United States
Environmental Protection
Agency

Region 4
345 Courtland Street, NE
Atlanta, GA 30365

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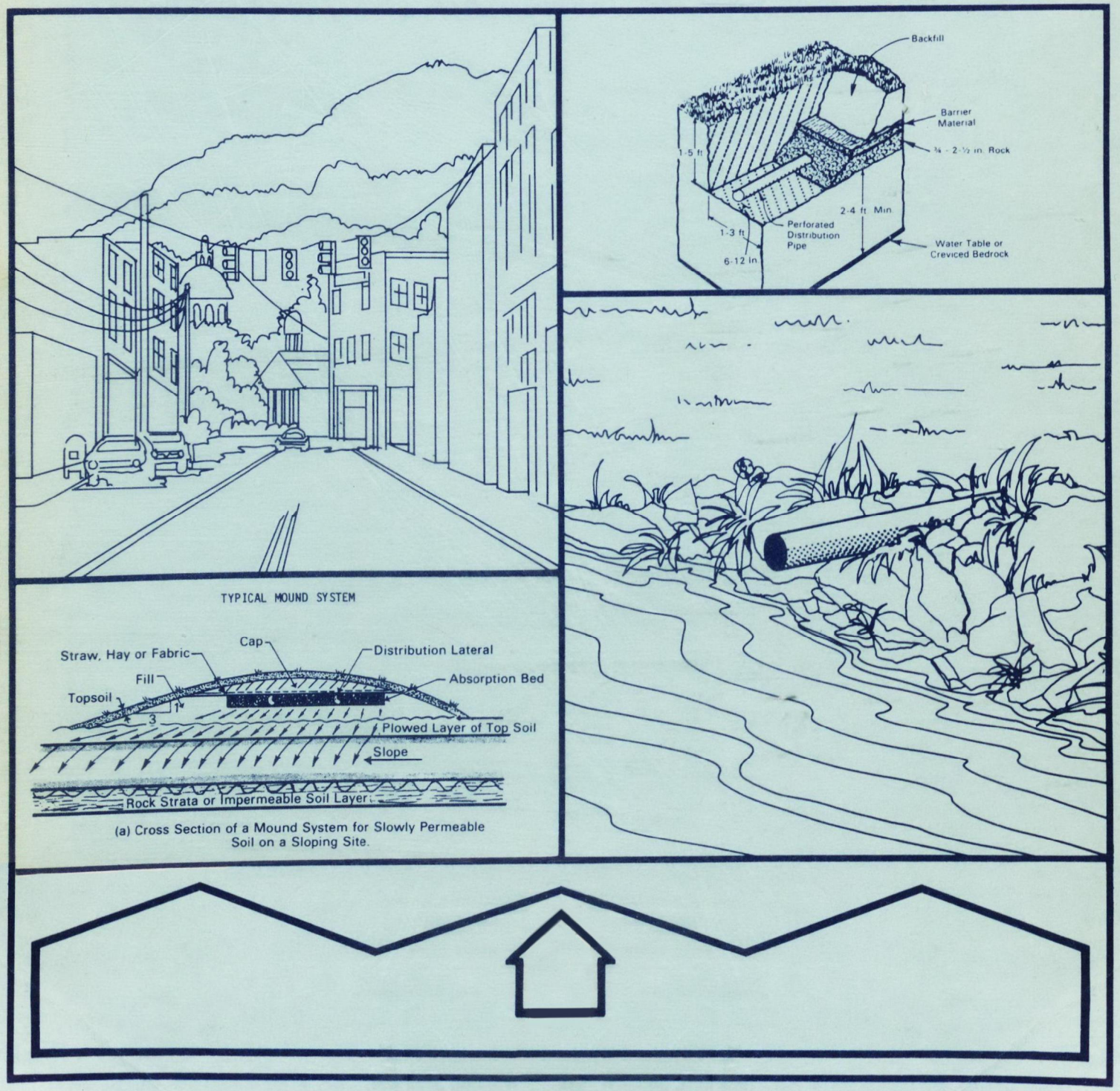
EPA

Mountain Communities Wastewater Management

Guidance Handbook



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GUIDANCE HANDBOOK

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION IV—ATLANTA, GEORGIA

Assisted by:
GANNETT FLEMING CORDDRY AND CARPENTER, INC.
APPLIED BIOLOGY, INC.

MOUNTAIN COMMUNITIES WASTEWATER MANAGEMENT

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USER SUMMARY

Overview of the Handbook

This handbook is a problem-solving tool. It presents step-by-step procedures for defining community wastewater needs and developing appropriate solutions. This process is based on the findings of previous study reports which determined that low technology solutions, including the familiar septic system, can meet wastewater needs in rural areas.

If you are interested in finding solutions to wastewater management problems in rural areas the handbook will be helpful. The text is readable and "user friendly." Necessary technical information is included or referenced, but the handbook is not a technical study. Technical jargon is kept to a minimum, and a glossary is provided.

The handbook is targeted at local agency officials, staff and consulting engineers—people who either are responsible for handling local wastewater problems or are called upon to plan or design their solution. Beyond this immediate audience, the secondary audience includes state and federal officials as well as local citizens. The handbook may be particularly useful to both groups to illustrate that alternatives to conventional approaches do exist. The handbook also describes what needs to be done to carry out these different approaches.

The following chapter presents background information which describes the types of problems found in mountain communities. Remaining chapters discuss separate phases of the problem-solving process. As shown on Figure 1, this process begins with the determination of needs and proceeds through development, evaluation and implementation of a solution. A series of steps is described within each chapter. Each step is also listed as a bulleted item within the four boxes on Figure 1. Each chapter describes these steps in more detail and presents techniques which may be used for completing the analysis or evaluation. Some techniques are briefly described; others are referenced. For example, in the needs determination phase, one of the key steps is the projection of future population and wastewater flow. This section of the handbook explains the population and flow projection process, and refers you to sources for population data and various projection techniques.

Community needs are determined in Chapter Three. In other words, it addresses questions including, "Do we have a problem?," "Where is it?," "How bad is it?," and, "How much worse or better will it be in the future?"

Chapter Four describes how to develop feasible approaches to deal with your community's wastewater problems. This chapter identifies workable, low technology engineering approaches, and presents information on how to narrow these alternative techniques to those which are best for your community. A procedure is presented which describes how to develop alternative techniques to manage and finance the wastewater facilities.

Chapter Five covers the alternatives evaluation process. Detailed information is presented on evaluating reasonable engineering techniques, including how to develop site-specific data and costs. Other sections deal with management and financing techniques. These pages

SEQUENCE OF PROBLEM SOLVING PHASES

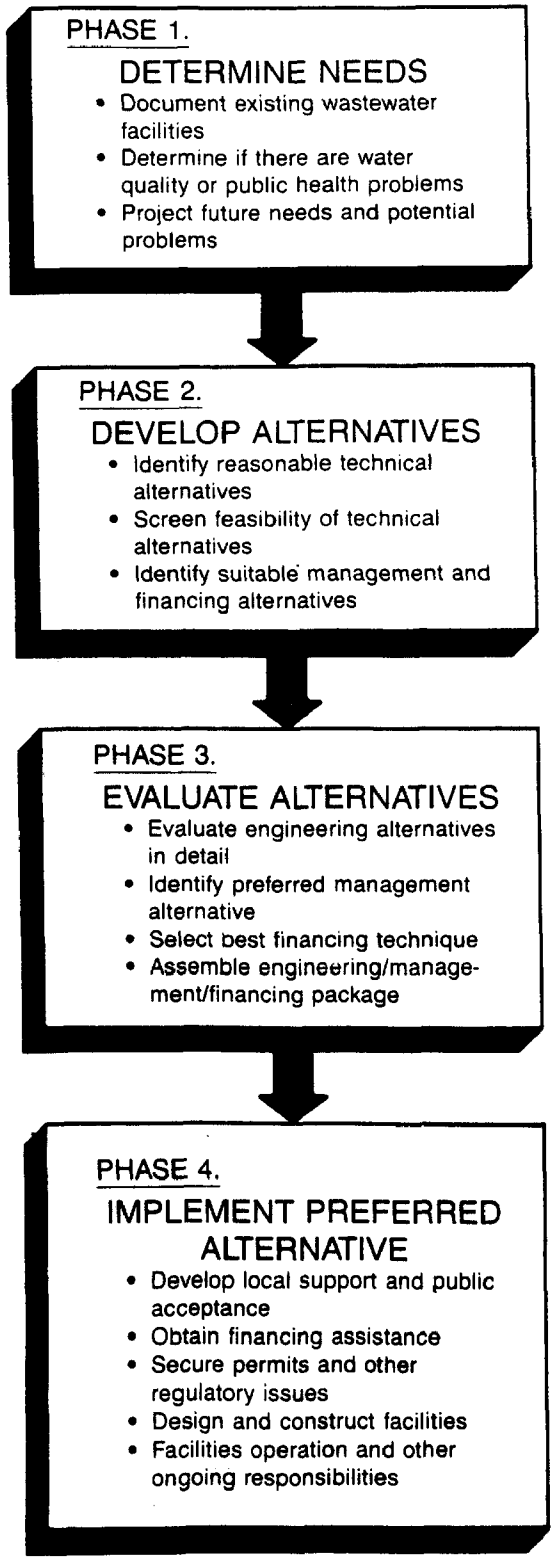


FIGURE 1

outline procedures for detailed evaluation of alternatives; the types of institutional and financial data required; and how to select the management and financing approach best suited to the community's needs and capabilites.

The handbook's final chapter deals with implementing the selected alternative. It identifies key issues, outlines procedures, and identifies the types of information needed to implement the selected alternative. The issues addressed include public participation/education; permits and other regulatory issues; assigning user charges; agency staffing requirements; and design, construction and operation of the selected wastewater facilities.

How to Use the Handbook

To benefit from this handbook, read it carefully and refer to the additional sources listed. The introduction and this user's guide should be thoroughly reviewed to understand the document's objectives. We strongly encourage you to refer to Figure 1, and the schematic diagrams introducing each chapter. These diagrams summarize the key issues in each step of the process.

As discussed earlier, this handbook is the final product of a two-year study which has also produced four other reports. The handbook is not a summary of these reports. But it is a separate guidance document designed to give a "big picture" of how to deal with wastewater problems. The most important details are dealt with here, but for a more in-depth discussion, refer to sources listed in the bibliography. A particularly valuable document is the *Final Alternatives Development Report*, completed as part of this overall project in November, 1984. This report was published in four separate volumes: Volume I, *Introduction*; Volume II, *Technical Alternatives*; Volume III, *Institutional Management Alternatives*; and Volume IV, *Financial Alternatives*. These volumes were distributed extensively throughout the study area. Additional copies are available from Region IV EPA in Atlanta. These volumes are referenced throughout the handbook. For example, this handbook does not present information and illustrations of engineering techniques. For this, we refer you to Volume II of the *Alternatives Development Report*. If you intend to plan and implement wastewater facilities, we encourage you to obtain these four volumes as a valuable detailed reference to the handbook. The majority of you who desire an easily readable overview of how to solve rural wastewater problems may find the guidance handbook sufficient.

BACKGROUND

Needs of the Study Area and Objectives of the Project

The Appalachian area suffers from significant environmental as well as economic problems. Many residents use privies or dispose of domestic wastewater through straight pipes to adjacent streams. Recent studies show that as many as 19 percent of the households in eastern Kentucky have no wastewater disposal system at all. Even in the much less isolated mountainous region of South Carolina, households with no approved disposal facilities run as high as 36 percent in certain areas. Even in communities that have public wastewater facilities, lack of capacity and improper maintenance have often led to discharge of low quality or even untreated effluent. Water quality in rivers of all six states within the study area is adversely affected by municipal discharges.

Extensive use of creeks, shallow wells and springs for domestic water supply makes this lack of appropriate wastewater disposal more significant. Most residents outside of small rural communities do not have a protected public water supply source. Documented major public health problems do exist in Appalachia. However, the connection between improper wastewater disposal, use of unprotected or untreated water supplies, and public health problems has not been adequately researched.

In 1978, the Kentucky River District Health Department conducted a survey of private drinking water supplies in six southeastern Kentucky counties. The survey found 80% of the wells tested to be contaminated by coliform organisms. Data from the Kentucky Cabinet for Human Resources indicate that residents of southeastern Kentucky are almost twice as likely to contract hepatitis A as other state residents. Certain counties within southeastern Kentucky have rates of hepatitis infection as much as 20 times the national average. Hepatitis is not the only disease which can be spread by contaminated drinking water. Southeastern Kentucky's rate of gastroenteritis is almost twice that of the state. Other prevalent waterborne diseases include ascariasis, strongyloidiasis, and giardiasis.

These problems have been recognized and plans have been proposed for new or renovated wastewater facilities for Appalachian communities. However, this planning was carried out before alternative or innovative treatment systems were considered. Also, it was assumed that federal funding support would remain high. It is now recognized that many of the plans for mountain communities are well beyond the means of the communities unless extensive federal assistance is available. In most cases, these plans are also inappropriate to the area's physical, environmental and socio-economic conditions. For this reason, Region IV EPA decided that a generic regional study should be conducted to better define the unique needs and particular problems in mountain communities and to develop alternative approaches to these needs. This study is designed to help implement more appropriate wastewater facilities and create significant environmental and public health benefits for the citizens of mountain communities.

Scope of the Project

Although the findings of this study are useful to any small community, the analysis focused on a particular geographic area and on specific technical issues.

The project study area is shown on Figure 2. The area includes 82 counties in six states—Kentucky, Tennessee, North Carolina, South Carolina, Georgia and Alabama. Its boundaries are based on the Appalachian Regional Commission (ARC) highlands areas which includes the most remote and rugged portion of Appalachia.

The scope of the project analysis addresses engineering, management and financial issues. The engineering analysis focuses on wastewater technologies for small mountain communities. The emphasis is on small scale, alternative technologies such as on-site systems, cluster systems, and alternative small community technologies. Conventional gravity sewer collection systems are also addressed.

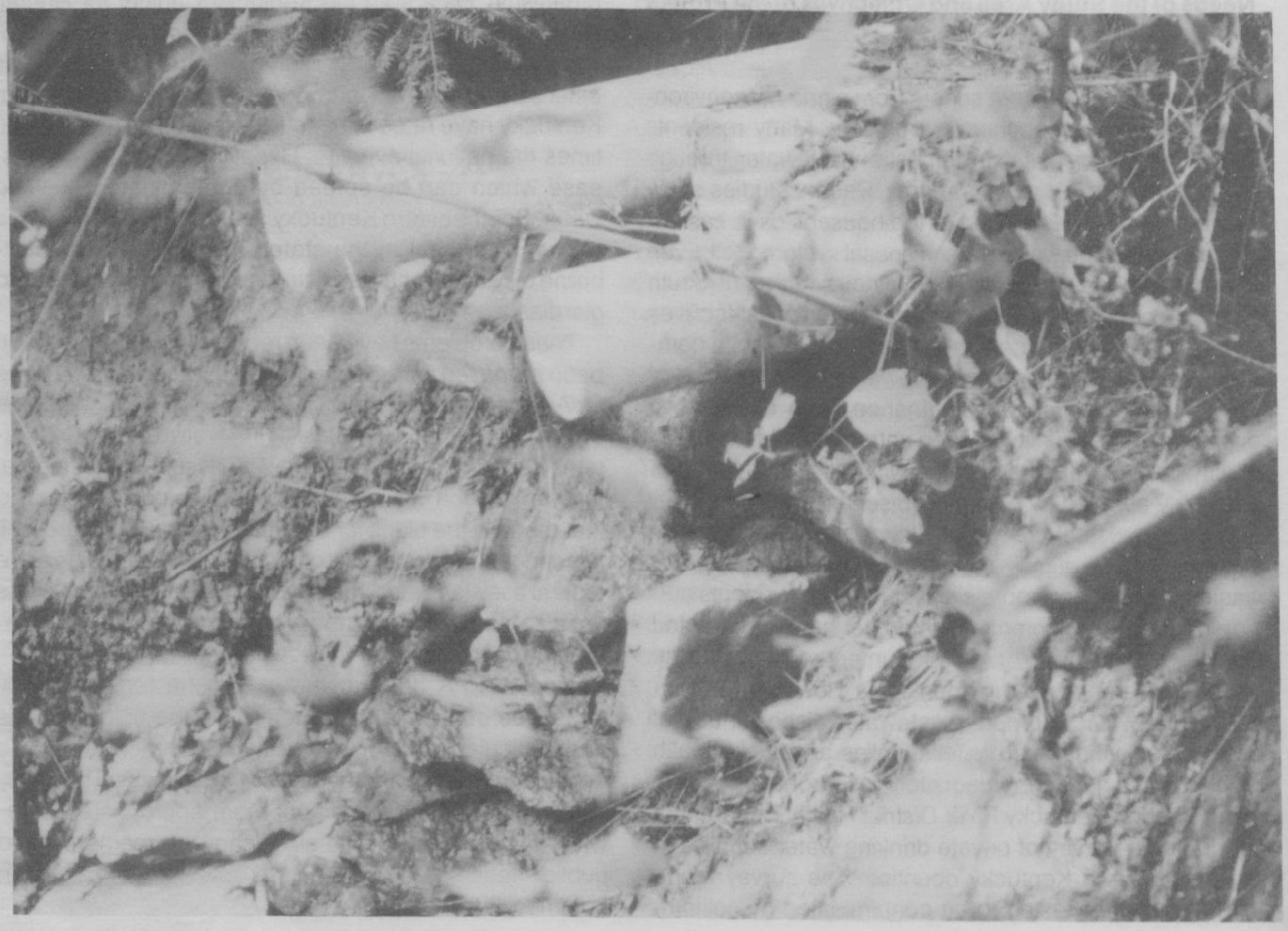
Solving the region's wastewater problems begins with selecting appropriate engineering techniques, but without proper management and financing even the best engineering solutions cannot be implemented. Therefore the assessment emphasizes developing and evaluating alternative management and financing approaches.

Summary of Project Activities

The Mountain Communities Wastewater Management Assessment began in March, 1983. After five work phases, this guidance document has been produced.

Phase I developed the project *Background and Orientation Report*, July, 1983. This report indentifies the study area, defines the setting and key issues, and sets forth a study plan for the remainder of the project. Field meetings were held with representatives of water quality and public health agencies from all six states in the study area. A project mailing list and a technical review committee was developed. The review committee has 32 members who represent state and federal agencies, local officials, environmental groups, regional planning agencies, professional societies, and academia. Five committee meetings were held at the end of each phase of work. The committee members critiqued the work products, and successfully guided the project toward a useful conclusion.

The second phase of the project describes the significant man-made and natural environmental features that influenced wastewater management activities in the study area. The area's water quality and public health problems were identified. Phase II produced the *Survey of Existing Conditions Report* in December, 1983.



Phase III of the project developed alternative engineering, management, and financing approaches. These approaches meet the needs and accommodate the natural and man-made features identified in Phase II. Based on this phase, the *Draft Alternatives Report* was presented to the review committee in July, 1984. On the committee's recommendation, a *Final Alternatives Development Report* was printed and distributed. This report included the committee's comments and revisions in four separate volumes.

The fourth phase of the project completed three case studies. The case study phase built on information developed in Phase 3, and applied engineering, management, and financing alternatives within a "real world" setting. The three case study communities represent a range of "typical" small mountain community conditions. Although each area is unique and represents one specific problem and need, together they reflect conditions that are found in many other settings throughout the study area.

Based on work completed during these four project phases certain significant conclusions were reached regarding future approaches to wastewater management in rural mountain areas.

- New or renovated on-site systems can be an acceptable, cost-effective means for managing domestic wastewater in many rural communities.
- On-site systems can be permanent solutions which will protect water quality and public health. New management controls may be required to ensure proper systems operation and maintenance.
- Although most local residents can afford to fund appropriate technologies, state loans or bond guarantees would significantly aid in implementation.

The final project phase covered developing and producing this guidance handbook. The objective of this report is to present "how to" information to local planners and decision-makers to help them implement wastewater management solutions. This guidance is based on conclusions reached in previous project reports, most notably the *Case Study Report* conclusions listed above. The report can help communities implement smaller-scale, appropriate technology approaches which better suit their needs and resources.

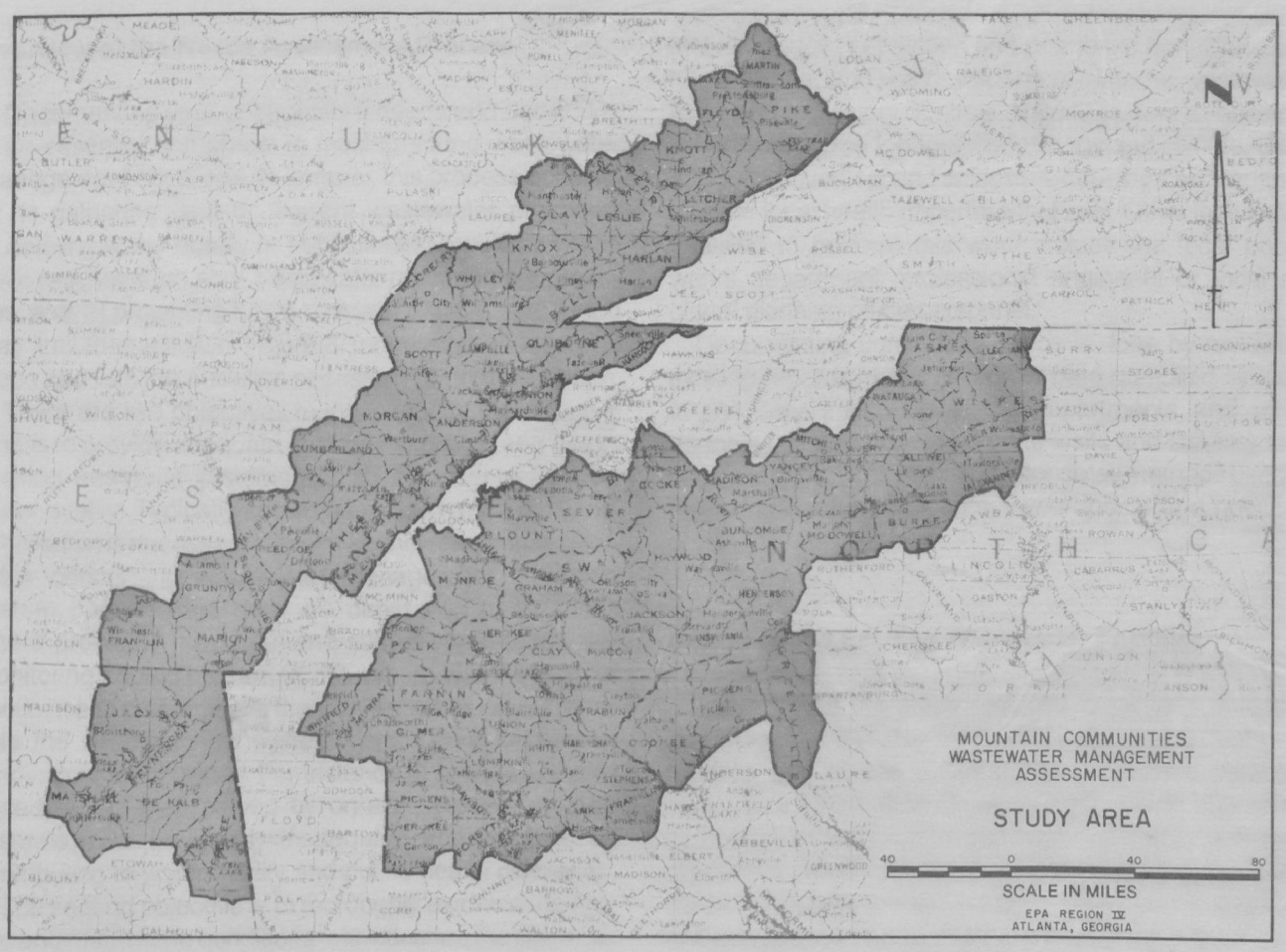


FIGURE 2

Phase I
PROCEDURES FOR DETERMINING COMMUNITY NEEDS

Overview of the Needs Assessment Process

Documenting your community's needs and conditions is an essential first phase in making sound wastewater management decisions. In general, this process consists of: 1) gathering data on current wastewater practices; 2) defining water quality or public health problems which have resulted from poor wastewater management practices; and, 3) projecting future needs and the factors which may limit their solution. Figure 3 summarizes these three steps and lists the activities necessary to complete each.

There are two objectives in this phase of the process. One is to provide adequate data on the design and use of existing treatment systems and their present effect on water quality. Typically known as performance data, this information is necessary to make sound, reasonable decisions concerning wastewater management. Accurate system performance data will direct you to locations where problems may exist and surface or groundwater monitoring should be carried out. Where water quality or public health problems are then identified this will substantiate the need for new system construction or system renovations or changes. For instance, if sewers are proposed for an area served by on-site systems, existing systems must be clearly inadequate and found to be contributing to water quality and public health problems.

The second objective is to thoroughly examine the natural and man-made conditions that influence the size, type and siting of wastewater facilities. Man-made factors include current population and economic conditions and future trends; land use development patterns; wastewater flows and regulatory controls. Natural factors to consider include soil types, topography, geology and climate. Generally, this inventory and analysis is done by a sanitarian or another local health department official. Other individuals qualified to perform this work include the local public works department, professional engineers or local regional planning office personnel.

Documenting community needs is done by reviewing existing records, maps and other data compiled by local health departments, planning departments and other agencies, and performing on-site visits and sanitary surveys. Later sections of this chapter detail methods used in gathering each type of data—who does it and how it is done.

Documenting Existing Wastewater Facilities

Table 1 lists the steps required to perform a facility inventory. The first step is to identify all existing treatment facilities and on-site systems and to develop pertinent descriptive information on each. Data which should be gathered for centralized or package facilities include type of process, present flow, reserve capacities, location, plant condition, population served or service area boundaries, and compliance with effluent permit limitations. Sources of information on existing treatment plants include the listing

PHASE I
STEPS IN DETERMINING COMMUNITY NEEDS

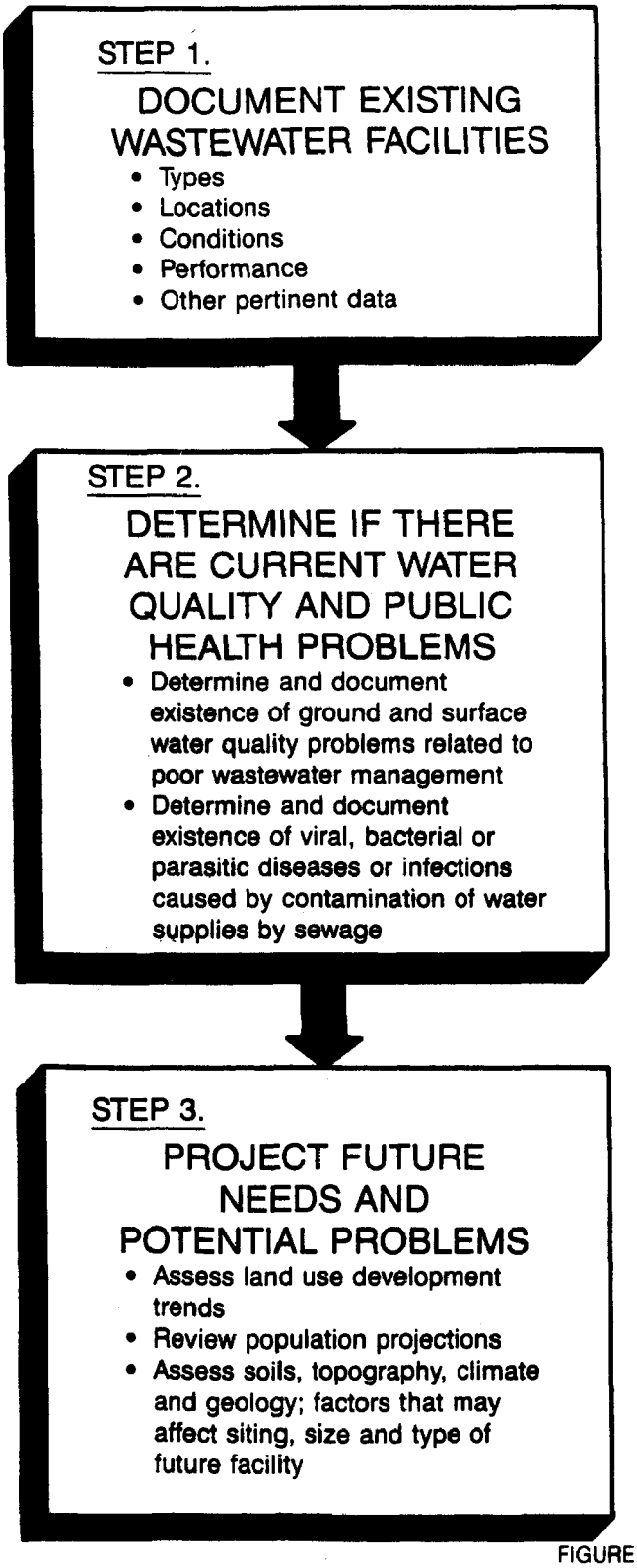


FIGURE 3

of discharges and the associated NPDES permit maintained by the water quality agency in each state. Treatment plants keep daily logs of their influent and effluent quality and may also have records noting any plant malfunctions. The state agency contacts listed in Appendix A can help you obtain this information. Local or county health departments keep records of on-site failures and they may have performed some water quality sampling. Personnel at the health department and the public works agency may be familiar with the area's water quality problems including those which occurred because of a malfunctioning treatment system. If existing treatment plants are producing effluent quality equal to permit limitations, it is unlikely that they could presently be causing a local water quality or public health problems.

The type of data which should be gathered for on-site systems include numbers of traditional septic tank soil-absorption systems, numbers and types of alternative on-site systems, locations, ages and conditions of each. This data is also gathered through record reviews, although site surveys may also be necessary. This inventory can be performed by local sanitarians, part-time recently trained individuals or volunteers. Health department records may provide data on the number and types of on-site systems in use in an area and the number of new installations through their permit records; and failures, if reported. Also, existing surveys or studies of area systems may be available for review. Other techniques useful in inventorying existing systems include interviews with local septic tank contractors, dye studies, remote sensing and aerial surveys which can be used to detect surface malfunctions. Detailed descriptions of inventory techniques are provided on pages 4-4 and 4-5 of Volume III of the *Mountain Communities Wastewater Management Report.*

The way to obtain good detailed site information is a sanitary survey. The survey is used to collect and analyze data on the number and condition of existing on-site systems. This may indicate the need for improved wastewater facilities in unsewered areas. Several specific objectives can be achieved through the survey:

- identification of possible sources of water quality and public health problems,
- evaluation of causes of system malfunction or poor performance,
- assessment of the feasibility of the continued use of on-site systems or of new systems,
- provision of information on types and frequency of malfunctioning systems,
- collection of data on individual properties and their on-site systems for future use.

The survey process should include preparation, on-site inspection, homeowner interview or questionnaire and data analysis.

Before beginning a door-to-door survey, efforts should be made to involve local citizens in the project. If not already done, now is an appropriate time to develop a Citizens Advisory Committee (CAC) and a public participation program. Procedures for doing so are discussed in the Implementation section of this handbook. Newspaper, radio or television publicity can also be used to inform residents of the program. Early contact and dissemination of information to local citizens can help positively involve homeowners and avoid misunderstandings later in the project.

The sanitary survey can vary depending on its purpose(s), funds available, expertise of available personnel, and the extent of existing information on the performance of on-site systems in the area. If comprehensive, up-to-date information on individual system performance is available through health department permit records as well as failure data and interviews with local sanitarians and septic tank contractors, then only a partial sanitary survey may be needed. A partial survey reaches a limited number of residences for which there is no data on systems condition. If survey funds are limited or if the survey area is relatively large, then local volunteers or low-cost part-time employees may be trained in a limited period of time to locate obvious problem systems. Otherwise, full-time health department sanitarians, soils scientists or other experienced personnel are typically used. A standardized sanitary survey form developed and used by EPA Region V is included in Appendix B. This form provides spaces to answer questions, to take notes, and to record observations during the homeowner interview and visual site inspection. This survey form is sufficient to assist in the inventory and description of existing systems. A more detailed site analysis is required before carrying out system renovation or replacement.

After the performance of existing systems has been evaluated, you may determine that these facilites are performing adequately. In this case, there is no need to develop new facilities to serve the existing population.

TABLE 1
Steps in Performing A Facility Inventory

INVENTORY STEPS	INVENTORY METHODS	PERFORMED BY
a. Numbers and types of centralized and package treatment plants	a. -review state records -contact local public works agency	a. through e. Sanitarian or other health department employee; part-time personnel or volunteers; consulting engineer if already hired.
b. Total treatment plant available and reserve capacity at each facility	b. -review treatment plant records -contact local public works agency	
c. Define facility service area boundaries and population served	c. -review state and treatment plant records -contact local public works agency	
d. Number of traditional septic tank-soil absorption field systems	d. -review local or county health department records -interview local septic tank contractors	
e. Numbers and types of alternative on-site systems	e. -review local or county health department records -interview local septic tank contractors and engineers	
f. Locations, conditions of and ages of on-site systems	f. -review local or county health department records -interview local septic tank contractors and engineers -perform sanitary or site surveys -perform aerial surveys	f. and g. Sanitarian; soil scientist; engineer, part-time employees; volunteers; consultant staff.
g. Identify other methods of handling wastewater in your community (e.g. straight pipes)	g. -contact local/county health department -contact local public works agency -perform site-by-site survey	

Determine If There are Current Water Quality or Public Health Problems

Based on the inventory of existing systems, you should now have a good idea of where in the community public health or water quality problems may occur. You must now document that waters are contaminated resulting in public health or environmental problems.

Surface and/or ground water quality sampling is one primary method for documenting water quality problems. Surface water quality sampling is used in communities where a centralized system disposes to surface water and also in the case of on-site systems with direct disposal to surface water. Ground water quality sampling—wells and springs—is generally used to confirm potential contamination from systems using land disposal. Water quality sampling should be used in conjunction with other techniques, like a sanitary survey, to confirm the existence of problems related to wastewater management.

You may use the sanitary survey to detect water quality problems as well as inventory systems. The surveyor can inspect streams, drainage ditches, tile fields, and lakes and ponds on or adjoining private property for signs of illegal discharges, nutrient enrichment, and possible impact on drinking supply. You can sample wells or springs as part of a sanitary survey to detect or confirm water quality problems from malfunctioning on-site systems. You can inspect surface waters receiving centralized plants discharge for signs of raw sewage discharge or nutrient enrichment which may indicate problems at the plant. Contamination from wastewater is generally indicated by the presence of fecal coliform bacteria. Coliform bacteria, however, are produced by other animals such as dogs and cows, and are not a certain indicator of human contamination.

Reviewing state and local agency records and contacting the local public works agency are additional ways to determine water quality problems. State records include 208 areawide waste treatment management plans, 303e river basin plans and 305b water quality inventory reports. Each report is prepared by the state according to the Clean Water Act. Data required in these reports is found in the appropriate sections of the Act.

Public health problems associated with water supply contamination can be documented through the following procedures:

Review of Local Hospital and Clinic Records. This procedure involves contacting local hospitals and clinics to review records and identify occurrence of diseases or infections which indicate water supply contamination. Such infections include ascariasis, strongyloidiasis, giardiasis, impetigo and hepatitis. These problems are associated with improper human waste disposal and inadequate sanitary practices.

Sanitary Survey. The most cost-effective way to detect unreported illnesses is to include an illness survey along with the sanitary survey described earlier. Other ways include homeowner interviews, mailed questionnaires or a door-to-door survey.

Review of Local/County Health Department Records. This procedure involves contacting local and/or country health departments to review records and identify diseases as described above for hospital and clinic records.

Project Future Needs and Potential Future Problems

The community's future needs can be estimated by examining area population and economic projections, land use and development trends, physical features and institutional controls. The rate and type of land development and expected population growth will determine the size, type and placement of wastewater facilities needed in the future. Economic conditions will determine the ability to pay for facilities as well as the possible need for additional infrastructure to aid in economic development. Although EPA will not provide financial assistance for projects intended solely for economic development, FmHA and other agencies will. Physical features will impact the size, type and placement of facilities, and may limit the growth that can take place without environmental impact. Institutional controls, such as permits for on-site systems and land use regulations will determine whether growth projected for a community can be accommodated within the environmental constraints without resulting in water quality or public health problems.

Current population may be determined by reviewing data from the U.S. Department of Commerce, Bureau of the Census. See Appendix C for the source of census data. Begin with the most recent decennial census. For more current information, obtain copies of *Current Population Reports* Series P-25, *Population Estimates and Projections.* This publication estimates population for counties, incorporated places and minor civil divisions (townships and villages) by state. These estimates are dated two years before the report date. Census publication, Series P-26, *Federal State Cooperative Program for Population Estimates*, is another good source. This report contains population estimates for counties and metropolitan areas by state and the estimates are dated one year before the report date. Numerous public agencies will be able to provide these documents or other population data sources. Groups including state, regional and local planning agencies; health agencies or community development agencies; or regional water quality management agencies such as river authorities or basin commissions can provide these projections directly. Municipal and county planning departments or government offices may also provide data on rural area populations from tax rolls, utility connections, school censuses and building permits. These sources can be used to determine the rate of growth, permanent or seasonal composition of the

population—a common characteristic of the population make-up of many study area communities today—the current number of dwelling unis and other characteristics of a specific population. Local real-estate agents, homeowner assocations, chambers of commerce, utilities, other community groups and local or state universities may also provide information to help predict growth trends. This information can be used to project the area's growth. (See population estimation techniques below.)

If a lack of usable published data on current population and land use trends exists, you will need to estimate population. First, establish well-defined study area boundaries. If the area is not a legal entity (i.e. county, township, community) establish and map other boundaries possibly with physical limits (i.e. river or stream, forest, mountain, etc.). Then employ population estimation techniques. Such techniques include:

- *House Survey Method:* This involves a comprehensive housing unit inventory and personal interviews with a sample or all of the households, to determine the average household size in an area. This and other estimation methods are described in Appendix D.
- *Tax Roll Survey Method:* This produces an accurate count of permanent and seasonal housing units and their locations.
- *Aerial Photo Analysis Method:* This can provide accurate counts of housing units through examination of aerial photos. Information on the use of aerial surveys for population estimates and projections is provided in Appendix D.
- *Dwelling Unit Review Method:* This involves updating census house counts by reviewing building permit records..

A "windshield" survey of the community or area in question can help determine current land use and identify development areas. To carry out the survey you will need a local map at a small enough scale—like a tax map—to help identify land tracts. This survey identifies present development and property that will be developed in the near future. In addition, many of the population estimation techniques described earlier, such as the house survey, tax roll survey, aerial photo analysis and dwelling unit review methods can assess land development trends.

To determine future needs for wastewater facilities, population projections should now be developed. First, contact local, regional and state planning agencies to see if projections have already been made. If appropriate projections are not available then use accurate current population figures and trends to develop them. Population projection techniques include mathematical models, economic/employment models, cohort analysis, component method, ratio-share method and land use models. Each technique is described in planning and engineering texts as well as other EPA publications.

Future land use can be determined by recent trends, for example, if developable land exists in an area where steady development occurred, assume that growth will probably continue there or in areas where large tracts of developable land exist. Also, state or local planning agencies may have developed an up-to-date comprehensive plan or another document which includes future land use predictions for the study area.

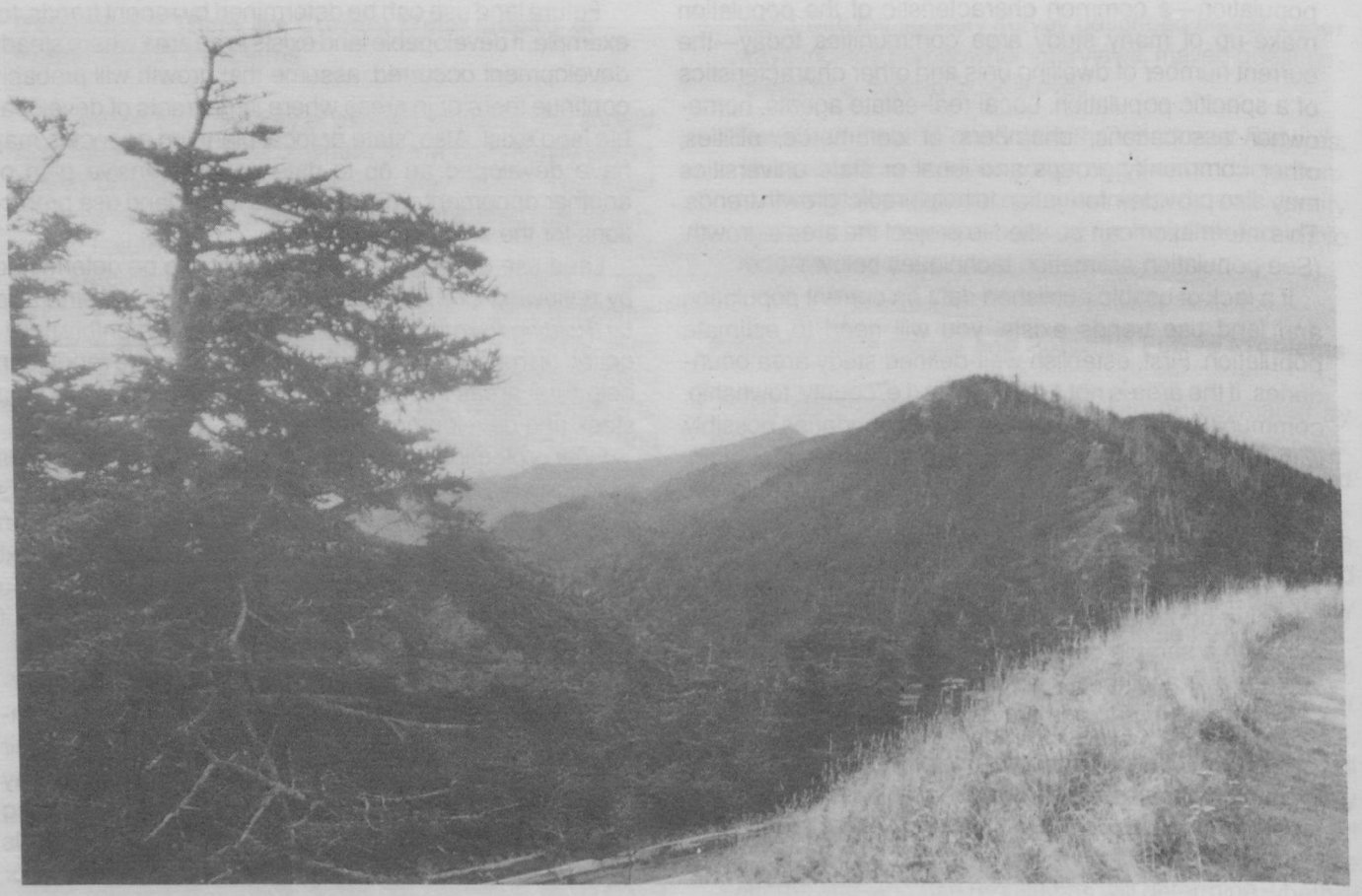
Land use development trends can also be determined by reviewing *Construction Reports—Housing Authorized by Building Permits and Public Contracts*, a monthly publication of the Census Bureau. Information in the report can help rural areas assess the rate of growth of the housing stock and development trends.

Flow projections should be made as part of the needs assessment process. The projection of wastewater flows for your community now will be a critical consideration in developing appropriate engineering techniques in the next phase. For instance, wastewater flow figures will help you decide whether a centralized system is appropriate and if so, what its capacity should be.

Two methods help estimate future residential commercial and institutional wastewater flows. Each method combines the sources of wastewater flows and expresses their total contribution as gallons per capita (persons) per day (gpcd). The first method involves estimating the existing average daily flow based on reliable water supply records adjusted for losses, or on records of wastewater flows for extended dry periods minus estimated infiltration, and flows from industrial and limited users.

The second method involves calculating future average daily base flow (adbf) by multiplying the future population projection by 60 to 70 gpcd. This is the maximum acceptable gpcd amount if you are applying for EPA Construction Grants monies. If you propose a higher gpcd figure, you must justify it to EPA and include the results of flow reduction and, for sewered areas, infiltration/inflow (I/I) analyses. U.S. EPA's *Construction Grants, 1985* provides details on performing both methods of flow projecting and on doing flow reduction and I/I analyses. *Construction Grants, 1985* is available from the U.S. EPA or National Technical Information Service (NTIS). Phone numbers and addresses are listed in Appendix C.

You should develop basic data on natural features during this project phase. Many problems with wastewater facilities, particularly on-site systems, are due to inadequate consideration of soil and site characteristics—particularly permeability—depth to bedrock and water table and land slope. By thoroughly analyzing the community's general soil and geology characteristics before planning on-site systems, you can eliminate inappropriate alternatives. The U.S. Department of Agriculture, Soil Conservation Service (SCS) publishes detailed county Soil Surveys, Interim Soil Reports, and State General Soil Maps. These surveys provide information on general characteristics such as physiography, geology, relief and drainage, climate, and water supply. Detailed descriptions



of each soil series and soil associations are provided as well as information on what to look for when doing a soil field examination. Maps delineating distribution of soil types within the county are included. Depths to bedrock, depth to water table and land slope are also important in siting of sewers and treatment plants. Planning information on these factors is contained in the SCS soils survey.

Also obtain and review local regulations controlling land development and installation of on-site systems. Where stricter controls on septic systems have been put in place, it may be possible for even large increases in population to be accommodated in a community without any adverse environmental impacts. Each component must be considered together—growth, natural conditions, and institutional controls—before the precise nature of future problems can be defined.

population—a common characteristic of the population make-up of many study area communities today—the current number of dwelling unis and other characteristics of a specific population. Local real-estate agents, homeowner assocations, chambers of commerce, utilities, other community groups and local or state universities may also provide information to help predict growth trends. This information can be used to project the area's growth. (See population estimation techniques below.)

If a lack of usable published data on current population and land use trends exists, you will need to estimate population. First, establish well-defined study area boundaries. If the area is not a legal entity (i.e. county, township, community) establish and map other boundaries possibly with physical limits (i.e. river or stream, forest, mountain, etc.). Then employ population estimation techniques. Such techniques include:

- *House Survey Method:* This involves a comprehensive housing unit inventory and personal interviews with a sample or all of the households, to determine the average household size in an area. This and other estimation methods are described in Appendix D.
- *Tax Roll Survey Method:* This produces an accurate count of permanent and seasonal housing units and their locations.
- *Aerial Photo Analysis Method:* This can provide accurate counts of housing units through examination of aerial photos. Information on the use of aerial surveys for population estimates and projections is provided in Appendix D.
- *Dwelling Unit Review Method:* This involves updating census house counts by reviewing building permit records..

A "windshield" survey of the community or area in question can help determine current land use and identify development areas. To carry out the survey you will need a local map at a small enough scale—like a tax map—to help identify land tracts. This survey identifies present development and property that will be developed in the near future. In addition, many of the population estimation techniques described earlier, such as the house survey, tax roll survey, aerial photo analysis and dwelling unit review methods can assess land development trends.

To determine future needs for wastewater facilities, population projections should now be developed. First, contact local, regional and state planning agencies to see if projections have already been made. If appropriate projections are not available then use accurate current population figures and trends to develop them. Population projection techniques include mathematical models, economic/employment models, cohort analysis, component method, ratio-share method and land use models. Each technique is described in planning and engineering texts as well as other EPA publications.

Future land use can be determined by recent trends, for example, if developable land exists in an area where steady development occurred, assume that growth will probably continue there or in areas where large tracts of developable land exist. Also, state or local planning agencies may have developed an up-to-date comprehensive plan or another document which includes future land use predictions for the study area.

Land use development trends can also be determined by reviewing *Construction Reports—Housing Authorized by Building Permits and Public Contracts*, a monthly publication of the Census Bureau. Information in the report can help rural areas assess the rate of growth of the housing stock and development trends.

Flow projections should be made as part of the needs assessment process. The projection of wastewater flows for your community now will be a critical consideration in developing appropriate engineering techniques in the next phase. For instance, wastewater flow figures will help you decide whether a centralized system is appropriate and if so, what its capacity should be.

Two methods help estimate future residential commercial and institutional wastewater flows. Each method combines the sources of wastewater flows and expresses their total contribution as gallons per capita (persons) per day (gpcd). The first method involves estimating the existing average daily flow based on reliable water supply records adjusted for losses, or on records of wastewater flows for extended dry periods minus estimated infiltration, and flows from industrial and limited users.

The second method involves calculating future average daily base flow (adbf) by multiplying the future population projection by 60 to 70 gpcd. This is the maximum acceptable gpcd amount if you are applying for EPA Construction Grants monies. If you propose a higher gpcd figure, you must justify it to EPA and include the results of flow reduction and, for sewered areas, infiltration/inflow (I/I) analyses. U.S. EPA's *Construction Grants, 1985* provides details on performing both methods of flow projecting and on doing flow reduction and I/I analyses. *Construction Grants, 1985* is available from the U.S. EPA or National Technical Information Service (NTIS). Phone numbers and addresses are listed in Appendix C.

You should develop basic data on natural features during this project phase. Many problems with wastewater facilities, particularly on-site systems, are due to inadequate consideration of soil and site characteristics—particularly permeability—depth to bedrock and water table and land slope. By thoroughly analyzing the community's general soil and geology characteristics before planning on-site systems, you can eliminate inappropriate alternatives. The U.S. Department of Agriculture, Soil Conservation Service (SCS) publishes detailed county Soil Surveys, Interim Soil Reports, and State General Soil Maps. These surveys provide information on general characteristics such as physiography, geology, relief and drainage, climate, and water supply. Detailed descriptions

of each soil series and soil associations are provided as well as information on what to look for when doing a soil field examination. Maps delineating distribution of soil types within the county are included. Depths to bedrock, depth to water table and land slope are also important in siting of sewers and treatment plants. Planning information on these factors is contained in the SCS soils survey.

Also obtain and review local regulations controlling land development and installation of on-site systems. Where stricter controls on septic systems have been put in place, it may be possible for even large increases in population to be accommodated in a community without any adverse environmental impacts. Each component must be considered together—growth, natural conditions, and institutional controls—before the precise nature of future problems can be defined.

Phase II:
DEVELOPING WASTEWATER MANAGEMENT ALTERNATIVES

Overview of the Development Process

After you determine whether there is a need for improved wastewater facilities you are ready to develop reasonable solutions. The objective of this phase is not to find the one best engineering, management or financial alternative. It is to identify a range of reasonable alternatives from which you can choose the best approaches based on more detailed evaluation.

The steps in the development process are summarized on Figure 4. As shown on this diagram, the first step is to identify reasonable technical alternatives. This process begins with the most basic technologies and works up to more complex approaches where necessary. The second step is to screen the feasibility of this preliminary group of technical alternatives. Here, these alternatives are compared to the community's general needs and charactertistics in order to screen out less feasible approaches. Then compare preliminary cost estimates to local income levels to gauge affordability. The final step is to identify management and financial alternatives which work well with remaining technical alternatives. The following sections of this chapter discuss how to carry out these three steps.

Identifying Reasonable Engineering Approaches

The engineering alternatives discussed in this section have a wide range of costs and effectiveness depending on local conditions and the thoroughness of system design, installation and operation. All of the technologies to improve wastewater management can be categorized as one of the six basic forms illustrated in Figure 5. The choices for solving community problems include use of existing systems; new on-site systems for individual establishments; cluster or small community systems serving multiple establishments; and area-wide sewer systems. In general, Alternative 1 in Figure 5 is less costly and less complex than Alternative 2 which, in turn, is less costly and less complex than Alternative 3 and so forth. We encourage you to evaluate the less-costly systems first.

It is only reasonable to use existing systems with no changes (Alternative 1) when the costs or limitations of the other five alternatives in Figure 5 are greater than the impacts of existing public health/water quality problems. For example, if outbreaks of water-borne diseases are attributed to failing wastewater systems, continued use with no changes will jeopardize public health. However, if the outbreaks are not associated with existing wastewater systems, then renovations or new systems may be wasteful and unnecessary. Continued use of existing systems with no changes should be evaluated wherever the existing problem cannot be defined or wherever wastewater systems cannot be singled out as the source of the community's problems.

The second alternative—system renovations—can be relatively inexpensive, but the effectiveness of renovations will vary widely. Renovations can include structural modi-

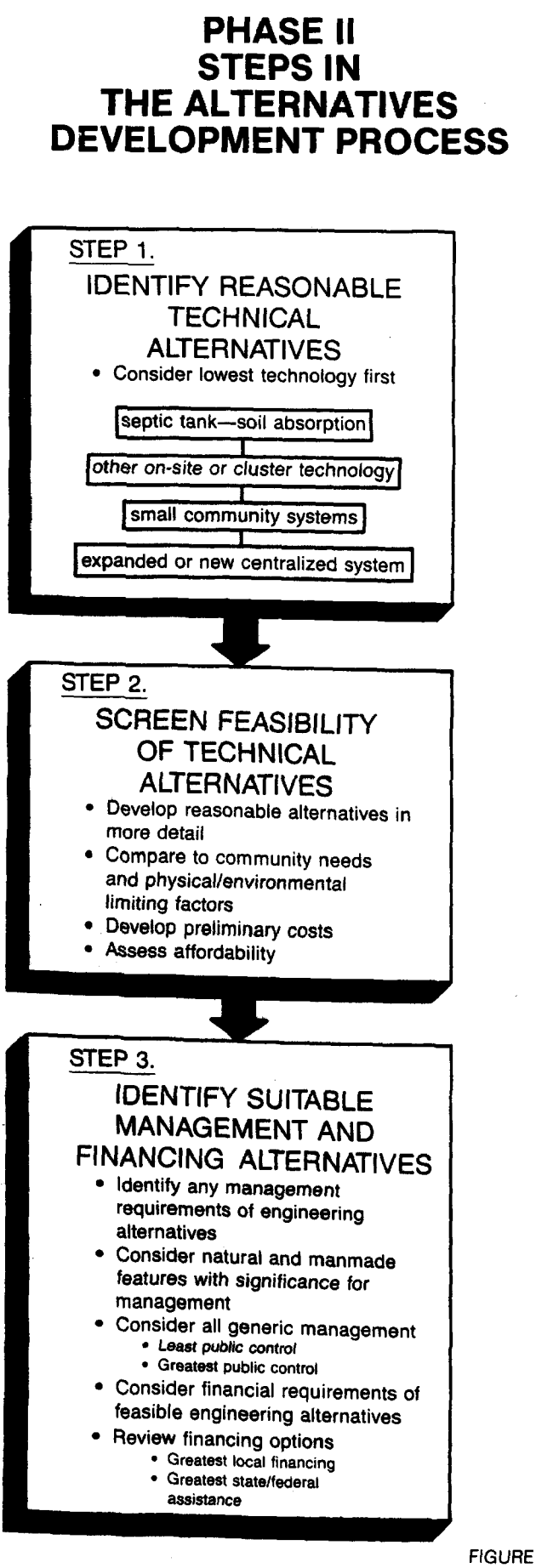


FIGURE 4

fications, nonstructural measures, or revised operations and maintenance (O&M) practices. Table 2 lists common renovation techniques for various types of malfunctions associated with on-site wastewater systems. Most of these renovations are less costly than any type of new wastewater system.

Techniques such as water-saving shower heads and toilets can easily and inexpensively correct problems in certain cases. System renovation or water conservation, however, will not address all problems. For more information about techniques for renovating on-site systems, use U.S. EPA, *Design Manual, On-Site Wastewater Treatment and Disposal Systems*, as well as written guidance from the state agency responsible for on-site wastewater systems and your state land grant university. See Appendix C for information sources.

If you cannot effectively utilize existing on-site systems, new on-site systems should be considered (Alternative 3 in Figure 5). By replacing an old or excessively small septic tank and absorption field, you can solve the problem if site constraints such as soil characteristics, slope, and lot size, do not prohibit using on-site systems. Your state health department has established site limitations for using on-site systems, such as minimum depths of soil above the water table, minimum soil depths above bedrock, and maximum land slope. A number of site constraints can be overcome with recently developed wastewater technologies as long as some basic requirements are met. For example, use of low-pressure pipe or mound systems can increase the soil depth to the water table or bedrock. Some mountainous southeastern states allow newer technologies more often than other states. Also, the minimum site requirements for on-site systems vary from state to state. Follow your state's requirements. All of the basic on-site wastewater technologies are found in the first 20 fact sheets of Volume II—*Technical Engineering Alternatives*—prepared as part of this project and available from EPA's Atlanta office. A list of these basic technologies appears here as Table 3.

Alternatives 4, 5 and 6 involve using sewers and a common treatment facility to serve a number of establishments. Sewers and centralized treatment in combination are generally more costly for rural communities than on-site systems. The collection system is chiefly responsible for this higher cost. Typically, at least 80 percent of the total capital cost of wastewater facilities for rural areas is spent for sewers. Figure 6 shows how the cost for gravity sewers increases as the population density declines. Therefore, sewers should be restricted to locations where on-site systems are "not feasible" due to small lot size, very shallow soils, very low permeabilities shallow depth to water table or excessively steep slopes. Table 4 lists wastewater technologies suitable for community-wide application.

Alternative 4—Cluster or Small Community Systems—will typically serve from 20 to 30 homes connected to one wastewater treatment facility, usually by gravity sewers or

pressure sewers. Of the technologies listed in Table 4, a few are practical only for cluster or small community systems. These technologies include: septic tanks in series or parallel; sand filter(s) as the only form of treatment at a facility; and disposal via community trenches, beds or mounds. All other technologies listed in Table 4 are practical for any community-wide wastewater system.

Alternatives 3 or 4 are also suitable for meeting industrial and commercial wastewater disposal needs. Ground absorption systems for these users have the same siting requirements as residential units. However, where significant volumes of wastewater are generated, large disposal field areas will be required.

Alternative 5—New Area-wide Sewer System—is relatively expensive due to capital expenditures required to install sewer lines. As a result, the EPA Construction Grants Program was developed in the early 1970's to assist communities with these large, up-front capital expenditures. Such grants are still available but to a lesser extent than during the 1970's and only if smaller-scale systems (Options 1 through 4) are not less cost-effective or have greater impacts, operation and implementation requirements. Any system discharging to surface waters will require a discharge permit from the state. Some land disposal systems will also require permits.

Alternative 6—Connect to Nearest Existing Sewer System—requires developing a new collection system to serve the community and constructing a major pipe connection to an existing treatment facility. The collection system can be the same as that developed under Alternative 5, but it could also vary depending on the the location for the connection point to the adjacent system. Topography determines whether the system interconnection would use either large diameter gravity sewers or force main and pump station.

Screen Feasibility of Technical Alternatives

Any number of basic engineering technologies may be reasonable for your community. With 10-15 reasonable choices, you may wonder which are most feasible. The following sections describe how to develop more specific alternatives, and then screen these to a manageable number of feasible approaches.

First, develop more detailed technical descriptions of each alternative. Begin with U.S. Geological Survey topographic maps. If more detailed local maps are available, use them as well. Local maps may be obtained from state or local highway or public works departments or tax assessor's office. Appendix C lists sources for U.S.G.S. maps.

Using the topographic maps, block out a service area. This area should include portions of the community where existing systems are providing inadequate treatment or where water quality and public health problems have occurred. If substantial growth is forecast for the community, these areas should also be included.

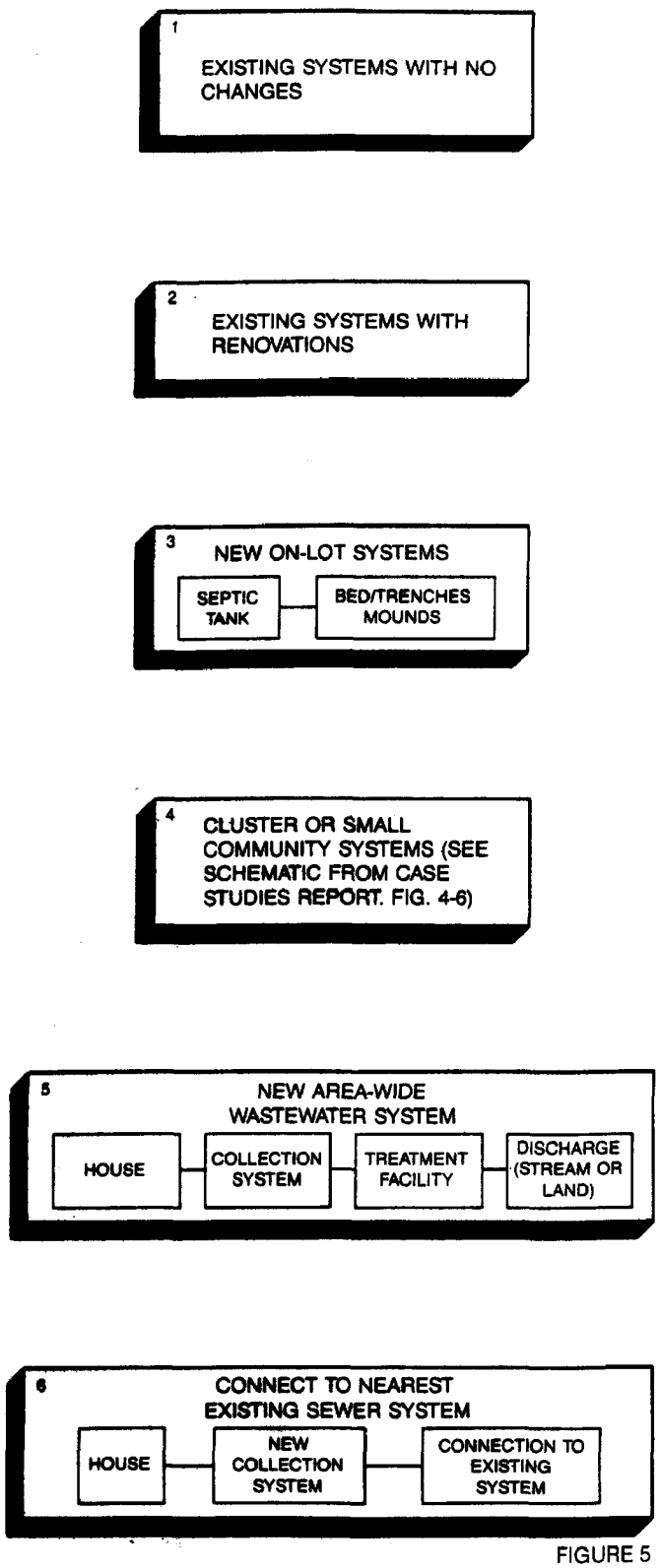


FIGURE 5

TABLE 2
Common Types of On-site Wastewater System Renovations

Type of Malfunction	Possible Renovations
Plumbing back-up	Inspect entire system from house to absorption area
	After inspection, consider ways to unplug system
	Avoid use of garbage disposals
Hydraulic overloading	Divert excess water away from system (e.g. roof drains, inflows from leaks)
	Pump out septic tank
	Install curtain drains
	Reduce water consumption (e.g. low-flow shower heads or toilets)
	Evaluate ways to more evenly distribute wastewater over entire disposal area (e.g. dosing, renovate distribution box)
	Clean and back flush distribution network
	Repair/replace/expand disposal area
Ground Water Pollution	Pump out septic tank
	Avoid disposal of toxic solvents to septic tank
	Provide additional wastewater treatment (e.g. larger or two-compartment septic tank)
	Modify absorption area to provide a soil with less permeability and more treatment potential

TABLE 3
Basic On-site Wastewater Technologies

Treatment at Individual Homes or Businesses	Distribution at Individual Homes or Businesses	Disposal at Individual Homes or Businesses
• Septic tank	• Distribution Box	• Trenches
• Aerobic tank	• Drop box (or drop man-hole)	• Shallow trenches
• Sand filter	• Conventional pipe (3 to 4 in.)	• Bed
• Seepage pit	• Siphon	• Mound over trenches or bed
• Holding tank	• Pumping tank	• Sand filter with or without underdrains
	• Low-pressure pipe (1 1/4 to 2 in.)	• Drip irrigation
		• Sprinkle irrigation
		• Evapotranspiration bed
		• Leaching chamber
		• Seepage pit
		• Privy
		• Composting toilet (for toilet wastes only)

Note: For information about specific technologies, see U.S. EPA, 1984 document prepared as part of the Mountain Communities Environmental Assessment.

Next, determine the number of households within the study area based on mapped information and population data developed during the needs assessment. Then, for on-site systems, estimate the number of renovations that may be required, and what type of renovation techniques will be used. At the same time, estimate the number of new on-site systems needed and decide how many will be traditional septic tank systems and how many alternative or cluster systems will be required. At this point, base these estimates on general familiarity with the service area and the data gathered in the needs assessment phase.

To develop small community system alternatives, delineate groupings of homes which can be efficiently served by one small system. The total number of homes should be limited to about 300. Groups should be as dense as possible to keep sewer cost per home at an acceptable level. Groupings should consider topography so that a reasonable arrangement of sewer lines can be developed. Sewer lines are typically layed out on a watershed basis with lines coming together like branches of a stream flowing downhill. In steeper terrain, small diameter gravity sewers may be feasible. In terrain with little slope, vacuum sewers may be an attractive alternative to large diameter gravity sewers. Pressure sewers using septic tank effluent pumps or grinder pumps may be feasible in more average terrain. Finally, discharge locations must be considered. Each community service area will need a feasible land or water discharge location and, perhaps, a discharge permit.

To develop centralized systems in more detail, follow much of the process described above for the small community alternative. In this case, however, define one large service area. The guidelines regarding dwelling density, topography and discharge locations still apply. If you are considering connection to an existing treatment system (Alternative 6), no treatment and discharge point will be needed. The existing system provides treatment and discharge. To develop this option more fully, you will need to lay out and size an interceptor to connect with the existing facility. You will also need to know the conveyance and treatment capacity of the existing system and whether additional capacity is required.

When you have developed the service areas, collector lines, treatment and discharge points for each reasonable alternative, these complete systems can then be compared to the community's needs and the physical features which may limit implementation. Table 5 presents factors to consider in this screening process.

For example, renovation of on-site systems will not be feasible if general soil, bedrock and water table conditions throughout the areas planned for these systems are too limited. New on-site systems would also be limited under these conditions unless alternative technologies such as mounds or low pressure pipe systems were used. On-site systems may not allow for substantial high density development in the future and, therefore, may not be appropriate in communities with high growth projections. On-site systems generally are not effective if lot sizes are less than 1/4 acre.

TABLE 4
Basic Community-wide Wastewater Technologies
(Alternatives 4, 5 and 6)

Community Sewers	Community Treatment	Community Disposal
• Conventional gravity	• Septic tanks in series or parallel*	• Discharge to stream, river or lake
• Small-diameter gravity	• Trash and grit removal	• Sprinkle irrigation (forest, open or farm land)
• Force main	• Aerobic (biological) tank(s)	• Trenches or beds (with or without mounds)*
• Septic tank effluent pump (STEP)-pressure	• Sand filter(s)*	• Overland flow
• Grinder pump-pressure	• Trickling filter(s)	• Discharge to wetland
	• Rotating biological contractor	
	• Lagoon(s)	
	• Disinfection (usually chlorine)	
	• Artificial (created) wetland	
	• Nutrient removal	

* Only practical for Alternative 4—Cluster or Small Community Systems

Note: For information about specific technologies, see U.S. EPA, 1984 document prepared as part of the Mountain Communities Environmental Assessment.

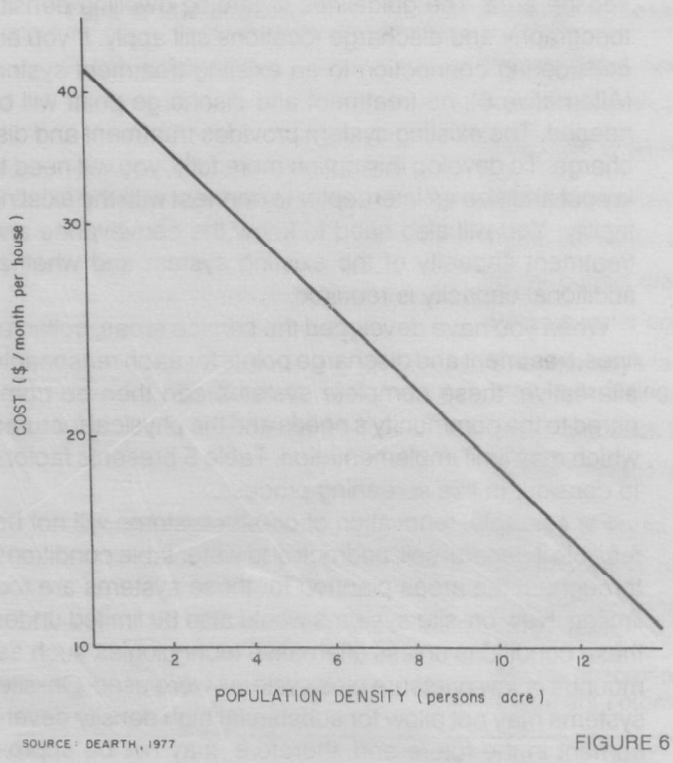


FIGURE 6

The larger-scale alternatives such as small community and centralized systems may not be applicable for other reasons. Existing water quality standards may make numerous small system discharges totally unfeasible or may require very high levels of treatment. Particular concerns might include ammonia, total nitrogen and residual chlorine. Connection to another system may be ruled out strictly on the basis of distance or the impacts of topography on pump sizes and costs. By evaluating the screening factors on Table 5 against local conditions in this manner, you may rapidly cut back the number of feasible alternatives.

Once the alternatives are developed and compared to limiting physical features, a preliminary cost estimate should be made so as to eliminate financially unfeasible options as soon as possible. Costs can differ from location to location even throughout the mountainous portion of the southeastern U.S. The following steps are recommended to estimate costs:

- *For on-site systems*

  1. Obtain unit costs for an average-sized system from local installers.

     Average the costs from the various installers.

     Add the unit costs based on technical requirements, for example, a specified septic tank size and a specified amount of absorption area.

- *For cluster or small-community systems*

  1. Use unit costs from local installers for septic tanks, if needed, and trench placement of sewer lines.
  2. Outline a typical system for your community including number of homes/businesses, lengths and diameters of sewer lines, method of treatment and disposal.
  3. Estimate a cost per household by combining unit costs and a typical system configuration.

- *For an area-wide sewer system*

  1. Estimate the location, pipe diameters, lengths and installation depths for the sewers, and pump stations if utilized. Assume a certain length of lateral sewer per household based on local lot and septic tank configurations. Assess whether pavement replacement is required.
  2. Estimate treatment plant size, required treatment processes and method for disposing treated wastewater and sludge.
  3. Develop unit costs based on values shown in Table B-6 of the *Case Study Report* modified based on updated, regional cost indices, available from EPA Atlanta office and from *Engineering News-Record* magazine, and based on verification from local contractors.
  4. Combine the efforts of steps 1 and 2 with the unit costs developed in step 3 and estimate a total cost per household.

For costs estimated for the three case studies, Mud Creek, KY; Harrogate, TN; and Highlands, NC, refer to the *Mountain Communities Draft Case Study Report*, issued by Region IV in May, 1985.

All cost estimates should include capital costs and annual operation/maintenance/repair costs. The easiest way to combine these costs is by converting the total capital costs to equivalent annual capital costs and then adding the two sets of annual costs to obtain total annual costs. Annual capital costs + annual operation/maintenance costs = total annual costs. Convert total capital costs to equivalent annual capital costs through a multiplication factor—usually a number between 0.05 and 0.2—which is based on the length of the payback period—presumably based on a bond or loan—the interest rate, and the amount of insurance coverage. Commonly 10 percent coverage is assumed. Table 6 gives multiplication factors for various interest rates assuming a 25-year payback period and 10 percent coverage. To use Table 6, consider an interest rate of 8.5 percent, a capital cost of $800,000 and an annual operation/maintenance/repair cost of $5,000. The total annual cost is estimated to be

TABLE 5
Screen Factors for Basic Types of Wastewater Systems

Renovation of On-Site Systems

- Define site limitations (for example, lot size, open space available, soil depth to water table and bedrock, soil permeability)
- *Condition of existing systems (materials, dimensions, variability within study area)*
- Compare potential methods of renovation with the site features and system conditions

New On-Site Systems

- Define site limitation(s) (see above)
- Match site limitation(s) with problem(s) at hand and available on-site technologies

Cluster and Small Community Systems

- Use of conventional or small diameter gravity sewers vs. pressure sewers with vacuum sewers as a third, less-utilized technology (topography, minimum sewer slopes, required excavation depths, right-of-way, pavement replacement)
- Number of homes and businesses, average and maximum wastewater flows
- Average distances from building (or septic tank) to street and lengths of sewers along right-of-way
- Number and location of pump stations (if any)
- Number and length of stream, highway, and rail crossings
- Treatment process (plant) selection and location
- Need for chlorination or some other form of disinfection
- Method and location of wastewater disposal (Discharge to nearest body of water is usually the least costly disposal method.)

Area-Wide Wastewater System

- Number of homes and businesses to be sewered, average and maximum wastewater flows
- Use of gravity sewers vs. force mains/pump stations
- (All other aspects listed above for cluster and small community systems apply to area-wide systems as well).
- Types of treatment based on costs, water quality standards, susceptibility to upset due to flow variations or toxic inputs and based on other factors such as operation requirements.
- Alternative locations for a treatment plant and for the wastewater discharge

Connect to Nearest Existing Sewer System

- Capacity of existing sewer lines and treatment facility
- Size and length of new sewer lines (including number of establishments to connect and flows)
- Use of gravity vs. force mains/pump stations

[($800,000) × (0.1)] + $5,000 or $85,000. If 500 establishments were served—based on the number of households projected to be sewered midway through the life of the wastewater system—a uniform user charge is estimated at $85,000 - 500 or approximately $170 per year or $14 per month.

You should compare the EPA financial affordability criteria with the estimated monthly user charge to get a preliminary assessment of the cost of the alternative wastewater facilities. The affordability criteria used by EPA are as follows for single family households, expressed as a percentage of median household income.

- 1.0 percent if median income is less than $10,000
- 1.5 percent if median income is between $10,000 and $17,000
- 1.75 percent if median income exceeds $17,000.

Since your state may have financial affordability criteria that better match local economic conditions, you are encouraged to check with state representatives as you develop your wastewater facility planning effort. From the previous example, a charge of $170 per year is considered affordable by EPA only if the median household income for your community (based on census figures or local planning department estimates) exceeds $11,000 to $12,000. If you cannot afford a system you must reduce or simplify its scale.

Often the biggest difficulty for any system is showing that improved wastewater facilities will alleviate public health/water quality problems. Without this assurance, the need to spend money may not be recognized. For in any community, the problems may be difficult to define, and tracing the source of the problem to wastewater facilities can be even more difficult.

Identifying Suitable Management and Financing Approaches

The remainder of this chapter discusses suitable management and financing alternatives. First, five generic management system models are described. Then, procedures for matching suitable management approaches with the engineering techniques just screened are put forth. Financing options are reviewed and an approach to identify the more suitable financing option is presented.

The five generic management alternatives differ primarily in their degree of public involvement. The alternatives range from very limited public management to total public responsibility. Public involvement is described in terms of seven management functions including:

- problem identification
- system planning and design
- construction and installation
- permitting
- operation and maintenance
- monitoring and compliance
- training and public education

The first management alternative is conventional homeowner-centered management. Under this alternative, private homeowners or some other private entity are responsible for system ownership, operation and maintenance. Public agency functions are typically limited to permitting and investigating complaints from local residents.

The second alternative is the conventional approach with public monitoring. It is similar to the homeowner-centered approach; but here the public agency is responsible for regular monitoring of wastewater systems. Instead of just responding to complaints, the public agency monitors the system to assess the extent of proper functioning.

Private ownership with required operation, maintenance and monitoring is the third alternative. Here, a private homeowner or other party still owns the wastewater system. The management agency, in addition to its regular monitoring function, ensures that proper O&M is carried out.

Alternative four is private ownership with public operation and maintenance. Here, the public agency is responsible for all system functions—except ownership. The management agency directly operates and maintains the system and also monitors, permits and ensures compliance with pre-set performance standards.

The final management system alternative is full public sector-oriented management. This involves complete public responsibility for the wastewater system. The public agency (e.g. a city or county health or public works department) owns, operates, maintains, and monitors all systems. For more detailed descriptions of these five alternatives, see the fact sheets at the end of Volume III of the *Alternatives Development Report.*

Two factors must be considered to determine which of these approaches is most suitable for your community. First, identify management requirements of the selected engineering alternatives. Second, identify natural or man-made features of the community which may impact management options. Then review the management alternatives individually. Select those approaches that require the least public management activity, and yet meet other community requirements.

The homeowner-centered management approach may be adequate is rural areas with scattered development, farms and large-tract subdivisions and where physical features allow traditional septic tank-soil absorption systems. Also the community should be one where little future growth is projected and where physical features do not limit the functioning of on-site systems. If your community meets these requirements, you may wish to retain conven-

tional homeowner management for further evaluation.

The conventional system with monitoring is most applicable to conventional on-site and cluster systems in communities with a higher number of failing systems, greater growth rates and less suitable natural conditions. Monitoring can greatly increase the performance and reliability of all types of wastewater facilities. Regular monitoring and maintenance of system performance helps ensure that new systems are properly operated and maintained, and renovated systems continue to function properly in the future. With proper monitoring and maintenance, systems will be more likely to function properly, and areas with greater population densities and natural limitations may be better served by on-site and cluster systems. This alternative is not suggested for areas experiencing explosive second home growth or recreational development.

Private ownership with monitoring, required operation and maintenance builds upon the previous example and adds required operation and maintenance to the other management functions. Since systems are generally owned by private entities, this alternative applies most in communities where on-site systems are the prevalent method of wastewater disposal. Because operation and maintenance is ensured, this management approach is more suitable to alternative and innovative on-site and cluster systems as well as small, privately-owned small community systems. With the addition of required O&M, this management alternative is more applicable to communities where extensive growth or physical limitations present the potential for wastewater management problems.

With private ownership with public operation and maintenance, operation and maintenance functions are performed directly by the public management agency instead of by the private system owners. This alternative applies to communities similar to those suitable for the above alternative, however, the increased control provided by direct public O&M can ensure adequate system performance and wastewater treatment for all types of systems—even where physical features or extensive future growth may present significant problems in managing wastewater.

Under full public sector-oriented management, a public agency assumes ownership of all wastewater facilities, and either performs or has performed all of the necessary management functions. This approach is typical in more populous urban and suburban areas where conventional centralized collection and treatment systems are prevalent. Although public ownership of facilities is usually applied to large-scale conventional treatment plants and sewers, this approach may be applied to small community, cluster, and on-site systems. Complete public responsibility may be the preferred approach for communities with numerous wastewater problems, extensive growth and natural or socio-economic limitations.

Now that you have determined the range of feasible engineering alternatives and the likely management approaches, we will consider the facilities. To identify suitable financing options you must consider any financial requirements of engineering alternatives, the facilities' cost and the suitable management techniques. Financing alternatives include:

- major federal funding
- limited state or federal assistance
- local financing
- privatization

The fact sheets included in Volume IV of the *Alternatives Development Report* describe specific financial programs at the federal, state and local levels; program objectives; requirements; fund uses; and limiting factors. The U.S. Environmental Protection Agency has been the primary source of major federal funding for wastewater projects through its Construction Grants program. The basic grant allotment covers 55 percent of eligible project costs. As much as 20 percent additional grant money is available for utilizing innovative and alternative I/A techniques. For a thorough discussion of I/A technologies, you are referred to EPA's *Innovative and Alternative Technology*

TABLE 6
Approximate Multiplication Factors for Converting Total Capital Costs to Equivalent Annual Capital Costs

For 25-Year Payback Period and 10 Percent Insurance Coverage

Interest Rate, %	4.0	7.0	8.0	9.0	10.0	12.0	14.0
Multiplication Factor	0.07	0.09	0.10	0.11	0.12	0.14	0.16

For Varying Payback Periods at 10% Interest Rate with Insurance

Payback Period	10	15	20	25	30
Multiplication Factor	0.17	0.14	0.13	0.12	0.12

Assessment Manual. Volume IV of the *Alternatives Development Report* provides more information on funding of I/A technologies beginning on page 5-8. As part of this program, rural states must reserve from 4.0 to 7.5 percent of their construction grant money for I/A projects. The Farmers Home Administration is the other major source of federal assistance for wastewater facilities. The Appalachian Regional Commission and the U.S. Economic Development Administration also have federal funds for small community wastewater projects but at lesser levels than EPA and FmHA. These agencies, along with the various state funding alternatives available, are the primary sources for limited state and federal assistance. Persons to contact regarding funding from each of the above agencies are listed in Appendix C.

Local financing techniques include general obligation bonds, revenue bonds, bond anticipation notes and short-term bank loans. Private sources of funding include short-term loans, private developers and partnerships, and private ownership and operation (privatization). Descriptions of each of these are in Volume IV of the *Alternatives Development Report.*

To find the best financial alternative for your community, consider the requirements or limitations of the preferred engineering and management alternatives. If the preferred alternative involves renovation of on-site systems, a relatively inexpensive alternative, then major federal funding, state funding and even local funding would be feasible. If the preferred technology is solely construction of a centralized system, then major federal funding is the most reasonable financial alternative.

The selected management techniques may also impact the preference of financing approaches. For instance, EPA Construction Grants may only be awarded to a privately-owned system which has existed since December 27, 1977. Only government-owned (county, city or authority) facilities are eligible for State of Georgia Emergency Grants. In some states, certain local financing mechanisms (i.e. issuance of general obligation bonds or revenue bonds) may only be used by a municipality or county agency. The fact sheets and text in Volume IV of the *Mountain Communities Wastewater Management Alternatives Report* present information on the special requirements and limitations of each financing technique.

Phase III: EVALUATING THE MORE FEASIBLE ALTERNATIVES

Overview of the Evaluation Process

Now you are ready to evaluate the alternatives. During the development phase, you identified feasible engineering alternatives and discussed the most reasonable approaches. Then suitable management and financing alternatives were identified. Now the task is to narrow down the engineering alternatives to the best one or two, and match the engineering with preferred management and financing alternatives.

Figure 7 is a diagram of the four separate steps involved in the evaluation process. First, the engineering approach is narrowed down based on more detailed site information and cost estimates.

In step two, the final management alternative is selected. Existing institutional structure within the community, detailed information on available authority of existing public agencies, expertise and availability of local agency personnel and public concerns and preferences are considered.

The best financing technique is selected in step three. This decision-making is based on local financial conditions, agency financial authority, and grant eligibility requirements.

The final step is to put together the three selected components and make sure they fit as a package. Then this combined approach is implemented in the final phase.

Evaluating Reasonable Engineering Alternatives in Detail

The first step in the evaluation process is to select the preferred engineering alternative based on detailed site assessments. If you are considering repair or renovation of existing on-site systems, it is imperative that you first determine the cause of failure or unsatisfactory performance. The extent of field investigations depends on the nature of the problem and the age and type of the sewage system being studied. In particular, many problems center around improper siting, installation, hydraulic overloading and lack of maintenance.

When going into the field, determine the frequency of the problem before pinpointing the cause. Problems may be: continuous; increasing with time; or noticeable only during wet weather periods. Problems of a continuous nature are sometimes difficult to diagnose, and may need a considerable amount of information from the field. For these problems a site investigation and soil testing is necessary to determine whether the problem is due to improper siting, design or installation. If the system functioned properly for a year or longer, check for hydraulic overloading or maintenance-related problems. Problems of a periodic nature are often easier to diagnose and repair than continuous problems. Since the system works properly for periods of time, faulty design and installation are

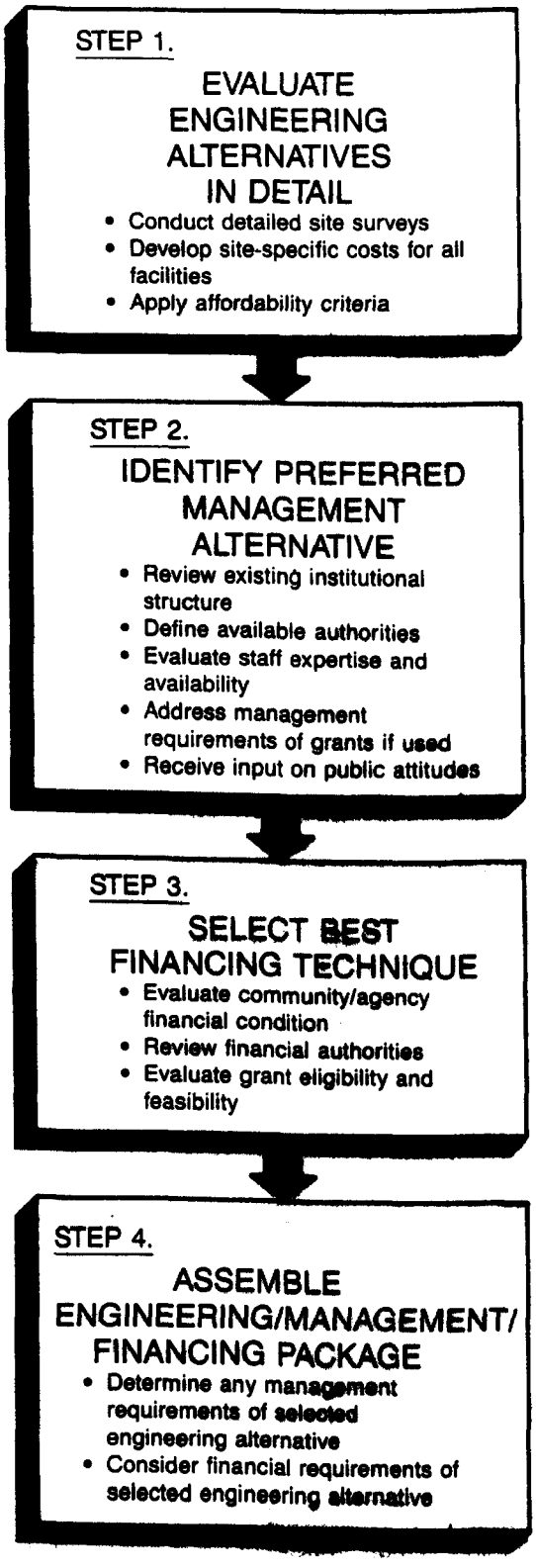


FIGURE 7

not likely sources of the problem. Poor performance in these situations is often due to poor siting, improper maintenance or excessive water use and/or groundwater infiltration.

When troubleshooting problems in the field, you must look at the absorption area to determine the surface and subsurface drainage characteristics of the site as well as that of the adjacent land. Initially, you must determine if the surface drains or runoff from adjacent areas and rooftops accumulate on or near the absorption area. Use a rule and hand level to take spot elevations that will precisely determine flow paths and directions. Also check physical damage. Driving heavy equipment, constructing paved areas, or building over septic tanks and absorption areas can collapse both tanks and laterals. This can cause partial or complete failure of the sewage system.

Uneven wastewater distribution is another souce of system failure. Therefore, you should evaluate the distribution system. In gravity systems, laterals and distribution boxes may have settled thereby overloading a segment of the system. Check septic tanks and cesspools for structural integrity, tightness (i.e. waterproof), existence and condition of baffles which frequently deteriorate and fall out of their designed locations. Then you must use either hand tools or a backhoe to determine the physical properties of the soils (e.g. texture, structure, depth and permeability) and to identify restrictive features such as high water tables, excessive or fractured rock and clay pans.

Once these site analyses are completed, you need to determine the best methods to renovate the system. Various techniques are listed on Figure 8. The overall feasibility of the renovation alternative is determined by listing the number of systems involved, the source of problems determined from the site work and the probable renovation techniques. If most systems can be rehabilitated with fairly basic procedures, renovation is a preferred alternative.

The field work required to evaluate new on-site systems is outlined in the various state standards, rules and regulations governing the use of sewage treatment and disposal facilities. In siting future small-scale sewage facilities, you should review the preliminary information gathered during the needs assessment phase. You can then begin the detailed field testing needed to describe and map the characteristics of the site as well as to develop specific information pertaining to the future design of the sewage facilities. The site analysis procedures are similar to the activities just described. A recommended step-by-step procedure and site requirements for various on-site systems are included in Appendix E.

For a larger system such as multi-family dwellings, schools and small businesses, more detailed testing is required to ensure proper treatment and disposal. Many mountain region communities have shallow unsaturated soil depths due to rock or high water table. Here subsequent groundwater mounding may cause flooding when larger sewage volumes are added to the soil. In all cases, a study of groundwater and geology should be conducted to:

- Determine the wastewater characteristics
- Establish background ground/soil water characteristics
- Define aquifer recharge characteristics
- Determine lithographic and fracturing features
- Establish aquifer permeabilities
- Establish groundwater flow patterns
- Identify possible monitoring locations

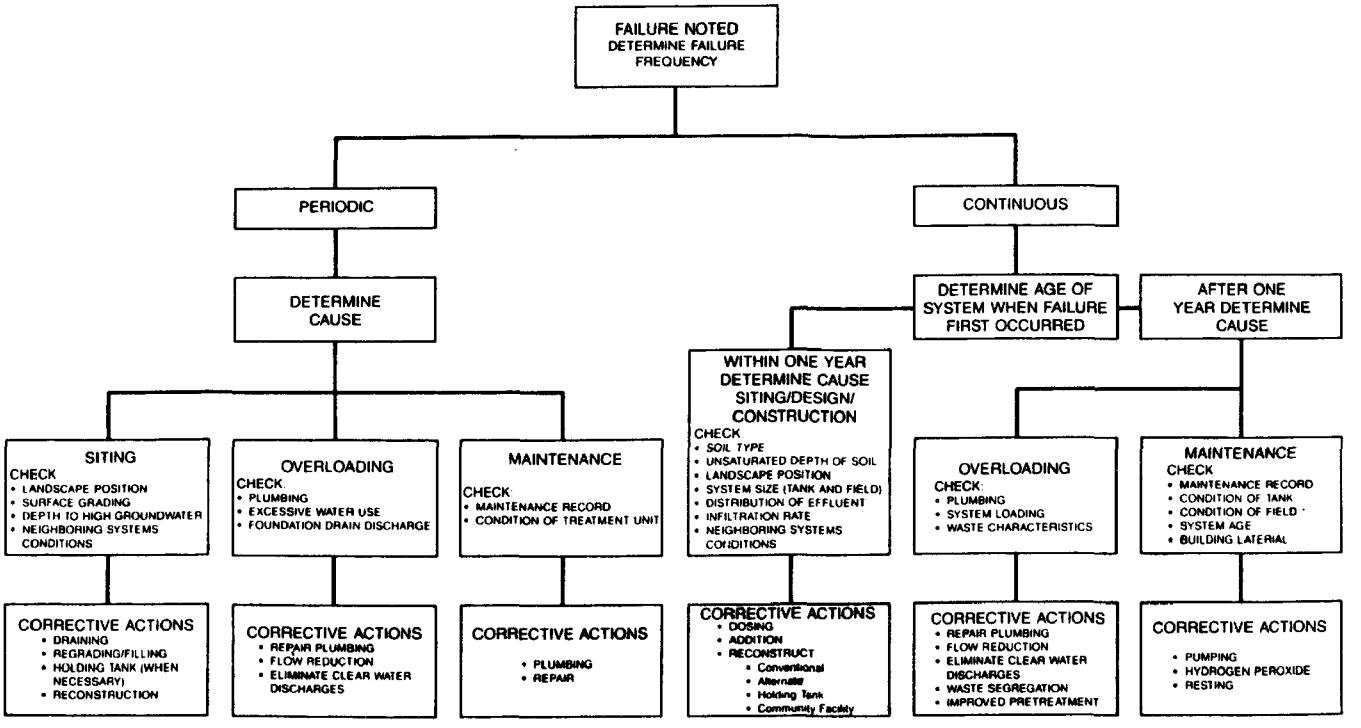
When considering clustering or grouping of sewage facilities, perform a site investigation similar to that described above for individual systems. Pay particular attention to the type and volume of wastewater generated. Larger waste flows can be treated by septic tanks, sand filters, lagoons and package plants. Based on the treatment mechanism considered in the design proposal, field testing is needed to confirm the validity of using such techniques for the project. In all instances, determine the characteristics of the site. Briefly, soil absorption systems and lagoons may be land intensive. On the other hand, sand filters may be buried and take up little surface area. When considering grouping sewage facilities, determine how the wastewater will be collected from individual sources and conveyed to the treatment facility. Field surveys and soil borings will be needed to evaluate the potential routes of wastewater conveyance. Where depths to rock and groundwater are limited you may want to consider shallow-placed pressure sewers that use STEP systems or grinder pumps.

Information collected during the analysis will allow you to determine the feasibility of on-site systems on a site-specific basis, On-site systems may not be suitable for many homes and businesses or many cluster or more complex on-site systems may be required. In such communities small community systems or a centralized facility may be preferable.

If some form of on-site system appears feasible for your community, you will also need to evaluate the feasibility of septage disposal. Septage is the solid material which accumulates in the septic tank. For the system to operate properly, the septage must be pumped out every few years. Without timely removal, the solids will flow into the drainfield, clogging the holes in the distribution pipe. The need for proper septage disposal will be particularly significant in communities where proper O&M of on-site systems is performed and the septic tanks are emptied in a timely manner.

Septage can be properly disposed of in many ways. If your community has a central treatment facility or is close

METHODS OF SOIL ABSORPTION FIELD REHABILITATION



SOURCE EPA DESIGN MANUAL ONSITE WASTEWATER TREATMENT AND DISPOSAL SYSTEMS OCT 1980

FIGURE 8

to one, the septage may be disposed there. Check with the plant operator to make sure that the dosage of material will not disrupt proper treatment functions at the plant.

Septage may also be applied directly to the surface or just below the surface of farm and forest land. It is preferable to inactivate the septage before land application by anaerobic digestion or stabilization with lime or other amendments. The feasibility of land application is primarily determined by the same soil, geology and climate factors considered in evaluating on-site systems. Where these systems are feasible, land application will generally also be feasible.

Composting with woodchips, leaves, garbage or other bulking agents is another approved disposal technique. This process results in a dry, odor and pathogen-free material which can be beneficially used as a soil amendment. Septage can also be treated by anerobic digestion in special biogas treatment facilities. Biogas digesters are becoming more and more common in rural areas especially on dairy farms where livestock and household wastes are used to produce biogas to heat homes, greenhouses and dairies. Biogas can also be compressed to form methane for fueling equipment and powering electrical generators. Large volumes of methane can produce enough electricity for an entire small community with surplus power being sold to a local power utility. The residual product from this digestion process can then be land applied and provide a source of plant nutrients. Septage may also be applied directly to croplands, pastures, woodlands and disturbed lands such as unreclaimed strip mines where the soil has lost valuable nutrient-rich topsoil. Septage with its organic material and nutrient content can restore or improve these lands and enrich plant growth. When using septage in agricultural activities, liquid forms can be directly injected into the plant root zone using conventional liquid manure injections. Subsurface injection of septage adds valuable nutrients and water to subsurface soil horizons for subsequent plant root utilization. Liquid or dewatered septage and sludge can be spread directly on grasses and other forage crops after cutting and harvesting. This topdressing of septage serves as a source of nutrients, organic material and moisture for supporting subsequent crop stands.

These disposal techniques are preferred, but they can add to the cost of managing on-site systems. Stabilized septage may also be disposed of in approved landfills. With this technique, no beneficial reuse is obtained, but costs are held down.

The evaluation of small community and centralized systems requires analysis of some of the same issues discussed above as well as a number of new considerations. The primary issue here is the cost of the collection system. This cost is influenced by the type of system selected and its constructability. Carry out a windshield survey to evaluate topographic details and to better determine excavation depths required to provide adequate pipe slope through undulating terrain. Soil borings along proposed sewer alignments will reveal the type of material to be excavated and tell whether rock needs to be removed. From this information you can determine whether large gravity sewers are necessary and feasible or if small diameter gravity or pressure sewers are required.

Next consider the treatment plant location. Develop rough size estimates and visit alternative land parcels of adequate size. The best site is flat, fairly level, away from homes, and convenient to the point of discharge but preferably out of the floodplain. Floodplain sites may be feasible if they can be economically flood-proofed and if construction is not prohibited by floodplain ordinances. Collect information on land costs at this time. Remember, EPA grants do not apply to land purchase.

You will also need to consider the feasibility of discharge locations for small community and centralized systems. The characteristics of the receiving stream and the discharge limits specified by the state will have a major impact on the feasibility of this approach. You may want to check other discharges along the stream reach that would receive your community's discharge. Also, you may want to sample ambient water quality in the stream (particularly during low flows) and review the existing water quality classification and corresponding standards. With this information you can meet with state water quality officials to better define potential discharge limits. At the same time, determine any state concerns regarding a discharge, such as potential adverse effects of residual chlorine in the discharge.

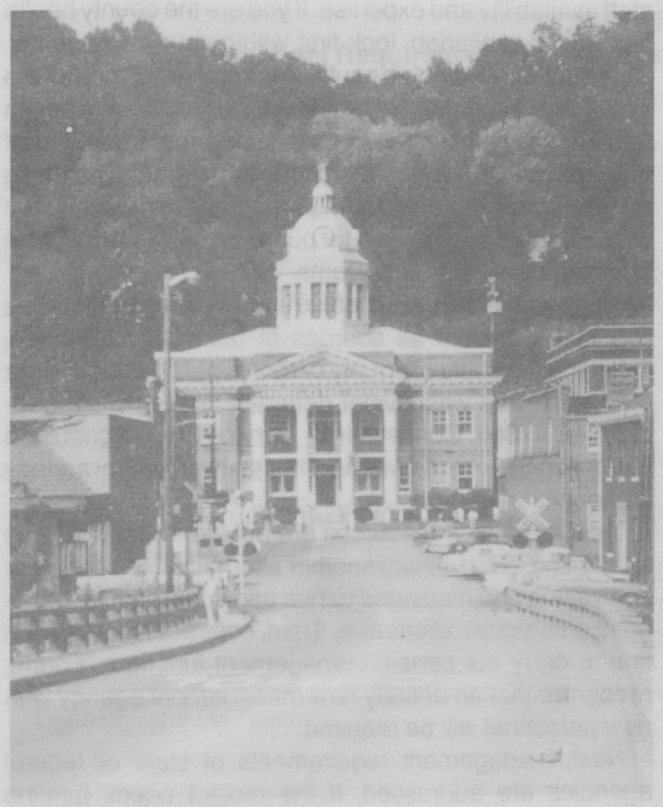
The last issue to evaluate is the feasibility of sludge disposal. Sludge is the term applied to the more solid residual material produced by a treatment plant. Sludge is similar to septage which was discussed under Alternatives 1-4. Disposal techniques are similar to those for septage. It is important to recognize that a solids disposal plan is an integral component of management for both on-site and centralized facilities.

Once the alternatives have been evaluated, you can develop final, site-specific costs. You now know the actual number of rehabilitations required and the remedial measures necessary for on-site alternatives. You also know the number of new septic tank-soil absorption systems needed and how many and what types of alternative on-site systems are needed. The number of cluster or small community systems are now defined along with the number of homes served, the types of treatment technology, and the method of effluent disposal. For centralized systems, you now know the specifics of the collection and treatment systems and the type and location of discharge. For all systems, you can now estimate land costs.

With this more detailed cost data you should go back and refine the original cost estimates. You may also need to generate net present worth costs in addition to the total annual costs developed in Phase 2. Present worth costs alllow you to evenly compare the cost to your community today of alternative systems which may have different operating lives and different comparative levels of O&M

and capital costs. If you anticipate EPA funding, present worth costs will be required.

The final issue to consider is the relative impact of these finalized costs and their affordability to the community. The affordability criteria discussed in Phase 2 should be applied to the final cost estimates. If an EPA grant is utilized, you need to select the engineering alternative with the lowest present worth cost. If other financing techniques are used, you may have a greater choice. In rural mountain communities the best engineering approach is the one which can adequately treat and dispose of the community's wastewater with the lowest possible charge to local residents.



Identifying the Preferred Management Alternative

Selecting a preferred management alternative involves making decisions on a wide variety of issues. First you should consider the existing institutional structure within the community. In other words, determine which public management agencies currently serve the area. Then develop a list of these agencies and their service area and responsibilities. These agencies may include:

- city agency
- county agency
- interlocal agreement
- joint management agency
- county service district
- county water & sewer district
- sanitary district
- water & sewer authority
- metropolitan water district
- metropolitan sewerage district
- private corporation
- combination of above.

In general, each of these entities is some variation of a municipal agency, public authority, special district, joint management agency or private corporation. Their characteristics are described in detail in Volume III of the *Alternatives Development Report.*

The local health department is one agency which exists in all communities within the study area. It oversees state regulations for ground absorption wastewater disposal systems. Most counties have an individual health director and supervising sanitarian. Others may be part of a health district and share staff with one or more counties. Regardless of the arrangement, the supervising sanitarian will be familiar with all aspects of on-site wastewater disposal. Contact with the sanitarian, along with the county executive, town mayors and other government heads is the fastest way to inventory existing managment agencies. Once the inventory is complete, decide whether any one of these existing agencies could adequately manage new wastewater facilities. In some communities—particularly where more than one incorporated jurisdiction is involved—establishment of a new agency, such as a joint management agency or special district, should be considered.

Next, consider the authority available to these local agencies. An agency cannot carry out management functions unless it is permitted to by state laws and regulations. Although it may be possible for new laws to be passed authorizing additional management functions, it is better to select a management alternative with adequate regulatory authority.

The authorities all agencies need to properly manage wastewater systems include:

- to own, purchase, lease and rent both real and personal property,
- to meet the eligibility requirements for loans and grants for construction of wastewater—particularly decentralized—systems from both federal and state governments,
- to enter into contracts, undertake dept obligations either by borrowing and/or by issuing stock shares or bonds, and to sue and be sued,
- to fix and collect charges for sewerage usage, including taxes for payment of construction of decentralized systems and user charges,
- to operate and maintain installed units,

- to plan and control how and at what time wastewater facilities will be extended to property within the jurisdiction,
- to regulate the planning, design, construction and operation, and maintenance of decentralized systems, and
- to have right of entry onto private property to inspect for adequate performance in the operation and maintenance of wastewater facilties.

Direct discussions with local officials will help determine which authorities are available to existing agencies. Contact directors of the agencies identified above, the city or county attorney, and if necessary, the state attorney general's office. You can also review reports, law digests and the state laws directly. Reference information for study areas states include:

- Tennessee State Code, Chapters 13, 16, 34, 81 and 82.
- Kentucky Revised Statutes, Chapters 74 and 76.
- Wastewater Management in Coastal North Carolina.
- South Carolina Code of Laws. 1976 and 1984 Supplements. Chapter 31, Section 10 and up.
- Constitution of Georgia. 1983. Article 9. Section 2, Paragraph 3.
- Official Code of Georgia, annotated. Section 36-34-5.
- Code of Alabama. Title 11.

Volume III of the *Alternatives Development Report* developed a series of tables that identify the authorities for each type of agency for all six states within the study area. These tables are included in Appendix F.

Research and discussions with local officials will allow you to list authorities available to all of the existing agencies within the community. If none of the agencies have adequate authority to carry out the necessary management functions, decide whether you can put in place a more broadly authorized public body. The county or state attorney will be able to provide guidance regarding other public bodies that may be established and tell which authorities are available.

Next, evaluate the availability of existing agency staff and their expertise. In other words, how many staff members are in the local management agencies and what are they trained to do? The objective is to determine whether the existing agencies can provide properly skilled manpower to carry out the desired management functions.

Although a wide range of capabilities may be necessary to properly manage wastewater facilities, many basic functions can be performed by the present staff. Many administrative functions can be handled by existing agency secretarial staff. Often one person can assume numerous management functions. Sanitarians can become planners, engineers and regulators. Management alternatives which require greater supervision and regulation of systems may need more staff time and specialized expertise. The information presented on Table 7 will help you estimate the types of skills and the amount of staff time required for particular management functions. Resource requirements for different management alternatives are discussed in Volume III of the *Alternatives Development Report*.

Using Table 7 as a starting point, you should ask the directors of existing management agencies about their staff availability and expertise. If you are the county health director or sanitarian, look first within your own agency. Your staff will probably be sufficient to carry out most of the necessary management functions. Existing county health department or municipal public works department staff may be able to perform all functions up to and including supervision of required O&M procedures. Increased staff will probably be necessary for public performance of O&M or public ownership of systems.

Staff availability and expertise should be as extensive as possible. Consider all sources of potential assistance, including the staffs of county or municipal agencies, other than water and wastewater departments; regional agencies; U.S. Soil Conservation Service and Agriculture Extension Service; as well as other state or federal agency personnel.

If sufficient staff resources are not identified, you have four options. First, select another alternative. Second, recognize that you may need to hire additional staff to implement a particular alternative. Third, contract with a private firm to carry out certain management functions. Fourth, recognize that an entirely new management agency with new personnel will be required.

Next, management requirements of state or federal agencies are addressed. If the project needs funding assistance to be cost-effective you must provide the management functions which the funding agency requires. In the case of EPA, for example, if on-site or cluster treatment systems are proposed, performance of the following management functions will be required:

- assuming responsibility for the systems including proper installation, operation and maintenance
- assuring that systems will be constructed, operated and maintained to protect underground potable water sources
- developing a user charge system
- obtaining reasonable access to all systems
- establishing a comprehensive management and periodic inspection program including water well testing.

EPA also has specific management requirements for grants covering conventional collection and treatment systems. Refer to *Construction Grants, 1985* and EPA grants regulations: 40 CFR, Parts 30 and 35. Refer to Appendix C for a list of data sources.

If FmHA grant or loan funds are being applied to the project, follow that agency's management requirements. FmHA requirements for loan and grant assistance are set out in regulations contained in 7 CFR 1942 A and 1942 H. Primary guidance in 1942 A addresses most issues of concern including eligibility requirements, fundable projects and application procedures. These documents are available from the local FmHA offices listed in Appendix A.

Other state and federal agencies may also have management requirements which you should consider. Refer to the fact sheets on financing alternatives presented in Volume IV of the *Alternatives Development Report*. The agency contacts listed can provide further information on management requirements.

The last issue to consider when evaluating management alternatives is public attitudes. The citizens of the community must accept the management alternative for it to succeed.

To best gauge public response to various management alternatives, seek input from a citizen advisory committee (CAC) and hold public meetings or workshops. Input from

TABLE 7
Personnel Requirements for Management of Small-scale Sewage Facilities

Function	Person-days Required	Personnel Required[1]	Comments
Problem Identification (Sanitary survey)	.1-.5/system	g,h,k,m,n	Inspect site, drainfield and wells; interview homeowner
System Planning and Design			
Planning	.25-.5	c,f,k,m	Preliminary site investigation, site mapping, soil analysis
Design Conventional Systems	.25-1/system	a,m	Sewage facility design after site analysis completed
Design I/A Systems	.5-2/system	a,m	
Construction/Installation			
Inspection	.2/each	d	Number may vary dependent
Installation	3-8/system	g,h,i,o	on type and size of system
Permitting	.5/permit	b,c,f,k,m	Involves time involved in permit issuance only
Operation and Maintenance	N.E.[2]	d,f,g,j,l	Dependent on level of involvement and type of systems
Monitoring and Compliance			
Water Quality Monitoring			
-Well	.1/well	d,j,k,o	Sample collection and analysis
-Surface water	N.E.[2]	d,j,k,o	Dependent on type and size of water body and other factors
Enforcement	2/violation	b,c,d,e	Involves inspection and court time
Public Education	.5/month	c,k	Public meetings and development of information materials

[1]Personnel Required
a -Civil/Sanitary Engineers
b -Clerks
c -Administrators
d -Inspectors
e -Attorney
f -Soil Scientist
g -Laborers
h -Equipment Operators
i -Plumbers
j -Laboratory Technicians
k -Environmental Planner
l -Wastewater System Operators
m -Sanitarian
n -Volunteers

[2]N.E. = Not Estimatable.

Source: Adapted from *Technical Reference Document, Final-generic Environmental Impact Statement, Wastewater Management in Rural Lake Areas*, Volume II, U.S. EPA Region V, 1983.

a CAC throughout the development and evaluation process can help ensure that the alternatives being considered are understood and generally accepted by the community. Describe the different management alternatives at a public meeting so citizens understand their responsibilities. Citizens will better accept increased controls over on-site systems when the existing problems and needs are described and when the reason for greater control is understood. Local residents want assurance that burdens and benefits fall evenly upon all.

The public is often particularly concerned about access to private property or public ownership of on-site facilities. You may decide to drop public ownership of individual systems from further consideration based on input received at public meetings. Perhaps even cluster systems would be better controlled by a homeowners organization than by a public agency. If there is substantial citizen concern regarding public operation and maintenance of on-site systems, it may be best to select a management alterntive where O&M are supervised by the public agency instead of directly performed by the agency. Techniques such as a revocable operating license may be feasible. Here, the owner must prove to the management agency that proper O&M have been carried out. The actual work itself can be performed by the homeowner or certified septage hauler or installation contractor. Other techniques include:

- maintenance permit forms
- permit to operate
- maintenance personnel certification.

These are described in Volume III of the *Alternatives Development Report*.

During Phase 2 management alternatives were screened based on compatibility with the feasible engineering alternatives and suitability to the significant natural and man-made features. At this point, the remaining alternatives can be evaluated based on available authority, local expertise, and public acceptance.

Conventional homeowner-centered management has no requirements for additional authority or expertise. In most communities it should be highly acceptable to local citizens. In communities where renovations or new on-site systems are implemented with homeowner funding, homeowner management will probably be the preferred alternative. However, caution is raised. Where public funds are used to develop on-site systems and the costs are retired over time, homeowner-centered management may not provide sufficent assurance that the systems will continue to function adequately throughout the payback period. To protect the public investment, a greater degree of management will be required. Some of this approach's limitations may be overcome if the local health department aggressivley enforces existing siting and installation regulations. To choose a preferred management approach for on-site systems, we suggest that:

- homeowner-centered management may be appropriate for privately financed septic tank-soil absorption systems in communities with suitable natural and man-made conditions
- more extensive public responsibility may be necessary where public funds are utilized or local conditions require more complex engineering technologies
- in communities with lower levels of income and education, proper management of on-site systems may require greater levels of public involvement.

The conventional system with monitoring is the next management system alternative. This approach provides a slightly increased level of control over facilities. It also requires more public agency involvement and perhaps an increase in agency staff to carry out the regular monitoring activities. In most states, public health departments can perform system monitoring without increased authority. Since the level of public activity remains low, this approach should be acceptable to even skeptical citizens. Where conventional management is not being considered because of citizen concerns, engineering requirements or local physical features, the conventional approach with monitoring may be an acceptable alternative.

Private ownership with monitoring and required operation and maintenance is the next step in terms of public control. As discussed above, the public monitoring function may be performed with little increase in agency staff. Depending on the state, additional regulatory authority may be needed before a public agency can require preventative maintenance or certain operating procedures. Because agency personnel do not need to directly access private property, required O&M may be a feasible management approach where citizens are concerned with extensive government controls. Overall, this alternative may be the most satisfactory middle-of-the-road approach for communities where natural and man-made features limit conventional management.

Private ownership with public operation and maintenance will require most local agencies to increase their staff to perform the maintenance functions. Regulatory authority over public operation and maintenance of systems on private property is not clearly defined in each state. To determine the need for additional authorities, refer to the tables on agency authorities included in Appendix F for preliminary guidance and follow-up with staff of the state attorney's office. This management approach may not work in communities where the public strongly opposes increased government activities. Health-related compliance activites may be required in these areas.

The final managment alternative is full public-sector management. This approach is generally taken in communities where a centralized collection and treatment system is used. Full public management of small community or centralized systems is quite typical and does not

require increased authorities for most local agencies. Staff increases, however, are likely to be significant. Full public management of on-site systems is another matter. Authority to publicly own on-site systems is not clear. Only North Carolina expressly permits full public management. In other states, authorities will need to be clarified and possibly augmented before this alternative is viable. Significant expansion of staff will probably be required as well. For all these reasons, this alternative may not be the preferred approach to managing on-site systems. Even in communities where local needs and physical limitations are great, the previous two alternatives will probably provide adequate management. To implement full public management, even in communities such as these, a substantial public education effort to overcome citizen concerns may be needed.

Privatization is an alternative to public ownership of centralized facilities which may be an attractive alternative for many communities. It transfers the management and other responsibilities to a private contractor who carries out management functions for all types of facilities: on-site; cluster; small community; or centralized. If your community can afford reasonable user fees, you may want to request privatization proposals from private firms.

Selecting the Best Financing Technique

The third step in the evaluation process is to select the best financing technique for the community. To make the proper selection, consider the following factors:

- the community's financial condition
- available financial authority
- eligibility for and availability of financial assistance.

Begin financial evaluation by developing a profile of the community's financial condition. Volume IV of the *Alternatives Development Report* presents a financial evaluation worksheet on page 5-33. A reprint of EPA's financial planning checklist is also included in Appendix IV-B of that report. These two reference sources provide an excellent step-by-step procedure to use in evaluating your community's financial condition. EPA also has developed a Wastewater Facilities Financial Information Sheet (Federal Register February 17, 1984) which is an approved format for documenting financial capability of the community. See Appendix C for the source for this document.

The objective of this first step is to estimate how much the community can afford to pay to build and maintain wastewater facilities. Even if the community is counting on state or federal financial assistance, it still must demonstrate overall financial health, and be prepared to finance the local share of the total project cost.

Examine information such as household income, property values, community growth and development, public revenues and expenditures, and total assets to gauge the community's financial condition. Specific financial data reviewed should include:

- state or local legal limitations on debt
- net direct and overlapping tax-supported debt per capita,
- percentage of current property tax delinquency,
- percentage of debt service on tax-supported debt to total revenues of the community's operating budget,
- average life of existing tax-supported debt in terms of general obligation bonds,
- the ratio of projected revenues to the total annual debt service, and
- the ratio of the depreciated value of the community's revenue producing facilities to the outstanding (remaining) bonded indebtedness of the facilities.

The second issue concerns available financial authorities. Here you need to determine whether the agency which will carry out the project has the authority to issue bonds and notes; impose assessments; levy taxes; set fees, rates and charges; enter into contracts and hold property. In most states, public agencies may set fees, enter into contracts and hold property. Bonding Authority and taxing power, however, are much more limited. Counties and municipalities generally have these authorities. Health departments do not. For other management agencies, the authority will vary from state-to-state. In some states an agency may issue revenue bonds but, unless the agency has taxing power, it does not have the authority to issue general obligation bonds. The tables of agency authorities in Appendix C provide a preliminary indication of financing capabilities. Further information can be obtained from the agency's attorney.

The final factor concerns the agency's eligibility to receive grant or loan funds, and the feasibility or likelihood of the funds being provided. Refer to the agency authority tables in Appendix C for a presentation of grant-eligible agencies. In general, funds from the u.s. Department of Housing and Community Development under the Community Development Block Grant Program (CDBG) are available only to county and municipal governments. EPA funds are available to a wider range of agencies. FmHA funds may be available to the greatest number of groups including profit and non-profit community organizations and developers. Further information on eligibility for EPA construction grant funds is contained in the regulations for the program published in the February 17, 1984 Federal Register. (See Sections 35.2000a and 35.2005b[27].) FmHA eligibility requirements are listed in 7 CFR, 1942 subparts A and H.

The second half of this issue of assistance availability is the feasibility of receiving a grant and the timeframe involved. Even if your community agency is eligible to

receive financial assistance, it does not mean that its application will be approved or that funds would be available in a reasonable timeframe.

EPA grants are awarded to communities on the basis of a state priority list procedure. States annually develop a project priority list with one section indicating projects to be funded from the current annual allotment and a second portion listing other projects anticipated to be funded from future fund allotments. Each state submits its priority list to EPA by August 31 of each year to allow the Regional Administrator sufficient time for review prior to the beginning of the next fiscal year on October 1.

In most states similar priority rating schemes are used for large and small communities. However, the rating procedures are changing to better address those small communities without any centralized collection and treatment facilities. In Tennessee, for example, a greater number of rating points are given to communities with serious public health problems resulting from failing septic systems.

Following the priority rating of a particular project, the states then assemble a priority ranking list of all applicants for construction grants under the Federal Construction Grants Program. This listing is then used to allocate monies available from each state's general grant fund. In many states, only the top five or so projects are fundable in any one fiscal year. Although some added preference in rating is now being given to small community or I/A projects, as the above example from Tennessee shows, in general, state priority list procedures tend to favor large-scale wastewater facility projects serving metropolitan areas. EPA does require that certain amounts of state funds be reserved for innovative or alternative projects and for small community projects. Since most states establish separate priority lists for these categories of projects, your community's project would be more likely to receive funding if it is eligible for small community or I/A set-aside funds. See the state contacts listed in Appendix A for further advice on the feasibility of your community's receiving EPA funding assistance.

Although FmHA loans are specifically targeted to rural communities, the total amount of grant and loan funds available is much less than from EPA, so the likelihood of receiving assistance is only slightly better. For both the grant and loan program, FmHA allocates money to each individual state. The amount to each state varies, based on population and number of households below the poverty level. Each community must apply for a grant or loan at the state level. (See Appendix A for a list of state FmHA contacts.) The state FmHA office prioritizes applications based on a ranking system set forth in federal guidelines. The priority system has three major categories:

- population
- existence and extent of present health hazard
- income.

Points awarded vary within each category. For example, the smaller the community, the greater the number of points awarded. The same is true for communities with low median family incomes.

Other factors for which points are awarded include:

- merging of two or more small facilities
- enlargement or extension of existing facility
- public body, Indian tribe or truly rural area
- private sector financing.

To look into funding assistance from other federal or state programs, refer to the contact persons indicated on fact sheets following page 5-36 of Volume IV of the *Alternatives Development Report*.

Based on the information gathered on the community's financial condition, financial authorities and eligibility for funding assistance, you can now decide which overall financing approach offers the best potential. If the selected management agency is not eligible for funding, select another agency or recognize that major federal funding is not a feasible financing alternative.

If your community is grant eligible, you should first evaluate the major federal assistance and the limited state/federal assistance alternatives. Major federal assistance up to 100 percent is available from FmHA, or as a 75 percent grant from EPA. This represents a conventional 55 percent grant plus 20 percent I/A add on

You should probably assume that a large FmHA grant is not a likely financing alternative because of the very limited total grant funds available. For smaller projects though, FmHA may be available. A 75 percent grant from EPA may be possible if I/A technology is part of your engineering alternatives. The number of projects funded each year is small, however, and it could be more than five years before funding is available.

Limited state or federal funding is probably a more realistic alternative for most small communities. All of the study area states except Alabama have some form of grant or loan program for wastewater facilities. The amounts available are limited, however, and generally are used to help match federal funds already secured. Clearly, these state programs will not serve as an acceptable financing approach on their own.

Smaller grants from EPA may actually be less likely than larger ones. Unless a rural community is on the separate I/A funding list, it will have a very hard time competing against major metropolitan areas for EPA funds. Limited federal funding from other sources, however, such as a small FmHA grant or CDBG funds on a yearly basis may be a very realistic financing alternative for small rural communities.

Even if some funding assistance is secured, the community will still need to raise a portion of the capital costs itself and support the entire burden of O&M costs. General Obligation (G.O.) bonds or revenue bonds are usually used for local financing of capital costs.

In general, it may be difficult for small rural communities to issue bonds. Discussions with the county or city attorney and the state public service commission may help evaluate the feasibility. We also recommend consultation with a bonding attorney. G.O. bonds are repaid from general tax revenue, and are backed by the community's *full faith and credit (taxing power)*. To evaluate the feasibility of issuing a G.O. bond, you should examine the community's taxable base, debt ratio and level and reliability of tax collections. If these conditions are favorable, a G.O. bond may be feasible. Because General Obligation bonds are more secure, they are more saleable. You should recognize, however, that voter approval is generally required to issue G.O. bonds. The public often responds negatively to any action which may increase taxes. One alternative—which has been used in Tennessee—is to issue secure G.O. bonds, but to pay them off using revenues. In this way property taxes are not affected. The public may accept this approach more readily for local financing.

Revenue bonds are paid for through user charges. They are more risky and carry a higher interest rate because they are solely backed by the revenue and solvency of the selling agency. Based on the *Case Study Report*, we detemrined that "appropriate technology" solutions are inexpensive enough that most study area residents can afford both O&M costs and retirement of capital costs. Based on this analysis, a revenue bond may be a feasible approach. However, small communities with a weak financial picture probably cannot sell revenue bonds. If they can, the interest rate will probably be quite high.

Privatization is the final alternative to evaluate. This is the most applicable to communities in good financial condition with reasonable household incomes. It has only been applied to centralized or small community facilities, although in theory, it could be applied to on-site systems as well. Factors determining the feasibility of private-sector funding are similar to the basic financial indicators discussed above. Appendix G includes a checklist of the factors you should evaluate.

The final step in the evaluation process is to assemble a complete engineering/management/financing package. This is where separate components of the solution are put together to select the best alternative. In considering the preferred engineering alternative, ask whether it can be put in place using the best management and financing techniques. Here, you must face the financial reality of expensive engineering systems. A total package which includes a centralized system and limited local financing probably will not work. Likewise, a package providing for numerous publicly financed, complex on-site systems will not work in a community where homeowner management is the only implementable alternative.

Guidance has been provided on this interrelationship of alternatives throughout the preceding sections. Hopefully you have found a feasible package. If the package you assembled does not fit or if it is not feasible, try again. Go back through the previous steps and reconsider the impact of one alternative on the other, and then reevaluate all feasible alternatives. Then put the three alternatives together again. Once you have achieved a fit, you are ready to implement the package.

Phase IV: IMPLEMENTING THE PREFERRED ALTERNATIVE

Overview of the Implementation Process

The final phase in solving your community's wastewater problems is implementing the preferred alternative. Steps must now be taken to move the selected alternative from the planning stage to reality. Figure 9 is a diagram which shows the sequence of steps followed in this process. A wide variety of activities are involved in the implementation process. Each activity is extremely important and critical to the success of the project. Improper implementation of these steps will sabotage even a well-planned project.

Develop Local Support and Public Acceptance

Perhaps the most important step in the implementation process is public involvement. Regardless of the community's needs and validity of the selected alternative, plans will not be implemented unless the citizens accept the proposal, and are willing to pay for it. To ensure public acceptance, we suggest you communicate with citizens and make sure that they understand what you are doing. You can do this by establishing a citizens' advisory committee (CAC) during the first phase of the planning process. The CAC should be made up of recognized community leaders from local constituencies including church and community organizations, environmental groups, and business and development interests.

During each phase of the problem-solving process there will be numerous critical points that must be communicated to the CAC and other community residents. At each of these points you must adequately communicate with, and educate, the public regarding the project response to these issues.

The first critical point is during the needs assessment phase. Here, you must convince the public to do something to improve existing wastewater management practices. The best way to achieve widespread recognition of problems is to convincingly demonstrate the need. Presenting results of a sanitary survey or water quality sampling data are not techniques which will spur a community to action. More successful approaches include designating certain citizens as "stream watchers" who monitor specific stream reaches and report obvious water quality or public health threats. North Carolina, for example, has established a very successful state-wide stream watch program to get the public directly involved in water quality monitoring.

A field trip can also be useful in conveying needs. Show the CAC members straight pipes and gray streams with fecal material and toilet paper. Another alternative with good potential is to distribute dye packets to school children. As part of a class project on health or environmental problems, ask the children to flush the dye down the toilet at home. If dye blooms appear in backyards, ditches and local streams, the public has proof of local problems.

The CAC may be called on to develop alternatives of its own. Where on-site systems are feasible, property owners

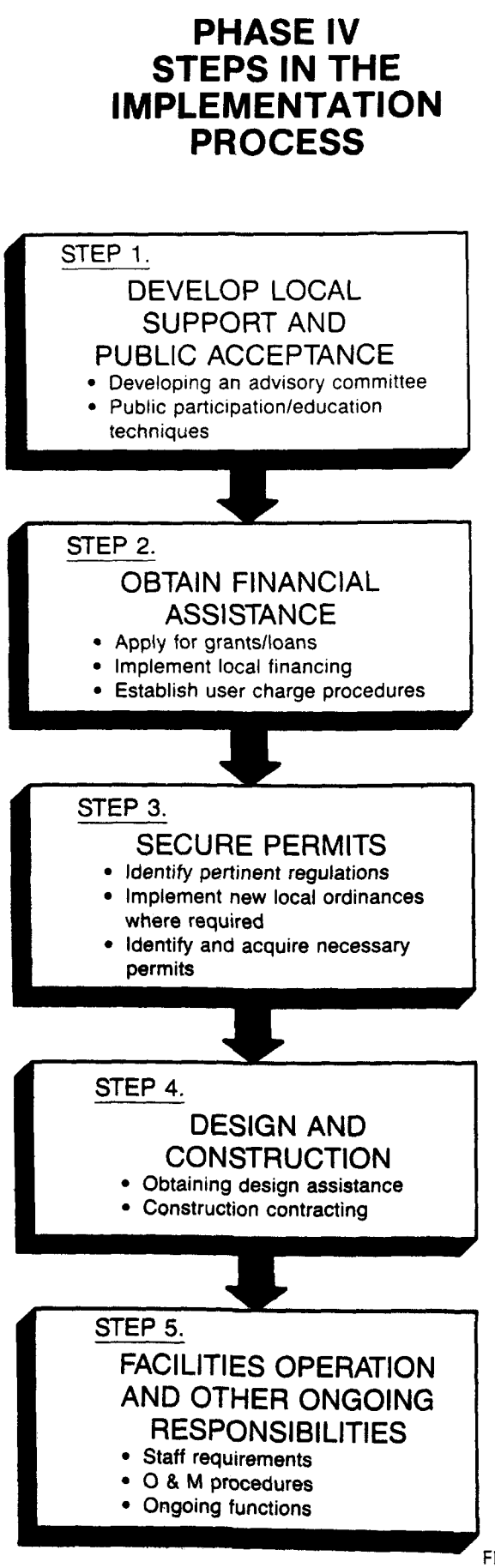


FIGURE 9

will want to be involved in selecting the facilities required on their property. Their first opportunity for this will likely be public meetings during the alternatives development phase. At this time, review technologies selected on a tentative basis with interested owners. Maps indicating the tentative selections should be posted at the meetings for this purpose. Be prepared to explain the basis of selection and to discuss additional steps that will confirm or modify the selection. If on-site systems are feasible, the next step is a detailed site analysis. This may require minor excavation and other property disturbances. Therefore, property owners should be notified so they may agree and be present. Care in preserving the property's appearance at this point as well as during construction will help preserve the owner's cooperation.

When you evaluate the feasible alternatives, request the CAC to recommend specific evaluation factors which best reflect the values of the community. Ask what is most important in your community: total costs; who pays; absolute environmental quality; public health; or aesthetic issues. Use all available lines of communication to convey your understanding of community values and to solicit further community response. Newspaper coverage of project needs and alternative solutions can be extremely helpful. Throughout this process, recognition and understanding of what the community values most is critical to the project's success.

Obtaining Financing Assistance

Once you have selected the alternative and have received a public vote of confidence, you can start putting the plan into practice. Now you should apply for financial assistance, and put together local financing packages and user charge systems.

Application for grant or loan assistance should be addressed first. If the preferred alternative requires major federal funding or limited state or federal assistance, you need formal grant applications. If the alternative needs only local funds, you still may want to apply for funding assistance because it could further lower the user charges. Most communities must apply for EPA funds when planning and design are complete, but small communities that cannot afford planning and design fees may apply earlier for an "allowance" to cover these costs. EPA needs to know how you plan to fund the local share of project costs as part of the application. For the purposes of EPA funding, assume local funding will be required for either 25 percent or 45 percent of project costs depending upon whether you qualify for greater I/A funding. Chapter 13 of *Construction Grants, 1985* provides detailed guidance on the procedures required to apply for EPA funds. This document identifies all the materials that must be included with the application, and provides additional references on EPA application procedures. Once you apply, you will be placed on the state priority list. Projects are

funded in the order in which they are ranked. In most states, only projects in the top five to ten places are funded each year.

You must also submit a grant application to receive a grant or loan from the FmHA. Procedures for this application are presented in 7 CFR 1942. We strongly advise you to contact the regional FmHA representative for further references and direct guidance. Contact persons for FmHA are listed in Appendix A. Persons to contact for information and applications for other loan and grant programs are also noted on the fact sheets.

If you attempt to issue a bond, we recommend that you employ an experienced financial advisor. The community attorney and chief financial officer will be involved in the process. Also a recent audit of the community's financial condition is required. If possible, retain an investment banking firm to perform advisory services in planning the financing as well as the marketing of the bonds. A bond-counsel firm should be retained to provide a legal opinion on the issuance, the security for the bonds, and the federal tax exemption. In small communities, the bond-counsel firm is especially important. If a rated bond is planned, a rating agency such as Standard & Poor's or Moody's must be called on to examine the community's finances, to determine the strength of the specific issuance, and to establish a rating.

The prepared bond is then offered for sale. In purchasing the bonds, the investing community will consider the rating and may directly examine the community's finances. Issues of interest to the investment community include the existing debt burden, the make-up of the community, whether there is a broad customer base or if it is a single industry town. The Government Finance Officers Association (GFOA) is a valuable source for guidance information regarding local financing options. Refer to Appendix C for GFOA's address.

To develop an alternative using private financing, you must hold discussions with the selected privatization firm. This firm will be responsible for arranging financing, designing, and constructing the selected facilities. To implement a privatization approach the community must draft a contract and negotiate an agreement with the privatization contractor. A sample form used for contract management of existing facilities is included in Appendix H. Contracts for a totally private development project are more extensive.

Once a final financing package is developed, you must make decisions on allocation of charges to users of the system. First, if EPA funds are used on the project, certain requirements must be met. EPA's *Construction Grants, 1985* discusses these requirements in section 12.2. Also refer to EPA's *A User Charge Guidance Manual.*

The community and the system managers are more concerned with how local costs are distributed among users and how the fees are collected. These techniques will have a significant impact on community acceptance, as well as the long-term financial health of the program.

Local costs may be paid individually by each homeowner or may accrue to the public at large. Which of these two categories facility costs will fall into will depend on the management and financing alternative chosen. Under some alternatives, all capital and O&M costs for facilities would be private costs to each homeowner. An example is individually managed, homeowner-financed on-site systems. On the other hand, if total public ownership of on-site systems is implemented, all capital and O&M charges become public costs—even the capital cost for the septic tank and drainfield.

Along with the question of allocating costs to public or private accounts there is a question of how to distribute the public costs among users. Costs may be averaged among users or allocated based on certain user characteristics. For example, the most typical method of assigning costs is based on rates of water use and assumed sewage flow. Those who use the most, pay the most. Users may also be charged individually on the basis of their effluent characteristics—strong, weak, toxic—or on the types of service they require. One drawback to this approach occurs with on-site system alternatives. Here, those users lucky enough to have suitable sites for on-site disposal would be charged very little. Homeowners whose site requires mound or low pressure pipe systems could end up being charged more than they could possibly afford. Under these circumstances, it may be more equitable to average the cost of both inexpensive and more costly systems so that every community resident is provided some form of adequate, affordable wastewater facilities.

Once you finalize the amount assessed to the users, you still need to determine how to bill them. Generally, capital costs and O&M costs are recovered from users in different ways. Connect fees, tapping fees, and monthly charges are typically used to cover O&M and administrative costs of the system. Debt service on capital costs is generally retired through general tax revenue or some type of special assessment. Although debt retirement may be included as part of the monthly fee, EPA does not allow this on projects it supports.

The method of billing capital costs will depend on how the capital was originally raised. If G.O. bonds were used, tax assessments are the likely source of collection; for revenue bonds, user charges. Costs which are assessed as part of the community's taxing process may be easier to collect. Few homeowners would risk a tax lien for nonpayment of sewer charges.

Securing Permits

The third step involves securing the permits and implementing any new local ordinance which may be needed to put the chosen facilties in place. First, identify regulations that apply to your proposed facilities. There may be different state, federal and local regulations which must be complied with for each community before a project can begin.

You should be aware of the division of responsibilities between state health departments and water quality agencies. In South Carolina and Tennesee, these two agencies are within the same larger department, but the agencies themselves are separate. In the four other study area states, health and water quality functions are not even within the same department. This is important to you because different types of facilities will be under two totally different regulatory programs. Alternatives using ground absorption are regulated by state health departments. Systems discharging to surface waters, whether they are on-site, small community or centralized facilities are regulated by state water quality agencies. This may become an issue if you anticipate receiving EPA funds for a project using ground absorption treatment. The EPA construction grant program is administered through a division of the state's water quality agency; however, you will need to meet regulatory requirements of the state health department. It benefits communities atempting to use EPA funds for ground absorption systems where these separate state activities are effectively coordinated. State construction grant agencies could designate a staff or utilize resources of the health department to provide more information on ground absorption systems to small community applicants.

All states within the study area have now received authority to administer National Pollutant Discharge Elimination System (NPDES) permits. Therefore, federal agency involvement will probably be limited to compliance with grant regulations. It should be pointed out, however, that the construction grant program is covered by the National Environmental Policy Act (NEPA). Therefore, it may be necessary to develop an environmental impact statement (EIS) on projects using federal funds. Small-scale projects in small communities will generally not have this additional requirement to meet. If you are applying for EPA funds, the state representative will advise you as to the environmental assessment procedures required. (See the list of state contacts in Appendix A.)

Agencies with regulatory authority at the local level include the health department, planning department, and building inspector.

Request permit applications from the agencies with regulatory authority at each governmental level. In general, the permits required will include: an NPDES permit for surface water discharge; state health department permits for ground absorption systems; and various local zoning and construction permits. Appendix I includes a list of some of the applicable permits and contact points with the regulatory agencies.

The final item in this step concerns the need for new local ordinances or other implementation authorities. Depending on the type of management and financing alternative selected you may need more local authority than is presently available. Based on the evaluation of local authorities completed in Phase 3, you should know what additional authorities are needed.

To develop new authorities, you must recognize that the state delegates all local authority, for both county and municipal governments. Therefore, unless the state has delegated general authority to begin with, you may not establish additional specific authorities by passing local ordinances. If an authority does not exit under the present municipal charter and state legislation, a new state law—not a new local ordinance—must be passed.

Of the six states in the study area, only North Carolina has passed state legislation explicitly permitting on-site wastewater management districts. The North Carolina statute is included in Appendix J. In other states, the necessary authorities may still be available to local agencies, but they have not, as a defined group, been explicitly delegated. Depending on state statute, municipal and local public health agencies may have the right to abate or prevent nuisances and to require permits and licenses for various activities. These general grants may provide the authority to require renewable operating permits for on-site systems and to allow public access for either monitoring or direct public O&M. Specific management ordinances will need to be adopted to implement these authorities. An example of a local agency management ordinance is included in Appendix K. If adequate authority does not exist, public access rights can be obtained through an easement grant with individual owners without requiring new statutory authority from the state. EPA requires an easement agreement or direct statutory authority that grants access rights to any on-site system for which it funds. Where access authority is not available and easements cannot be obtained, you will need to seek new state legislation.

You may also need to rate other actions locally to aid in implementing the facilities. For example, if you want to establish a joint management agency inter-agency agreements will need to be negotiated. If you need to create a new special district agency you will need a local referendum, particularly if this agency has taxing powers. You will also need a local vote of approval if general obligation bonds are funding the facilities.

Design and Construction

The fourth step in the implementation phase is design and construction of the facilities. After all the planning, financial and regulatory analysis, public participation, and permitting, you are finally ready to put something in the ground.

If a community agency plans to carry out this work itself, a good place to being is with the series of design manuals which EPA has produced for all forms of wastewater treatment facilities. The *Design Manual, On Site Wastewater Treatment and Disposal Systems* will be most helpful to small communities.

Where small scale, on-site facilities are being used, local agency staff may also carry out the facility construc-

tion. You will need to contract some heavy equipment work and to procure materials from outside suppliers. Chapter 16 of *Construction Grants, 1985* can guide you on procurement procedures.

For large-scale projects, you will probably need a design consultant and construction contractor. You can find out how to prepare an RFP and how to evaluate proposals from various professional organizations as well as state and federal agencies. The contacts with FmHA and EPA will help you obtain design and construction assistance.

Facilities Operation and Other On-Going Requirements

The final step in the problem-solving process deals with on-going responsibilities. These are the activities necessary to perform once the facilities are in place. Unless the facilities are managed properly, your entire investment in improved water quality and public health may be useless in only a few years.

First, provide adequate staff to manage the system. Personnel requirements were determined in Phase 3 and compared to existing resources. If a management alternative requires additional personnel, hire them as soon as possible. Staff members who will implement the project should be on board during the planning process. Table 8 presents a list of average salaries for some staff capabilities which you may need to add to the management agency. The expense of additional staff may be quite a burden in smaller rural towns. Additional staff and administrative costs should be added to other charges already computed for the system. Total costs may then be more than users can afford. One solution is to share specialized staff with other local communities, or to establish a formal circuit-rider program. Under such a program, specialized personnel would spend one day a week in each of five communities or some other rotation schedule. A regional planning agency or council of governments can often help implement a circuit-rider program. This agency may also help put the program in place for you.

Alternative means of augmenting your staff include part-time employees, contract services, volunteer or intern staff, and obtaining grant assistance to cover staff salaries. The management contract form included in Appendix H provides an example of how certain staff services may be contracted. State and local volunteer bureaus may help find volunteers. Local community colleges and universities are often ready sources of temporary intern assistance. Whatever the source of staff assistance, you should also put in place a training program to ensure that new personnel have the knowledge and skills to properly operate and maintain the community's wastewater facilities.

The most important on-going responsibility is to ensure that proper operation and maintenance are carried out. If

the homeowner is the party primarily responsible for O&M functions, the management agency must see that systems are designed and installed properly, and that the homeowner receives all the technical assistance necessary to know how and when to maintain his facilities.

If O&M is required of the homeowner by the management agency, techniques must be developed for administering operating permits or licenses and certification of private firms which may be retained to carry out O&M functions. Some form of feasible enforcement technique to ensure compliance with the program is a key requirement. If the agency fails to keep track of what O&M has been done, and fails to require compliance where proper O&M procedures have not been followed, then the systems will not function properly. Enforcement techniques include:

- violation orders
- injunctions
- deed attachments
- termination of water/electricity
- condemnation

These are discussed on pages 4-22 through 4-25 of Volume III of the *Alternatives Development Report.*

The preferred enforcement procedures are those which are effective but not too onerous. For example, in many counties the only way to enforce proper maintenance of on-site systems is by threatening condemnation. Most rural community judges are reluctant to impose such a santion, however, For this reason, many local health department officials feel that they have no realistic method of enforcement. Shutting off water where a public supply is provided may be a solution. In many cases, though, homeowners may return to unsanitary wells or springs for water supply, and then a new public health problem will exist. Cutting electrical service is probably the most satisfactory approach. For very poor residents, there may be no way to force adequate O&M if they simply cannot afford the proper procedures. In this case, consider public O&M.

TABLE 8
Average Salaries for Typical Managment Agency Personnel

Personnel	Average Annual Salaries($)
Soil Scientist 2	20,000
Laborer	9,500
Equipment Operator	13,500
Plumber 1	12,000
Plumber 2	18,000
Small Waste Flows Contractor	20,000
Laboratory Technician 1	9,500
Laboratory Technician 2	14,000
Water Resource Scientist	25,000
Environmental Planner	15,000
Wastewater System Operator 1	9,500
Wastewater System Operator 2	15,000

Source: *Final Generic Environmental Impact Statement Wastewater Management In Rural Lakes Areas,* Technical Reference Document, Volume II.

It is difficult to enforce publicly performed O&M. Where the facility put in place is a centralized system employing surface discharge, then the NPDES permit specifies discharge limits which are enforced. Proper O&M cannot be directly required, but lax procedures may eventually result in violations of discharge limits. Such violations are subject to various fines and other enforcement procedures by the state and by EPA. Where public management of on-site systems is carried out local performance standards will probably exceed those of the state health department or other regulatory agency. Therefore, if the local agency does not perform proper procedures, no one else will.

Beyond the issue of compliance procedures, many other activities must be considered important on-going functions. Agency administration is one of these. Proper stuff organization, record keeping and accounting procedures will help to ensure that the management agency, itself, continues to function properly. Many of the EPA publications previously cited provide guidance on recommended administrative procedures. Proper accounting is one of the key considerations. An adequate reserve account is required where revenue bond financing is used. Any well-run management should develop accounting and budgeting practices to ensure an adequate capital reserve. FmHA has very strict administrative procedures which grantees must follow. As a result, the delinquency rate is less than 1.5 percent on all FmHA projects, including those using more "creative" financing. FmHA instructions for grantees and *Accounting for Rural Water Systems,* developed by the National Rural Water Association provide further guidance on effective management and accounting procedures. Local FmHA contacts can provide you with this information.

Two management functions most often overlooked are planning and public education. Yet these are perhaps the most important to the long-term success of any wastewater management program. You must keep citizens informed of progress toward water quality and public health goals. At the same time, continuing planning activities will make certain to ensure that future needs are met. If a proper alternative for the community's needs has been established, proper management that provides for long-term planning and involvement by the public should ensure a permanent solution to the community's wastewater problems.

GLOSSARY

Citizen's Advisory Committee (CAC)—a group of recognized community leaders from local constituencies including church and community organizations, environmental groups and business and development interests, concerned with representing the feelings and interests of the community or service area as a whole in solving wastewater problems.

Clean Water Act—formerly the Federal Water Pollution Control Act of 1972. Objective is to "restore and maintain the chemical, physical and biological integrity of the nation's waters."

Comprehensive Plan—document developed by a planning agency for a specific community or region. Generally contains a statement of community development goals and objectives, a land use plan, a transportation plan, a community facilities plan and a statement of the relationship of the community's future development to adjacent areas.

Engineering Alternative—method used for properly collecting, treating and disposing of wastewater. Range from centralized system to traditional septic tank-soil absorption system.

EPA affordability criteria—an applicant for EPA funds must be eligible based on criteria primarily concerned with income levels.

Financial Alternative—method of financing the preferred engineering alternative. Range from major federal funding (e.g. EPA) to local financing (e.g. General Obligation Bond) or any combination.

Homeowner's organization—a non-profit group comprised of property owners. In many states a homeowner's organization can finance and manage a wastewater system.

Innovative and Alternative (I/A)—U.S. EPA classification of wastewater projects based on technology. According to the Clean Water Act, these technologies are primarily supposed to conserve, reclaim or reuse water, recover energy, recycle resources or reduce costs. "Alternative" technologies are those which have been proven or used in practice, while "innovative" ones are not fully proven under the circumstances of their planned use. Additional construction grant monies are set-aside for eligible I/A projects.

Management Alternative—method for institutional management of an engineering alternative. Consists primarily of system ownership, O/M and monitoring by a public entity or private individual or group.

Management Function—seven activities a management system should perform to maintain adequate public service and to guarantee long-term performance of wastewater systems. Functions are problem identification, system planning and design, construction and installation, permitting, operation and maintenance, monitoring and compliance and training and public education.

Management System—overall approach taken to managing wastewater. Ranges from total private (homeowner) to total public management with various combinations of the two in between. Five generalized models of management systems were developed for the *Alternatives Report* and are discussed in the Development and Evaluation sections of this handbook.

Needs assessment—process of determining wastewater needs of an area by examining the condition of present facilities and limitations posed by natural and man-made features.

Non-structural method—methods or devices used to improve the performance of an on-site system without major structural modification. Methods include, but are not limited to, use of watersaving devices, discontinued use of garbage disposals, and use of grease traps.

Performance data—data in the design and use of existing wastewater systems and their present effect on water quality, gathered as part of a needs assessment. This data helps document how well a system is working and substantiates the need for improved facilities.

Priority list—system used by several federal and state funding sources to rank grant applicants. Rankings may be based on population, existence of a health hazard, income or a number of other categories depending upon the funding source. Funding expediency is based on priority list ranking.

Privatization—private ownership and operation of wastewater treatment facilities. May involve private sector investment in construction and operation of facilities, operation of existing facilities or in the repair, expansion or rehabilitation of older sewage systems.

Regulatory authority—legal authority to manage a wastewater facility. May include issuing bonds, collecting taxes, entering private property, etc.

Service area—physical area which will be served by a given wastewater system. Includes current area served by either on-site systems or a centralized system and any areas having a high development potential.

Septage—solids which settle to the bottom of the septic tank.

Study area (relative to the Mountain Communities project)—original project study area included 82 counties in 6 states (Alabama, Georgia, Kentucky, North Carolina, South Carolina, and Tennessee) identified by the Appalachian Regional Commission as the highlands portion of southeastern Appalachia. Case study areas included Harrogate, TN; Highlands, NC and Mud Creek, KY.

Tax maps—maps available, usually at a cost, from a tax assessors office which show parcel location and sizes.

Waterborne diseases—diseases classified by the Center for Disease Control as being carried by water and generally caused by unsanitary practices.

Windshield survey—a field survey of land use. May also be used to note areas with standing sewage or other indications of malfunctioning systems.

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Bibliography

Appendices

APPENDIX A

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APPENDIX B

SAMPLE SANITARY SURVEY FORM

Resident:

Study Area:

Owner:

Surveyor/Date:

Address of Property:

Weather:

Lot Location:

Approximate Lot Dimensions:

Tax Map Designation:

_____feet by_____feet

Preliminary Resident Interview

Age of Dwelling: ___ years Age of sewage disposal system: ____ years

Type of Sewage Disposal System:

Maintenance: ____years since septic tank pumped. Reason for pumping:_____
____years since sewage system repairs (Describe below)
Accessibility of septic tank manholes (Describe below)

Dwelling Use: Number of Bedrooms:____actual, ____potential, ____Planned
Permanent Residents:____adults, ____children
Seasonal Residents:____, length of stay____
Typical Number of Guests:____, length of stay____

If seasonal only, plan to become permanent residents:____ In how many years?____

Water Using Fixtures (Note "w.c." if designed to conserve water):

____Shower Heads	____Kitchen Lavoratories	____Clothes Washing Machine
____Bathtubs	____Garbage Grinder	____Water Softener
____Bathroom Lavoratories	____Dishwasher	____Utility Sink
____Toilets	____Other Kitchen	____Other Utilities

Plans for Changes:

Problems Recognized by Resident:

Resident Will Allow Follow-Up Engineering Studies: ____Soil Borings ____Groundwater
____Well Water Sample

SAMPLE SANITARY SURVEY FORM

Surveyor's Visual Observations of Effluent Disposal Site:

Drainage Facilities and Discharge Location:

Basement Sump

Footing Drains

Roof Drains

Driveway Runoff

Other

Property and Facility Sketch

APPENDIX C

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APPENDIX D

POPULATION ESTIMATION AND PROJECTION TECHNIQUES

1. Estimation Techniques

a. House Survey Method. Small area population estimates may be developed by housing survey methods. This method consists of a comprehensive housing unit inventory and personal interviews with a sample or all of the households. The housing unit inventory should result in the number, location, and occupancy status of all the existing housing units in the planning area. The personal interviews conducted in conjunction with the inventory will result in either an average household size based on a partial sample of households or a complete population enumeration based on all households. This method will not distinguish permanent and seasonal populations unless the survey and interviews are conducted when seasonal residents are present.

The housing survey method produces a very accurate estimate of existing population levels as well as a complete housing inventory. The information developed is detailed and void of assumptions. However, the time and resources involved in field work may make this method impractical for all but extremely small planning areas.

b. Tax Roll Survey Method. Land population is estimated using tax rolls by first identifying the land parcels on lots that occur within the area to be studied and then determining the number of housing units that occur on these parcels through the tax records. The seasonal or permanent occupancy can be determined by the address of the land owner. It can be assumed that if the owner's place of residence is not within the general study area, the house is probably a seasonally occupied dwelling. This assumption, if made, should be supported by local knowledge that the number of absentee landlords renting to year-round residents is low.

This method alone does not supply all of the information required to develop an estimate of population. It only produces an accurate count of the number of permanent and seasonal housing units. The other data required to

make the estimate consist of the average size of households in the area and the current housing vacancy rate. The average household size can be determined through a limited sample of households, census figures updated to reflect current household trends, and estimates from knowledgeable local officials. Housing vacancy rates may be obtained through interviews with local real estate agents, knowledgeable local officials, or homeowner groups.

This method provides a relatively simple and efficient means of estimating population for small rural areas. The major drawback lies in the need for additional data beyond those that can be found in the tax rolls. Although these other data are available from other sources, they are somewhat subjective.

c. Aerial Photo Analysis Method. Small area population estimates can be developed through the use of current aerial photographs of the area. This method is similar to the tax roll survey described above except that the total number of housing units is determined by examination of aerial photographs. The aerial photo analysis will yield an accurate count of total housing units, provided that the analyst can distinguish between multiple and single-family structures. The number of seasonal and permanent housing units, however, cannot be determined through the photo analysis. This information and data on the housing vacancy rates and household size must be obtained through other sources. The main advantage of the aerial photo analysis method is that it is less time consuming than other methods primarily because it does not require extensive field work.

The major drawback of this method lies in the need to distinguish multiple-family from single-family dwelling units and to obtain additional information regarding seasonal-permanent population breakdown, vacancy rates, and average household size from other sources. However, used in combination with other data sources, the aerial photo analysis method provides perhaps the most efficient means of developing reliable population estimates.

d. Dwelling Unit Review Method. Instead of using surveys or other methods to obtain a housing count, the most recent census data regarding housing stocks

can be updated by studying building permit records. The local permitting agency or census publications can be used to determine the housing units built in the planning area since the date of the most recent housing count. This would result in a total dwelling unit count for the planning area broken down into single and multiple units.

Like many of the other methods, data would still need to be obtained regarding vacancy rates, household size, and permanent-seasonal population breakdown. This information can be obtained from other sources, however, and should result in a reliable population estimate.

Each of the population estimation techniques described has certain advantages and disadvantages regarding cost, reliability, and additional data needs. No single method can be considered superior since each method yields a certain piece of the required information. Normally, a combination of these estimation techniques is required to produce accurate results in a cost-effective manner. During the preparation of the Seven Rural Lake EIS, a combination of these techniques was utilized to best fit the needs of a particular planning area. In some cases, the resultant estimates were utilized to disaggregate larger area population estimates while other rural planning areas required original estimates for baseline population data.

2. Description of Population Projection Technique Used in Blount County, Tennessee EIS

Future populations in each district were projected by 5 year increments to the year 2000 using a comparative forecasting technique. This methodology assumed that future population in an area can be estimated by applying a growth rate identified in another area with similar characteristics. In this case future growth rates for the population districts were established based on growth rates for other similar areas in Blount County. For example, it was assumed that a population district which was distant from Maryville/Alcoa and Knoxville: with no water or sewer availability, poor accessibility, little buildable land and poor internal circulation: would grow in the future at the same rate as a sample area which was chosen with the same characteristics. In

each case, growth rates were expressed in terms of population density so it was possible to compare areas of similar density but varying total populations. Ideally, the comparison of growth rates established future growth in population districts based on historical rates in the sample areas. In some cases, however, it was necessary to extrapolate sample area growth rates and base a portion of the population district forecast on that extrapolated rate of growth.

Each sample area was a five square mile circle, chosen to be as representative of different growth-controlling parameters as possible: existing level of development; infrastructure availability; location; accessibility; and buildability. Population in each sample area was determined using house counts from historical aerial photography and applying persons per household rates. Because of limited aerial photo availability, only five sample areas could be chosen which were both adequately diverse and for which aerial photos were available for enough previous dates. They include the Laurel Lake area near Townsend; a rural area near Friendsville centered on Big Springs; a highly suburbanized area just outside Alcoa/Maryville along Route 411; a less developed suburban area southeast of Maryville; a very isolated rural area along Route 411; a less developed suburban area southeast of Maryville; and a very isolated rural area along the National Park boundary near Townsend. In each of these sample areas, house counts were made from aerial photos taken in 1953, 1967, 1973 and 1980 and converted to population based on an average persons per household rate determined from 1950-1980 Census data. This data was graphed in terms of persons per square mile and then historical growth rates from 1953 to 1980 were established. The rates were determined using different techniques depending on what was most applicable to the given data--linear regression; nonlinear regression; and, in one case, a series of different linear rates. These rates were then projected backward and forward to provide an adequate range to match with the 1980 population densities in each population district.

The actual projection for each district was then developed using the following series of steps:

1. Determine growth-controlling characteristics for population district;

2. Match with most appropriate sample area;

3. Determine 23 year growth rate for sample area beginning with year when density matched that of population district;

4. Apply this rate to population district.

In most cases, a clear match was possible between sample area and population district but in some cases sample growth rates were averaged between two sample areas to provide a best match.

The output of this process resulted in raw population totals which were then corrected based on a control total for the EIS study area. This figure, 35,780 was arrived at by assuming that the EIS study area will grow from 1980 to 2000 at the same rate as the county as a whole. Given the county population projection for the year 2000 of 92,900 developed by the Bureau of Economic Analysis, this 20-year rate is 19.5 percent.

Correction of the raw numbers to agree with this control total was achieved by modifying each district's rate of growth proportionally by the amount which the total rate of growth had to be decreased to meet the control. That is, if the rate of growth for the total study area had to be decreased by 5 percent to meet the control, then each district's rate of growth was decreased by 5 percent. Intermediate year populations within each district were then corrected to match the 2000 figure by assuming the same proportion of growth during each 5 year period as had been true with the raw total. For example, if the corrected 1980-1985 growth in a district represented 40 percent of the 1980-2000 growth with the raw total, this period was assumed to represent 40 percent of the lower 1980-2000 growth based on the controlled 2000 number.

APPENDIX E

SITE ANALYSIS PROCEDURES AND SITING CRITERIA FOR ON-SITE SYSTEMS

A. Field Testing

Field testing begins with a visual survey of the parcel to locate potential sites for subsurface soil absorption. Detailed soils investigations are made at these sites. If no sites can be found from either the visual survey or detailed investigation, site suitability for evaporation or surface water discharge should be evaluated.

Visual Survey

A visual survey (preferably with a hand auger or soil probe) is made to locate the areas on the lot with the greatest potential for subsurface soil absorption. The following should be noted and marked on the plot plan:

- General site features

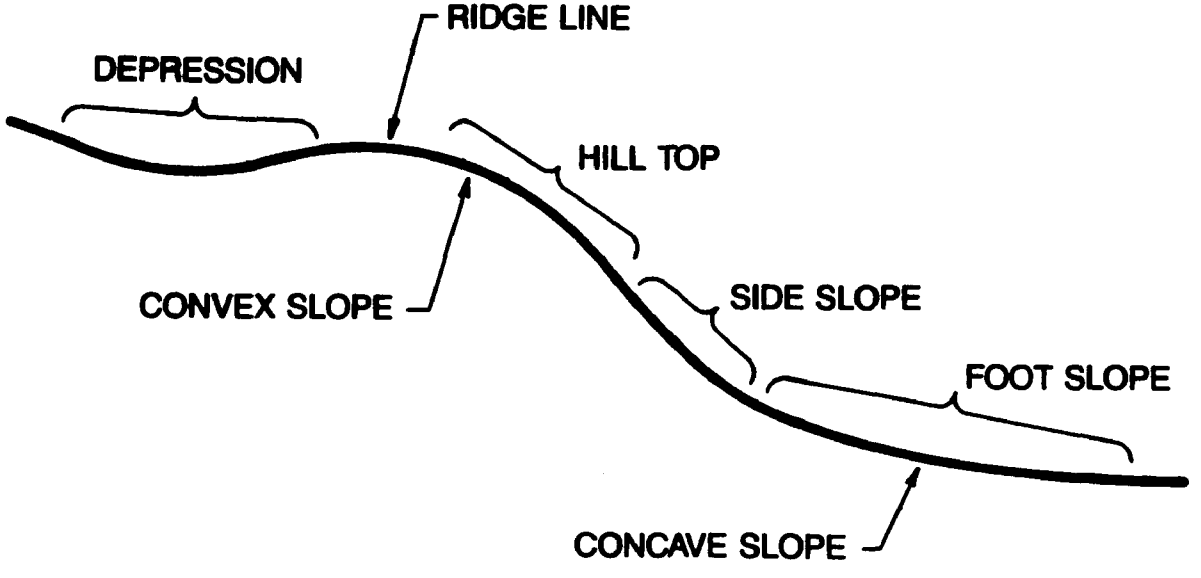
  The location of any depressions, gullies, steep slopes, rocks or rock outcrops, surface waters, roads, buildings and other obvious land and surface features should be noted and marked on the plot plan. Well travelled or compacted areas should be avoided.

- Landscape position

  Noting the landscape position and land form at the site is useful in estimating surface and subsurface drainage patterns. For example, ridge lines, hill tops and side slopes can be expected to have good surface and subsurface drainage, while depressions and foot slopes are more likely to be poorly drained. Figure E-1 can be used as a guide for identifying landscape positions.

- Flooding hazards

  Areas of obvious flood hazard should be avoided. (If necessary, soil absorption systems may be installed in flood fringe out of the flood way).



LANDSCAPE POSITIONS

FIGURE E-1

- Vegetation

  The type and size of the existing vegetation should be noted. The depth and drainage characteristics of the soil can be indicated from the type of vegetation. Large trees that must be removed or are to be saved may alter the design of the system.

- Slope

  The type and degree of slope indicates surface drainage problems and areas to avoid because of construction problems. Concave slopes cause surface runoff to converge while convex slopes disperse the runoff. Slopes greater than 20 to 25 percent present difficulties to excavating equipment and some absorption system designs. Abney or hand levels may be sufficient for simple slopes or small systems but a topographic survey is necessary for all larger systems.

- Horizontal setbacks

  Setbacks from wells, surface waters, buildings, property lines, etc., should be maintained on the parcel and between neighboring parcels to minimize the threat to public health if a failure should occur. The setbacks required are usually detailed in local codes.

Soil Borings

Detailed evaluation of soil characteristics is done in the areas selected during the visual survey. This can be done best from a pit excavated large enough to enter. However, an experienced soil tester can do a satisfactory job by using a hand auger or probe. Both methods are suggested. Hand tools can be used to determine soil variability over the area and pits used to describe in detail the various soils found. Power augers should not be used because the soil characteristics can be altered markedly.

- Location, depth and number

  Pits should be dug around the perimeter of the area. Pits dug within the absorption area often settle after the system is installed, disrupting the system. Hand augers can be used within the area. Pits

should be oriented such that the sun hits one face directly for good color observation. The borings should be deep enough to insure that a sufficient depth of unsaturated soil exists.

Sufficient borings should be made to describe adequately the soils and their variability. Each should be carefully located in relation to a permanent bench mark. The ground surface elevation at each pit relative to the bench mark is also desirable.

- Soil horizons

  Any obvious soil horizons are tentatively identified from differences in color, texture or structure.

- Soil texture

  Beginning at the top or bottom of the pit sidewall, the texture of each identified horizon is identified. Hand texturing can be done by moistening a sample and working it until it has the consistancy of putty. Using Table E-1, the texture can be described quickly. When the textures have been determined for each layer, the depth, thickness and texture of each layer is recorded.

- Soil structure

  The sidewall of the pit is carefully examined, using a pick, knife or similar device to expose the natural cleavages and planes of weakness. The durability of each structural unit is estimated by noting whether it withstands handling. If no cracks are visible, a sample of the soil is picked out and carefully separated into structural units by hand until any further breakdown can be achieved only by fracturing.

- Soil color

  It is important to have good sunlight and moist soils to observe the color. If the ped faces are dry, a mist bottle can be used to moisten the soil. Color may be described by estimating the true color or by comparing the color to the colors in a soil color book. In either case, it is particularly important to observe the colors and color patterns.

TABLE E-1

TEXTURAL PROPERTIES OF MINERAL SOILS

Soil Class	Feeling and Appearance	
	Dry Soil	Moist Soil
Sand	Loose, single grains which feel gritty. Squeezed in the hand, the soil mass falls apart when the pressure is released.	Squeezed in the hand, it forms a cast which crumbles when touched. Does not form a ribbon between thumb and forefinger.
Sandy Loam	Aggregates easily crushed very faint velvety feeling initially but with continued rubbing the gritty feeling of sand soon dominates.	Forms a cast which bears careful handling without breaking. Does not form a ribbon between thumb and forefinger.
Loam	Aggregates are crushed under moderate pressure; clods can be quite firm. When pulverized, loam has velvety feel that becomes gritty with continued rubbing. Casts bear careful handling.	Cast can be handled quite freely without breaking. Very slight tendency to ribbon between thumb and forefinger. Rubbed surface is rough.
Silt Loam	Aggregates are firm but may be crushed under moderate pressure. Clods are firm to hard. Smooth, flour-like feel dominates when soil is pulverized.	Cast can be freely handled without breaking. Slight tendency to ribbon between thumb and forefinger. Rubbed surface has a broken or rippled appearance.
Clay Loam	Very firm aggregates and hard clods that strongly resist crushing by hand. When pulverized, the soil takes on a somewhat gritty feeling due to the harshness of the very small aggregates which persist.	Cast can bear much handling without breaking. Pinched between the thumb and forefinger, it forms a ribbon whose surface tends to feel slightly gritty when dampened and rubbed. Soil is plastic, sticky and puddles easily.
Clay	Aggregates are hard; clods are extremely hard and strongly resist crushing by hand. When pulverized, it has a grit-like texture due to the harshness of numerous very small aggregates which persist.	Casts can bear considerable handling without breaking. Forms a flexible ribbon between thumb and forefinger and retains its plasticity when elongated. Rubbed surface has a very smooth, satin feeling. Sticky when wet and easily puddled.

- Seasonally saturated soils

  Seasonally saturated soils can usually be detected by soil borings made during the wet season or by the presence of mottled soils. Observation wells may also be used. The well is placed in but not extended through the horizon to be monitored. The well is grouted at the surface and capped. If water is noted in the well over several days, the water level elevation is assumed to be the elevation of the saturated soil horizon. The monitoring is most accurate in the spring with normal precipitation.

- Bedrock

  Bedrock may be in such a state of decay that it is difficult to determine where the true bedrock surface lies. It may be defined as that point where less than 50 percent of the excavated material is unconsolidated. The surface of sandstone bedrock can be defined as the point where resistance to penetration with a knife is encountered.

- Bulk density

  Relative bulk densities of each horizon can be detected by pushing a knife or other instrument into the soil. If one horizon offers considerably more resistance to penetration than others, its bulk density is probably higher. However, in some cases, cementing agents between soil grains or peds may be the cause of resistance.

- Swelling clays

  Swelling clays tend to be more sticky and plastic when wet.

Hydraulic Conductivity

In the areas where the soil borings indicate suitable soil for subsurface disposal, hydraulic conductivity testing follows. Several methods of measuring the soil's ability to transmit water have been developed. The "percolation test" is the most commonly used. When run properly, it can give an approximate measure of the soil's saturated hydraulic conductivity. The most common test procedure used is described in Table E-2. Common errors made in running the

test are poor hole preparation, inadequate soaking and inaccurate measurements.

Though percolation tests are highly variable and often criticized for inaccuracy, they can be useful if used together with the soil boring data. If results from properly run tests do not seem to agree with the texture of the soil, as shown in Table E-2, then structure or minerology may be significant. Further investigations may be warranted.

Table E-2

Estimated Hydraulic Characteristics of Soil (Bouma, 1975)

Soil Texture	Permeability in./hr	Percolation min./in
Sand	6.0	10
Sandy loams Porous silt loams Silty clay loams	0.2-6.0	10 - 45
Clays, compact Silt loams Silty clay loams	0.2	45

Hydrogeologic Investigations

If the soil is to be used to dispose of large volumes of wastewater daily, then hydrogeologic investigations are necessary to determine if the soils have the capacity to conduct the liquid away from the infiltration area without becoming saturated to within 2 to 3 feet of the infiltration surface.

- Groundwater elevation

  The groundwater elevation and seasonal variations must be determined by monitoring wells and soil patterns in the soil profile. Soils with perched water table conditions should be avoided.

- Groundwater gradient

  Horizontal gradients are determined by measuring the water elevation in wells just penetrating the phreatic surface. Vertical gradients are determined from two or more wells at the same location but at different depths within the water hole.

Siting Criteria for On-Site Systems

Tables E-3 and E-4 present siting criteria for trench and bed and for mound on-site systems, respectively. Site criteria are given for the landscape position, slope, typical horizontal separation distances from various lot features, and for soil parameters.

TABLE E-3

SITE CRITERIA FOR TRENCH AND BED SYSTEMS

Item	Criteria
Landscape Position[a]	Level, well-drained areas, crests of slopes; convex slopes most desirable. Avoid depressions, bases of slopes and concave slopes unless suitable surface drainage is provided.
Slope[a]	0 to 25%. Slopes in excess of 25% can be utilized but the use of construction machinery may be limited. Bed systems are limited to 0 to 5%.
Typical Horizontal Separation Distances[b]	
Water Supply Wells	50 - 100 ft
Surface Waters, Springs	50 - 100 ft
Escarpments, Manmade Cuts	10 - 20 ft
Boundary of Property	5 - 10 ft
Building Foundations	10 - 20 ft
Soil	
Texture	Soils with sandy or loamy textures are best suited. Gravelly and cobbley soils with open pores and slowly permeable clay soils are less desirable.
Structure	Strong granular, blocky or prismatic structures are desirable. Platy or unstructured massive soils should be avoided.
Color	Bright uniform colors indicate well-drained, well-aerated soils. Dull, gray or mottled soils indicate continuous or seasonal saturation and are unsuitable.
Layering	Soils exhibiting layers with distinct textural or structural changes should be carefully evaluated to insure water movement will not be severely restricted.

TABLE E-3 (continued)

Item	Criteria
Unsaturated Depth	2 to 4 ft of unsaturated soil should exist between the bottom of the system and the seasonally high water table or bedrock.
Percolation Rate	1-60 min/in. (average of at least 3 percolation tests).[c] Systems can be constructed in soils with slower percolation rates, but soil damage during construction must be avoided.

[a] Landscape position and slope are more restrictive for beds because of the depths of cut on the upslope side.

[b] Intended only as a guide. Safe distance varies from site to site, based upon topography, soil permeability, ground water gradients, geology, etc.

[c] Soils with percolation rates 1 min/in. can be used for trenches and beds if the soil is replaced with a suitably thick (> 2 ft) layer of loamy sand or sand.

TABLE E-4

SITE CRITERIA FOR MOUND SYSTEMS

Item	Criteria
Landscape Position	Well-drained areas, level or sloping. Crests of slopes or convex slopes most desirable. Avoid depressions, bases of slopes and concave slopes unless suitable drainage is provided.
Slope	0 to 6% for soils with percolation rates slower than 60 min/in.[a] 0 to 12% for soils with percolation rates faster than 60 min/in.[a]
Typical Horizontal Separation Distances from Edge of Basal Area	
Water Supply Wells	50 to 100 ft
Surface Waters, Springs	50 to 100 ft
Escarpments	10 to 20 ft
Boundary of Property	5 to 10 ft
Building Foundations	10 to 20 ft (30 ft when located upslope from a building in slowly permeable soils).
Soil	
Profile Description	Soils with a well developed and relatively undisturbed A horizon (topsoil) are preferable. Old filled areas should be carefully investigated for abrupt textural changes that would affect water movement. Newly filled areas should be avoided until proper settlement occurs.
Unsaturated Depth	20 to 24 in. of unsaturated soil should exist between the original soil surface and seasonally saturated horizons or pervious or creviced bedrock.

TABLE E-4 (continued)

Item	Criteria
Depth to Impermeable Barrier	3 to 5 ft[b]
Percolation Rate	0 to 120 min/in. measured at 12 to 20 in.[c]

[a] These are present limits used in Wisconsin established to coincide with slope classes used by the Soil Conservation Service in soil mapping. Mounds have been sited on slopes greater than these, but experience is limited.

[b] Acceptable depth is site-dependent.

[c] Tests are run at 20 in. unless water table is at 20 in., in which case test is run at 16 in. In shallow soils over pervious or creviced bedrock, tests are run at 12 in.

APPENDIX F

REGULATORY AUTHORITIES
OF STATE ORGANIZATIONS

Tables F-1 thru F-6

TABLE F-1

REGULATORY AUTHORITIES OF STATE ORGANIZATIONS

NORTH CAROLINA

Power	City	County	Interlocal Agreement	Joint Management Agency	County Service District	County Water & Sewer District	Sanitary District	Sewer Authority	Private Corporation
Surveys of Sanitary problems/needs	X	X	X	X	X	X	X	X	
Issue general obligation bonds	X	X	X	X	X	X	X		
Issue revenue bonds	X	X	X	X	X	X	X	X	
Impose Assessments	X	X	X	X	X	X		X	
Levy taxes	X	X	X		X	X	X		
Set fees, rates or charges	X	X	X	X	X	X	X	X	
Receive grants/ loans	X	X	X	X	X	X	X	X[2]	
Hold title to all real property of the system	X	X	X	X	X	X	X	X	
Operate System	X	X	X	X	X	X	X	X	
Enter into contracts	X	X	X	X	X	X	X	X	
Install/operate/ maintain systems on private property	X	X	X	X	X	X	X[1]	X	

[1] Sanitary district cannot require installation of sewer lines in new subdivisions or adopt subdivision regulations.

[2] Sewer authority cannot receive federal revenue-sharing funds or community development grants.

Source: Water Resources Research Institute of the University of North Carolina.

TABLE F-2

REGULATORY AUTHORITIES OF STATE ORGANIZATIONS

KENTUCKY

Power	City	County	Interlocal Agreement	Joint Management Agency	County Service District	County Water & Sewer District	Sanitary District[2]	Sewer Authority[3]	Private Corporation[1]
Surveys of Sanitary problems/needs	X	X	X	X	X	X	X	X	X
Issue general obligation bonds	X	X	X	X	X	X	X	X	
Issue revenue bonds	X	X	X	X	X	X	X	X	
Impose Assessments	X	X	X	X	X	X	X	X	X
Levy taxes	X	X	X	X	X	X	X	X	
Set fees, rates or charges	X	X	X	X	X	X	X	X	X
Receive grants/ loans	X	X	X	X	X	X	X	X	X
Hold title to all real property of the system	X	X	X	X	X	X	X	X	X
Operate System	X	X	X	X	X	X	X	X	X
Enter into contracts	X	X	X	X	X	X	X	X	X
Install/operate/ maintain systems on private property	X	X	X	X	X	X	X	X	X

[1] Only public body can issue general obligation bonds, issue revenue bonds and levy taxes.

[2] A sanitation district is considered a "quasi-public body", but after June 1984 will be subject to Fiscal Court control (legislative body of counties).

[3] Kentucky also provides for a Metropolitan Sewer District with similar authorities.

Source: Kentucky Natural Resources and Environmental Protection Cabinet.
Kentucky Revised Statutes.

TABLE F-3

REGULATORY AUTHORITIES OF STATE ORGANIZATIONS

GEORGIA

Power	City	County	Interlocal Agreement	Joint Management Agency	County Service District	County Water & Sewer District	Sanitary District	Sewer Authority	Private Corporation[1]
Surveys of Sanitary problems/needs	X	X	X	X	X	X	X	X	X
Issue general obligation bonds	X	X							
Issue revenue bonds	X	X	X	X	X	X	X	X	X
Impose Assessments	X	X	X	X	X	X	X	X	X
Levy taxes	X	X							
Set fees, rates or charges	X	X	X	X	X	X	X	X	X
Receive grants/ loans	X	X	X	X	X	X	X	X	[2]
Hold title to all real property of the system	X	X	X	X	X	X	X	X	X
Operate System	X	X	X	X	X	X	X	X	X
Enter into contracts	X	X	X	X	X	X	X	X	X
Install/operate/ maintain systems on private property	X	X	X	X	X	X	X	X	X

[1] Private groups can provide wastewater management services through contractural arrangements.

[2] Only public entities can receive grants or loans.

Source: Georgia Department of Natural Resources. Environmental Protection Division.

TABLE F-4

REGULATORY AUTHORITIES OF STATE ORGANIZATIONS

SOUTH CAROLINA

Power	City	County	Interlocal Agreement	Joint Management Agency	County Service District	County Water & Sewer District	Sanitary District	Sewer Authority	Private Corporation[1]
Surveys of Sanitary problems/needs	X	X	X	X	X	X	X	X	
Issue general obligation bonds	X	X	X	X	X	X	X	X	
Issue revenue bonds	X	X	X	X	X	X	X	X	
Impose Assessments	X	X	X	X	X	X	X	X	
Levy taxes	X	X	X	X	X	X	X	X	
Set fees, rates or charges	X	X	X	X	X	X	X	X	
Receive grants/ loans	X	X	X	X	X	X	X	X	
Hold title to all real property of the system	X	X	X	X	X	X	X	X	
Operate System	X	X	X	X	X	X	X	X	
Enter into contracts	X	X	X	X	X	X	X	X	
Install/operate/ maintain systems on private property	X	X	X	X	X	X	X	X	

[1] Private utilities may provide wastewater services, although they may not exercise all the powers of public bodies (including management/planning powers).

Source: South Carolina Department of Health and Environmental Control.

TABLE F-5

REGULATORY AUTHORITIES OF STATE ORGANIZATIONS

TENNESSEE

Power	City	County	Interlocal Agreement	Joint Management Agency	County Service District	County Water & Sewer District	Sanitary District	Sewer Authority	Private Corporation
Surveys of Sanitary problems/needs	X	X	X	X	X	X	X	X	X
Issue general obligation bonds	X	X	X	X					
Issue revenue bonds	X	X	X	X	X	X	X	X	X
Impose Assessments	X	X	X	X	X	X	X	X	X
Levy taxes[2]	X	X	X	X					
Set fees, rates or charges	X	X	X	X	X	X	X	X	X
Receive grants/ loans[1]	X	X	X	X	X	X	X	X	X
Hold title to all real property of the system	X	X	X	X	X	X	X	X	X
Operate System	X	X	X	X	X	X	X	X	X
Enter into contracts	X	X	X	X	X	X	X	X	X
Install/operate/ maintain systems on private property[3]									

[1] limited to municipalities receiving state-shared taxes

[2] any county; metropolitan gov't; incorporated town or city

[3] powers are not covered in laws.

Sources: Tennessee Department of Health and Environment.
1983 Tennessee State Code

TABLE F-6

REGULATORY AUTHORITIES OF STATE ORGANIZATIONS

ALABAMA

Power	City	County	Interlocal Agreement	Joint Management Agency	County Service District	County Water & Sewer District	Sanitary District	Sewer Authority	Private Corporation
Surveys of Sanitary problems/needs	X	X				X	X	X	X
Issue general obligation bonds									
Issue revenue bonds						X	X	X	
Impose Assessments	X	X							
Levy taxes									
Set fees, rates or charges						X	X	X	
Receive grants/ loans	X	X				X	X	X	X
Hold title to all real property of the system	X	X				X	X	X	X
Operate System	X	X				X	X	X	X
Enter into contracts	X	X				X	X	X	X
Install/operate/ maintain systems on private property									

Note: Sewer authorities in resort areas have the same regulatory powers as cities/counties.

Source: Alabama Department of Environmental Management, 1984.

APPENDIX G

PRIVATIZATION CHECKLIST

There are many approaches to privatization of wastewater facilities: with or without equity; lease or direct ownership; industrial development revenue or pollution control bonds, etc. Although each of these approaches has individual characteristics, they all have one common feature--reliance on the tax-exempt revenue bond market to raise the debt necessary for construction. (from 75% to 100% of project costs, depending upon whether equity investment is a part of the transaction.)

Wastewater privatization projects can be financed if: 1) they are economically viable on their own merits; and 2) they incorporate acceptable and adequate security mechanisms. Water and wastewater bond issues are especially attractive to bond buyers because with the systems literally being "in the ground", the users are dependent on their continued performance for the maintenance of public health. In other words, bond buyers presume that in the event of technical or financial problems, all necessary actions will be taken to keep the system operating, regardless of cost.

The Financial Checklist

A number of issues and concerns must be considered by the investment banker in the development of a privatization transaction. These include:

The Project

- The project must be truly needed.
- A financial feasibility study must document that the project is economically viable without resorting to extreme financial machinations.
- The current and projected economic health of the service area must be adequate to support the project.

- Promises of goods from related parties (for example, to supply bulk water) must be strong and enforceable.

Financial Structure (Equity)

- The local government must decide in the beginning whether it will require an initial cash investment.

- If equity investment is required, the choice usually will be between using a lease or a limited partnership arrangement.

- If equity is infused during construction or at start up, rather than in full upfront, it must be fully committed and irrevocably secured by the time of bond closing.

- The financial arrangement must meet provisions of Section 103 of the Internal Revenue Service Code.

- The arrangement must also effectively shelter the equity owner(s) from actual construction/O&M burdens, otherwise investors will not be secured.

Financial Structure (Debt)

- The issuer must be an Industrial Development Agency or other agency which can issue bonds on behalf of private parties.

- Generally, the issue should be conventionally structured: capitalized interest; funds trusteed under an indenture; unqualified approving opinion of bond counsel.

- The term of the financing should be 20-30 years, to realize affordable annual debt service coverage.

- Generally, the issue should be designed for public distribution, unless institutional market-oriented devises such as low, variable-rate bonds are used.

- There should be "additional bonds" provisions to accommodate expansion.

Principal Contractors

- Construction. The builder must have the demonstrated technical capability to build the project on time and within budget, and the financial resources (including insurance) to pay potentially substantial damages for partial or complete non-performance.

- O&M. The operator must have the demonstrated capability to operate the project according to set standards and the financial resources to pay damages and/or State-imposed fines for partial or complete non-performance.

- Ideally, the operator should be sufficiently substantial to convenant to remain in business for the duration of its service agreement.

- If the operating company is a subsidiary of a larger firm, its performance should be guaranteed by that parent.

Contractual Basis

- The procurement of construction and/or operating services must strictly adhere to state law to protect the financing from legal challenges.

- The supply of "raw material" (water or wastewater) must be guaranteed for the life of the bonds.

- There should be provisions for the builder to pay damages or "buy down" bonds for non-delivery of the project or if guaranteed design (processing) capacity cannot be attained.

- There must be adequate provisions for adjusting service prices to reflect inflation, expansion and other significant events.

- The operator should be subject to damages and/or fines for substandard performance, as well as subject to requirements to correct self-created problems at its own cost. The removal of the operator for default should be enabled.

Financing Security

- The financing must be adequately secured, using mechanisms such as:

  - debt service reserve fund
  - other reserves (such as repair and replacement)
  - municipal rate covenant
  - municipal collection or municipal guarantee of collections from individual system users
  - enforceable contractor guarantees
  - municipal bond insurance or letter of credit.

Regulatory Basis

- If the project is subject to rate regulation by a State utilities commission, the effect of this on the marketability of both the debt and equity will need to be assessed.

- Because of the essential public health and welfare nature of water and wastewater systems, it is unlikely that a Public Utility Commission would allow a project to financially default by not enabling rate increases. Therefore, rate regulation should not fatally affect bond marketability.

- Regulation will affect the tax credits and benefits available to equity investors, which in turn will affect the amount of equity invested. This will have an impact on the amount of debt required, and, thus, annual debt service levels.

Conclusion

Water and wastewater privatization projects have access to the equity market that is tapped for other tax-exempt utility financing. The same debt market used for other privatization financings is also available to water and wastewater transactions, requiring the same types of security mechanisms.

Because privatization is keyed to equity investment, whether direct as cash or indirect as long-term O&M subsidies (or, service cost reductions), the ability to attract private capital is essential. As much as this involves the structure of the transaction, it also involves the technical and financial strength and capabilities of the contractors and vendors participating in a project. Strict security and financial measures are necessary to attract both debt and equity. If a project can be so structured to attract the equity, a community can be confident of the ability to also sell the debt.

Source: Adapted from David Mackenzie. "A Financial Checklist for Privatization", Clean Water Finance 1985. Copyright, the American Clean Water Association, edited by Larry Silverman and Bernard C. Nagelvoort.

APPENDIX H

WATER RESOURCES ASSISTANCE CORPORATION -
FINANCIAL AND FIELD MANAGEMENT CONTRACT

1. Water Resources Assistance Corporation, hereafter WRAC, is a non-profit corporation established to provide various services to water districts, municipal water systems and related entities.

2. _____, hereafter Water System, is a Water District providing water service in _____ County, Kentucky.

3. Water System has determined that it is in the best interest of its consumers to have WRAC provide exclusive financial and field management services to the System. These services are to consist of operating the system, connecting customers, reading the meters, preparing and sending bills, collecting revenues, making repairs, water sampling, keeping financial records, making reports to regulatory and funding agencies, and other related financial and field management services as are set out below.

4. WRAC does not assume responsibility for any existing contractual or financial obligations of the Water System, but will collect the bills, keep the financial records and recommend action on financial obligations to the Water System. WRAC will maintain Water System inventory of materials and supplies pursuant to the execution of this contract. WRAC will also oversee for the Water System any special contract services, i.e., line extension contracts, etc., to the same extent that the District would so function exclusive of professional service contracts. In instances where it is necessary to obtain extraordinary services or supplies from an outside source, WRAC will not obligate Water System for any such obligations without prior approval of the Water System except in the case of emergencies, and will in those instances make every attempt to obtain prior approval from an authorized agent of the Water System.

5. WRAC's policy requires that WRAC treat each Water System with which it contracts as a separate and distinct entity. WRAC will therefore maintain separate records and bank accounts enabling it to do so. The Water System shall designate an FDIC insured bank to be used as a depository for funds received on its behalf by WRAC, and all such funds will be maintained in a separate account in Water System's name in that bank.

6. WRAC will maintain office hours from 8:00 a.m. to 4:30 p.m. weekdays (excepting legal holidays). WRAC will arrange for staff to attend the monthly meeting of the Board of Commissioners of the Water System. WRAC will assign personnel to respond to emergency problems outside of normal working hours (see Section 14 below). It is understood that all other services will be performed during normal working hours.

7. BILLING: WRAC agrees to read the customers meters, prepare and send monthly bills, including delinquent and disconnect notices, to receive payment and deposit them to Water System credit in the designated bank, and to prepare and maintain appropriate billing records including:

a. A customer profile card for each customer.

b. A customer folder for each rental unit.

c. A monthly billing register containing information on all accounts billed.

d. A monthly billing journal

e. A monthly consumption report

8. ACCOUNTING: WRAC will maintain Water System's accounts in a form where all separate accounts required by the Kentucky Public Service Commission, bond ordinances, or sound management practice can be readily ascertained. WRAC will prepare monthly statement of accounts, will balance the accounts and do reconciliations, and will also prepare projections of income and expenses where appropriate.

9. REPORTS: WRAC will prepare and file all periodic reports required by state and federal funding and regulatory agencies and will in addition provide routine data to support rate increase applications.

10. PAYMENT OF BILLS: WRAC shall at the monthly meeting of the Board of Directors of the Water System report on revenues, showing sources, funds available, and obligations. WRAC will make recommendations to the board as to obligations requiring payment. Upon authorization by the Water System, WRAC shall prepare checks for signature by the Chairperson or other designated member of the Water System Board of Commissioners.

11. OPERATIONS: WRAC will perform all routine operating functions including:

a. New residential connections to existing system

b. Reconnections

c. Disconnects

d. Meter changes

e. Water sampling and records

f. Water testing and records

g. Chemical treatment and records

h. Master meter reading and records

i. Visual inspection of facilities

j. Flushing lines as required

k. Maintaining system maps

12. MAINTENANCE: WRAC will perform all routine maintenance functions including repairing water leaks not requiring replacement or renewal of conduit or appurtenances and routine maintenance of all facilities owned by the Water System not requiring replacement or renewal of facilities, but specifically excluding repainting of water towers and pump houses.

It is understood and agreed that this Agreement shall apply only to routine operations and maintenance necessary to provide service to customers of the Water System, and shall be limited to normal repairs and scheduled maintenance.

Repairs to the system shall be deemed normal maintenance if such repairs do not require complete replacement of a major component, i.e., section of piping, major control mechanism, pump, water meter, electric motor, etc. The Corporation shall exchange from the inventory customer meters as required to maintain continuity of service and billing for the consumer, but is not responsible for repairs to such meters.

13. NON-EMERGENCY RENEWAL AND REPLACEMENT AND SYSTEM EXTENSIONS: WRAC agrees to make non-emergency renewal and replacements, extensions of the system, and new commercial-industrial connections, if it has personnel and facilities available for such services, at its cost. Such services shall be performed only after a cost estimate has been made by WRAC and approved by the Water System. In addition, it is understood that no line extensions shall be made unless same is subject to the standard Water Extension Contract as approved by the Board of Commissioners and no new commercial-industrial connections shall be made unless in accordance with the rules and regulations of the Water System. All such services are in addition to the services under the basic contract and are not covered by the basic contract charge.

14. EMERGENCY RENEWAL AND REPLACEMENT: In the case of an emergency situation, WRAC shall attempt to contact the appropriate agent of the Water System to obtain approval of immediately required renewal and replacement. However, it is understood that if no such contact can be made, WRAC is authorized to make those repairs necessary under the circumstances, and to be compensated for the actual cost of the repairs including time and one-half the normal salary rate of employees, as required by law, in addition to the basic contract charge.

15. INVENTORY: WRAC agrees to maintain a complete inventory of materials and supplies as required for the routine operation and maintenance of the Water System. The Water System will be invoiced for supplies and materials as same are acquired and/or placed in service.

16. COMPENSATION: WRAC shall commence to perform all of the above described services on_____ for a charge to the Water System of $_____ per month per residential equivalent customer billed.* Water System agrees to pay WRAC a sum equal to the number of residential equivalent customers billed the prior month times the monthly rate each month beginning one month after service is commenced. Water System also agrees to pay WRAC for all other services rendered under this contract or which may be agreed to in addition to the contract thirty (30) days after such services are rendered.

17. RENEGOTIATION OF AMOUNT OF COMPENSATION: WRAC shall at the close of the second quarter review all services performed under the contract and tabulate the total receipts under this contract and provide such information to the Water System. If the amount of revenue received is greater than the actual costs of providing these services by more than 10%, the charge per month per customer billed shall be adjusted proportionately for the remaining two quarters of the contract year.

18. COSTS: For the purpose of computing cost under this contract, WRAC shall maintain records of materials and supplies and employee and equipment time utilized in performing services under this contract. Employee time shall include employee benefits, employer taxes and other costs directly related to the payment of wages. Equipment time shall include operating

* Calculated on the basis of_____ _____customers.

and maintenance costs, depreciation, finance charges and other charges directly related to the utilization of the equipment. Administrative overheads including supervisory salaries, rents, utilities, interest cost on inventory, office equipment, and related charges may be allocated directly, as a percentage of other charges, or on a per customer basis, using generally acceptable principles of cost accounting.

19. POWERS: The Water System hereby authorizes the Corporation to act as agent for the Water System in carrying out the functions that WRAC has agreed to perform. WRAC agrees to obtain insurance to protect itself and the Water System against any error or omissions by itself or its employees as available and to inform the Water System of the limits and coverage of the insurance that has been obtained. WRAC shall also provide fidelity bond coverage by an insurance company on all WRAC employees handling Water System funds.

20. DURATION: The contract shall become effective and shall remain in effect for a period of one year from effective date given above, provided however, that the charge for succeeding years will be established as set out in Sections 17 and 18 above. An executed copy of this contract shall be submitted to the Economic Development Administration (EDA) as per direction of that Agency. Notice of termination of contractual arrangement may be given by either party for cause upon 30 day written notice to the other party, upon written approval of the EDA and/or its successors.

21. Authorized agent(s) of the Water System pursuant to Sections 4 10, and 14 above is/are:

Chairman and/or Commissioner(s)

22. Depository Bank for Water System pursuant to Section 5 above is

IN WITNESS WHEREOF, the Water Resources Assistance Corporation, a non-profit Corporation, and the_____, a Water System, have caused their corporate name to be signed hereto, attested by their duly authorized officers, on respective dates as hereinafter set forth:

ATTEST:

BY:_____

Water Resources Assistance Corporation

BY:_____

Date:_____

ATTEST:

_____
Water System

BY:_____
Title

BY:_____
Chairman

_____
Commissioner

_____
Commissioner

APPENDIX I

STATE PERMIT REQUIREMENTS

Tables I-1 thru I-6

TABLE I-1

ALABAMA
PERMITS

Permit	Issuing Agency	Limitations/Exceptions Notes
NPDES	Department of Environmental Management	
State Indirect Discharge (SID) permit	Department of Environmental Management	Issued to any person who is a non-municipal, non-domestic discharger and who discharges or proposes to discharge pollutants from any source into a publicly-owned treatment works.

TABLE I-2

GEORGIA
PERMITS

Permit	Issuing Agency	Limitations/Exceptions/ Notes
NPDES	Department of Natural Resources Environmental Protection Division	
Pre-treatment Permit	Department of Natural Resources Environmental Protection Division	Not applicable to individual domestic dischargers.
Permit to operate a land disposal system	Department of Natural Resources Environmental Protection Division	
Land-Disturbing Activities Permits	Department of Natural Resources Environmental Protection Division	Exemptions: 1. projects involving 5 acres or less when such activities are more than 200 feet from the bank of any state waters which drain land area of at least 100 square miles. 2. any public utility under the regulatory jurisdiction of the public service commission.

TABLE I-3

KENTUCKY
PERMITS

Permit	Issuing Agency	Limitations/Exceptions/ Notes
NPDES	Department of Natural Resources and Environmental Protection, Division of Water Quality	
Plumbing Installation Permit	Local Boards of Health	Issued only to licensed master plumbers, except in specified conditions where homeowners desire to install plumbing in homes actually occupied by them.
On-site sub-surface Sewage Disposal Permit	Local Boards of Health	Upon permit approval and issuance, a plumbing installation permit is granted.
Construction Permit	Department of Natural Resources and Environmental Protection	Upon permit approval and issuance, a plumbing installation permit is granted.
Construction Permit	Department of Natural Resources and Environmental Protection, Division of Water Quality.	Applicable to an on-site system if it will discharge to surface waters or onto the land (e.g. spray irrigation).

TABLE I-4

NORTH CAROLINA
PERMITS*

Permit	Issuing Agency	Limitations/Exceptions/ Notes
NPDES	Department of Natural Resources and Community Development, Environmental Operations Section, Division of Environmental Management	
Improvements Permit	Local Health Departments	Must be obtained before a sewage disposal system or privy is installed, repaired or renovated.
Certificate of Completion	Local Health Departments	Issued after a post-construction inspection is performed to ascertain whether all specifications of system design and location have been followed. Applies to on-site system.

* Office of Regulatory Relations (DNRCD) is responsible for providing permit information and assistance. P.O. Box 27687, Raleigh, N.C. 27611 Director: Anne Taylor (919)733-6376.

TABLE I-5

SOUTH CAROLINA
PERMITS

Permits	Issuing Agency	Limitations/Exceptions/ Notes
NPDES	Department of Health & Environmental Control (DHEC), Industrial and Agricultural Wastewater Division & the Domestic Wastewater and Municipal Grants Administration Division	Any system discharging to a surface water body.
State Construction	Same as above	Allows for regulatory review of treatment plant design. Has been effective in controlling no-discharge systems (e.g. spray irrigation, evapotranspiration, etc.) and pretreatment plants. Requires prior submission of "as-built" plans and specifications.

TABLE I-6

TENNESSEE
PERMITS

Permits	Issuing Agency	Limitations/Exceptions/ Notes
NPDES	Department of Public Health, Division of Water Quality Control	
Building Permits	Local Health Departments	Approves building permits for lots planning on-site disposal.
		Tennessee local governments have the authority and responsibility for controlling on-site domestic waste disposal (as a non-point source) in their enabling legislation. No statewide coordinated policy.

APPENDIX J

NORTH CAROLINA ON-SITE SEWAGE DISTRICT LEGISLATION

The following are pages from the North Carolina State Code dealing with the authorities of counties, cities, towns and water and sewer authorities (last page). As can be noted, each of these governmental entities or organizations has the authority to operate sewage collection and disposal systems of all types, including on-site systems. Other chapters of the Code not included here which deal with additional organizations also provide this authority.

§§ 153A-272, 153A-273: Reserved for future codification purposes.

ARTICLE 15.

Public Enterprises.

Part 1. General Provisions

§ 153A-274. Public enterprise defined.

As used in this Article, "public enterprise" includes:

(1) Water supply and distribution systems,

(2) Sewage collection and disposal systems of all types, including septic tank systems or other on-site collection or disposal facilities or systems,

(3) Solid waste collection and disposal systems and facilities,

(4) Airports,

(5) Off-street parking facilities,

(6) Public transportation systems. (1965, c. 370; 1957, c. 266, s. 3; 1961, c. 514, s. 1; c. 1001, s. 1; 1971, c. 568; 1973, c. 822, s. 1; c. 1214; 1977, c. 514, s. 1; 1979, c. 619, s. 1.)

§ 153A-275. Authority to operate public enterprises.

A county may acquire, lease as lessor or lessee, construct, establish, enlarge, improve, extend, maintain, own, operate, and contract for the operation of public enterprises in order to furnish services to the county and its citizens. A county may acquire, construct, establish, enlarge, improve, maintain, own, and operate outside its borders any public enterprise.

A county may by ordinance or resolution adopt adequate and reasonable rules and regulations to protect and regulate a public enterprise belonging to or operated by it. (1955, c. 370; 1957, c. 266, s. 3; 1961, c. 514, s. 1; c. 1001, s. 1; 1967, c. 462; 1971, c. 568; 1973, c. 822, s. 1.)

CASE NOTES

Constitutionality of Former Statute. — Former § 153-9(46), was constitutional, violating neither § 5 nor § 17 of Art. I of the Constitution of 1868. Ramsey v. Rollins, 246 N.C. 647, 100 S.E.2d 55 (1957).

The limitation upon the counties contained in Art. VII, § 7 of the Constitution of 1868, requiring that bonds for the construction of water and sewer systems be approved by the voters in such county, did not impair the constitutionality of the grant of the power to construct such systems in any respect. Ramsey v. Rollins, 246 N.C. 647, 100 S.E.2d 55 (1957).

OPINIONS OF ATTORNEY GENERAL

As to authority for county to appropriate nontax funds for water and sewer system, see opinion of Attorney General to Mr. M. Alexander Biggs, Special Counsel, Nash County Board of Commissioners, 40 N.C.A.G. 92 (1970).

ARTICLE 16.

Public Enterprises.

Part 1. General Provisions.

§ 160A-311. Public enterprise defined.

As used in this Article, the term "public enterprise" includes:

(1) Electric power generation, transmission, and distribution systems;
(2) Water supply and distribution systems;
(3) Sewage collection and disposal systems of all types, including septic tank systems or other on-site collection or disposal facilities or systems;
(4) Gas production, storage, transmission, and distribution systems, where systems shall also include the purchase and/or lease of natural gas fields and natural gas reserves, the purchase of natural gas supplies, and the surveying, drilling and any other activities related to the exploration for natural gas, whether within the State or without;
(5) Public transportation systems;
(6) Solid waste collection and disposal systems and facilities;
(7) Cable television systems;
(8) Off-street parking facilities and systems;
(9) Airports. (1971, c. 698, s. 1; 1975, c. 549, s. 2; c. 821, s. 3; 1977, c. 514, s. 2; 1979, c. 619, s. 2.)

CASE NOTES

Applied in Dize Awning & Tent Co. v. City of Winston-Salem, 29 N.C. App. 297, 224 S.E.2d 257 (1976).

Cited in Duke Power Co. v. City of High Point, 22 N.C. App. 91, 205 S.E.2d 774 (1974); Big Bear of N.C., Inc. v. City of High Point, 294 N.C. 262, 240 S.E.2d 422 (1978); Advance Publications, Inc. v. City of Elizabeth City, 53 N.C. App. 504, 281 S.E.2d 69 (1981).

§ 160A-312. Authority to operate public enterprises.

A city shall have authority to acquire, construct, establish, enlarge, improve, maintain, own, operate, and contract for the operation of any or all of the public enterprises as defined in this Article to furnish services to the city and its citizens. Subject to Part 2 of this Article, a city may acquire, construct, establish, enlarge, improve, maintain, own, and operate any public enterprise outside its corporate limits, within reasonable limitations, but in no case shall a city be held liable for damages to those outside the corporate limits for failure to furnish any public enterprise service.

A city shall have full authority to protect and regulate any public enterprise system belonging to it by adequate and reasonable rules and regulations.

A city may operate that part of a gas system involving the purchase and/or lease of natural gas fields, natural gas reserves and natural gas supplies and the surveying, drilling or any other activities related to the exploration for natural gas, in a partnership or joint venture arrangement with natural gas utilities and private enterprise. (1971, c. 698, s. 1; 1973, c. 426, s. 51; 1975, c. 821, s. 5; 1979, 2nd Sess., c. 1247, s. 29.)

(9) The term "sewage disposal system" shall mean and shall include any plant, system, facility, or property used or useful or having the present capacity for future use in connection with the collection, treatment, purification or disposal of sewage (including industrial wastes resulting from any processes of industry, manufacture, trade or business or from the development of any natural resources), or any integral part thereof, including but not limited to septic tank systems or other on-site collection or disposal facilities or systems, treatment plants, pumping stations, intercepting sewers, trunk sewers, pressure lines, mains and all necessary appurtenances and equipment, and all property, rights, easements and franchises relating thereto and deemed necessary or convenient by the authority for the operation thereof.

(10) The word "sewers" shall include mains, pipes and laterals for the reception of sewage and carrying such sewage to an outfall or some part of a sewage disposal system, including pumping stations where deemed necessary by the authority.

(11) The term "sewer system" shall embrace both sewers and sewage disposal systems and all property, rights, easements and franchises relating thereto.

(12) The term "water system" shall mean and include all plants, systems, facilities or properties used or useful or having the present capacity for future use in connection with the supply or distribution of water, and any integral part thereof, including but not limited to water supply systems, water distribution systems, sources of water supply including lakes, reservoirs and wells, intakes, mains, laterals, aqueducts, pumping stations, standpipes, filtration plants, purification plants, hydrants, meters, valves, and all necessary appurtenances and equipment and all properties, rights, easements and franchises relating thereto and deemed necessary or convenient by the authority for the operation thereof. (1955, c. 1195, s. 2; 1969, c. 850; 1971, c. 892, s. 1; 1979, c. 619, s. 8.)

§ 162A-3. Procedure for creation; certificate of incorporation; certification of principal office and officers.

(a) The governing bodies of any two or more political subdivisions may by resolution signify their determination to organize an authority under the provisions of this Article. Each of such resolutions shall be adopted after a public hearing thereon, notice of which hearing shall be given by publication at least once, not less than 10 days prior to the date fixed for such hearing, in a newspaper having a general circulation in the political subdivision. Such notice shall contain a brief statement of the substance of the proposed resolution, shall set forth the proposed articles of incorporation of the authority and shall state the time and place of the public hearing to be held thereof. No such political subdivision shall be required to make any other publication of such resolution under the provisions of any other law.

(b) Each such resolution shall include articles of incorporation which shall set forth:

(1) The name of the authority;

(2) A statement that such authority is organized under this Article;

(3) The names of the organizing political subdivisions; and

(4) The names and addresses of the first members of the authority appointed by the organizing political subdivisions.

APPENDIX K

GEORGETOWN DIVIDE PUBLIC UTILITY MANAGEMENT PROGRAM AND ORDINANCE

ORDINANCE NO. 71-3

AN ORDINANCE ESTABLISHING RATES AND CHARGES FOR SEWAGE DISPOSAL SERVICE AND PROVIDING PROCEDURES FOR ITS ENFORCEMENT

AUBURN LAKE TRAILS AREA

BE IT ENACTED by the Board of Directors of the Georgetown Divide Public Utility District, El Dorado County, California, as follows:

ARTICLE 1. GENERAL PROVISIONS

1.1 Short Title. This ordinance may be cited as "Georgetown Divide Public Utility District Sewage Disposal Service Charge Ordinance."

1.2 Definitions. Unless the context otherwise indicates, terms used herein have the following meanings:

a) "District" means the Georgetown Divide Public Utility District.

b) "Board" means the board of directors of the District.

c) "Sewage disposal charges" means fees, tolls, rates, rentals or other charges for services and facilities furnished by District in connection with sanitation or sewage systems.

d) "Report" means the report referred to in §5473 of the Health and Safety Code of the State of California.

e) "Sewage disposal system" means a septic tank or any other facility designed and constructed for the purpose of receiving and disposing of sewage.

f) "Sewage" means any combination of water-carried wastes discharged from buildings in the District.

1.3 Need for Regulation. The District has heretofore formed Improvement Districts A and B of the Georgetown Divide Public Utility District, Auburn Lake Trails Area, pursuant to Resolutions Numbers 70-4 and 71-7, adopted by the Board of Directors on February 2, 1970, and January 13, 1971, respectively, for the purposes, among others, of planning and designing and operating and maintaining works necessary to

provide sanitary sewage and sewage disposal service to the areas within said improvement districts. By reason of the geology of said areas and the intensity of the subdivision development thereof the disposition of sewage into private sewage disposal systems within said areas without District regulation and control will create a hazard to health and water quality and the danger of contamination of the water supply of the District.

1.4 Separability. The Board hereby declares that it would have passed this ordinance and each section, subsection, sentence, clause or phrase thereof, irrespective of the fact that any one or more of the sections, subsections, sentences, clauses or phrases be declared unconstitutional.

1.5 Posting. This ordinance shall take effect thirty (30) days after its passage. At least one week before the expiration of the said thirty (30) days, copies of the ordinance shall be posted at three (3) public places in the District, and published once in the Town Crier.

ARTICLE 2. SEWAGE DISPOSAL SYSTEMS

2.1 Sewer Not Available. Where a public sewer is not available within either of said Improvement Districts A and B the building sewer shall be connected to a sewage disposal system to be constructed on the site pursuant to this ordinance, and complying with all rules, regulations and ordinances of the District.

2.2 Permit Required. Before commencement of construction of a sewage disposal system, the owner shall first obtain a written permit signed by the District Manager or his authorized representative. The application for such permit shall be made on a form furnished by the District, which shall request the District to provide plans, specifications and other information as deemed necessary by the District. A permit fee in the amount of Five Dollars ($5.00) shall be paid to the District at the time application is filed. The form of application for permit shall include a grant to the District of the right to maintain,

satisfaction, and an agreement to observe all District rules, regulations and ordinances and to pay all District charges.

2.3 No Building Permit. Subject to the approval by the Board of Supervisors of the County of El Dorado, no building permit for a building within either of said Improvement Districts A and B shall be issued by the County Building Inspector until the District has issued a permit for a sewage disposal facility as required herein.

2.4 Inspection Required. A permit for a sewage disposal system shall not become effective until the installation is completed to the satisfaction of the District Manager or his authorized representative. He shall be allowed to inspect the work at any stage of construction and, in any event, the applicant for the permit shall notify the District Manager or his authorized representative when the work is ready for final inspection, and before any underground portions are covered. The inspection shall be made within forty-eight (48) hours, Sundays and holidays excluded, of the receipt of the notice. Installation shall conform to the plans and specifications furnished by District pursuant to the permit application.

2.5 Design Requirements. The type, capacities, locations and layout of a sewage disposal system shall comply with all recommendations of the El Dorado County Health Department. No permit shall be issued for any sewage disposal system employing subsurface soil absorption facilities where the area of the lot is determined to be inadequate by the Board of District. No septic tank or cesspool shall be permitted to discharge to any public sewer or directly to any stream of water course.

2.6 Abandonment of Facilities. At such time as a public sewer becomes available to a property served by a sewage disposal system, a direct connection shall be made to the public sewer in compliance with the ordinances, rules and regulations of District, and any septic tanks, cesspools, and similar private sewage disposal facilities shall be abandoned and filled with suitable material as determined by the

District Manager or his authorized representative.

2.7 Maintenance and Monitoring by District. The District shall operate and maintain the sewage disposal facilities constructed pursuant to this ordinance in a sanitary manner at all times. To assure protection of surface and subsurface waters the District will maintain a watershed monitoring program throughout said areas of said Improvement Districts A and B, such program to be in conformance with standards determined in conjunction with the El Dorado County Health Department, the Regional Water Quality Control Board and the Bureau of Reclamation. The District Manager shall prepare, and from time to time as necessary amend, rules and regulations governing said operation and maintenance of sewage disposal facilities and said monitoring program, subject to approval thereof by resolution of the Board.

2.8 Additional Requirements. No statement contained in this Article shall be construed to interfere with any additional requirements that may be imposed by any law, ordinance, rule or regulation or by the Health Officer of the County. In the event any sewage disposal system installed pursuant to this ordinance requires modification by reason of conditions below ground level which were not apparent on the surface, and which become apparent during construction of said system or as a result of the monitoring program specified in Section 2.7 of this ordinance, the owner of the lot shall make such modification at his expense. In the event of failure of such owner to do so, within thirty (30) days after written notice, mailed to his address as shown on the last county equalized assessment roll or as filed with the Clerk of District, then District shall make such modification and the lot shall be subject to a service charge therefor pursuant to Section 3.1(c) of this ordinance.

ARTICLE 3. RATES AND CHARGES

3.1 Charges. Charges for the services of the District rendered pursuant to this ordinance are hereby established as follows:

a) ~~$6.00~~ #10.20 to 6/1/ per R-1 residential lot per year (payable by all

b) $12.00 per commercial lot per year (payable by all commercial lots within said Improvement Districts A and B);

c) An amount equal to the actual cost to the District of performing any extraordinary maintenance or repair of a sewage disposal system, including pumping of a septic tank, or making any replacement or modification of a sewage disposal system, or portion thereof (any such charge to be applicable only to the particular lot for which such service is rendered).

3.2 Effective Date. Said charges shall become effective as to all properties within said Improvement Districts A and B on the first day of the month next succeeding the effective date of this ordinance.

3.3 Amendment. Any or all of the rates and charges established by this Article may be amended by resolution of the Board duly adopted and filed in the office of the Secretary, copies of which shall be available on request.

ARTICLE 4. BILLING AND COLLECTING

4.1 Billing. The regular billing period will be for each calendar month, or such other period as may be determined by the Board. Schools and other public institutions shall pay semiannually on bills rendered on the first days of January and July of each year for the next preceding semiannual period.

4.2 Opening and Closing Bills. Opening and closing bills for less than the normal billing period shall be for not less than one month.

4.3 Billing Time. Bills for sewer service shall be rendered at the beginning of each billing period and are payable upon presentation except as otherwise provided.

4.4 Penalties and Interest. All bills not provided prior to delinquency to be collected on the tax rolls on which general district taxes are collected, that are not paid on or before the 20th of the month in which said bill was rendered, shall be delinquent and a penalty of 10% of the bill or amount due, plus 1/2 of 1% per month from the first day of said month, shall accrue for the period of said

nonpayment and be collected as a part of the principal amount thereof.

4.5. Collection by Suit. As an alternative to any of the other procedures herein provided, the District may collect said unpaid charges by suit, in which event it shall have judgment for the cost of suit and reasonable attorneys' fees.

ARTICLE 5. COLLECTION WITH OTHER UTILITY CHARGES

5.1 Other Utility Charges. The Board of District may provide by contract for the collection of its sewer service charges with the rates for the services, facilities and water of the water system or other utility service funished by it or the owner of such system. The sewer service charges shall be itemized, billed upon the same bill, and collected as one item, together with and not separately from such utility service charge.

5.2 Discontinuing Service. If all or any part of the bill of any privately-owned public utility or public entity on which any sewer service charge is collected is not paid, the privately-owned public utility or public entity may discontinue its utility service until such bill is paid.

5.3 Compensation. The District may provide in the contract with the privately-owned public utility or public entity on which sewer service charges are collected, the compensation for making such collections.

5.4 Other Remedies. The District may provide otherwise for the collection of such delinquent charges. All remedies herein provided for their enforcement and collection are cumulative and may be pursued alternatively or collectively as the District determines.

ARTICLE 6. USE OF TAX ROLL

6.1 Billing and Collecting on Tax Roll. District may provide for the collection of current and/or delinquent charges upon the tax roll upon which District taxes are collected, in the manner provided by law therefor.

6.2 Procedure. When the District elects to use the tax roll on which general District taxes are collected for the collection of current and/or delinquent sewer service charges, proceedings therefor shall be had as now or hereafter provided therefor in Article 4 (commencing with §5470), Chapter 6, Part 3, Division 5 of the Health and Safety Code.

6.3 Report. A written report shall be prepared and filed with the Secretary, which shall contain a description of each parcel of real property receiving such services and facilities and the amount of the charge for each parcel for the forthcoming year, computed in conformity with the charges prescribed by this ordinance.

6.4 Notices. The Secretary shall cause notice of the filing of the report and of the time and place of hearing thereon to be published once a week for two successive weeks prior to the date set for hearing, in the Town Crier, a newspaper of general circulation, printed and published in the District. Prior to such election for the first time, the Secretary shall mail a notice in writing of the filing of said first report proposing to have such charges for the forthcoming fiscal year collected on the tax roll, and of the time and place of hearing thereon, to be mailed to each person to whom any part or parcel of real property described in the report is assessed in the last equalized assessment roll on which general district taxes are collected, at the address shown on said roll or as known to the Secretary.

6.5 Hearing. At the time of said hearing, the Board shall hear and consider all objections or protests, if any, to said report referred to in said notice and may continue the hearing from time to time.

6.6 Final Determination of Charges. Upon the conclusion of the hearing on the report, the Board will adopt, revise, change, reduce or modify any charge or overrule any or all objections and shall make its determination upon each charge as described in said report, which determination shall be final.

6.7 Filing of Report With County Auditor. On or before the 10th day of August in each year following the final determination of the Board, the Secretary shall file with the Auditor a copy of said report with a statement endorsed thereon over his signature, that it has been finally adopted by the Board of District, and the Auditor shall enter the amounts of the charges against the respective lots or parcels of land as they appear on the current assessment roll.

6.8 Parcels Outside the District. Where any such parcels are outside the boundaries of the District, they shall be added to the assessment roll of the District for the purpose of collecting such charges.

6.9 Parcels Not on Roll. If the property is not described on the roll, the Auditor shall enter the description thereon together with the amounts of the charges as shown on the report.

6.10 Lien. The amount of the charges shall constitute a lien against the lot or parcel of land against which the charge has been imposed as of noon on the first Monday in March of each year. The Tax Collector shall include the amount of the charges on bills for taxes levied against the respective lots and parcels of land.

6.11 Tax Bill. Thereafter, the amount of the charges shall be collected at the same time and in the same manner and by the same persons as, together with and not separately from the general taxes for the District, and shall be delinquent at the same time and thereafter be subject to the same penalties for delinquency.

6.12 Collection. All laws applicable to the levy, collection and enforcement of general taxes of the District, including but not limited to those pertaining to the matters of delinquency, correction, cancellation, refund and redemption, are applicable to such charges.

6.13 Compensation of County. The Tax Collector may, in his discretion, issue separate bills for such charges and separate receipts for collection on account of such charges. The County shall be compensated for services rendered in connection with the levy, collection and enforcement of such charges for the District in an amount to be fixed by

agreement between the Board of Supervisors and the Board of District. The compensation shall not exceed one percent (1%) of all money collected. The compensation shall be paid into the County salary fund.

6.14 Alternative. The powers authorized by this Article shall be alternative to all other powers of the District, including addition of delinquent charges to the annual assessment levied upon the land as now or hereafter provided in Article 3 (commencing with §16469), Chapter 4, Division 7 of the Public Utilities Code, and alternative to any other procedures adopted by the Board for the collection of such charges.

ARTICLE 7. USE OF REVENUES

7.1 Use of Revenues. Revenues derived under this ordinance shall be used only to defray the costs and expenses of performing the services to be provided by District pursuant to this ordinance.

ARTICLE 8. RELIEF FROM INEQUITY

8.1 Relief on Application. When any person by reason of special circumstances, is of the opinion that any provision of this ordinance is unjust or inequitable as applied to his premises, he may make written application to the Board, stating the special circumstances, citing the provision complained of, and requesting suspension or modification of that provision as applied to his premises.

If such application be approved, the Board may, by resolution, suspend or modify the provision complained of, as applied to such premises, to be effective as of the date of the application and continuing during the period of the special circumstances.

8.2 Relief on Own Motion. The Board may, on its own motion, find that by reason of special circumstances any provision of this regulation and ordinance should be suspended or modified as applied to a particular premise and may, by resolution, order such suspension or modification for such premises during the period of such special circumstances, or any part thereof.

ATTESTED:

President, Georgetown Divide Public Utility District

I hereby certify that the foregoing Ordinance No. 71-3 was duly adopted by the Board of Directors of the Georgetown Divide Public Utility District, El Dorado County, at a meeting thereof duly held on the 21st day of June, 1971, by the following vote:

AYES, and in favor thereof, Directors: Nance, Price, Joynes and Figgins

NOES, Directors: None

ABSENT, Directors: Porter

Secretary

CHARLES F. GIERAU

GRANT AND AGREEMENT

I/We hereby grant to GEORGETOWN DIVIDE PUBLIC UTILITY DISTRICT the right to maintain, operate and repair the sewage disposal facility situate upon Lot....., Auburn Lake Trails Subdivision, Unit No. ....., El Dorado County, California as shown on that map recorded in Book..... of Maps, at Page ....., El Dorado County Records, upon its completion to the satisfaction of said District.

I/We agree to observe all of said Districts rules, regulations, and ordinances heretofore and hereinafter enacted, and pay all of said Districts charges including, but not limited to, charges incurred by the District for modifications required by said rules, regulations, and ordinances, which I/We fail to make as so required.

I/We further agree that this grant and agreement shall be binding upon all of my/our successors and assigns of said lot.

I/We further agree that this grant and agreement shall not obligate said District in itself to maintenance, operation or repair of said sewage disposal system.

DATED:..... SIGNED:.....

.....

.....

.....

Signatures of the owners of the lot, trustees or beneficiaries under any deed of trust are required.

STATE OF CALIFORNIA
COUNTY OF ..... } ss.

On....., before me, the undersigned, a notary public in and for said county and state, personally appeared .....

.....

known to me to be the person whose name is/are subscribed to the within instrument and acknowledged that he they executed the same.

WITNESS my hand and official seal.

.....
NOTARY PUBLIC IN AND FOR THE COUNTY OF

....., STATE OF CALIFORNIA.

RESOLUTION NO. 84-6

A RESOLUTION OF THE BOARD OF DIRECTORS OF GEORGETOWN DIVIDE PUBLIC UTILITY DISTRICT DECLARING INTENT TO FORM AN ON-SITE WASTEWATER DISPOSAL ZONE IN A PORTION OF GEORGETOWN DIVIDE PUBLIC UTILITY DISTRICT

AUBURN LAKE TRAILS SUBDIVISION
ON-SITE WASTEWATER DISPOSAL ZONE
GEORGETOWN DIVIDIE PUBLIC UTILITY DISTRICT

BE IT RESOLVED by the Board of Directors (BOARD) of Georgetown Divide Public Utility District (DISTRICT), El Dorado County, California:

WHEREAS, the BOARD of DISTRICT has been requested by representatives of Transamerica Development Company (TADCO) and the Auburn Lake Trails Property Owners Association (ASSOCIATION) to form an On-Site Wastewater Disposal Zone for Auburn Lake Trails Subdivision, which comprises a portion of DISTRICT territory, a copy of said request, marked Exhibit B, is attached hereto, incorporated herein, and made a part hereof; and,

WHEREAS, TADCO and ASSOCIATION have further requested the BOARD to discontinue the proceedings of Sewer Assessment District No. 1, which would provide for the construction of a sanitary sewage system for all of the lots and properties within the boundaries of the Auburn Lake Trails Subdivision, as more particularly set forth in said Exhibit A; and,

WHEREAS, A Summary Report of On-Site Disposal Suitability for Auburn Lake Trails Subdivision has been prepared dated May, 1984, revised June and July, 1984, marked Exhibit C, attached hereto, made a part hereof, and incorporated herein by reference, which finds, subject to conditions and limitations stated therein, that approximately 1105 but not exceeding 1110 lots have been judged

suitable for on-site disposal in Auburn Lake Trails, subject to the final design approval and issuance of DISTRICT permit and El Dorado County Health Department approval; and,

WHEREAS, the proposal to form Sewer Assessment District No. 1 to construct a sanitary sewage system has met with opposition of many landowners within the Auburn Lake Trails Subdivision.

NOW, THEREFORE, THE BOARD OF DISTRICT finds and orders as follows:

1. The Board of Directors deems it necessary to form an On-Site Wastewater Disposal Zone for Auburn Lake Trails Subdivision, which comprises a portion of DISTRICT territory.

2. The Board of Directors hereby declares its intent to form an On-Site Wastewater Disposal Zone in a portion of DISTRICT, known as the Auburn Lake Trails Subdivision.

3. A description of the boundaries of the territory proposed to be included in the Zone is attached hereto, marked Exhibit A, made a part hereof, and incorporated herein by reference.

4. A map showing the boundaries of said Auburn Lake Trails Subdivision and the On-Site Wastewater Disposal Zone is on file at the office of DISTRICT, Main Street, Georgetown, California.

5. The public benefit to be derived from the establishment of an On-Site Wastewater Disposal Zone in the Auburn Lake Trails Subdivision is to protect existing and future water uses, protect public health, prevent and abate nuisances, promote water quality, prevent the pollution, waste, and contamination of water and to allow most property owners, including TADCO, to develop their property in the Auburn Lake Trails Subdivision, which would otherwise not occur without the construction of subdivision community-wide sewers or

sewage systems, which subdivision community-wide sewers or sewage systems may not be financially feasible.

6. A description of the proposed type of On-Site Wastewater Disposal Zone systems is attached hereto, marked Exhibit D, made a part hereof and incorporated herein by reference

7. The proposed plan for wastewater disposal is attached hereto, marked Exhibit E, made a part hereof, and incorporated herein by reference. The individual lots within the Zone, except as hereinafter noted shall utilize a system based upon an on-site investigation which includes, but is not limited to, (a) Soils analysis, (b) Depth to groundwater, (c) Depth to impermeable barrier, (d) Percolation characteristics, (e) Topographic analysis and (f) Legislated setbacks. The DISTRICT shall investigate, test, design, operate, monitor, inspect, and if necessary, maintain and repair the On-Site Wastewater Disposal Systems within the Zone at the individual homeowner's expense. A limited number of lots within an area known as the Community Disposal System (CDS) have been investigated, tested, and designed and shall be operated, monitored, inspected, and, if necessary, maintained and repaired at the individual homeowner's expense. CDS lots shall incorporate individual on-site primary wastewater treatment systems with connection to common sub-surface and/or mound disposal systems. The DISTRICT shall assume jurisdiction over maintenance and operation functions, and if necessary construct additions to existing said common sub-surface disposal systems and common mound disposal systems, investigate, test, design, operate, monitor, inspect and if necessary maintain and operate said common sub-surface disposal systems and common mound disposal systems.

The DISTRICT will issue a permit for each on-site system, subject to final design approval by the DISTRICT and El Dorado County Health Department.

8. The number of residential units and commercial units in the proposed Zone which the DISTRICT proposes to serve is:

A. Approximately 1105, but not to exceed 1110 single family residential units, and one residential unit connected to a clubhouse on-site disposal system;

B. Not more than 12 other on-site disposal system units for equestrian center users, office complex users, clubhouse users, swimming pool users, tennis court users, campground users, and a small building now used by a private day school, all of which are, or shall be facilities owned or controlled by the ASSOCIATION.

9. The proposed means of financing the operation of the Zone are service charges for maintenance and operation, connection charges and transfer of ASSOCIATION funds for capital improvements and replacements of the Community Disposal System. Extraordinary expenses incurred by the DISTRICT for maintenance operation, testing, monitoring, surveillance, repairs or replacement of individual on-site wastewater disposal systems or community disposal systems shall be assessed solely to the benefitting property owners as provided for under Section 6978, et sec. of Health and Safety Code of the State of California. The proposed budget at today's costs for the first year's operation of said On-Site Wastewater Disposal Zone is attached hereto, marked Exhibit F, made a part hereof, and incorporated herein by reference.

10. The time and place for hearing by the Board for the proposed On-Site Wastewater Disposal Zone on the question of formation

of the proposed Zone,and on the type of residential and commercial users that the DISTRICT proposes to serve in the proposed Zone is October __, 1984 at ____ P.M. at the Northside School Auditorium, Highway 49, Cool, California. At such time and place, any interested persons will be heard by the Board.

11. A certified copy of this Resolution of Intention shall be filed and recorded in the Office of the County Recorder of El Dorado County, in which all of the land in the proposed Zone is situated.

12. Notice of said hearing shall be given pursuant to Section 6958 of the Health and Safety Code of California.

13. The local Health Officer is requested to review and report his findings in writing to the Board pursuant to Section 6960 of the Health and Safety Code of California.

14. The California Regional Water Quality Control Board Central Valley Region, is requested to review the proposed formation and report its findings in writing to the Board pursuant to Section 6960.1 of the Health and Safety Code of California.

15. The formation of the On-Site Wastewater Disposal Zone shall be effective but shall not become operative until the following conditions have been met:

A. There is Finality of Judgment in Class Action, Case Number 34594, Superior Court of the State of California, in and for the County of El Dorado, as a result of the Agreement of Compromise and Settlement of Class Action executed by TADCO and ASSOCIATION. Finality of Judgment will occur on the date which is 20 days after the date the time for appeal shall expire as to any judgment approving the ASSOCIATION and TADCO Settlement is made by the Superior Court

or, if an appeal is taken, the date of final judgment on appeal approving the Settlement.

B. TADCO shall agree to retire, pay off, or amortize all obligations for water bonds with respect to lots deeded by TADCO to ASSOCIATION as open space. If TADCO elects to amortize payment of these water bonds, TADCO agrees to indemnify the ASSOCIATION from and against any loss from water bonds attributable to lots and other TADCO properties so deeded to ASSOCIATION as common area. With respect to restricted and easement lots defined in said Agreement of Compromise and Settlement of Class Action, TADCO shall agree to pay off or amortize the water bonds for the period in which it owns said restricted and easement lots reserving the right to sell these lots subject to purchasers' assumption of water bond obligations, providing any water bond obligation thereon is a legally chargeable obligation against any purchaser thereof, and if not, reserving the right to sell these lots and retire, pay off, or amortize all obligations for water bonds with respect to these lots.

C. El Dorado County shall adopt an Ordinance substantially in the form of Exhibit G, attached hereto, incorporated herein and made a part hereof applicable only to Auburn Lake Trails Subdivision.

D. The California Regional Water Quality Control Board, Central Valley Region, shall accept the variances from the State Water Resources Control Board, Guidelines for Mound Systems, January, 1980, set forth in said Exhibit D.

E. TADCO shall make the contributions set forth in said Exhibit F to be made on behalf of TADCO and convey any easements owned by TADCO required for disposal sites for the CDS and MCDS as referred to in Exhibit F.

F. POA shall make the contributions set forth in Exhibit F to be made on behalf of POA, shall execute an agreement to collect fees as provided in said Exhibit F, shall convey any easements owned by POA required for disposal sites for the CDS and MCDS as referred to in Exhibit F, and shall amend its by-laws for DISTRICT participation in its Design Committee as set forth in said Exhibit E.

G. The California Regional Water Quality Control Board, Central Valley Region, shall issue its Waste Discharge Requirements required for said On-Site Wastewater Disposal Zone and providing for the removal of TADCO and POA from any obligation under said Waste Discharge Requirements, unless TADCO and/or POA waive such removal.

PASSED AND ADOPTED by the Board of Directors of Georgetown Divide Public Utility District this 8th day of August, 1984, at a duly called regular meeting by the following vote:

AYES: Directors John C. Lampson, Fred G. DeBerry, Wade B. Milner, Arthur E. Smoot and Robert E. Flynn
NOES: None.

ABSENT: None.

John C. Lampson

John C. Lampson, President
Board of Directors
GEORGETOWN DIVIDE PUBLIC UTILITY DISTRICT

ATTEST:

Charles F. Gierau

Charles F. Gierau, Clerk and ex officio
Secretary, Board of Directors, GDPUD

CERTIFICATE

I hereby certify that the foregoing is a full, true and correct copy of Resolution 84-6, duly and regularly adopted by the Board of Directors of the GEORGETOWN DIVIDE PUBLIC UTILITY DISTRICT, El Dorado County, State of California.

CHARLES F. GIERAU, Clerk and ex officio Secretary, Board of Directors, GEORGETOWN DIVIDE PUBLIC UTILITY DISTRICT

SUMMARY OF ON-SITE DISPOSAL SUITABILITY
AUBURN LAKE TRAILS SUBDIVISION
MAY, 1984
REVISED JUNE, 1984
REVISED JULY 6, 1984

At the request of Auburn Lake Trails Property Owners Association (ALT POA) and Transamerica Development Company (TADCO), Georgetown Divide Public Utility District (GDPUD) hereby presents a compilation of lots in Auburn Lake Trails Subdivision which have been found suitable for on-site waste disposal.

Suitability has been assessed via five avenues. These are:

1. Approval of El Dorado County Health Department, Division of Environmental Health (EDCHD) prior to and during the inception of the existing On-Site Waste Management District. This category pertains primarily to a few lots with homes built before and during 1971.

2. Lots tested and found suitable by consulting sanitarians, geologists, or engineers employed privately by lot owners, and reviewed and accepted by GDPUD.

3. Lots tested by GDPUD on an individual basis at the request of the lot owner and found suitable.

4. Lots tested and found suitable under the auspices of the "Auburn Lake Trails Suitability Study for On-Site Waste Disposal, April, 1980" conducted by GDPUD.

5. Lots tested and found suitable as a result of the "Assimilation Study," conducted by Larry Walker Associates, Inc. (LWA), by joint agreement of ALT POA, TADCO, and GDPUD. Findings were reviewed and accepted by GDPUD.

Details of the evolution of the Assimilation Study are presented in "Auburn Lake Trails Assimilation Alternative; Preliminary Report on Technical Feasibility, April 1983." Under the auspices of that report, technical decisions regarding which lots or lot combinations merited further investigation and for which type systems were made jointly by ALT POA and GDPUD. TADCO provided administrative input for proposed lot combinations and easements.

Criteria, methodology, and personnel employed by Larry Walker Associates are presented in "Analysis of On-Site Disposal Suitability; Phase I and Community Disposal Systems, August, 1983" published by LWA.

TADCO functioned as coordinator of the Assimilation Study provided clerical services but did not provide technical input. GDPUD

provided technical input and reviewed all phases of the study. After soils and engineering work were completed by LWA in February, 1984, GDPUD staff reviewed the technical data in the context of lots accepted and rejected throughout the subdivision. At that time proposed combinations were reassessed on the basis of disposal potential, and, with TADCO, new combinations or easement options were defined.

Prior to the Assimilation Study, 618 lots were judged suitable for on-site disposal on the basis of mechanisms 1 through 4 outlined above, including existing homes and lots served by the Community Disposal System. An additional 485 lots have been judged suitable as a result of the Assimilation Study, potentially defining a subdivision of 1103 buildable lots. State and County acceptance of the subdivision on a long term on-site disposal basis is predicated on the existence of systems management and water quality monitoring programs. GDPUD intends to administer these programs via an On-Site Wastewater Disposal Zone (OSWDZ).

Suitability of the lots has been judged on the basis of existing soils and engineering data. Suitability is subject to affirmation at the time a system design is formally submitted by or to GDPUD, whereupon GDPUD will have the authority to issue an OSWDZ permit for on-site disposal to a lot with a properly designed system on a suitable site. Final approval of design and suitability rests with El Dorado County Health Department, to be rendered at the time a system design is formally submitted to the County as part of an application for a building permit.

Because of acceptable advances in waste disposal technology and/or creation of adequate waste disposal area by means of lot combinations, boundary adjustments, or granting of disposal easement rights, lots deemed unsuitable prior to the Assimilation Study may have been reassessed during the Study and judged suitable. Determinations of the Assimilation Study supersede previous determinations.

Each of the undeveloped lots judged suitable for on-site disposal has been accepted on the basis of a specific system type and, in most cases, a specific site on the lot to be reserved for disposal and replacement area. On some smaller lots, it has been necessary to fix the site of the future residence in order to ensure sufficient reserved area for sewage disposal. Alteration of the fixed disposal site during grading or construction may render the lot unbuildable.

The 1103 lots judged suitable for on-site disposal in Auburn Lake Trails are broken down into the following categories:

A) 338 homes existing at the time of this writing.

B) 337 existing lots have been found suitable for conventional type on-site disposal systems.

C) 62 lots have been found suitable for conventional type systems on the basis of combination with an adjacent lot(s).

D) 73 lots have been found suitable for conventional type systems on the basis of an easement for disposal on an adjacent or nearby lot or POA Common Area.

The entire category of conventional type disposal systems in Auburn Lake Trails is considered on a "Special Design" basis by El Dorado County Health Department, Division of Environmental Health. The specific parameters of the special design vary from lot to lot. For most lots, special design designation implies standard systems with rigorous construction inspection requirements. For approximately 10% of lots approved for conventional type systems, special designs may also include trenches of non-standard depth, pumps, elevated fill, pressure dosing manifolds, sand-lined trenches, and/or other mechanisms accepted by EDCHD as special design modifications of conventional type systems.

E) 106 existing lots have been found suitable for mound type systems.

F) 24 lots have been found suitable for mound type systems on the basis of combination with an adjacent lot(s).

G) 62 lots have been found suitable for mound type systems on the basis of an easement for disposal on an adjacent or nearby lot or POA Common Area. Six of these lots are to be served by a common mound on POA Common Area immediately adjacent to the lots.

The large scale use of mound type systems in Auburn Lake Trails is predicated on the existence of a management district, and subject to final approval by EDCHD and Central Valley Regional Water Quality Control Board.

H) 101 existing unimproved lots are designated for Community Disposal System (CDS) service. Of these, 45 lots were so designated before 1983; 56 lots have been added during the Assimilation Study by virtue of a proposal to expand CDS capacity with a modular mound system. Detailed analysis of the CDS is presented in "Report on the Community Disposal System, Auburn Lake Trails, May 1979," by GDPUD, and "Analysis of Onsite Disposal Suitability; Phase I and Community Disposal System, August 1983," by Larry Walker Associates, Inc. 33 homes are currently served by the CDS.

Table 1 enumerates the lots in Categories A through H. A summary of the number of lots in each category is presented in Table 2.

All proposed lot combinations and easements are subject to compliance with County parcel map requirements.

Reports referenced in this summary, other technical reports pertaining to Auburn Lake Trails, and technical information on individual lots are available for examination at the office of Georgetown Divide Public Utility District.

TABLE 2

NUMBERS OF LOTS IN EACH CATEGORY

Category	Special Design Conventional Systems	Mound Systems	Other Alternative Systems	SI/TI CDS Connections	Total
A	292	4	9	33	338
B	338				
C	62				
D	73				
E		106			
F		23			
G		62			
H				45 orginally designated 56 additional	
Totals	765	195	9	134	1,103

EXHIBIT D

PROPOSED TYPES OF SYSTEMS

A. Conventional subsurface disposal systems utilizing alternating fields.

B. Conventional subsurface disposal systems utilizing pressurized dosing techniques.

C. Select fill subsurface disposal systems utilizing pressure dosing techniques.

D. Elevated fill subsurface disposal systems utilizing alternating fields and/or pressurized dosing.

E. Elevated fill (mound) systems.

F. Individual on-site primary wastewater treatment systems with connection to a common subsurface disposal system.

G. Individual on-site primary wastewater treatment systems with connection to common mound systems.

It is proposed that the foregoing types shall not be considered exclusive in that advances in technology may provide future alternatives which are cost effective and enhance the achievement of water quality and public health objectives.

The following variances (underlined) are required from El Dorado County Ordinance Code, Chapter 15·33·020:

C. Disposal systems shall be designed to utilize the most permeable or absorptive portions of the soil formation as determined by a percolation test and soil profile analyses. There shall be a minimum of five feet of permeable soil below the bottom of the proposed conventional sewage disposal system. There shall be a minimum of four feet of soil below the distribution manifold in a proposed pressure dosed special design system. The five feet of soil below the bottom of a conventional sewage disposal system, and the four feet below the distribution manifold of a pressure dosed special design system shall be free from the effects of groundwater and possess appropriate textural and structural characteristics to promote effective renovation of wastewater.

E. No property shall be improved in excess of its capacity to absorb sewage effluent in the quantities and by the means provided in this code unless appropriate measures (i.e. easements) have been taken to provide sufficient suitable lands for this purpose.

PROPOSED PLAN FOR WASTEWATER DISPOSAL

The proposed plan for wastewater disposal; individual lots within the Zone, except as hereinafter noted shall utilize a system based upon an on-site investigation which includes, but is not limited to, (a) Soils analysis, (b) Depth to groundwater, (c) Depth to impermeable barrier, (d) Percolation characteristics, (e) Topographic analysis, and (f) Legislated setbacks. The District shall investigate, test, design, operate, monitor, inspect, and if necessary, maintain and repair the On-Site Wastewater Disposal Systems within the Zone. A limited number of lots within an area known as the Community Disposal System (CDS) have been investigated, tested, and designed and shall be operated, monitored, inspected, and, if necessary, maintained and repaired. CDS lots shall incorporate individual on-site primary wastewater treatment systems with connection to common sub-surface and/or mound disposal systems. The District shall assume jurisdiction over maintenance and operation functions, and if necessary construct additions to existing said common sub-surface disposal systems and common mound disposal systems, investigate, test, design, operate, monitor, inspect and if necessary maintain and operate said common sub-surface disposal systems and common mound disposal systems.

The DISTRICT will issue a permit for each on-site system, subject to final design approval by the DISTRICT and El Dorado County Health Department.

The DISTRICT on behalf of the Zone will assume management, jurisdiction and control of the CDS, including the disposal site and

collection system currently in place and additional collection system to be installed at the subdivision, and the MCDS including the disposal site and collection system scheduled to be constructed at the subdivision and to collect connection charges from lot owners connecting to them.

The DISTRICT on behalf of the Zone will accept ownership of easements for the disposal sites of the CDS and any Mini Community Disposal System (MCDS), and easements for the collection lines, transmission lines, pumping stations and appurtenances for the CDS and MCDS.

The DISTRICT on behalf of the Zone shall pay for, from funds collected by it for connection charges and funds transferred to it by POA above for the CDS, shall make future modifications and/or expansion of the CDS and MCDS as may be required as additional homes are connected, also paid from said funds and charges.

It is presently contemplated that 80 homes may be served in the existing CDS on-site disposal area after modifications to said CDS System and an additional 58 homes may be served by expansion of the CDS System.

It is presently estimated that 6 homes may be served on the MCDS to be constructed.

A staff person of DISTRICT (one responsible for design) on behalf of the Zone shall participate on POA's Design Committee as a non-voting member and for purposes of Zone input only.

The DISTRICT on behalf of the Zone may exercise all powers authorized by Sections 6975 through 6979 of the Health and Safety Code of California in the conduct of said Zone, in addition to any other DISTRICT powers provided by law.

EXHIBIT E

TENTATIVE BUDGET
AUBURN LAKE TRAILS
ON-SITE WASTEWATER DISPOSAL ZONE
FISCAL YEAR 1984-85

LABOR		$ 69,630
ADMINISTRATION	$ 5,739	
TECHNICAL	23,608	
PROFESSIONAL	31,949	
CLERICAL	8,334	
ACCOUNTING AND AUDIT		1,200
EQUIPMENT M & O - GENERAL		250
EQUIPMENT M & O - C.D.S.		1,500
OFFICE SUPPLIES		750
MATERIALS & SUPPLIES		1,500
UTILITIES, GENERAL		2,750
UTILITIES, C.D.S.		1,000
VEHICLE MAINTENANCE		250
VEHICLE OPERATION		1,000
COMPUTER BILLING		500
DEPRECIATION		1,500
CAPITAL EXPENDITURES, GENERAL		3,000
CAPITAL REPLACEMENT, C.D.S.		4,800
U.S.G.S. CONTRACT		4,500
MISCELLANEOUS EXPENSES		500
ENGINEERING CONSULTATION		4,000
LEGAL CONSULTATION		3,000
INSURANCE		1,000
COMPUTER INPUT		10,000
SUB TOTAL		$ 112,630
CONTINGENCIES 10%		11,263
TOTAL		$ 123,893

EXHIBIT F

CHARGES

$11.25 per month per homesite except Community Disposal System (CDS)

$21.55 per month per homesite in CDS

$ 5.75 per month per vacant lot, except in CDS

$ 8.75 per month per vacant lot in CDS

$415.00 Design and inspection fee

$265.00 Design review if design done by private consultant and inspection fee.

$1,365.00 Design, inspection and connection fee in CDS

CONTRIBUTIONS

A sum not to exceed $20,000.00 to be paid to DISTRICT from Transamerica Development Company (TADCO) representing any and all monies required by DISTRICT for acquisition of computer software and hardware in connection with the set up and operation of said Zone.

A sum not to exceed $7,500.00 to be paid to DISTRICT by TADCO to be expended by DISTRICT for a Report and Design Costs as estimated by Larry Walker & Associates in connection with the CDS and the Mini Community Disposal System (MCDS) now planned for said Zone.

The cost of installation of pipe to the community leach field system which is required in order to connect the additional 58 lots to be connected to said system pursuant to the summary report referenced in Paragraph 2 hereof to be paid by TADCO.

EXHIBIT F

Auburn Lake Trails Property Owners Association (POA) shall transfer to DISTRICT its remaining accounts of three Time Deposit funds in the amount of approximately $31,407.04 plus any interest which has accrued. Said funds will be held by DISTRICT for the following purposes: approximately $14,427.00, capital reserve for CDS leach field expansion; approximately $8,840.00 for capital replacement and improvement to CDS collection system, and approximately $8,140.00 for CDS operation and maintenance fund.

If the DISTRICT on behalf of the Zone is precluded for collecting connection fees from owners connecting to the CDS or Mini Community Disposal System (MCDS), the POA will collect such fees from connecting owners and pay such amounts to the DISTRICT.

The DISTRICT on behalf of the Zone may exercise all financial powers authorized by Sections 6975 through 6981 of the Health and Safety Code of California in the conduct of said Zone, in addition to any other DISTRICT powers provided by law.

POA and TADCO shall convey any easements owned by them required for disposal sites for CDS and MCDS, and required for CDS and MCDS collection line, pumping station and transmission line easements.

EXHIBIT F