard work.

TASK 10: ESTABLISH PUBLIC EDUCATION AND TECHNICAL ASSISTANCE PROGRAMS

As pointed out in the DNREC 208 Report No. 10, "most people are ignorant of the problems involving siting, operation and maintenance of septic systems ... In order for (any) regulatory program to work, its rationale must be understood by the public."

The DNREC should assume a more active role in (1) preparing and disseminating information to homeowners and (2) assisting communities in understanding their technical and institutional options in providing wastewater management.

10.1 Provide homeowner information materials (goal 4, objective 1).

The DNREC should prepare a brochure for public distribution, which would outline acceptable site evaluation procedures, alternative system designs, and proper maintenance practices. The brochure should be oriented to homeowners, realtors, subdividers, developers and local officials. The purpose of such a brochure is to make the general public more aware of the alternative systems available, and the factors to be considered in order to avoid improper application of on-site systems.

10.2 Identify potential rural wastewater management agencies, and assist in local program implementation (goal 4, objectives 2 and 3).

The DNREC Projects and Planning Section has developed technical assistance-type relationships with local communities in various 208/CZM Program projects. These previous activities have included attempts to help develop local implementation programs to solve various non-point source pollution problems. These DNREC technical assistance efforts should be continued, and where possible expanded, to promote concepts of wastewater management at the local level. DNREC should coordinate such activities with the County Cooperative Extension Service (USDA) and involve local extension agents in providing such technical assistance. This approach was very successful in the Pilot Wastewater Management Study undertaken in Frankford and Dagsboro.

TASK 11 PILOT STUDIES, FURTHER RESEARCH, ETC.

To complement the activities described in the preceeding ten (10) tasks, several special studies, in the form of pilot studies, demonstration programs, and research and development projects, should be initiated.

11.1 Initiate study to develop groundwater management strategies and technical data leading to the implementation of density limitations based on groundwater protection objectives (Goal 5, Objective 2; and Goal 4, Objective 4).

Developing a policy and set of regulations governing the density of septic systems is a complex and multi-faceted issue. It is an issue of importance for the rural wastewater management program as well as the groundwater management program. Various methods for determining minimum lot sizes have been described in Technical Report No. 2. These alternative approaches should be evaluated in groundwater management studies based on actual groundwater data for Delaware, so that decisions and policies regarding groundwater protection and management can be factored into minimum lot size determinations.

11.2 Initiate septage management studies to investigate the volume of septage generated in Southern Delaware and evaluate methods of treatment and disposal.

No one knows how much septage is being pumped from septic tank systems in Southern Delaware. Little is known of the destination of the septage; that is, how much is treated at public wastewater treatment facilities, how much is disposed of on land, and at what sites. As a result the overall water quality impact of septage disposal is not well understood. Promotional campaigns to encourage on-site system maintenance may increase the volume of septage generated in Southern Delaware.

Studies of best disposal techniques, water quality impacts and institutional/legal factors should be initiated in concert with other resource managment studies (e.g. facilities planning and areawide sanitary surveys). Septage disposal needs should also be given more attention in the preparation of facility plans.

11.3 Conduct a pilot study of cumulative impact assessment for a proposed large development and formulate a standard assessment methodology (Goal 5,Objective 3).

A similar recommendation had been made by the New Castle County 208 Program. The New Castle Program proposed that a "water quality impact" analysis be done to evaluate the impacts of new development. The cummulative impact analysis, proposed herein, is a variation of the New Castle recommendation. Studies of cummulative impact would focus on "carrying capacity" concerns, and would serve as a basis for developing density restrictions that address the implications of incremental development on surface and groundwater quality. Pilot studies would be necessary to test the feasibility and cost of conducting such impact studies.

11.4 Fund demonstration projects to test various mandatory on-site system management techniques (Goal 4, Objective 4).

The concept of mandatory on-site operation and maintenance requirements is one which has been frequently discussed in this study. Various optional methods have been cited. The techniques that should be evaluated include:

- o Maintenance permit provisions (i. e. periodic inspections or pumping tied to permit renewal)
- o Pre-sale inspections of septic system operating condition
- o Publicly managed on-site systems (via on-site management districts)
- o Private contractor - managed on-site system service agreements (i. e. service agreements between private septage haulers and homeowners or on-site management districts. The agreements can be initiated voluntarily or be required by legislation).
- o Homeowner Associations providing maintenance services and/or public education for members.

The DNREC needs to re-define the powers of existing sewerage agencies as they pertain to managing on-site sewage systems (see Task 1.4). Once this occurs, more meaningful attempts at organizing local management programs can be initiated.

11.5 Conduct a pilot study to prepare areawide surveys and initiate appropriate facility planning activities (Goal 6, Objectives 1 and 2).

An important consideration in future wastewater facility planning activities in Southern Delaware is that many facility planning projects will be for small unincorporated communities, where conventional wastewater management solutions may be too costly to implement. DNREC needs to develop a means of conducting areawide sanitary surveys for these areas (using combinations of aerial photography, household interview and field inspection techniques). Methods of determining planning boundaries based upon the extent of the problems, physical site conditions, and logical service area configurations also need to be developed. The planning area delineation techniques need to be developed through the cooperation of the Division of Environmental Control, Projects and Planning Section (which administers

the construction grants priority list) and the Water Resources Section (which administers wastewater treatment and discharge, and septic system management programs). Enabling legislation, as discussed in Task 1.7, also needs to be developed to support rural area facility planning activities.

11.6 Hold in-house technical training sessions to educate DNREC Staff on soil evaluations, basic on-site system design, and alternative technologies; fund attendance at training courses, etc. (Goal 8, Objective 1).

Existing DNREC County Unit and State Permits Group staff are not adequately equipped or experienced in conducting the type of site evaluation and design reviews proposed in this report. As the state-of-the-art technology advances, more sophisticated systems will be marketed, and demands on agency personnel, for reviewing and approving both alternative and conventional technology will increase. The DNREC County Unit staff should be required to attend training sessions and pass the same written and field exams offered to site evaluators. In addition, DNREC staff should be encouraged to attend training sessions and seminars on the topic of septic system management, and on-site system design. Such seminars offer technical training, as well as, interaction with regulartory personnel from other states.

11.7 Offer periodic training courses to on-site system installers and septage haulers (Goal 8, Objective 3).

A scaled-down version of the soil evaluator training program should also be offered to system installers and septage handlers. While installer-hauler licensing and certification programs are not being proposed at this time, these individuals also have to be aware of the regulatory and administrative changes adopted since they will be installing and servicing these units, and more important, they deal directly with homeowners, subdividers, and developers. The ability of installers and haulers to serve as technical information disseminators should not be overlooked.

11.8 Conduct studies to test and monitor alternative system performance in Delaware (Goal 2, Objective 3).

Many alternative systems that are proposed in this report have not been applied in Delaware. While their design and technical reliability have been tested in other states, there has not been any extensive formal testing of alternative subsurface disposal techniques in Delaware. Future research and development efforts

should consider system design and performance testing programs as a means of establishing acceptable design criteria and standard operating practices. This testing program should be designed to complement similiar demonstration programs in neighboring states.

TASK 12 HIRE ADDITIONAL PROGRAM STAFF

Carrying out the programs suggested will require additional staff at both the County Units, and in the State Permits Group (in Dover). Estimates of required manpower (not including clerical support) are provided in addition to some suggestions for financing extra staff. It is assumed that no additional staff for the Enforcement Division (i. e. EPO's) will be necessary for the septic system program, since their role has been more narrowly defined with the program changes recommended.

12.1 State Permits Group

The State Permits Group should have the following personnel for septic system management.

1. Supervisor to administer the residential and small community wastewater systems program, water well program, and septage management program.

2. Soil Scientist to help set up the soil evaluator training program, conduct subdivision feasibility studies and provide technical assistance to County Units.

3. Analyst to assist the soil scientist and supervisor in various technical capacities. Also to assist County Units when needed.

None of these positions are currently staffed at the State Permits Group. At the time of report preparation, vacant line positions exist for the Supervisor and Soil Scientist.

12.2 County Units

The DNREC Sussex County Unit should have the following personnel:

1. Supervisor to administer the County Unit office, provide special technical reviews on permits, and offer input on subdivision feasibility studies.

2. Resource Control Specialists (2) to review permit applications, and conduct site visits for new installations. To assist sanitarians on inspections of system repair and replacements for emergency permits.

3. Sanitarian to respond to complaints of failing systems, investigate problems and offer advice on system corrections.

Given present staffing the Sussex County Unit will have to add a sanitarian to meet these manpower requirements.

The DNREC Kent County Unit will most likely be organized in the same way with:

1. Supervisor

2. Resource Control Specialists (1)

3. Sanitarian

The Kent County Unit would also have to add a sanitarian to their present staff, to carry out the recommended programs.

12.3 Investigate financing alternatives to support new personnel.

With limited state and federal funds available to finance staff increase, DNREC should consider the following approaches to adding staff:

1. Transfer of staff from other agencies.

2. Establishing permit fees to cover administrative costs.

In the first option listed, there may be staff reorganization within DNREC to accomodate the needed staff for the State Permits Group or County Units. Also, existing staff (and appropriate responsibilities for handling residential water quality-related problems) could be transferred from the County Health Units to the DNREC County Units to fill the sanitarian positions. The sometimes overlapping responsibility of water well (drinking water) and septic system related problems between the Health Department and DNREC deserve special attention in times of manpower limitations.

Regarding the second option listed, there currently is no charge for permit fees in Kent or Sussex Counties for residential septic system permits. A permit fee can be established to help offset the administrative costs imposed. The following are representative permit fees for septic system programs in New Castle County, Delaware and other counties in neighboring states.

	Dorchester Co., MD	Fairfax Co., VA
Subdivision Plat Review		
(small subdivisions)	$25/lot	$127 plus $14 per lot
(large subdivisions)	$25/lot	$214 plus $1.60 per lot
Single Lots - new Systems	$40/lot	$65/lot
Repair/replacement	$10/lot	$30/lot

	Chester Co., PA	New Castle Co.,DE
Subdivision Plat Review		
(small subdivisions)	$15 plus $2 per lot	$10/lot
(large subdivisions)	$30 plus $14.50 per lot	$10/lot
Single Lots - new Systems	$60/lot	$100/lot
Repair/replacement	$15/lot	$50/lot

These represent a range of permit fees for both on-site system permitting and subdivision review. Certainly, any permit fee charged would contribute to supporting the cost of the programs recommended. In fact such programs can be made totally self-sufficient if desired.

CHAPTER 4

IMPLEMENTATION STRATEGY

The Implementation Tasks presented in the previous chapter represent a positive DNREC commitment to improved septic system management in Kent and Sussex Counties. From the discussion in Chapter 3, it should be clear that the existing regulations and administrative procedures are deficient in providing an effective septic system management program (i.e., a program that achieves the goals and objectives stated in Chapter 2). These proposed legislative and administrative changes are necessary, however, these changes cannot be made overnight. Carrying out these proposed recommendations will be a difficult and time-consuming activity. An implementation strategy needs to be adopted. A proposed strategy to "phase-in" the recommended legislative and administrative changes is presented in this final chapter of the report.

The proposed implementation strategy is divided into two parts to reflect the fundamental program areas where changes have been recommended; legislative implementation strategy and administrative implementation strategy. While these two areas are related, their discussion is handled separately to identify the opportunities for immediate implementation activities.

LEGISLATIVE IMPLEMENTATION STRATEGY

Draft legislation should be prepared immediately by DNREC. While this process is taking place, efforts should be made to discuss recommended changes with representatives of the Governor's Office, state legislative, county and local units of government (and agencies), other state and Federal agencies, realtors and businessmen associations (e.g., home builders associations, clubs, civic groups, etc.). Members of the 208 Program Technical Advisory Committee should be called upon to assist in this educational effort.

A timetable for implemention should be prepared and updated, according to the reaction toward the proposed changes by the

aforementioned groups. The process of educating decision makers, drafting legislation and obtaining necessary approvals can take up to two years. Areas of potential controversy include:

- The "set-aside" area recommendation (see Implementation Task 1.8) is likely to be a key issue for public debate since many existing lots may be too small to accommodate the recommended set-aside area requirements.

- The restriction of having site suitability tests performed only by a "soil evaluator" (Implementation Tasks 1.2 and 1.3) may also create public concern. Homeowners would not be allowed to perform site tests and complete the application forms for septic system permits as they do now under current regulations.

- The suggestion to adopt enabling legislation for "on-site management agencies" (Implementation Task 1.4) may not be as controversial since it basically only broadens the capability of existing sewerage agencies to assume on-site management responsibilities, and does not have a direct impact on the general public.

- The proposed changes in subdivision platting, and septic system permitting procedures (i.e., requiring DNREC approval of wastewater management plans before subdivision platting) as discussed in Implementation Task 1.1, and the requirement for an occupancy permit (Implementation Task 1.5) represents a significant modification of current regulatory policies. Although this recommendation will almost certainly meet with resistance from the agencies administering these programs and from the private sector (i.e., the applicant), the changes suggested are necessary to assure that on-site systems are applied only when appropriate site conditions exist.

- Requiring site suitability tests before land purchase (Implementation Task 1.6) will help protect the consumer, and should, therefore, be positively received by the general public. Certain private sector interests (e.g., banking, real estate, developers, etc.) may be opposed to such a requirement.

- Given DNREC authority to require local units of government to correct widespread septic system problems (Implementation Task 1.7) will likely meet with opposition from local governments. However, sufficient legal authority to enforce pollution abatement requirements at a community-wide level does not presently exist, and should be addressed.

Obviously any of these recommendations can stir considerable public debate, and delay the adoption of necessary legislation. DNREC must be prepared to respond to these, and other public and private sector concerns. Certain measures may be taken to alleviate significant public concerns and promote the adoption of the proposed legislation. Measures which might be enacted to provide improved septic system management in the interim period (i.e., before adoption of one necessary legislation) are described in the Administrative Strategy, which follows.

ADMINISTRATIVE STRATEGY

Various revisions to current administrative procedures can be made, pending the adoption of the proposed legislation. As discussed in Chapter 3, major implementation tasks associated with changes in the "guidelines" and in "administrative procedures" are tied directly to proposed legislative changes. Any interim program improvements, therefore, must be based upon the existing legislation and guidelines. It is possible, however, to make selective modifications to the existing guidelines, short of wholesale revision as proposed in Chapter 3.

The following are suggested interim administrative measures that can help promote improved septic system management within the existing legislation:

- Promote public education on the importance of site suitability and system maintenance.

- Amend the sewage flow table and tile field design and sizing standards contained in the guidelines, as proposed in the DNREC 208 Report No. 10 (pgs. 26-27).

- Encourage the use of alternating fields (DNREC 208 Report No. 10 pg. 29).

- Require a reserve area for an alternate field.

- Promote uniform and reliable site tests for individual lots. DNREC County Unit personnel should witness each site test to assure that the tests are performed correctly. (The County Unit Staff should be trained in proper site testing methods by the DNREC Soil Scientist). This requirement will also help to assure that the most suitable location of each lot is designated as the site for the septic system, and that the house and well are located accordingly. DNREC County Unit personnel should also take a more active role in inspecting installations (see Implementation Task 7).

- Notify owners of vacant undeveloped lots (which are situated in platted subdivisions) that draft regulations are being prepared and that site tests should be done to determine site suitability for septic systems before plans to develop the property are finalized.

- Encourage potential lot owners to investigate soil suitability before they buy land. Work with attorneys and realtors to include standard provisions in agreements of sale to condition the sale of property subject to an acceptable site evaluation. (As mentioned earlier, site evaluations performed according to the proposed procedure are recommended over the procedure outlined in the current regulations).

- Offer the use of alternative systems for property owners whose land is not suitable for standard on-site systems. DNREC's attitude should be to "work with landowners" in seeking a mutually beneficial solution to overcoming site limitations.

- Homeowners should also be encouraged to install water saving devices, such as flow restrictors or watersaving toilets, particularly in small lot situations.

While these actions are designed to provide improved septic system management in the interim period (i.e., up to the adoption of revised legislation and new guidelines), certain longer

term administrative procedural changes will be required to enforce the proposed legislative changes. The administrative measures to be considered include:

- Local zoning regulations should be made consistent with site evaluation, density restrictions and other state regulations which affect lot size. Zoning and land use planning should be based on soil and geologic factors as well as sewage and water utility service availability. DNREC needs to encourage local government to enact such changes in their own best interest.

- For land owners with small lots (i.e. platted prior to the new regulations), collector systems should be provided. Management arrangements to provide for periodic inspections and service should also be defined.

- "Success story" experiences from within Delaware and neighboring states of septic system management approaches and techniques (on a community-wide and residential development setting) should be advertised to promote such beneficial concepts.

Both the legislative and administrative Implementation Strategy will require a considerable amount of time and energy by DNREC to implement. As mentioned earlier, the existing program has several serious deficiencies, which in order to correct, will require a greater commitment of DNREC to septic system management, as a significant environmental protection program.

The proposed legislative and administrative recommendations are intended to shift the perspective of the septic system program in Delaware to one that emphasizes "preventive solutions" and "cooperative approaches". The recommendations offered are aimed at preventing and mitigating problems associated with the on-site disposal of sewage wastes. Considering the rural character of Delaware, this program will have a profound impact on future development trends in the state. DNREC must address the issues raised by this study if the state is to be prepared for this future development.

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