CORPUS CHRISTI BAY NATIONAL ESTUARY PROGRAM
STUDY OF ON-SITE SEWAGE FACILITIES

Submitted to:

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Contract No. 72-000000-47

December 8, 1997

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ACKNOWLEDGMENTS

The Corpus Christi Bay National Estuary Program Study of On-Site Sewage Facilities (OSSF) represents a compilation of information, findings, and recommendations which have involved close coordination and input from primarily county health departments staff as well as Texas Natural Resources Conservation Commission staff. This coordination has been ongoing to help ensure a cooperative study process, an accurate characterization, recommendations that are hopefully achievable and compatible with local government programs, and a document that should help improve OSSF understanding, management, and compliance.

We wish to acknowledge the assistance of the following individuals and their staff who contributed their time and efforts providing information, developing recommendations, and critiquing the study document:

* Jim McFarland - Director, Nueces County Health Department
* Ivan Santoyo - Environmental Investigator, Texas Natural Resources Conservation Commission - Region 14
* Judge Charles Stone - County Judge, Refugio County
* Marilyn Torno - Director, San Patricio County Health Department
* Tom Touchstone - Director, Aransas County Health Department
* Warren D. Samuelson - Occupational Certification Section, Texas Natural Resources Conservation Commission
* Ken Graber - Occupational Certification Section, Texas Natural Resources Conservation Commission

LIST OF ACRONYMS

AA	Authorized Agent
AMFI	Area Median Family Income
ASTM	American Society for Testing and Materials
CCBF	Corpus Christi Bays Foundation
CCBNEP	Corpus Christi Bays National Estuary Program
CCN	Certificates of Convenience and Necessity
CCNCDH	Corpus Christi- Nueces County Department of Health
CPLP	Colonia Plumbing Loan Program
DO	Dissolved Oxygen
DR	Designated Representative
ED	Executive Director
EDAP	Economically Distressed Areas Program
EMC	Event Mean Concentrations
EPA	Environmental Protection Agency
ET	Evapotranspiration
FC	Fecal Coliform
FEMA	Federal Emergency Management Agency
FmHA	Farmer's Housing Administration
HILP	HOME Improvement Loan Program
HUD	Housing and Urban Development
LPD	Low Pressure Dosing
MGD	Million Gallon per Day
NEC	National Electrical Code
NEI	Naismith Engineering, Inc.
NEP	National Estuary Program
NPDES	National Pollution Discharge Elimination System
NPS	Non-Point Source
NSF	National Sanitation Foundation
OSDS	On-Site Waste Disposal Systems
OSSF	On-Site Sewage Facility
PE	Professional Engineer
Rules	30 TAC Chapter 285
RDA	Rural Development Administration
RS	Registered Sanitarian
SDR	Standard Dimension Ratio
SE	Site Evaluator
STEP	Small Town Environmental Program
SWQM	Surface Water Quality Management
TAC	Texas Administrative Code
TC	Total Coliforms
TDH	Texas Department of Health
TDOHCA	Texas Department of Housing and Community Affairs
TEEX	Texas Engineering Extension Service
TNRCC	Texas Natural Resources Conservation Commission
TSWQS	Texas Surface Water Quality Standards
TWC	Texas Water Code
TWDB	Texas Water Development Board
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey

CORPUS CHRISTI BAY NATIONAL ESTUARY PROGRAM
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EXECUTIVE SUMMARY

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The Corpus Christi Bay National Estuary Program (CCBNEP) is currently developing a Comprehensive Conservation and Management Plan (Coastal Bend Bays Plan, or "Plan"). The Plan addresses problems, goals, and objectives related to seven (7) "priority issues" identified by the program. Related to the priority issue of "water quality degradation" is the issue of wastewater being discharged to surface or groundwater from malfunctioning on-site sewage facilities (OSSFs) as well as unpermitted or non-compliant systems. Septic tank systems are the most commonly used OSSFs within the CCBNEP study area. Historically, these individual wastewater treatment systems were found primarily in rural areas. However, rapidly increasing urban populations, combined with shifts in population from rural to urban areas, have led to pressure for widespread suburban development. In many cases, municipalities are unable to shoulder the high costs of providing centralized wastewater collection and treatment systems in these newly developed areas. As a result, many suburban residential areas rely exclusively on OSSFs. Unfortunately, in some areas, subdivisions have been located in areas with soil conditions unsuitable for conventional septic systems; quite often, lot sizes are no larger than those found in subdivisions serviced by centralized water and sewerage facilities. In such areas, there is often evidence of wide-spread saturation of the soil, malfunctioning of the septic systems, improper maintenance, sewage on the surface of the ground and in roadside ditches, and strained relationships between neighbors. These problem areas can have not only public health concerns, but can potentially have secondary detrimental effects due to biological loading, particularly in receiving streams and in localized bay systems.

In order to address these issues, better understand and help with the management of OSSF, this study of OSSFs was performed. The primary objectives of this study were to compile available OSSF information; assess the OSSF programs, problems, and needs in the key coastal counties of Nueces, San Patricio, Aransas, and Refugio Counties; and make recommendations to help improve the management of OSSFs in the context of the State's new OSSF rules adopted February 4, 1997. Achieving these objectives, utilizing a cooperative approach involving all parties, was a critical project goal.

This report has been prepared in cooperation with county designated representatives (DRs) (health directors), TNRCC-OSSF Program staff, and area OSSF contractors. Development of the report provided an opportunity to coordinate project development and findings with these aforementioned personnel that have OSSF responsibilities, and includes their review comments and recommendations. Report development, therefore, was accomplished in a manner that helped encourage "cooperation among all parties" and helped achieve the OSSF study goals and objectives.

Regulating the design, installation, and management of OSSFs requires the coordination of multiple entities at both the state and local level. Overall regulatory control of OSSFs falls under the authority of the TNRCC - the state agency responsible for developing guidelines and implementing rules and regulations related to OSSFs. Implementation of these rules and general management of OSSFs involves the TNRCC in Austin and their regional offices, authorized agents (AAs) (typically in counties), DRs (individuals appointed by the AA or other permitting authority to carry out OSSF program management and regulatory duties), site evaluators, and installers. The new regulations emphasize compliance through training of installers, apprentices, site evaluators, and DRs.

Key issues identified during the study include outdated subdivision ordinances and platting requirements, bypassing of raw sewage and related public complaints, maintaining compliance with low income homeowners who cannot afford adequate sewage, local government OSSF program staffing constraints, lack of understanding with the court system regarding OSSF importance to public health and water quality and the need for greater enforcement action, and limited information and data correlations relating public health or water quality problems associated with septic tanks and corresponding data making correlations.

The county with the largest number of OSSFs is Aransas County, which also continues to have the greatest activity regarding newly permitted facilities. Although any community with OSSF concentrations adjacent to a river or bay are potential problem areas, particularly important "potential" problem areas are along Copano Bay near the communities of Bayside, Copano Cove, Copano Ridge, and Salt Lake; the Tivoli area which drains to the San Antonio Bay system, various rural subdivisions located along the Nueces River, and subdivisions along Oso Bay near Flour Bluff in the City of Corpus Christi. There is no water quality data correlateing bay system water quality to septic tank concentration areas.

In addition, a number of "colonias" (low income areas with inadequate water and wastewater service) have been identified throughout these counties which have high public interest from a public health standpoint.

Although there are several funding opportunities which can benefit communities in all counties, such as the Texas Department of Housing and Community Affairs (TDOHCA) grants and the "Colonia Fund", only San Patricio County qualifies for Texas Water Development Board's (TWDB)

Economically Distressed Areas Program (EDAP). Other funding opportunities such as the EPA 319 (h) Stormwater Pollution Prevention Program may provide new funding opportunities that can benefit OSSF management.

While local government, the TNRCC, and other OSSF interested parties are cooperatively working together on a difficult issue, there are various recommendations to help improve OSSF management and compliance that have been developed during this study. These recommendations have been closely coordinated with all County DRs. Provided below is a summary list of overall management strategies, monitoring and compliance plan components, and funding management strategies.

OSSF Management Strategies

1. An OSSF Implementation Plan Committee should be developed to help implement study recommendations.
2. The OSSF Design Standards Costing Study should be monitored and findings addressed by TNRCC/ DRs.
3. New Subdivision Ordinances should be developed by all counties.
4. Platt Approval Rules should be developed by all counties.
5. Public Information Programs should be actively pursued on a more regional basis.
6. Contractor Education and training should be expedited.
7. Non-Conventional Systems need more active promotion.
8. Effective OSSF Legislation should continue to be developed to accomplish OSSF study recommendations.
9. Improved enforcement is necessary through Education of the Court System.
10. Water Quality Studies should be performed in key OSSF concentration areas near rivers and bays of interest.

Monitoring and Compliance Plan Components

1. Enhanced Manpower Resource Capabilities will help compliance effectiveness.
2. CCBNEP- Sep Track Computer Management System is an example of a system that can streamline compliance.
3. The OSSF Brochures should be published and made available to the public.
4. A Regional OSSF Public Information Plan should be developed.
5. A Coastal Bend OSSF Educational Program should be developed.
6. Environmental Compliance Procedures can improve DR compliance efficiency.
7. OSSF Data Management Systems can help improve compliance.

Funding Management Strategies

1. A OSSF Funding and Grant Assistance Workshop should be organized.
2. Increased applications to the TDOHCA Colonia Fund and Comprehensive Colonia Planning Fund should be made.

3. A Grant Assistance Services group or program assisting local government should be developed.
4. Funds from Septic Tank Sales and Subdivision Application Fees should be investigated as a source of funding for helping maintain compliance.
5. Subdivision Developer Fees are necessary as a funding source and should be increased.
6. County Permit Fees should be increased as a source of added funds for OSSF management.
7. EDAP and EPA (319) h Funds are funding opportunities that need increased attention to maximize their applicability "regionally".
8. Assistance obtaining Local Matching Contributions is necessary to help local government obtain grant assistance.

The CCBNEP Study of OSSFs and its focus on the four (4) Coastal Bend counties of Nueces, San Patricio, Aransas, and Refugio has created an opportunity to address OSSF compliance issues on a regional basis. As a result, local government can obtain additional support and help by combining their efforts to satisfy key common issues. While certain of these strategies and plan components can be uniquely addressed only by that county, there are certain strategies which are better satisfied through a regional approach. These key regional strategies are as follows:

Key Regional Strategies

1. Providing grant assistance and identifying new grant opportunities such as jointly applying for EPA 319 (h) funds for projects better justified on a regional basis
2. Educating the Coastal Bend public of its unique regional compliance and water quality/ public health issues
3. Educating a broad range of interested parties (such as developers and the court system) who can help control problems
4. Developing a forum of OSSF professionals to plan and implement common data management systems or projects such as the Sep Trac computerized environmental data management system for tracking septic tank compliance information.
5. Studying correlations between OSSF concentration areas and water quality in potential problem areas
6. Providing resources to enable increased surface and groundwater monitoring at colonias

Provided in Table 1 is a summary of OSSF characteristics for the study area counties including: numbers of OSSFs, failing percentages, common problems, and predominant soil characteristics.

TABLE 1 - OSSF STATISTICS FOR THE FOUR STUDY AREA COUNTIES

	Nueces County	San Patricio County	Aransas County	Refugio County
Total number of OSSFs (estimated):	5,918*	5,722*	6,456*	1,033*
Percentage of OSSFs believed to be failing:	20%	data not available	data not available	data not available
Primary concentrations of OSSFs:	In colonias scattered throughout the unincorporated portions of the county, along Oso Bay and Nueces River subdivisions	Ingleside on the Bay, St. Paul, Bethel Estates, Lake City, Lakeside, Doyle Addition, San Patricio, colonias	Copano Bay, Salt Lake, Holiday Beach, Copano Cove, Palm Harbor, Bahia Bay, colonias	City of Tivoli, City of Bayside, colonias
Most common OSSF problems:	Flooding, poor drainage, inadequate soils, improperly designed systems	Located in floodplain, inadequate lot size, unsuitable soils	Flooding, inadequate lot size, unsuitable soils, improperly installed systems	Inadequate lot size, located in floodplain, improperly installed systems
Predominant soil classification:	Victoria (Class IV - unsuitable for standard septic tank systems)	Victoria (Class IV - unsuitable for standard septic tank systems)	Galveston-Mustang-Dianala (Class I - unsuitable for standard septic tank systems)	Victoria (Class IV - unsuitable for standard septic tank systems)

*US Census Bureau, 1990

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1. INTRODUCTION

1.1 Project Background

The Corpus Christi Bay National Estuary Program (CCBNEP) is currently developing a Comprehensive Conservation and Management Plan (Coastal Bend Bays Plan, or "Plan"). The Draft Plan is scheduled for public release and comment by October 1997, with the final Plan to be completed by August 1998. The Plan will address problems, goals, and objectives related to seven (7) "priority problems" identified by the program. Related to the problem of "water quality degradation" is the contributing factor of malfunctioning or otherwise faulty on-site sewage facilities (OSSFs), as well as unpermitted or non-compliant systems.

Septic tank systems are the most commonly used OSSFs within the CCBNEP study area. Historically, these individual wastewater treatment systems were found primarily in rural areas. However, rapidly increasing urban populations, combined with shifts in population from rural to urban areas, have led to pressure for widespread suburban development. In many cases, municipalities are unable to shoulder the high costs of providing centralized wastewater collection and treatment systems in these newly developed areas. As a result, many suburban residential areas rely exclusively on OSSFs.

Unfortunately, in some areas, subdivisions have been located in areas with soil conditions unsuitable for conventional septic systems. Quite often, lot sizes are no larger than those found in subdivisions serviced by centralized water and sewerage facilities. In such areas, there is often evidence of wide-spread saturation of the soil, malfunctioning of the septic systems, improper maintenance, sewage on the surface of the ground and in roadside ditches, and strained relationships between neighbors. These problem areas can not only have public health concerns, but can potentially have secondary detrimental effects due to biological loading, (particularly in receiving streams and in localized bay systems).

The Committee on Natural Resources recognized the widespread problems relating to OSSFs in its Committee Report to the 75th Texas Legislature (December, 1996):

> *The on-site wastewater treatment program in Texas has many areas of concern that need to be addressed by the Legislature. Approximately one-third of the state's population currently utilizes on-site sewage facilities (OSSFs). The number of new permit applications has more than doubled in the past five years and is expected to increase in the foreseeable future. Failure of OSSFs is widespread and has significant public health and environmental consequences. Non-complying systems are frequently the result of improper installation and maintenance. The TNRCC recognizes the need for training and education throughout the OSSF industry and has responded by*

proposing increased emphasis on the site evaluation phase and further training, education, and certification requirements.

Due to lack of manpower, enforcement of OSSF rules and regulations is grossly inadequate in many areas of the state where the program is being administered by the TNRCC, and in many areas where it is administered by a local entity. Additionally, because some areas of the state in which the TNRCC administers the program cover such vast distances, installers often must endure travel-time delays for inspectors on the order of many days to weeks. Combined, these circumstances not only result in the proliferation of many unpermitted and inappropriately installed on-site systems, but also put installers who attempt to comply with the letter of the law at a competitive disadvantage.

The Texas Natural Resource Conservation Commission (TNRCC) is the state agency in charge of developing guidelines and implementing rules and regulations, pertaining to OSSFs. New OSSF rules, cited in 30 Texas Administrative Code (TAC) Chapter 285 (Rules), should improve the design, construction, operation, and maintenance standards for newly constructed OSSFs.

1.2 Project Objectives and Approach

The primary objectives of this report are to compile available OSSF information; assess the OSSF programs, problems, and needs in Nueces, San Patricio, Aransas, and Refugio Counties; and make recommendations to help improve the management of OSSFs in the context of the State's new changes to the Rules. Achieving these objectives and utilizing a coordinated approach involving all parties, will help ensure successful implementation of OSSF management strategies, plans, and educational programs in these counties of the CCBNEP.

The approach for accomplishing the objectives involved completing the tasks in Table 2 consistent with the Contract for Services - Scope of Work in the TNRCC Invitation for Bid (Requisition No. 582-7-64627, dated December 20, 1996). (A number of methods were used to accomplish the above tasks including literature and data reviews, personal interviews, and extensive research.) Following the task number and description is the report section in which it is included.

This report has been prepared in cooperation with county designated representatives (DRs) or county health directors, TNRCC-OSSF Program staff at Region 14 in Corpus Christi and Austin, and area OSSF contractors. Development of the report provided an opportunity to coordinate project development and findings with these aforementioned personnel that have OSSF responsibilities and includes review comments and recommendations from these individuals.

TABLE 2 - REPORT SECTION WHERE EACH WORK TASK IS ADDRESSED

Task #	Task Description	Section #
1	Compile and Summarize Existing State of Texas OSSF Requirements and Authorities	2.1
2	Compile and Summarize Local Ordinances Regarding OSSFs	2.2
3	Identify County OSSF Regulatory Authorities and Describe the Problem Resolution Tactics	2.2
4	Identify OSSF Technical Assistance Programs and Evaluate Program Effectiveness	2.3
5	Identify and Map OSSF Problem Areas	4.0
6	Provide a List of Local OSSF Construction Contractors and Summarize Their Practices	2.5
7	Estimate Nutrient and Bacterial Loadings Related to OSSFs	3.0
8	Provide Recommendations for a Management Strategy to Assist Local Governments with OSSF Funding	6.0, 7.0
9	Review Local and State Government Enforcement Capabilities, Educational Materials and Programs	2.1, 2.4
10	Develop an Improved Monitoring and Compliance Plan	7.2
11	Prepare an OSSF Educational Brochure For Homeowners and Businesses	5.0
12	Prepare an OSSF Educational Brochure for Local Governments and Policy Makers	5.0
13	Summarize Existing Public Health and Receiving Water Conditions	3.0

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2. REGULATORY AND PROGRAM REVIEW

Regulating the design, installation, and management of OSSFs requires the coordination of multiple entities at both the state and local level. Overall regulatory control of OSSFs falls under the authority of the TNRCC, the state agency responsible for developing guidelines and implementing rules and regulations related to OSSFs. Implementation of these rules and general management of OSSFs involves the TNRCC in Austin and their regional offices, authorized agents (AAs) (typically in counties), DRs (individuals appointed by the AA or other permitting authority to carry out OSSF program management and regulatory duties), site evaluators, and installers. Further information on the duties and responsibilities of each of these groups are detailed in Appendix A and described in the sections that follow.

2.1 State Regulations and Programs

The State of Texas became involved in OSSF regulation in the late 1960s. In 1977, the Texas Department of Health (TDH) developed statewide minimum standards for OSSF design, construction, and installation. Since then four (4) sets of state standards have been developed involving septic tank systems. Shortly afterwards, the 70th Texas Legislature established uniform OSSF regulations for the state with the passing of House Bill 1875. The Bill established the TDH as the permitting authority, authorized the delegation of permitting to local government entities, and established an OSSF installer licensing program. In 1988, new standards were developed establishing closer separation distances between the bottom of the drain field trench and water table. In 1991, the authority of the TDH for OSSFs was transferred to the TNRCC with the passing of Senate Bill 2, during the 72nd Texas Legislature.

In 1994, a committee of 12 individuals representing industry and TNRCC staff assembled to make recommendations for improving OSSF regulation. A TNRCC concept paper was developed in 1995 which outlined proposed changes and a new OSSF rules revision process. On February 4, 1997, the new OSSF Rules were adopted.

Table 3 summarizes each of the sections or subchapters of the Rules. In addition, a series of summary tables comparing the new rules to the old rules can be found in Appendix B, Comparative Summary of OSSF Rules. The new rules can be broken into the three basic categories. They are described in the following paragraphs and are illustrated in Figures 1a-1c.

2.1.1 Installation and Maintenance

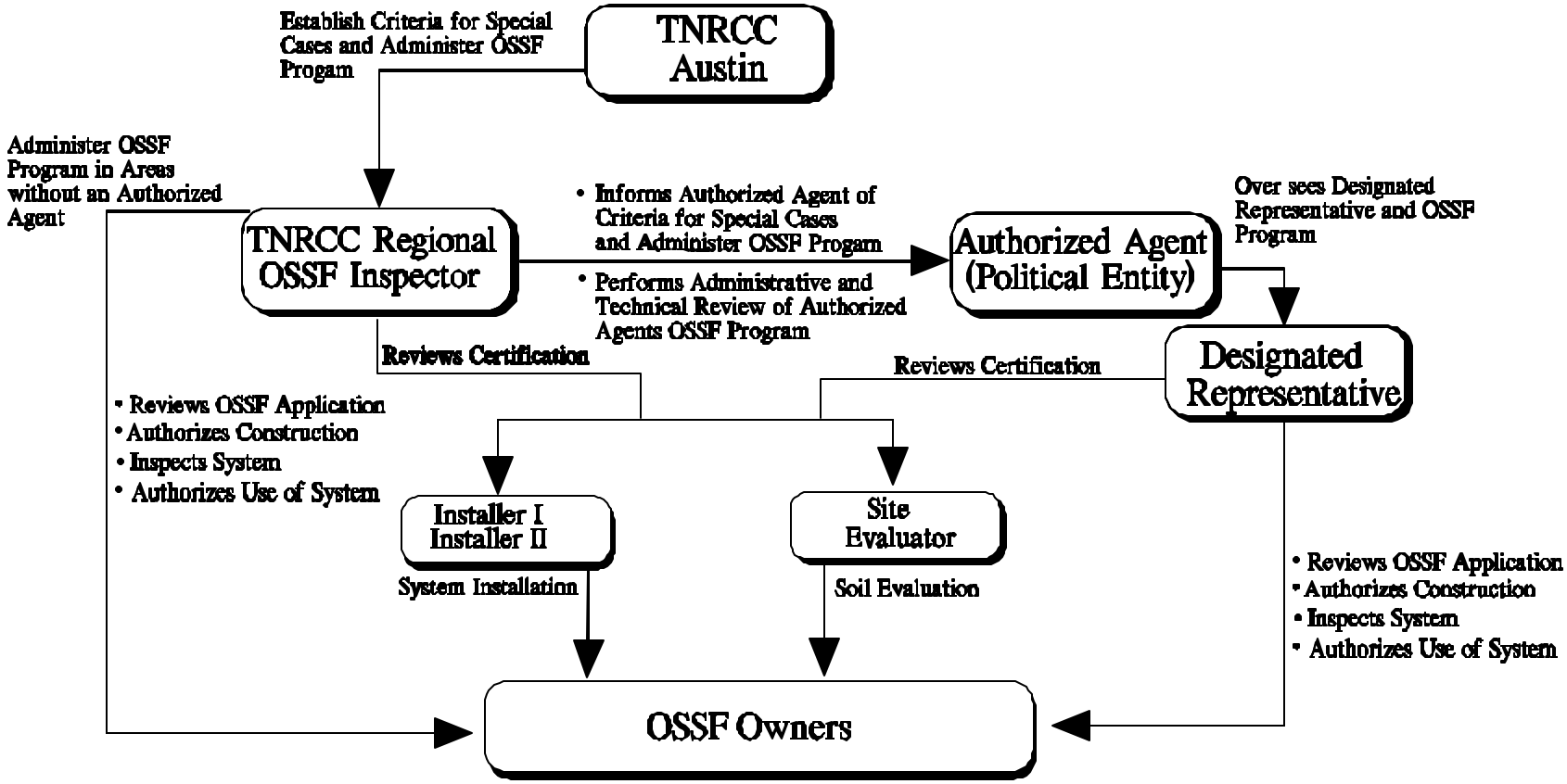
The Rules emphasize compliance through training of installers, apprentices, site evaluators, and DRs. This training includes initial classes, an exam, and requirements for continuing education on OSSF

information and requirements. As shown in Figure 1a, installation and maintenance of OSSFs requires coordination between multiple entities.

TABLE 3 - SUMMARY OF RULES (30 TAC, CHAPTER 285)

SubChapter	Summary
A	Provides the purpose and definitions of Chapter 285. Other areas addressed in this subchapter are the applicability, variance and exclusion requirements, the land planning and site evaluation requirements, and installation requirements for cluster systems. Requirements for the application and maintenance of OSSF systems are also discussed.
B	Discusses the process required to become an AA. Discussed in this subchapter are the processes of obtaining and relinquishing the AA status. The responsibilities of the executive director (ED) and AA in this process are also defined in this section.
C	States the requirements and fees necessary to begin construction of an OSSF system.
D	Addresses the planning, construction and installation standards for OSSF systems. Discussed in this section are the site evaluation process, criteria and construction requirements for sewage treatment and disposal systems, emergency repair requirements, removal and abandonment requirements, and maintenance and management practices of OSSF systems.
E	States the requirements for OSSF systems in the Edwards Aquifer. Since this aquifer is not located in any of the counties being addressed in this study, this subchapter is not addressed in this report.
F	Addresses the registration, certification and training requirements for installers, apprentices, evaluators and DRs. This section addresses the EDs responsibilities for the administration and management of the certification and registration of installers, apprentices, site evaluators, and designated representatives. In addition, the required qualifications, applications, training and exams for installers, apprentices, site evaluators, and designated representatives are listed.
G	Discusses the enforcement capabilities of the ED. This subchapter outlines the types of matters the ED or AA may investigate, and what may be required of the property owner.
H	Discusses the requirements for new construction or modification to an existing grey water system.
I	Contains the necessary figures and tables for the proper location, planning, construction and installation of an OSSF.

Figure 1a - Organizational Chart for the Installation and Maintenance of OSSFs



This chart was developed through a review of Chapter 285 and coordination with the Texas Natural Resource Conservation Commission Region 14 Office.

The TNRCC in Austin is responsible for administering the OSSF program and establishing criteria for those OSSF systems requiring special design. The TNRCC Regional OSSF Inspector is responsible for administering the OSSF program in areas without AAs. In these situations, the OSSF inspector assumes the roles of the DR. In areas with AAs, the TNRCC Regional OSSF Inspector has the responsibility of auditing the DR.

The DR or TNRCC Regional OSSF Inspector is also responsible for ensuring that installers and site evaluators are adhering to the Rules and regulations including proper certification and training. Site evaluators are responsible for soil evaluations, and installers are responsible for proper installation of OSSF systems.

2.1.2 Enforcement

The TNRCC in Austin primarily administers the enforcement of the OSSF rules through the TNRCC Regional OSSF Inspectors and AAs. In situations where there is conflict between DRs and an OSSF owner, the TNRCC in Austin will investigate. It is the responsibility of the TNRCC Regional OSSF Inspector or the DR to investigate complaints from homeowners and enforce OSSF rules and regulations. In addition, they must make sure Installers and Site Evaluators are adhering to Chapters 341 and 366 of the Health and Safety Code, and complying with Chapter 26 of the Texas Water Code (TWC). Table 4 summarizes the roles and responsibilities of the TNRCC in Austin and the Region 14 office in Corpus Christi with regard to providing enforcement, training and technical assistance, and educational and regulatory guidance. Provided in Figure 1b is an organizational chart describing regulatory enforcement responsibilities between the TNRCC and County AAs and DRs

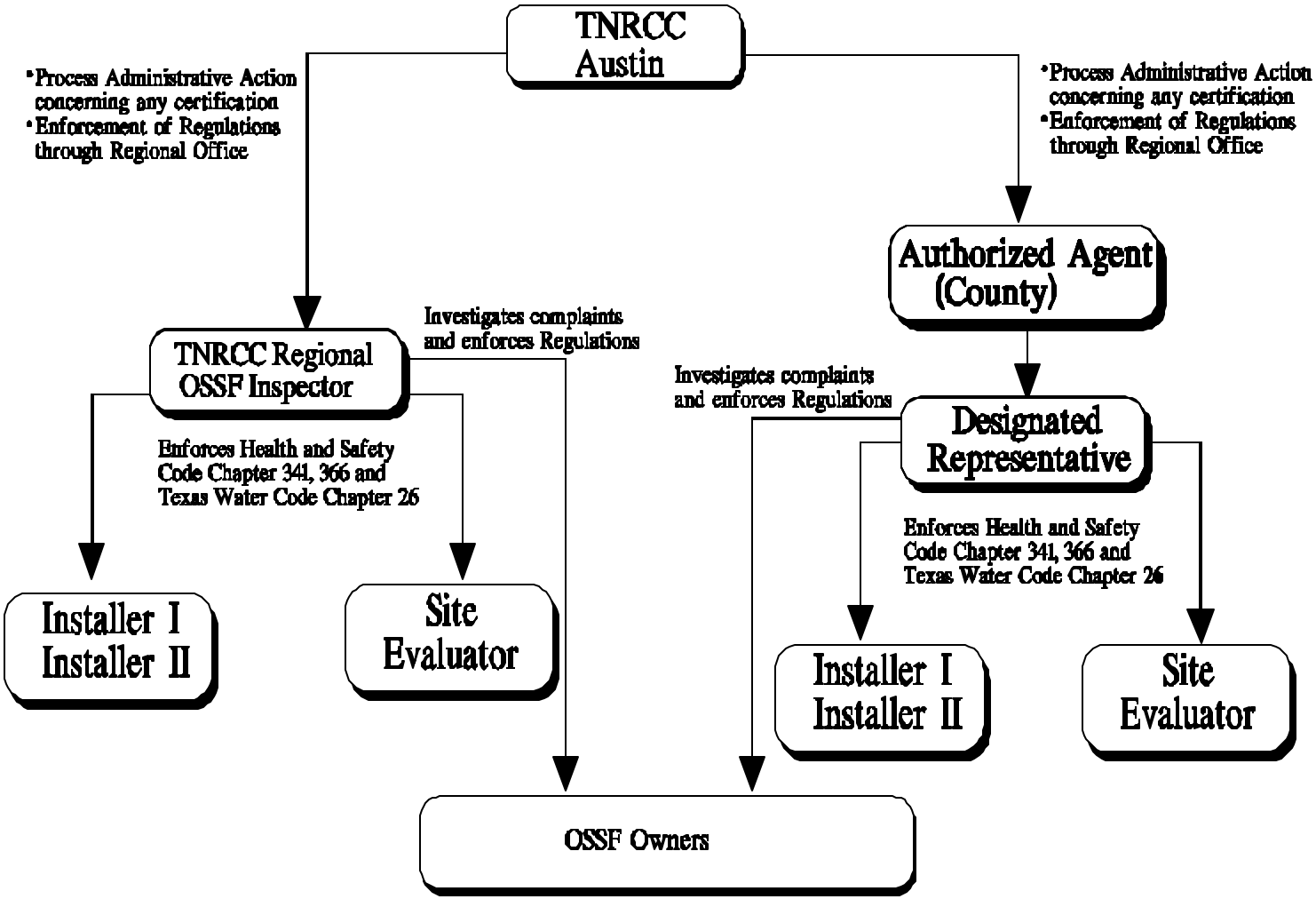
TABLE 4 - SUMMARY OF RESPONSIBILITIES AND RESOURCES FOR THE TNRCC'S OSSF PROGRAM

TNRCC PROGRAM IN AUSTIN	TNRCC PROGRAM IN CORPUS CHRISTI
Enforcement • Process information provided by TNRCC regional offices • Sole authority to initiate enforcement for civil suit violations, civil penalties, and administrative penalties	**Enforcement** • Compliance reviews of County OSSF programs • Enforce OSSF regulations in areas without an AA
Training and Technical Assistance • Administer training program • Coordinate Installer, Apprentice, Site Evaluator, State Inspector, and DR training with Texas Engineering Extension Service (TEEX)	**Training and Technical Assistance** • Provide informational brochures and pamphlets to the public • Provide technical assistance to the Counties
Education and Guidance Materials • Provide guidance documents	**Education and Guidance Materials** • Provide informational brochures and pamphlets to the public
Resources • Four person staff	**Resources** • One manager of multiple water programs, including OSSFs • One OSSF Inspector

2.1.3 Training and Application Process

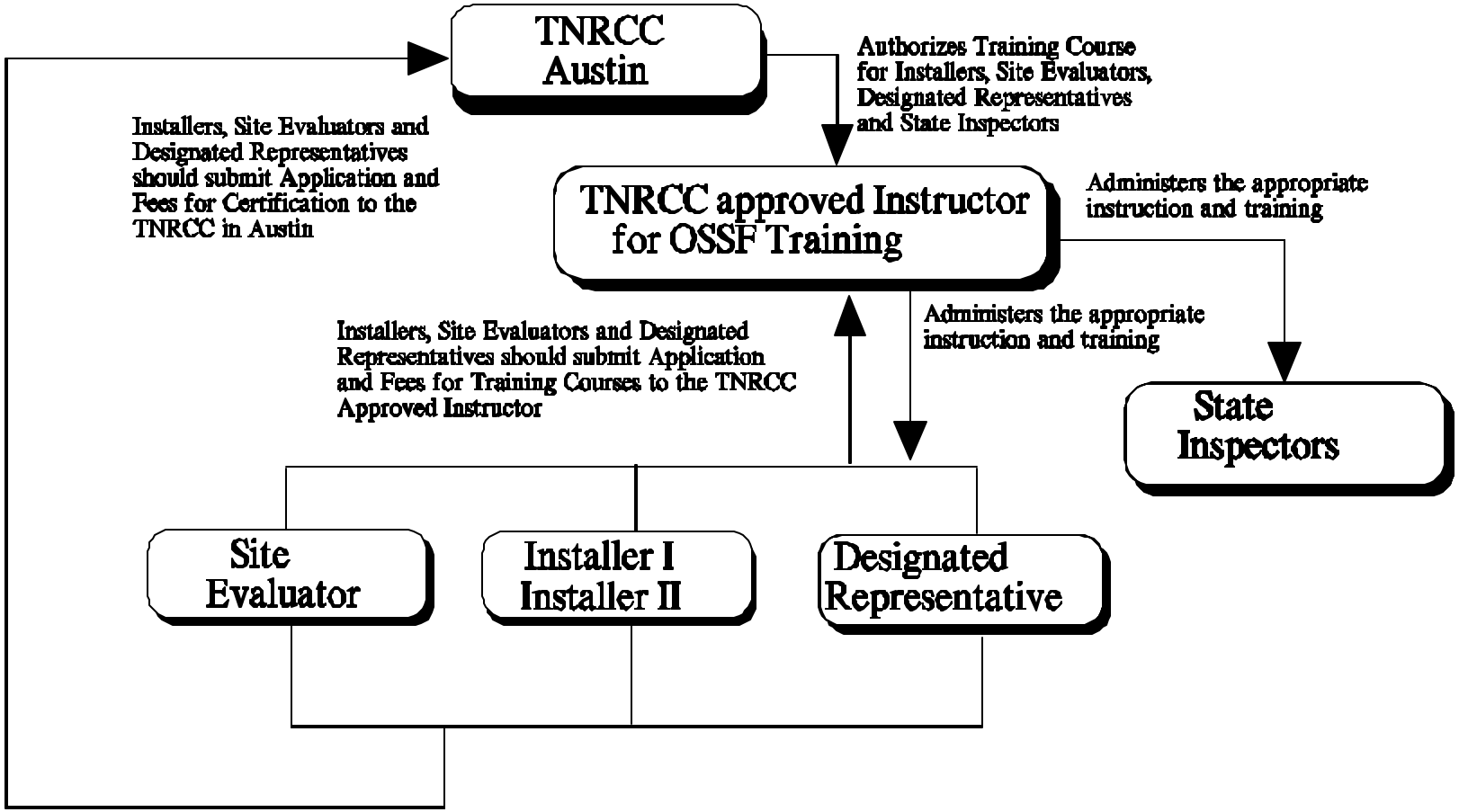
The TNRCC in Austin acts as the overall OSSF Program administrative agency. This includes authorizing training courses for installers, site evaluators, and DRs. These courses are to be instructed by a TNRCC approved instructor. In addition, the TNRCC in Austin accepts applications and fees for certification from installers, site evaluators, and DRs. Installers, site evaluators and DRs must submit applications and fees to the TNRCC approved instructor to enroll in training courses. Provided in Figure 1c is an organizational chart describing the training and application process for installers, evaluators, and DRs.

Figure 1b - Organizational Chart for the Enforcement of Regulations for OSSFs



This chart was developed through a review of Chapter 285 and coordination with the Texas Natural Resource Conservation Commission Region 14 Office.

Figure 1c - Organizational Chart for the Training and Application Process for Installers, Site Evaluators and Designated Representatives



This chart was developed through a review of Chapter 285 and coordination with the Texas Natural Resource Conservation Commission Region 14 Office.

2.1.4 TNRCC Guidance Program

In order to ensure consistent interpretation and implementation of Rules, the TNRCC has initiated an extensive general guidance program. Guidelines include many definitions and specifications which clarify the Rules. The guidelines also are intended to answer common questions and resolve problems. Unresolved issues that await guidance include the adoption of the new model ordinance, and the ability of installers to achieve design criteria in certain areas of the state. To standardize and ensure that the OSSF program has consistency throughout the State, the TNRCC is striving to disseminate the operating practices indicated in Figure 2.

FIGURE 2 - OPERATING PRACTICES TO BE DISSEMINATED STATEWIDE

1. The processing of OSSF permit applications under the old rules will occur as long as all required material is received prior to the effective date of the new Rules.
2. OSSF site evaluation will be dependent on accurate analysis and classification of soils.
3. ASTM C 1227-93a will be adhered to for the material, manufacture and structural design requirements for precast concrete septic tanks.
4. The TNRCC "Approved List of On-Site Aerobic Wastewater Treatment Units" will indicate which units require a pretreatment/trash tank for installation.
5. An attempt will be made to simplify the attainment of documentation from the Climatic Atlas of Texas for standard disposal excavations.
6. The National Electrical Code (NEC), 30 TAC, 285.34(b)(4) shall be used for electrical wiring of OSSFs.
7. The appropriate treatment and disposal of grey water will be defined.
8. The TNRCC OSSF permit fees may be waived for all low-income assistance projects sponsored by the Texas Department of Housing and Community Affairs (TDOHCA).
9. TNRCC personnel will not be able to conduct real estate inspections of OSSFs.
10. The requirements and procedures for certification of OSSF installers, apprentices, DRs and site evaluators will be established.

2.2 County Programs

2.2.1 County OSSF Management

Each of the Counties of Nueces, San Patricio, Aransas, and Refugio are AAs for the OSSF programs to help maintain compliance with Rules and regulations governing the management of OSSF systems. Each County has its own OSSF management program which reflects the nature of

the County's geographic region, public socio-economic characteristics, and the extent of County manpower and financial resources for OSSF management.

Each study area county, except Refugio County, has an environmental health department and director that is responsible for maintaining compliance with the OSSF rules and acting as the county OSSF AA. In Refugio County, however, the County Judge and his staff are responsible for the environmental health related activities. The following is a summary of the various elements to each county's OSSF program:

- Regulatory review, interpretation, TNRCC coordination
- Administration of related ordinance procedures
- Subdivision review
- OSSF permitting and licensing
- OSSF site inspection (documentation of checklists, installation procedures)
- Complaint investigation and resolution/ variances (complaint investigation roster)
- Technical assistance (soil evaluation, percolation tests, etc.)
- Public education and information availability
- Enforcement and legal actions
- Data reporting to TNRCC
- Record keeping (applications, design, construction authorization, permit fees)
- Installer certification verification

Each County has differences with regard to the types of County health programs administered, organizational and staffing resources, funding and budget availability, geographic, and technical issues. In addition the environmental health department has various additional responsibilities besides OSSF management. The extent and type of additional responsibilities also differs between counties. It is important to understand these "other responsibilities" when considering the workload challenges facing DRs, the difficulty in maintaining compliance, and identifying OSSF management system needs. In general, the following are examples of "other responsibilities" of county environmental health departments:

- Permitting and inspection of food service and retail establishment
- Weekly food handling classes and permits
- Day care and foster care general sanitation inspection
- Swimming pool water quality inspection
- Inspection of food service mobile units at public events
- Lead (Pb) poisoning assessment of homes, equipment, and individuals
- Communicable disease report investigation
- Ambulance personnel inspections for safety
- General sanitation complaint investigation
- Bacteriological sampling and analysis of surface water

Many of the larger cities within each county have sewer system Certificates of Convenience and Necessity (CCN) from the Texas Natural Resources Conservation Commission. This CCN gives authority to the municipality to provide public sewer service and to charge the public with a sewer service rate. However, this does not mean that all areas within the CCN boundary are served by a public sewer system. Various outlying areas within many incorporated city boundaries that are not in proximity to a public sewer system also contain OSSFs.

Within a CCN boundary, a respective municipality would need to have a city ordinance to assume the responsibility for OSSF management, or an interlocal agreement with the respective County to allow the County to administer the OSSF program. Otherwise, the OSSF authorized agent responsibility reverts to the TNRCC. Depending on the city and the respective county, the responsibility for OSSF management in a particular city, is different and at stages of development with regard to interlocal agreements or providing of public service. Although various cities are expanding their public sewer service or developing interlocal agreements to improve sanitary service, there are also many suburban areas that need improved OSSF management.

The County Environmental Health Directors who are their respective county's DR for the OSSF program are listed below with their address, telephone, and facsimile information.

Aransas Co. Health Department
1931 FM 2165
Rockport, Texas 78382
Dir: Tom Touchstone
(512) 790-0121
Fax (512) 790-0157

County Judge's Office
808 Commerce
Refugio, Texas 78377
Dir: Judge Charles Stone
(512) 526-4434
Fax (512) 526-5100

Nueces Co. Health Department
P.O. Box 9727
Corpus Christi, Texas 78469
Dir: Jim McFarland
(512) 851-7200
Fax (512) 850-1327

San Patricio Co. Health Department
313 Rachal
Sinton, Texas 78387
Dir: Marilyn Torno
(512) 364-6208
Fax (512) 364-4518

2.2.2 Comparison of County Programs

Provided in Table 5, Summary of County OSSF Programs, is a comparison of various key county OSSF program elements involving regulations and rules, compliance and enforcement, county OSSF staff resources, and educational and training programs. County involvement with different funding opportunities is provided in Section 6, Wastewater System Funding Alternatives.

In 1996, the Region 14 office of the TNRCC began a program of reviewing compliance (audit) of Counties with OSSF AA status. An audit was conducted of San Patricio County on July 25, 1996, Aransas County on April 24, 1997, Refugio County on May 20, 1997, and in Nueces County during August, 1997. The TNRCC audit identified conflicts between local

TABLE 5 - SUMMARY OF COUNTY OSSF PROGRAMS

PROGRAM DESCRIPTION	NUECES COUNTY	SAN PATRICIO COUNTY	ARANSAS COUNTY	REFUGIO COUNTY
REGULATIONS/ ORDINANCES				
Adopted New Rules in OSSF Ordinance	Yes	Yes	Yes	In Progress
Developed New Subdivision Ordinance	Under Consideration	Yes	Under Consideration	Under Consideration
Subdivision Review by the Health Department	No	No	No	No
Administer OSSF Program in Cities Upon Request	Yes	Yes	Yes	No
COMPLAINTS AND ENFORCEMENT				
County Staff Perform Inspections	Yes	Yes	Yes	Outside Contractor
Average Monthly Complaints (by public)	3	6	10	3
Computerized Permitting/ Inspection/ Complaint System	Yes	No	Yes	No
Audited by TNRCC Region 14 and Generally in Compliance	Underway	Yes	Yes	Yes
Court System for Processing Violations/ Fines	County Attorney	County Attorney	Justice of Peace	Justice of Peace
OSSF RESOURCES				
Designated OSSF Staff (man hour equivalent)[1]	Yes (1)	Yes (1)	Yes (1.5)	No (Use Contractors)
County Environmental Health Department Staff	3	4	3	County Judge
EDUCATION/ TRAINING				
Provide Available Brochure to Public	Yes	Yes	Yes	Yes
Utilize T.V. Medium to Inform Public	Yes	No	No	No
Soils and Floodplain Data Available for Public	Yes	Yes	Yes	Yes

[1] Man hour equivalent is the “number” of full-time OSSF staff based on combining the OSSF related workload from several staff with various environmental health department responsibilities.

ordinances and TNRCC rules. It also verified that the County records and programs are on file including permit applications, authorization to construct an OSSF, inspection checklists, and complaints. In addition, the TNRCC verified fees sent to the TNRCC, availability of information for public access, certified installer documentation, and verification of County procedures involving enforcement, subdivision rules, and technical review.

Coordination with the TNRCC Region 14 office identified the primary compliance review findings listed below. It should be noted that these findings are a summary of all four (4) county compliance review findings and do not represent any one county.

- New to complete subdivision ordinances consistent with the new OSSF rules
- Need to improve record keeping of OSSF permits and complaints including documentation of complaint follow-up and timely resolution
- Need to submit more accurate monthly activity reports to TNRCC in Austin
- Need to improve OSSF inspections
- Need to have more organized and systematic enforcement program, procedures, and documentation
- Need to permit facilities according to the new OSSF Rules

2.2.3 County Issues and Recommendations

The most significant issues and recommendations expressed by the counties include the following:

2.2.3.1 Regulations/ Ordinances

1. Model subdivision ordinances should be developed with more strict controls involving design and construction of OSSFs.
2. When subdivisions are platted, they could be required to have 1 ½ acre lots; currently most lots are only required to be 1 acre.
3. The Rules do not significantly influence county programs due to the inherent problems of maintaining compliance and enforcement with the low income homeowner.

2.2.3.2 Complaints/ Enforcement

1. There is difficulty maintaining enforcement with a homeowner who cannot afford adequate sanitary sewer service, or upgrading an existing OSSF to new standards, due to the inability to effectively use fines and penalties on a low income homeowner. While all the counties have an enforcement program which responds to public complaints, some have a more systematic process of violation notices, scheduled follow-up with a

compliance deadline, through a formal complaint, and then Class C, B, or A misdemeanor fines.

2. The most common public complaint with all counties is raw sewage bypassing an inadequate OSSF or no OSSF.
3. More effective enforcement of sewage system related violations by trained law enforcement officers is needed. Certain counties rely on the sheriff department whereas other counties have staff in their Health Departments with law enforcement training and potentially, more effective enforcement programs.

2.2.3.3 OSSF Program Resources

1. Need for additional staffing and resources to maintain compliance and respond to the additional attention and concern regarding pollution.
2. Need for additional staff resources to increase inspections and follow-up regarding OSSF permit compliance.

2.2.3.4 Education/ Training

1. Need for improved training of TNRCC OSSF program support staff to assist county DRs.
2. Increased training and education within the court system regarding the OSSF issues, particularly, Justices of the Peace, to help promote more stringent enforcement and levying of fines and penalties. There is a need for quicker action by the court system. Some counties have never fined a homeowner for a public sewerage related violation.
3. Regarding installers/ contractors, there should be a more expedited training program by TNRCC regarding the new OSSF rules. It may be necessary to license the sale of septic tanks in order to better control proper design and installation.
4. Additional requirements are needed to ensure developers plan their subdivision with adequate notice to the county and provide proper lot size for OSSFs in the particular geographic area.

2.2.3.5 Funding

1. Increased funding opportunities for the low income homeowner and indigent to improve wastewater services.

2.2.3.6 Research

1. Additional studies are needed in the Copano Bay, Copano Cove, Copano Ridge, Salt Lake, and Bayside areas to better understand water quality issues related to the numerous OSSFs in these areas. Water front developments without substantial water

exchange and tidal flushing (water circulation) are more prone to potential problems then water front communities, for example, that are adjacent to deeper bays and waterways that get more tidal flushing.

Information on the number and type of OSSFs for each county since September 1994 has been obtained from the TNRCC and is summarized in Table 6. This data provides an indication of the relative degree of new systems in each county as well as the type of systems being reported. Based on this information, Aransas Pass has the greatest number of reported systems followed by Nueces County, San Patricio County, and Refugio County, respectively. The most common systems are "standard" in Aransas County and "low pressure dosing systems" in Nueces, San Patricio, and Refugio Counties. Provided in Appendix C is a list of the approved on-site aerobic wastewater treatment units.

TABLE 6 - NUMBER OF COUNTY OSSF SYSTEMS REPORTED[2], SEPT. 1994 - 1997

System	Nueces County	San Patricio County	Aransas County	Refugio County
Standard Systems	147	73	659	4
Low Pressure Dosing	176	218	n/a	95
Leaching Chambers	25	2	n/a	n/a
Gravelless Pipe	17	10	n/a	n/a
Spray Irrigation	2	n/a	n/a	n/a
Other	1	41	31	n/a

2.3 Other Technical Assistance Programs

Various other local, state, and federal programs exist which involve OSSF technical assistance programs, research and education, and information transfer. Most of these programs develop and disseminate information available to OSSF homeowners or individuals interested in OSSFs, including DRs. The following is a brief summary of these programs including contacts for obtaining additional information.

- *National Small Flows Clearing House*
  The Clearinghouse helps small communities meet their wastewater needs and is a non-profit group funded by the EPA. Small communities are defined as having less than 10,000 people of 1.0 million gallons per day (MGD) wastewater flows. The group is an information collection and dissemination center, and offers technical assistance regarding regulations, manufacturer information, case studies, and information regarding all aspects of

[2] Based on On-Site Wastewater Treatment Research Council Fee

wastewaters including OSSFs. They have numerous databases, newsletters, and other information free of charge to the public. Various septic tank related educational brochures are available from the Clearinghouse.

National Small Flows Clearinghouse
West Virginia University
P.O. Box 6064
Morgantown, WV 26506-6064
1 (800)-624-8301

- *National On-Site Wastewater Recycling Association (NOWRA)*
  The NOWRA is a non-profit trade group made up of manufacturers, regulators, local government, suppliers, and all interests involved with OSSF. The group requires membership and is involved with information transfer, research, regulatory and legislative development, continuing education and provides various materials and guides for all aspects of OSSF including the homeowner.

  NOWRA
  National On-Site Recycling Association
  P.O. Box 225
  Hartland, WI 53029
  1-(800)-966-2942

- *Texas On-Site Insights*
  The Texas Water Resources Institute of Texas A&M University provides information about OSSFs in Texas. The Institute is a non-profit organization and publishes a quarterly publication funded by the On-Site Wastewater Treatment Council. The publication "Texas On-Site Insights" provides information on regulatory and research developments as well as OSSF conferences, training courses, and university studies involving OSSFs.

  Texas Water Resources Institute
  Texas A&M University
  Texas Agricultural Experiential Station
  301 Scoates Hall
  College Station, TX 77843-2118
  1-(800)-845-8571

- *United States Natural Resource Conservation Services - Resource Conservation And Development Program (RCD Program)*
  This program and the NRCS provides technical assistance regarding geotechnical issues with OSSFs, and grant application and grant search assistance for wastetreatment systems

including OSSFs. The NRCS also provides technical assistance regarding constructed wetlands.

NRCS (RCD Program Coordinator, Refugio, Texas)
1-(512)-526-4466

- *Gulf Of Mexico Program*
  This program is funded and administered by the EPA and includes members from local, state, federal agencies, public, and businesses interested in maintaining the health of the Gulf of Mexico and all watersheds discharging to the Gulf. The program brings together these interests to exchange information and develop initiatives to solve common problems that influence the Gulf of Mexico including issues related to wastewater treatment, fecal coliforms, OSSFs, and water quality problems associated with sewage.

  The Gulf of Mexico Program has developed 10 environmental challenges and one such challenge is the Shellfish Challenge developed to increase molluscan shellfish areas for safe harvest. The program targets solutions to the problem. Two (2) of the top strategies involve OSSFs and include connecting poorly operating septic systems to wastewater treatments plants and reducing inputs of fecal coliform bacteria in runoff from densely populated areas

  The Gulf of Mexico Program provides an opportunity for technology transfer and the development of initiatives that can involve OSSFs. For example, initiatives such as the Shellfish Challenge Plan invovle a planning process to identify solutions to increase shellfish harvest impacted by coliform bacteria.

- *Texas Clean Rivers Program*
  The TNRCC administers this program to maintain and improve the quality of water within each river basin. The program uses a watershed management approach to identify and evaluate water quality issues, establish priorities, and identify water quality concerns and trends by basin. The program generates periodic regional assessments of water quality by coastal basin which includes data on fecal coliforms, and nutrients that may relate to sewage and OSSFs.

2.4 Available Educational Materials

Numerous educational materials are available from Texas State agencies, non-profit groups, and various professional associations which provide information on the proper installation and maintenance of OSSFs. A sampling of these materials and brochures are listed below and reproduced in Appendix D.

- American Society of Civil Engineers - Septic Tank News Brochure, September, 1996

- Texas Clear Rivers Program and Brochures
- A Guide to the Disposal of Household Sewage Pamphlet, TDH
- TNRCC Septic Tank Problems Poster
- TNRCC Wetland Protection Program Brochure, June, 1995
- A Reference Guide to Your Septic Tank System for Homeowners Brochure, 1990, Northern Virginia Planning District
- Groundwater Protection Brochure, National Small Flows Clearinghouse
- So… Now You Own a Septic Tank Brochure, National Small Flows Clearinghouse
- Homeowner's Guide to Water Use and Conservation Brochure, Texas Water Development Board
- 55 Facts, Figures and Follies of Water Conservation Brochure, 1991, American Water Works Association
- Homeowner's Septic Tank System Guide and Record Keeping Folder, National Onsite Wastewater Recycling Association
- Texas Groundwater Protection Committee, Brochure, November 1994, TNRCC

2.5 Contractor Practices

OSSFs must be constructed by individuals who are competent, properly trained in the appropriate installation procedures, and maintain a current license; homeowners installing their own systems are exempt from these requirements. If these individuals are either improperly trained, unwilling, or unable to follow proper installation procedures, OSSF problems will continue to appear, despite the new Rules. To gain an understanding of the current operating practices and problems encountered in completing the installation of OSSFs under the new Rules, written correspondence was submitted to each of the installers residing in the four counties. The complete list of licensed individuals in Nueces, San Patricio, Aransas, and Refugio Counties is included in Appendix E.

Figure 3, contains a summary of the comments and suggestions received during telephone conversations with a few OSSF installers. (*County DR comments regarding the installers comments are shown in italics.)*

FIGURE 3 - OSSF INSTALLER COMMENTS REGARDING INSTALLATION PRACTICES AND AGENCY COORDINATION

- Successfully excavating the 6" wide drainfield trench must be accomplished with a ditch witch type trenching machine - if working through wet clay soils, it can be next to impossible to complete, even with the largest machine in operation. *1) San Patricio County indicated the clay soils should not be wet. 2) Nueces County indicated there is better distribution with a 6" trench drainfield including a better absorption and soil recovery rate. Trenching should never be done in wet clay soils.*

- The SB2 drainfield pipe (gravelless installation) tends to become plugged prior to six (6) months after installation, causing improper drainage operation. It was related that piercing the exterior filter fabric of the drainfield was similar to puncturing a water pipe under pressure; the water quickly sprayed from the pipe. Removing the filter fabric on the upper section of the pipe allowed trouble-free operation thereafter. *In Nueces County, the 8" SB2 gravelless drainfield has functioned adequately. Systems installed 5 years ago still function properly.*

- There should be some leniency exercised in the quantity of pipe to be utilized in the installation of pressure systems to allow more efficient and cost-effective installations. *San Patricio County has been using 1,000 linear feet of pipe for many years with no problems.*

- The low pressure dosing systems work well, but they are very maintenance intensive. Also, the pumps for these systems typically do not last more than about two (2) years. *1) San Patricio County said they increased the size of the pump to ½ hp. 2*) *Nueces County indicated it's a small price to pay for a system that works even when covered with flood water.*

- The education of DRs is paramount to the successful implementation of the new Rules and to ensure construction practices result in good operating OSSFs. There are DRs who are not familiar with regulatory requirements or installation practices, which results in systems being installed that are not in compliance.

- Septic system installations that are being mandated in strict adherence to the regulatory requirements are experiencing fewer operating problems.

- Properties need to be closely evaluated for proper soil classification and the intended system loading to ensure that the appropriate type of septic system is installed (i.e. conventional versus a Pressure Dose Type System).

3. BIOGEOGRAPHICAL, POLLUTANT LOADING, AND PUBLIC HEALTH ISSUES

3.1 Biogeographical Factors

Appropriate soil types are a key factor in the successful operation of OSSFs. TNRCC classifies soils into five general groups for determining drainfield requirements:

- Soil Class Ia - Sandy texture soils which contain more than 30% gravel
- Soil Class Ib - Sandy soils which contain less than or equal to 30% gravel
- Soil Class II - Coarse loamy soils which includes sandy loam and loam textures
- Soil Class III - Fine loamy textured soils which include silt, silt loam, silty clay loam, clay loam, sandy clay loam, and sandy clay textures
- Soil Class IV - Fine textured soils which generally contain more that 40% clay-sized particles; includes silty clay and clay textures

Figure 4 shows a TNRCC recommended procedure for determining the soil texture and class and if soil conditions are suitable for OSSF drainfields. Soil class affects the allowable wastewater loading rates and required size of drainfields, as well as the type of disposal system allowed to be used on a site.

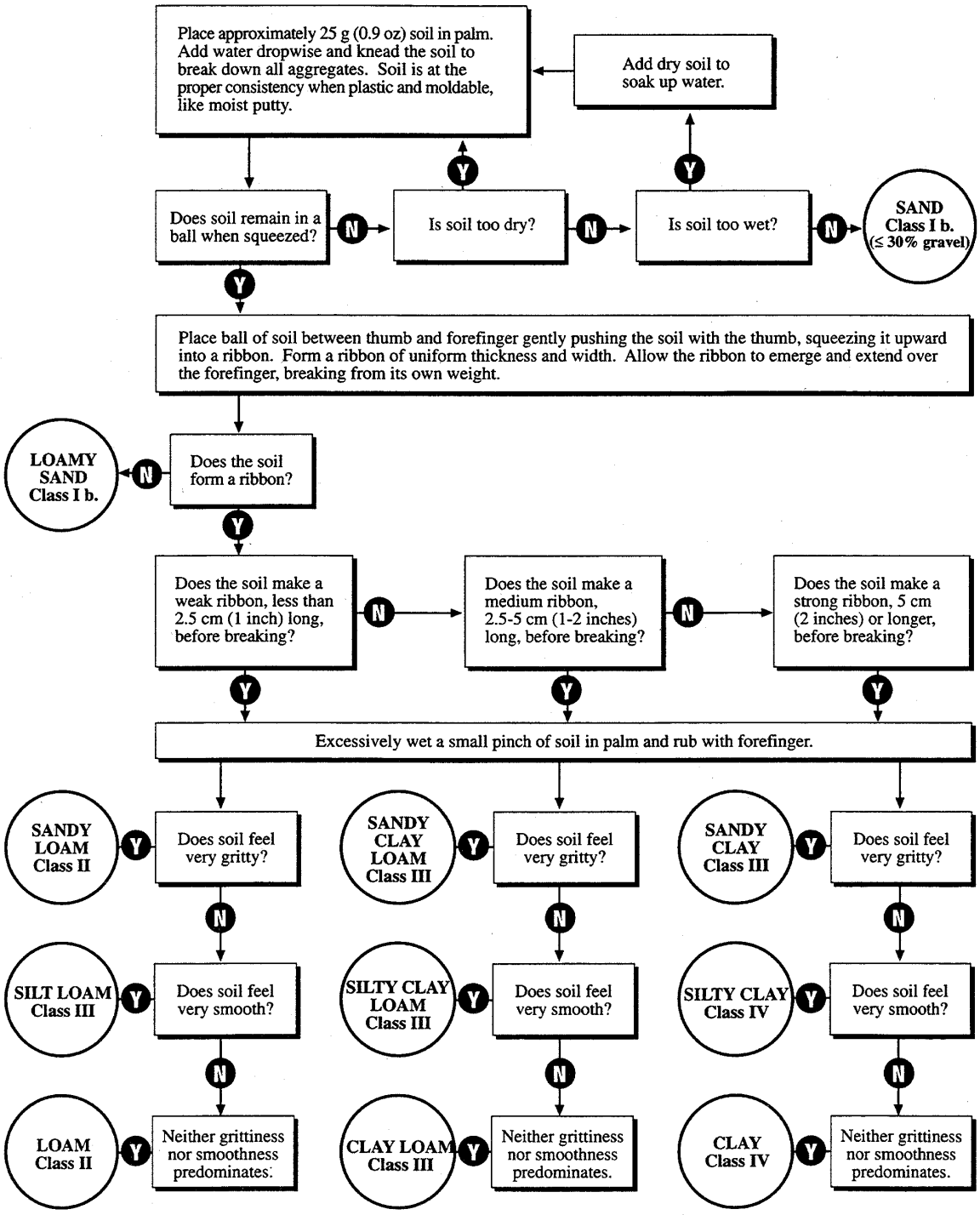
From previous discussions, it is apparent that most OSSFs are located in areas with TNRCC Class III and Class IV soils. Under the Rules, a site with Class IV soils requires either a nonstandard disposal system or a standard system that has been specifically designed for that particular site. In addition, OSSFs constructed in Class III and Class IV soils require much larger drainfields due to low effluent loading limits (0.2 gallons per square foot per day (gal/sf/day) for Class III soils and 0.1 gal/sf/day for Class IV soils). Evapotranspiration (ET) Systems or drip irrigation drainfields can be effective in these type soils, but as with all systems installed in Class IV soils, the drainfields must be specially designed for given site conditions, which can be expensive.

Another factor that can require increased drainfield design size is the moderate to low annual average net evaporation rate in the Coastal Bend area. TNRCC lists this rate as 0.15 inches per day. Because many of the OSSF concentrations are in areas of flat to gently sloping topography and also in 100 year floodplains, extra design considerations are needed to meet the required 20% run-off factor over the drainfield and to provide adequate evaporative surface area.

A final factor limiting the use of standard disposal systems is the depth to groundwater. In many of the OSSF concentration areas, particularly those in 100 year floodplain or are close to surface waters, the depth to groundwater is less than the 24 inches required by the TNRCC to be suitable.

The use of alternative systems or modified standard systems is critical to prevent contamination of groundwater or surface water, particularly in these areas.

FIGURE 4 - SOIL TEXTURE CHART



3.2 Pollutant Loading and Public Health Issues

3.2.1 Introduction

The quality of the waters in the CCBNEP study area is directly related to the degree of impacts received from an array of point and non-point sources (NPS) of pollution. Point sources are often associated with discharges flowing from outfall structures (such pipes, culverts, channels, and ditches) into receiving water bodies (such as creeks, rivers, lakes, bays, or oceans). These point sources are usually permitted and monitored by a regulatory authority such as the Environmental Protection Agency (EPA) or the TNRCC to ensure compliance with Texas Surface Water Quality Standards (TSWQS) specific to the stream segment receiving the discharge. However, the control and regulation of NPSs is not easily accomplished due to their entry into water bodies at multiple and highly variable locations. NPSs are often associated with stormwater runoff from agricultural areas, pastures, parking lots, streets and highways, landfills, septic tanks, residential and industrial developments, and airborne deposited materials. The NPSs can include hazardous substances, petroleum products, nutrients, fecal coliform, and sediments. High concentrations of such elements can significantly impact the quality of receiving waters. In most areas, water quality monitoring and stormwater control measures are used to limit the adverse impacts of NPS pollution.

3.2.2 Coliform Criteria

Of significance to this study are the potential NPS impacts to both surface and groundwaters resulting from OSSFs. Currently, there are several agencies and entities that monitor the bays, creeks, and rivers within the CCBNEP study area for compliance with TSWQSs, including fecal coliform (FC), that can emanate from either human or animal wastes. "Fecal coliform bacteria are frequently used as indicators of surface water contamination by pathogenic microorganisms." (TNRCC AS-105/SR, 1). Because faulty OSSFs may discharge or leach untreated or partially treated human waste to nearby surface or groundwater, FC concentrations may be used to identify possible OSSF problem areas. High FC concentrations can result in both beach closings for recreational users and restrictions on shellfish harvesting areas. According to 30 Texas Administrative Code, Chapter 307.7 (b)(1)(A), [paraphrased from (TNRCC AS-105/SR, 1)], contact recreational areas must comply with the following:

a) FC content shall not exceed 200 colonies per 100 milliliters (ml) as a geometric mean based on a representative sampling of not less than five samples collected over not more than thirty (30) days. *This standard is considered adequate protection against swimming-related gastrointestinal illnesses*.
b) FC content shall not equal or exceed 400 colonies per 100 ml in more than 10 percent (10%) of all samples, based on at least five samples, taken during any 30 day period. If 10

or fewer samples are analyzed, no more than one sample shall exceed 400 colonies per 100 ml. *This standard was developed to allow for variations in natural environmental conditions and to prevent unnecessary closings of recreational waters based on a single sample*.

According to Chapter 307.7 (b)(3)(B), [paraphrased from (TNRCC AS-103, 1)], shellfish harvesting areas must comply with the following:

a) A 1,000 foot buffer zone, measured from the shoreline at ordinary high tide, is established for all bays and gulf waters. FC content in buffer zones shall not exceed 200 colonies per 100 ml as a geometric mean of not less than five (5) samples collected over not more than 30 days or equal or exceed 400 colonies per 100 ml in more than 10% of all samples taken during a 30 day period.
b) Median FC concentration in bay and gulf waters, exclusive of buffer zones, shall not exceed 14 colonies per 100 ml, with no more than 10% of all samples exceeding 43 colonies per 100 ml.

3.2.3 Current Programs

Many government and non-profit agencies have on-going water quality monitoring programs, including the TNRCC, Texas Department of Health (TDH) [Seafood Safety Division], Corpus Christi-Nueces County Department of Health (CCNCDH), Texas Water Development Board (TWDB), and Coastal Bend Bays Foundation (CBBF). These programs and studies are summarized in Figure 5.

FIGURE 5 - WATER QUALITY MONITORING PROGRAMS IN THE CCBNEP STUDY AREA

- **TNRCC**: This agency has in-house divisions such as the Watershed Management Team, Groundwater Monitoring Team, and Regulatory Permitting Division that collectively gather and manage data from various locations around the state. The TNRCC is also actively involved in administering voluntary community programs to educate the citizens of Texas about non-point source pollution prevention such as the NPS Program, Clean Texas 2000 Program, Texas Watch Program, Wellhead Protection Program, Groundwater NPS Program, Community and Waste Collection Programs, Emergency Spill Response Program, and the Lake & River Cleanup Program.
- **TDH**: The Seafood Safety Division actively collects samples for the purpose of regulating shellfish (i.e. oysters) harvesting in coastal waters. The data collected include water temperature, salinity, dissolved oxygen, total coliforms (TC), and FC (CCBNEP-11,8). Maps indicating bacteriological sampling stations and the approved/ restricted shellfish harvesting areas are included in Appendix F.
- **CCNCDH**: The Nueces County Division collects and analyzes water samples for FC. Samples are collected along the beach near bath houses and outfall drains on a weekly to bimonthly schedule for the purpose of verifying the safety of swimming and contact recreation within the Corpus Christi Bay system (CCBNEP-11,11-12).
- **TWDB**: The data they collect (either by TWDB staff or under contract with another entity) are used for in-house studies of the bays and estuaries of Texas. The primary purpose of these studies is to evaluate the relationship between freshwater inflow and the "health" of the estuary. The data is used to define many water quality parameters and physical characteristics (CCBNEP,9).
- **CBBF**: The samples collected serve to provide quantitative information on the chemical quality of water and sediment in and adjacent to the La Quinta Channel and on the north shore of Corpus Christi Bay. The samples include occasional FC along with other parameters including salinity (conductivity), dissolved oxygen, temperature, and periodic fish tissue samples (CCBNEP-11,11).

3.2.4 Literature Review

Many studies have been conducted in the United States which explore the potential problems and pollutant loading issues associated with OSSFs, as identified in Appendix G. Unfortunately, however, the available data for the CCBNEP counties of concern do no provide a clear picture of the relationship between OSSFs and nutrient and bacterial loading to surface and groundwaters. Identifying sources of FC and nutrient loadings can be very difficult, especially following storm events. In addition to OSSFs, possible sources of FC contamination include sewage system overflow, animal wastes in stormwater runoff, and illegal sewage discharges. FC sampling results can also be highly variable depending on sample sizes, frequency of sampling, proximity to storm events, and sampling location. For example, samples collected downstream of bridges or road crossings, which house significant bat or bird populations, may indicate extremely high FC levels due to the high animal waste loadings. (See telephone conversation with TNRCC - Water Quality Modelling Section, Appendix H).

FIGURE 6 - DATA GAPS AND RELATED ISSUES

- Both TC and FC data are not always available. FC is more of an indicator of biological feces, but could originate from either humans or animals. To deduce a more precise conclusion, careful sampling procedures need to be employed in this area, while researching the location of sampling points relative to nearby OSSFs. Sampling needs to consider sampling in areas whose water quality is not impacted by animal feces.
- Studies or data that correlate FC with OSSFs are very limited, particularly for the CCBNEP area.
- In this area, there is not a strong perception that problem OSSFs are a significant health threat, which may stem from a lack of data and/or public knowledge.

Therefore, in correlating FC contamination with OSSFs, surrounding land uses and additional possible sources of contamination must be carefully assessed. Over the next two years, TNRCC plans to conduct a study to determine appropriate testing and sampling methods for better quantifying coliform densities. (See telephone conversation with TNRCC - Water Quality Modelling Section, Appendix H).

Despite the difficulties in correlating OSSFs with observed pollutant loadings, as indicated above in Figure 6, the studies evaluated in Appendix G, point to a few general findings.

- Septic tank drainfields installed in unsuitable soils are a major source of contamination in shellfish waters (Duda and Cromartie, 1996).
- Bacterial contamination from failing septic systems is one of the most significant causes of restrictions on shellfish harvesting in coastal areas (Puget Sound Department of Health).
- Septic systems can be significant contributors of phosphates to nearby surface water bodies (Harman, Robertson, Cherry, and Zanini, 1996).

- The primary inorganic constituents of concern for contamination of groundwater from septic system effluent are nitrate and phosphate (Harman, Robertson, Cherry, and Zanini, 1996).
- In one study, shallow groundwater was observed to be of the same quality as septic tank effluent (Gondwe, Mwanuzi, and Mbwette, 1997).

Of specific interest is a 1996 CCBNEP report (CCBNEP-05) on NPSs and loadings which found that event mean concentrations (EMCs) of FC in stormwater runoff exceeded the TSWQSs in residential, commercial, industrial, transportation, and rangeland areas. A second study examining FC and water quality following storm events in the Ingleside of the Bay Canal System (TNRCC, 1996) found high FC concentrations in canals adjacent to homes with OSSFs.

Based on the available regional information, as well as observed trends in other coastal areas, it is possible that faulty OSSFs are impacting receiving waters and may even be contributing to FC criteria exceedances for shellfish harvesting in coastal areas. However, there is not a strong perception that OSSF problems are a significant health threat, which may be due to a lack of information on the number and extent of faulty OSSF systems, as well as a lack of water quality data in impacted areas.

Continued implementation and enforcement of the Rules and regional OSSF management programs will reduce the threat of OSSFs on receiving water bodies in the future. However, existing OSSFs should be carefully monitored to reduce loadings from faulty systems to the greatest extent possible. Targeted monitoring studies could also be identified to better understand the influence of OSSFs concentration areas on the quality of nearby waters. Additional recommendations on improving the management of OSSFs can be found in Section 7, Recommendations.

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4. OSSF LOCATIONS

The primary location of OSSF concentration areas are primarily in the rural part of the counties, outside the boundaries of incorporated cities, or in some cases, in outlying suburbs of incorporated cities. These rural subdivisions, suburban areas, and colonias rely on septic tank systems and many have inadequate OSSFs or in the case of many colonias, no approved OSSF systems (i.e., use of cesspools or direct discharge).

The following information identifies the "primary areas" of OSSF concentrations within each county as well as key potential "problem areas" identified by the county or TNRCC. A comprehensive survey and mapping of all subdivisions, colonias, and areas with OSSF concentrations has not been performed as a part of this study. Additional information regarding OSSF concentration areas is provided for Nueces County since data for this county was already available to the principal investigator.

4.1 Nueces County

4.1.1 County-Wide OSSF Concentrations

Locations of known colonias, rural subdivisions, and key OSSF subdivisions within incorporated areas are shown on Figure 7. These are the areas where the concentrations of OSSFs are the highest. Appendix I contains a list of county rural subdivisions and colonias as well as the estimated population of each. While a small group of these subdivisions is clustered along the Nueces River west of Calallen, the remainder of the rural subdivisions are scattered throughout the unincorporated portions of the county. Within the Flour Bluff area of the city of Corpus Christ along Oso Bay there are several subdivisions with OSSF concentrations.

4.1.2 OSSF Problem Areas

In 1996, the staff of the Nueces County Public Works Department conducted an informal survey of known colonias. The survey group estimated the number of lots and houses in each colonia and the availability of public water and sewer. In addition, they estimated the number of failing septic tank systems and noted the main reason for the failures. The results of the survey are illustrated in Figure 7. There are approximately 5,900 OSSFs in Nueces County (based on 1990 census). Of that number, 20% are estimated to be failing or performing inadequately. The number one problem mentioned on nearly every survey form is flooding and/or poor drainage. Many of the colonias are located in the 100-year floodplain. These colonias are indicated by an asterisk (*) on Figure 7. Others are located in areas of low elevation near streams or creeks. When the drainfield of a septic tank system is under water or the soil of the drainfield is saturated, it can not perform correctly.

Other noted causes of septic tank system failures were improper use or operation, such as infrequent pumping of septic

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tanks, and improper lot sizes. Many colonias have problems from more than one household using the same septic tank.

In summary, key OSSF problem areas in Nueces County include:

- The eleven (11) colonias within Nueces County
- Various subdivisions along the Nueces River such as Riverside, Horsehoe Bend, Riverview, Sandy Hollow Addition, Dos Palomas, Los Escondidos, Riverside Suburban Acres, and Lindgreen River Lots
- Flour Bluff area along Oso Bay including Tara, Golden Oaks, and Rosher Subdivision

Another condition further contributing to the poor performance of OSSFs in the county is the unsuitability of native soils for use as septic system drainfields. According to the USDA Soil Survey for Nueces County, the Victoria Association covers approximately 66% of the county and is almost twice as large as all other soil associations combined. Victoria soils have a surface layer of dark gray, moderately alkaline clay approximately 38 inches thick. The next layer, to a depth of about 58 inches, is moderately alkaline, moderately saline, light gray clay. The underlying material, to a depth of 72 inches, is light gray, moderately alkaline, strongly saline clay. Victoria soils, which are typically classified as TNRCC Soil Class VI, are considered to have severe limitations for use in septic tank absorption fields due to low permeability and high shrink-swell potentials. In order for a septic tank system to function properly in Type IV soils, the system must be an alternative design or a standard system modified to meet TNRCC design requirements. These requirements must be strictly enforced to prevent the installation of unsuitable systems in Type IV soils. A summary of this information is shown in Table 7.

TABLE 7 - OSSF STATISTICS FOR NUECES COUNTY

OSSFs in Nueces County	
Total number of OSSFs (estimated):	5,918*
Percentage of OSSFs believed to be failing:	20%
Primary concentrations of OSSFs:	In colonias, scattered throughout the unincorporated portions of the county, along Oso Bay and Nueces River subdivisions
Most common OSSF problems:	Flooding, poor drainage, inadequate soils, improperly designed systems
Predominant soil classification:	Victoria (Class IV - unsuitable for standard septic tank systems)

*US Census Bureau, 1990

4.1.3 On going Programs

Many residents of the rural subdivisions rely on private wells for drinking water, since public water service is not provided. The County is currently trying to improve conditions for residents by obtaining grant funding for water improvements in various colonias, but efforts are hampered by the limited amount of funding available each year. Funding obtained from the Texas Department of Housing and Community Affairs (TDOHCA) Community Development Program is usually limited to $300,000.00 per funding cycle and will typically pay for water improvements for only one colonia each year in each county. Recently, Nueces County received a $90,000.00 grant from the TDOHCA for planning purposes to provide basic services including water and sewer. The grant will be used to map neighborhoods that qualify as colonias, assess available public services, and count residents. According to the Texas Department of Public Affairs, there area eleven (11) known colonias in Nueces County and 25 to 30 neighborhoods that could qualify as colonias. Section 6 contains additional information on funding alternatives.

The county is currently providing public water improvements funded by TDOHCA grants to the following colonias:

- Rancho Banquete
- Spring Gardens
- Suburban Acres
- Tierra Grande
- Fiesta Ranch

4.1.4 Location of Wastewater Improvements in Nueces County

The following Nueces County areas are listed with the TNRCC as having sewer Certificates of Convenience and Necessity (CCN). The sewer system service area boundaries for these areas are shown on Figure 7.

- City of Agua Dulce
- City of Bishop
- City of Corpus Christi
- Nueces County Water Control and Improvement District 4 (Banquete)
- City of Robstown
- Port Aransas

4.2 San Patricio County

4.2.1 County-Wide OSSF Concentrations

Particularly in rural areas of the county where no public sewer service is available, and certain areas within the limits of incorporated cities, there are numerous subdivisions and colonias that rely on septic tank systems for their wastewater disposal needs. Locations of known colonias are shown on Figure 8. These are the areas where the concentrations of OSSFs are the highest. The highest concentrations of OSSFs in San Patricio County are located along the shores of Lake Corpus Christi, within the City of San Patricio, rural subdivisions southwest of Sinton, the unincorporated community of St. Paul, Bethel Estates (south of Odem), several colonias south of Sinton, Doyle Addition (east of Portland), and the City of Ingleside on the Bay.

4.2.2 OSSF Problem Areas

As indicated in Table 8, discussions with TNRCC and San Patricio County Health Department officials, as well as research conducted as part of the County's Facilities Engineering Plan for economically distressed areas, indicate that the following areas have the most problems associated with poor performance of OSSFs:

TABLE 8 - OSSF PROBLEM AREAS IN SAN PATRICIO COUNTY

Area	Reasons for Septic Tank System Malfunctions
North Lakeshore Gardens	Located in floodplain, improperly designed systems
City of Lakeside	Located in floodplain, improperly designed systems
Lake City	Located in floodplain, improperly designed systems
City of San Patricio	Improperly designed systems, located in floodplain
Bethel Estates	Improperly designed systems, unsuitable soils
Community of St. Paul	Improperly designed systems, unsuitable soils
Colonias south of Sinton	Improperly designed systems, unsuitable soils
Doyle Addition (east of Portland)	Located in floodplain, high groundwater table
Ingleside on the Bay	Improperly designed systems

These areas are shown in Figure 8.

Inadequate sized drainfields due to small lot size is the most common problem in the OSSF concentration areas. The size of drainfields is critical for proper performance of septic tank systems in San Patricio County because the majority of soils found in the county are not suitable for use as drainfields without special design considerations. According to the USDA Soil

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Survey for San Patricio and Aransas Counties, the Victoria-Raymondville-Orelia map unit makes up approximately 47% of the county. The second largest map unit in the county is the Galveston-Mustang-Dianola unit at approximately 21%. Victoria soils have a surface layer of dark gray, moderately alkaline clay approximately 38 inches thick. The next layer, to a depth of about 58 inches, is moderately alkaline, moderately saline, light gray clay. The underlying material, to a depth of 72 inches, is light gray, moderately alkaline, strongly saline clay. Victoria soils are considered to have severe limitations for use in septic tank absorption fields due to low permeability and high shrink-swell potential.

Raymondville soils have a surface layer of moderately alkaline clay loam about 14 inches thick. The next layer, to a depth of about 38 inches, is moderately alkaline clay. The underlying material to a depth of 60 inches is light gray, moderately alkaline clay loam. Raymondville soils, typically classified as TNRCC Soil Class III or IV, also are considered to have severe limitations for use in septic tank absorption fields due to low permeability and high shrink-swell potential.

The Orelia soils are typically fine sandy loams with underlying light gray, moderately alkaline, strongly saline sandy clay loam. Orelia soils, typically classified as TNRCC Soil Class II or III, also have severe limitations for use as septic tank absorption fields.

The Galveston-Mustang-Dianola soils are typically moderately alkaline fine sands with underlying loamy sands. All three soils, typically classified as TNRCC Soil Class I, have severe limitations for use as septic tank absorption fields due to flooding potential and wetness.

In order for a septic tank system to function properly in Type I or IV soils, the system must be an alternative design or a standard system modified to meet TNRCC design requirements. These requirements must be strictly enforced to prevent the installation of unsuitable systems in San Patricio County. A summary of this information is shown in Table 9.

TABLE 9 - OSSF STATISTICS FOR SAN PATRICIO COUNTY

OSSFs in San Patricio County	
Total number of OSSFs (estimated):	5,722*
Primary concentrations of OSSFs:	Ingleside on the Bay, St. Paul, Bethel Estates, Lake City, Lakeside, Doyle Addition, San Patricio
Most common OSSFs problems:	Located in floodplain, inadequate lot size, unsuitable soils
Predominant soil classification:	Victoria (Class IV - unsuitable for standard septic tank systems)

*US Census Bureau, 1990

4.2.3 Ongoing Programs

Many residents of the colonias rely on private wells for drinking water since public water service is not provided. The County is currently trying to improve conditions for colonia residents by obtaining grant funding for water and wastewater improvements through the Texas Water Development Board's Economically Distressed Areas Program (EDAP). EDAP funding is currently being pursued to provide wastewater improvements for the following areas:

- Community of St. Paul
- Doyle Addition (Portland)
- City of Ingleside
- Bethel Estates
- City of Ingleside on the Bay
- City of Aransas Pass

4.2.4 Location of Wastewater Improvements

The following San Patricio County areas are listed with the TNRCC as having sewer CCN. See Figure 8 for sewer system service area boundaries.

- City of Ingleside
- City of Odem
- City of Sinton
- City of Portland
- City of Mathis
- City of Aransas Pass

4.3 Aransas County

4.3.1 County-Wide OSSF Concentrations

Only a very small portion of Aransas County residents are served by a public sewer system. These residents are within the city limits of Rockport-Fulton and Aransas Pass. In addition, some areas within these cities continue to rely on septic tank systems, while other areas are in a transition from OSSF to public sewer service. All other residential subdivisions utilize septic tank systems for wastewater disposal. Many of these subdivisions are located on waterfront property or canals with access to Aransas and Copano Bay. Concentrations of OSSFs are located in subdivisions around Salt Lake, between Rockport and Aransas Pass, and on the Lamar Peninsula near Holiday Beach and Goose Island State Park. (See Figure 9)

4.3.2 OSSF Problem Areas

As indicated in Table 10, discussions with TNRCC and Aransas County Health Department officials have indicated that the following areas have the most problems associated with poor performance of OSSFs:

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TABLE 10 - OSSF PROBLEM AREAS IN ARANSAS COUNTY

Area	Reasons for Septic Tank System Malfunctions
Copano Bay	Old or improperly installed systems, flooding conditions, improperly designed systems
Salt Lake	Old or improperly installed systems, flooding conditions, improperly designed systems
Holiday Beach	Old or improperly installed systems, flooding conditions, improperly designed systems
Copano Cove	Old or improperly installed systems, flooding conditions, improperly designed systems
Palm Harbor	Improperly designed systems, nuisance complaints
Bahia Bay	Improperly designed systems, nuisance complaints

Inadequately sized drainfields due to small lot size, high groundwater tables, and flooding conditions are all contributing factors to OSSF problems in Aransas County. Unsuitable soil types are another contributing factor to septic tank system failures in the problem areas. The identified problem areas are located in areas covered by the Galveston-Mustang-Dianola soil association, discussed in Section 4.2.2, OSSF Problem Areas. These rapidly permeable, sandy soils are typically classified as TNRCC Soil Class I and have low potential for urban and recreational use due to soil wetness, a high water table, and flooding. In order for a septic tank system to function properly in Type I soils, the system must be an alternative design or a standard system modified to meet TNRCC design requirements. These requirements must be strictly enforced to prevent the installation of unsuitable systems in Aransas County.

Because most of the problem areas in Aransas County are located adjacent to coastal waters, they have a high potential for causing water pollution. Water quality testing has been conducted in many of these areas, but additional more extensive testing is necessary in order to determine if septic systems are in fact causing a water quality decline. A summary of this is shown in Table 11.

TABLE 11 - OSSF STATISTICS FOR ARANSAS COUNTY

OSSFs in Aransas County	
Total number of OSSFs (estimated):	6,456*
Primary concentrations of OSSFs:	Copano Bay, Salt Lake, Holiday Beach, Copano Cove, Palm Harbor, Bahia Bay
Most common OSSFs problems:	Flooding, inadequate lot size, unsuitable soils, improperly installed systems
Predominant soil classification:	Galveston-Mustang-Dianala (Class I - unsuitable for standard septic tank systems)

*US Census Bureau, 1990

4.3.3 Ongoing Programs

The County is currently trying to improve conditions for residents by obtaining grant funding for wastewater improvements through the TDOHCA Community Development Program. Funding is currently being pursued to provide wastewater improvements for the following areas:

- Live Oak Colonia
- Southwest Rockport

4.3.4 Location of Wastewater Improvements

The following Aransas County areas are listed with the TNRCC as having sewer CCN. Sewer system service area boundaries are indicated on Figure 9.

- City of Rockport
- City of Aransas Pass
- Lamar Water Supply Corporation

4.4 Refugio County

4.4.1 County-Wide OSSF Concentrations

Figure 10 identifies cities within the county where public sewer service is available. Certain areas within these cities also continue to rely on OSSFs. Households in all other areas must utilize OSSFs. In the rural area of the county where no public sewer service is available, there are a few residential subdivisions and colonias. These households rely on septic tank systems for their wastewater disposal needs. Locations of known rural subdivisions are shown on Figure 10. These are the areas where the concentrations of OSSFs are the highest.

4.4.2 OSSF Problem Areas

As indicated in Table 12, discussions with TNRCC and Refugio County officials indicate that the following areas have the greatest problems associated with poor performance of OSSFs.

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TABLE 12 - OSSF PROBLEM AREAS IN REFUGIO COUNTY

Area	Reasons for Septic Tank System Malfunctions
City of Tivoli	Old or improperly installed systems, improperly designed systems
City of Bayside	Improperly designed systems, high groundwater, located in floodplain

Another condition further contributing to the poor performance of OSSFs in Tivoli and Bayside areas is the unsuitability of native soils for use as drainfields. According to the USDA Soil Survey for Refugio County, both Bayside and Tivoli are located in areas covered by the Victoria-Edroy-Orelia Association, which also covers approximately 53% of the county. These soils have layers of clay, sandy clay, and sandy clay loam, and are poorly suited for urban uses. Most of the soils have high shrink-swell potential, slow or ponded surface drainage, and high corrosivity to uncoated steel. The very slow permeability causes septic systems to fail during extended wet periods. These soils are typically classified as TNRCC Class IV, which means

that septic tank systems are required to be alternative designs or standard designs modified to meet TNRCC requirements. These requirements need to be strictly enforced to prevent the installation of inadequately sized systems or systems unsuitable for use in Type IV soils. A summary of this information is shown in Table 13.

TABLE 13 - OSSF STATISTICS IN REFUGIO COUNTY

OSSFs in Refugio County	
Total number of OSSFs (estimated):	1,033*
Primary concentrations of OSSFs:	City of Tivoli, City of Bayside
Most common OSSFs problems:	Inadequate lot size, located in floodplain, improperly installed systems
Predominant soil classification:	Victoria (Class IV - unsuitable for standard septic tank systems)

*US Census Bureau, 1990

4.4.3 On-going Programs

County and city officials in Refugio County are currently trying to improve conditions for residents by obtaining grant funding for wastewater improvements through the Rural Development Administration. Funding is currently being pursued to provide wastewater improvements for the following areas:

- City of Woodsboro - Wastewater treatment plant upgrades
- City of Bayside - New wastewater system and treatment plant

4.4.4 Location of Wastewater Improvements

The following Refugio County areas are listed with the TNRCC as having sewer CCN. The sewer system service area boundaries for these cities are shown on Figure 10.

- City of Refugio
- City of Austwell
- City of Woodsboro

5. EDUCATIONAL BROCHURES

Utilizing the materials and existing brochures identified in Task 9 and the findings from on-going coordination with all interested parties, a template for two (2) new educational brochures (master only) has been prepared. Both brochures have incorporated information currently in brochures and material available from the TNRCC and Counties. Where appropriate the information in these brochures has been updated based on current regulations. The brochures also include information about the CCBNEP and OSSF information related to CCBNEP goals and objectives.

The homeowners brochure, included in Appendix J, includes information on the proper design and functioning of OSSFs, and general maintenance and management practices. Finally, information is given on how to select a qualified installer and how to contact local and state government officials to obtain more OSSF information.

The second brochure, included in Appendix K, was created to inform local governments and policy makers about the changes in the new OSSF rules. Included in this brochure are the policies for certification of installers, site evaluators and DRs, and the responsibilities of county inspectors. Information about available OSSF funding has also been included. In addition, the brochure also stresses the importance of how a carefully worded and strictly enforced subdivision ordinance can help a local government with the enforcement of OSSF regulations.

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6. WASTEWATER SYSTEM FUNDING ALTERNATIVES

There are numerous options available for funding wastewater improvements in municipalities and rural areas. Available state and federal financial assistance programs are described below and summarized in Table 14.

6.1.1 Texas Department of Housing and Community Affairs (TDOHCA) Grants

Currently, the Community Development Fund allows for municipalities and Counties to apply for water, sewer, housing, streets and drainage improvements. This funding can only be used to provide services to areas that qualify under requirements for low to moderate income persons. Cities and counties may qualify if specific threshold percentages can meet current state requirements. *Program Contact: Ruth Cedillo, 512-475-3900.*

Another source of TDOHCA grants is the Colonia Fund, which provides assistance to eligible County applicants for infrastructure improvements and planning services in severely distressed unincorporated communities that meet the definition of "colonia". Eligible projects must be located within 150 miles of the Texas-Mexico border and be located outside of counties that are part of a Metropolitan Area that contains more than one million residents. *Program Contact: Ruth Cedillo, 512-475-3900.*

The TDOHCA - HOME Investment Partnership Program provides funds to local government entities for a variety of housing assistance needs such as rehabilitation or reconstruction of existing housing, and additions or repairs to bathrooms or septic tank systems. This program also provides assistance to first home buyers, rental project assistance, and pre-development loans. HOME funds are restricted to households that are low-income, defined by HUD as 80% or less of medium income for the area with adjustments for family size. *Program Contact: Joe Mann, 512-475-3109.*

The TDOHCA - Home Improvement Loan Program (HILP) provides low interest (6.99 percent) loans up to $25,000 to very low income homeowners (60% Area Median Family Income - AMFI - or less) for the purpose of substantially improving or protecting the livability of their home. Improvements in wastewater treatment including new or improved OSSFs would quality for these loans. The repayment terms vary depending on the loan amount with a maximum term of 20 years. The program has 13.2 million in funds available in Texas, including 6.1 million for colonias. The area defined for colonias includes those colonias in Nueces County, San Patricio County, and portions of Refugio County. Applications are made through the Home, Inc. office in Austin, Texas at (512) 343-8911. *Program Contact: Homero Cabello, Jr., 512-475-2118.*

TABLE 14 - LIST OF WATER AND WASTEWATER FUNDING OPPORTUNITIES

	Water			Wastewater				Bathrooms	Grant/Loan	Applicant
	Treatment	Distribution	Laterals & Hook-ups	Treatment	Sewers	Laterals & Hook-ups	On-site wastewater			
Texas Department of Housing and Community Affairs										
Community Development Fund	†	†	†	†	†	†	†	†	grant	political subdivision
Colonia Fund	†	†	†	†		†			grant	political subdivision
Small Town Environmental Program (STEP)	†	†	†	†	†	†	†	†	grant	political subdivision or non-profit corporation
Texas Water Development Board (TWDB)										
Economically Distressed Areas Program (EDAP)	†	†			†		†		grant/loan case by case	political subdivision or non-profit corporation
Colonia Plumbing Loan Program (CPLP)			†			†	†	†	100 % loan	political subdivision
Rural Development Administration (Farmers Home Administration)										
Water and Sewer Community Programs	†	†	†	†	†	†			grant/loan case by case	political subdivision or non-profit corporation
Section 306C Program (Special Colonia Funds)	†	†	†	†	†	†			grant	political subdivision or non-profit corporation
Housing Programs			†			†		†	grants/loans	individuals

† eligible

6.1.2 Small Town Environmental Program (STEP)

A final program, originated by the TNRCC and partially administered by TDOHCA, is the Texas Small Town Environmental Program (STEP). This program assists community "self-help" efforts to improve water and wastewater services. *Program Contact: Ruth Cedillo, 512-475-3900.*

6.1.3 Texas Water Development Board (TWDB)

The Economically Distressed Areas Program (EDAP) funds water and wastewater treatment works and water distribution and wastewater collection systems. Funds are in the form of a grant/loan combination which is negotiated on a case-by-case basis. The program does not fund laterals on private property or connection fees.

The Colonia Plumbing Loan Program (CPLP) funds loans to political subdivisions that in turn loan the money to individuals for laterals on private property, connection fees, indoor plumbing improvements, bathroom additions, and installation of septic tank systems. Funds are provided to political subdivisions by low interest loans and can include a grant of up to 9 percent for administrative expenses. The political subdivision must loan the money to individuals and make reasonable efforts to collect loan payments. *Program Contact: 512-475-2068.*

6.1.4 Rural Development Administration (RDA) (formerly Farmers Home Administration) (FmHA)

The Water and Waste Disposal Program provides for the installation, repair or improvement to water and sewer systems, as well as solid waste disposal and storm drainage systems, for rural communities and areas with populations of 10,000 or less. The program will fund laterals and connection assessments. The funds are a combination of grants and loans, but grants are awarded up to a maximum of 75% of eligible project costs and only when necessary to reduce the annual user charges to a reasonable level. RDA also guarantees water and waste disposal loans made by banks and other eligible lenders.

The Emergency Community Water Assistance Grant Program assists rural communities that have had a significant decline in quantity or quality of drinking water. Grants can be made in rural areas and cities or towns with a population not in excess of 5,000 and a median household income not in excess of the State's non-metropolitan median household income. Grants can be made for 100 percent of project costs, with a maximum grant of $500,000 when a significant decline in quantity or quality of water occurred within 2 years, or $75,000 to make emergency repairs or replacement of facilities.

The RDA also has housing programs that can be used for general home improvements, including the installation of plumbing fixtures needed to utilize public water and/or sewer service or the installation of

septic tank systems. These programs are normally direct grants and loans made to individuals by the RDA. *Program Contact: Jake Sherran, 512-664-0455.*

6.1.5 Environmental Protection Agency 319 (h) Program

Under the Federal Clean Water Act, Section 319 of the act provides for a national NPS water pollution prevention and control program. The TNRCC has a NPS Pollution Team that administers the Section 319 program in Texas for non-agricultural management project. The program awards grants that address major sources of NPS pollution affecting water quality. For example, Section 319 has provided funds to cities for public education and best-management practices involving OSSFs and fecal coliform problems in certain watersheds. Table 15 summarizes current funding activities in the four county study area.

TABLE 15 - SUMMARY OF CURRENT FUNDING ACTIVITIES

Funding	Nueces County	San Patricio County	Aransas County	Refugio County
Qualify with Ongoing EDAP Program	does not qualify	grant project on going	does not qualify	does not qualify
Texas Dept. of Housing and Community Affairs (TDOHCA) Grant Involvement	on going projects	on going projects	on going projects	no current projects
TDOHCA Colonia Fund Involvement	on going projects	on going projects	on going projects	no current projects
Rural Development Administration Fund Involvement	no current projects	no current projects	on going projects	on going projects
EPA Section 319 (h) Grant Involvement	no current projects	no current projects	no current projects	no current projects

7. RECOMMENDATIONS

7.1 OSSF Management Strategies

The development of the CCBNEP Study of OSSFs has involved numerous interviews and interaction with County AAs and TNRCC staff responsible for the OSSF program. The following recommendations were developed incorporating comments from these responsible County and state OSSF staff. Recommendations also include comments from contractors.

7.1.1 Cooperative Planning and Issue Resolution

1. Develop an OSSF Implementation Plan Committee

   The TNRCC will be convening an ad hoc committee to review the new OSSF rules and monitor what, if any, modifications should be made. Certain county health department officials within the four (4) counties have historically been involved with such committee activities and/or monitor committee activities through correspondence. A similar ad hoc group is recommended for the OSSF four county areas to take the findings from this CCBNEP Study of OSSFs and develop an implementation plan to accomplish the recommendations in this report. This implementation plan can help support current county programs regarding OSSF management. This implementation plan can also help maintain the momentum behind this OSSF study and be a vehicle to help ensure "cooperation between all parties" in accomplishing the goals of the CCBNEP Study of OSSFs.

   Significant time and resource constraints facing the counties and allocating the time to participate with such a group can be very time consuming. The CCBNEP should therefore possibly incorporate the activities of such a committee along with other CCBNEP - Coastal Bend Bay Plan initiatives affecting county health departments in order that such a group can address a wide range of "related" county issues together.

2. Monitor and Participate in OSSF Design Standards Costing Study

   Comments were provided that the new rules contained certain unreasonable design standards which should be revisited by the TNRCC. In addition, the On-Site Wastewater Research Council, which administers grants and contracts for OSSF research and technology transfer, plans to have a study completed to compare the old and new rules, (which would likely include the costs of these differences in design standards).

It is recommended that the CCBNEP help facilitate and jointly sponsor a coordinated effort between OSSF permitting authorities and designated representatives, engineers, sanitarians, installers, and homebuilders to provide Coastal Bend area comments regarding this study of costs. This effort could be combined with the goals of the suggested ad hoc committee recommended to develop an implementation plan.

7.1.2 Prevent OSSF Problems Before They Occur

1. Counties should make it mandatory for DRs to revise subdivision ordinances to prevent the installation of inadequate OSSFs on lots of improper size, inadequate soils, etc.
2. Rules should be established to prevent final plat approval until adequate water and wastewater facilities have been constructed or financial guarantees have been secured to assure construction of water and wastewater facilities.
3. Adequate information should be provided to property and/or home buyers about county OSSF installation and operation requirements.
4. Make sure that installers, apprentices, site evaluators or DRs are appropriately trained and licensed; this should include local TNRCC staff.
5. Since conventional OSSF systems (i.e., tank and drainfield) are typically unable to effectively treat sewage in areas that have very shallow groundwaters (i.e., depths of 0 to 10 feet) due to the soil air voids being saturated, consideration should be given to installing non-conventional OSSF systems, where appropriate.
6. Legislation may be necessary to help improve notice to the county of housing structures (such as colonias). With improved notification, the county could better enforce the new OSSF rules. Two (2) legislative efforts to pass bills requiring notification to the county by the Utility Commission of "utility connections" (Senate Bill 569) and giving the County authority to require subdivision platting approval (House Bill 2022) were not passed during the 1997 legislative year.

7.1.3 Better Understand and Correct Existing OSSF Problems

1. There should be increased enforcement against unlicensed installers and developers of inadequate subdivisions.
2. Water quality studies should be considered in the water bodies with high concentrations of OSSFs in adjoining lands including areas near Copano Bay, Copano Cove, Copano Ridge, Salt Lake, Bayside, Oso Bay, and the Nueces River. Water quality parameters should include not only FC, but also septic tank related nutrients (such as nitrates) and other chemicals. Funding could be pursued for a study of areas with large numbers of OSSFs adjacent to rivers and bays, as well as more studies of colonias. As a control, areas that are without OSSFs should be included in the study along with a study approach that will help differentiate the contributing source. Such a study should be coordinated with the TNRCC

watershed management program and development of total maximum daily loads for related CCBNEP watersheds. Additional parameters, such as phosphates or nitrates, that may be more appropriate in correlating contaminants to OSSF sources should be included along with fecal coliform.

3. Additional surface and groundwater monitoring should be considered in colonias with recognized problems including those located in proximity to watersheds.

7.2 Monitoring and Compliance Plan Development[3]

Information obtained during the study from county authorized agents and the TNRCC has identified "key" elements of the county program that are important to maintaining compliance. Although there are numerous OSSF issues and various program elements (previously listed in Section 2.2, County Program) there are certain "key" elements that are targeted in the following compliance plan which could help improve OSSF monitoring and compliance.

It is important to note that recent TNRCC compliance reviews of most county programs has indicated the counties are "generally in compliance". In addition, there are no known significant compliance problems between the TNRCC and counties; nor are there known significant public health threats nor significant surface or ground water quality problems attributed to septic tanks. Nevertheless, there are "issues" regarding septic tanks including a better understanding of related public health or water quality effects and developing actual data to show whether there is a correlation between OSSF problem areas and water quality. It is also understood that the job of maintaining compliance can always strive for improvement. As a result, the following is a general outline for a Monitoring and Compliance Plan addressing some of the "key" elements for improving compliance while maintaining cooperation between all parties (county, state, homeowner, installers, public, etc.) The key elements are briefly listed below and are further discussed in subsequent sections.

Manpower Resources - Adequate staff and funding capabilities including support mechanisms are necessary to accomplish the responsibilities of the county's OSSF program AA.

Computerization - Continued computerization of county OSSF management systems and program responsibilities can reduce paper work, help reduce time constraints, and potentially free-up time for increased inspections enforcement. A CCBNEP Sep Track computerized management system project could be developed.

Communication and Education - Communication within the county, with the court system between TNRCC-Counties-Cities-and the public, can help promote effective compliance and

[3] In order for a Compliance Plan to be effective and implementable, it should maintain compliance while being reasonably feasible and cost effective. Therefore, the plan should be county specific and tailored to the individual county. The scope of work for this Study does not include the development of a detailed Compliance Plan tailored to each county and is rather an outline of a plan with components that generally address elements common between counties.

cooperation. Additional education and training can help promote compliance through understanding between the homeowner, developer, installer, and interested public.

Compliance Procedures - Development and documentation of procedures necessary to maintain compliance can help communicate and define responsibilities and assist streamlining activities.

7.2.1 Manpower Resources

In order to effectively implement an OSSF compliance program at both the County and TNRCC level, there should be an appropriate organization. An effective compliance plan starts with the appropriate staff and budget to implement and carry-out the plan. Since county government, in their role as AAs assumes certain responsibilities of the TNRCC, there is a unique relationship between the County and TNRCC in maintaining compliance. Therefore the issue of appropriate resources is not only at the county level, but also at the TNRCC level. This is especially important in the advent of the new (and increased) OSSF rules, increased attention to OSSFs, colonia issues, and increased public attention to pollution issues. The following is a list of issues and plan components involving "manpower resources".

1. The need for additional staff at the local level should be considered especially with regard to addressing the "colonia" issues.
2. The need for additional staff should be evaluated along with the work load benefits obtained from continued computerization.
3. Inspections and enforcement is time consuming and additional effort could be provided through increased outside contractor use which would require additional budget expenditures.

7.2.2 Computerization

The Counties are at different stages in the computerization of their record keeping responsibilities. Although computerization has the end effect of streamlining operations and productivity, it takes time and funds to implement. Systems are being developed, for computerized "environmental management systems" which can cover any and all aspects of the county OSSF program. Such a system could be developed as a model for all counties to work towards and the CCBNEP could assist in developing such a system.

One such project has been developed by the Buzzards Bay, Massachusetts National Estuary Program called the Buzzard's Bay "Sep Track" Initiative. The Sep Track Demonstration Project was designed to provide computers and specialized software to communities to allow them to better manage information related to OSSFs, thereby freeing staff time to better design, review, enforce, and help identify patterns of failure. A report from the EPA on describing the "Sep Track" Initiative identified the following lessons learned:

- Technical assistance and support are necessary to train local government staff; one cannot simply provide the computers and software.
- Good software programs and computers are no substitute for good office management.

Counties could improve their current computer capabilities by obtaining an e-mail program with internet access capabilities. This capability could greatly reduce the cost of long distance telephone bills and mail correspondence with the TNRCC (Central and Regional office) whenever technical or regulatory assistance is required. Counties could finance their e-mail server by slightly increasing their permit fees.

7.2.3 Communication and Education

Communication and education regarding OSSF is a key component to develop understanding and commitment at all levels and within all parties involved with OSSFs. The CCBNEP study has developed two brochures, one for homeowners and another for local government. However, funds have not been provided to produce these brochures and a series of tasks should be defined for making these brochures available to not just the homeowner and OSSF staff, but also to the Justices of the Peace, developers, and the general public. While each county has its own program for public education and information availability, a joint program could also be developed between all counties and the TNRCC to address the OSSF issues on a regional or "Coastal Bend" area basis.

The following is a list of communication and education related plan components:

1. Publication of OSSF Brochures

   The CCBNEP would investigate their ability to co-fund with counties publication of the OSSF brochures. Funds could also be solicited from contractors, installers, developers.

2. Regional OSSF Public Information Plan

   A regional OSSF Public Information Plan would be developed with TNRCC including use of publications, video, and television media to inform the general public, owners, and government regarding importance of OSSF and CCBNEP relationship.

   The Public Information Plan jointly developed between County, TNRCC, installers, suppliers, and developers could also target colonias and other OSSF concentration areas with speaking opportunities at civic functions to help improve compliance through public outreach. TNRCC staff from Austin and Region 14, as well as concerned installers and suppliers could be solicited for involvement to help the time allocation for this effort, which would help develop corporation between all parties. The CCBNEP can assist facilitating such an effort.

3. Coastal Bend OSSF Educational Program

By utilizing a coordinated approach between study area counties and other interested parties including the TNRCC, funding could be solicited from the Section 319 (h) program (or other sources for an educational program to address OSSF issues in the CCBNEP study area). Such funding would have a greater opportunity to be awarded if justified based on a need in the Coastal Bend area watershed and key coastal counties.

7.2.4 Compliance Procedures

There are additional components to a Compliance Plan which could also be considered especially when tailoring a plan to a certain county. These additional components could include documented procedures (or a procedure manual) for all responsibilities comprising the OSSF program. Such procedures are also helpful in describing employee job descriptions or other departmental responsibilities related to the OSSF program, or to document compliance programs as a substitute for a "compliance review" by TNRCC (thereby freeing TNRCC staff to possibly assist the counties more with their responsibilities).

7.2.5 Compliance and Data Management Systems

A compliance or data management system includes those documents, forms, procedures, or activities necessary to accomplish the responsibilities of the county designated representative. In lieu of developing an improved computerized system (which costs training, time, and hardware/ software costs), there may be certain data management activities (forms, procedures) which are shared, for example, between different, but related inter- and intra- county department functions. If such systems are streamlined or consolidated to reduce paperwork and optimize efficiency, additional time could potentially be "freed-up" for compliance management priorities.

7.3 Funding Management Strategies

1. OSSF Funding and Grant Assistance Workshop

   A workshop should be organized in the OSSF study area for the purpose of providing information on obtaining funding related to OSSFs. The workshop should address funding opportunities, resources and approaches to help prepare grant applications, and initiatives between city, county, state, and federal authorities to source grant opportunities in the Coastal Bend and maximize the receipt of OSSF funds and grant awards.

2. Increased Applications to the TDOHCA Colonia Fund and Comprehensive Colonia Planning Fund

   Some opportunities exist and additional opportunities should be developed to obtain grant assistance from non-profit community service groups or agencies with the "grant application

process". Applying for grants can be time consuming, especially when managing compliance with increasing OSSF systems. Funds are also available for colonia "planning" that require no local match. Nueces County was recently awarded such a planning grant.

3. Grant Assistance Services

   The CCBNEP could help organize the development of a program office to provide grant assistance to local government including assistance obtaining local matching funds. This grant assistance office could utilize a volunteer base of individuals as well as utilize other technical support staff available from local, state, and federal authorities. Funds to help manage the office could be acquired through a grant such as the Environmental Protection Agency Section 319 (h) Program. The grant assistance program office could also be a key component to help obtain funds for other CCBNEP priority issues of importance to local government and study area stakeholders.

   In areas where small lot sizes, density of housing, or some other factor is contributing to OSSF failures, funding should be pursued to help provide public sewer service to those residents.

4. Funds From Septic Tank Sales, Subdivision Application Fees

   Initiatives should be considered to help collect fees from related OSSF program and facility elements (i.e., septic tank sales fee, subdivision approval fees, etc.) to help fund either the grant assistance program, additional TNRCC "local" staff assistance, or a low interest fund to assist qualifying homeowners in priority locations with OSSF system construction and/ or retrofit.

5. Subdivision Developer Fees

   Comments were received from one DR that "public" funds should not be the focus of funding and that an approach should be developed to obtain monetary support from developers responsible for "developing" subdivisions. Fees from subdivision construction authorization or another mechanism should be developed to obtain additional fees from the "developer" as well as increase developer responsibility and accountability to plan subdivisions in a manner to ensure conformity with OSSF rules.

6. Increased County Permit Fees

   Permit application administrative costs incurred by the county are five (5) times the permit application fee. County permit application fees vary widely. For example, in Nueces County the fee is $60.00 and in San Patricio County, $150.00. The TNRCC charges $200.00 for

permits the State administers. Some counties in the state are as high as $350.00 per application. These fees are an excellent source of revenue for the County OSSF program and should be reviewed by each County and increased to help provide funds that could help improve OSSF management efficiency.

7. Economically Distressed Areas Program (EDAP)

   The Counties of Nueces, Refugio, and Aransas do not qualify for EDAP funds due to very localized areas in the county with higher income that affect the county income average. Consideration should be given to modify the EDAP program to allow counties with disproportionate income levels. EDAP projects need to be better communicated to the public and their implementation expedited.

7.4 Summary of Recommendations

The following is a brief summary listing of OSSF Management Strategies, Monitoring and Compliance Plan Components, Funding Management Strategies, and Key Regional Strategies.

OSSF Management Strategies

1. An OSSF Implementation Plan Committee should be developed to help implement study recommendations.
2. The OSSF Design Standards Costing Study should be monitored and findings addressed by TNRCC/ DRs.
3. New Subdivision Ordinances should be developed by all counties.
4. Platt Approval Rules should be developed by all counties.
5. Public Information Programs should be actively pursued on a more regional basis.
6. Contractor Education and training should be expedited.
7. Non-Conventional Systems need more active promotion.
8. Effective OSSF Legislation should continue to be developed to accomplish OSSF study recommendations.
9. Improved enforcement is necessary through Education of the Court System.
10. Water Quality Studies should be performed in key OSSF concentration areas near rivers and bays of interest.

Monitoring and Compliance Plan Components

1. Enhanced Manpower Resource Capabilities will help compliance effectiveness.
2. CCBNEP- Sep Track Computer Management System is an example of a system that can streamline compliance.
3. The OSSF Brochures should be published and made available to the public.
4. A Regional OSSF Public Information Plan should be developed.
5. A Coastal Bend OSSF Educational Program should be developed.

6. Environmental Compliance Procedures can improve DR compliance efficiency.
7. OSSF Data Management Systems can help improve compliance.

Funding Management Strategies

1. A OSSF Funding and Grant Assistance Workshop should be organized.
2. Increased applications to the TDOHCA Colonia Fund and Comprehensive Colonia Planning Fund should be made.
3. A Grant Assistance Services group or program assisting local government should be developed.
4. Funds from Septic Tank Sales and Subdivision Application Fees should be investigated as a source of funding for helping maintain compliance.
5. Subdivision Developer Fees are necessary as a funding source and should be increased.
6. County Permit Fees should be increased as a source of added funds for OSSF management.
7. EDAP and EPA (319) h Funds are funding opportunities that need increased attention to maximize their applicability "regionally".
8. Assistance obtaining Local Matching Contributions is necessary to help local government obtain grant assistance.

The CCBNEP Study of OSSFs and its focus on the four (4) Coastal Bend counties of Nueces, San Patricio, Aransas, and Refugio has created an opportunity to address OSSF compliance issues on a regional basis. As a result, local government can obtain additional support and help by combining their efforts to satisfy key common issues. While certain of these strategies and plan components can be uniquely addressed only by that county, there are certain strategies which are better satisfied through a regional approach. These key regional strategies are as follows:

Key Regional Strategies

1. Providing grant assistance and identifying new grant opportunities such as jointly applying for EPA 319 (h) funds for projects better justified on a regional basis
2. Educating the Coastal Bend public of its unique regional compliance and water quality/ public health issues
3. Educating a broad range of interested parties (such as developers and the court system) who can help control problems
4. Developing a forum of OSSF professionals to plan and implement common data management systems or projects such as the Sep Trac computerized environmental data management system for tracking septic tank compliance information.
5. Studying correlations between OSSF concentration areas and water quality in potential problem areas
6. Providing resources to enable increased surface and groundwater monitoring at colonias

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APPENDICES

APPENDIX A

Outline of Regulatory Responsibilities

Outline of Regulatory Responsibilities

I. Responsibilities of the Texas Natural Resource and Conservation Committee Executive Director
- A. Delegation to Authorized Agents (Subchapter B; 285.10)
  1. Upon request forward copy of Model Ordinance to Local Entity
  2. Consult with local authorities to assist them in obtaining authorized agent status
  3. Review package requesting delegation and notify local entity of their authorized status
  4. May require revisions to local ordinances depending on new regulations
  5. Processes request for relinquishment or may revoke authorized agent status
- B. Review of Locally Administered Programs (Subchapter B; 285.11)
  1. Reviews an authorized agent's locally administered program not more than once per year
- C. Application Requirements General (Subchapter C; 285.20)
  1. Provide standard Application for Permit
- D. Criteria for Sewerage Treatment Systems (Subchapter D; 285.32)
  1. May issue temporary authorization for testing in an area
  2. After two (2) year period, may issue conditional approval for similar areas
  3. Establish monitoring methods for units
  4. After successful completion of monitoring, Executive Director may lift monitoring requirements
- E. Criteria for Sewage Disposal Systems (Subchapter D; 285.33)
  1. Must approve all Proprietary Disposal Systems not described in this section
- F. Other Requirements (Subchapter D; 285.34)
  1. Must approve composite toilets
- G. General Requirements for Registration and Certification (Subchapter F; 285.50)
  1. May allow reciprocity for an installer with a valid certificate from another state
- H. Administration (Subchapter F; 285.52)
  1. Responsible for the administration and management of the certification and registration of installers, apprentices, evaluators, and designated representatives
- I. Certificates/Renewal Applications (Subchapter F; 285.56)
  1. Shall issue appropriate installer, designated representative, or site evaluator certificates
  2. Thirty (30) days prior to expiration date must mail renewal application
  3. Issue certificate for renewal if requirements are met
  4. May deny Certificate and Registration

J. Training (Subchapter F; 285.59)
   1. Shall approve all training credits and instructors

K. Revocation, Suspension, or Reinstatement of Certificate and Registration (Subchapter F; 285.61)
   1. May request that the Commission schedule a hearing before the State Office of Administrative Hearings or the commission if good cause exists to revoke certificate of a site evaluator or designated representative, or a registration of an installer or apprentice

L. Agency Enforcement of OSSFs (Subchapter G; 285.70)
   1. May investigate matters concerning on-site systems, apprentices, installers of on-site systems, site evaluators, designated representatives, or authorized agents
   2. May take appropriate enforcement action
   3. May determine if OSSF is creating a nuisance and require property owner to initiate repair of malfunction
   4. Determines if enforcement action is warranted in response to a complaint

II. Responsibilities of the Texas Natural Resource Conservation Commission, Region 14 (Subchapter C; 285.20)

A. General Application Requirements
   1. Accept application for OSSF permits
   2. Will issue authorization to construct after receiving a complete application, appropriate fee, and a positive sight evaluation
   3. Will issue a license to operate the OSSF with I.D. number upon approval of the OSSF planning materials and construction inspection
   4. Accept fee for application for an OSSF permit

III. Responsibilities of the Authorized Agent

A. Subchapter B : Local Administration of the OSSF Program
   1. Delegation to Authorized Agents (Subchapter B; 285.10)
      a) Shall request for authorization in writing to Executive Director
      b) Shall draft a copy of an ordinance that meets the requirements of 366.032 of the Texas Health and Safety Code
      c) Shall cause notice to be published that a public hearing will be held
      d) Shall hold public hearing to discuss proposed order or resolution
      e) Will adopt resolution and send certified copy of minutes of meeting that adopted ordinance
      f) Shall send certified copy of the order to Executive Director
      g) Shall administer its OSSF program in accordance with its approved OSSF ordinance
      h) May initiate amendment procedure
      i) Shall resolve nuisance complaints
      j) Shall provide Executive Director with monthly report

k) Must inform Executive Director by certified mail at least 30 days prior to publishing notice of intent to relinquish OSSF order

l) Shall send Executive Director copies of Public notice, Publisher's Affidavit of notice, and certified copy of minutes of meeting in which it formally considered relinquishment of its delegation

m) Must consistently enforce Chapter 366 of Health and Safety Code

B. Subchapter D : Planning, Construction, and Installation Standards for OSSFs

1. Criteria for Sewage Treatment Systems (Subchapter D; 285.32)

a) May issue installation permits upon receipt of temporary authorization

C. Subchapter F : Registration, Certification and/or Training Requirements for Installers, Apprentices, Site Evaluators or Designated Representatives

1. Certificates/Renewal Applications (Subchapter F; 285.56)

a) Shall notify the Executive Director in writing of any changes in job status of its Designated Representative

IV. Responsibilities of Installers, Designated Representatives and Site Evaluators

A. Subchapter D : Planning, Construction, and Installation Standards for OSSFs

1. Site Evaluation (Subchapter D; 285.30)

a) Site Evaluator shall evaluate soil borings taken from absorption field area and perform an overall site evaluation

b) A Site Evaluator shall determine the presence of groundwater

2. OSSF Maintenance and Management Practices (Subchapter D; 285.39)

a) Installers shall provide the owner of an OSSF the maintenance and management practices and water conservation measures listed in this section

B. Subchapter F : Registration, Certification and/or Training Requirements for Installers, Apprentices, Site Evaluators or Designated Representatives

1. General Requirements for Registration and Certification (Subchapter F; 285.50)

a) No individual shall install, construct, alter, extend, or repair an OSSF unless the individual holds a valid certification issued by the Executive Director or is expressly exempted from the installer's certification or registration requirements

b) An installer shall comply with all requirements of this title and be responsible for the proper installation of all OSSFs installed under the installer's registration or certification

c) An installer shall directly supervise all individuals working under the installer's certificate during installation or repair

2. Qualifications (Subchapter F; 285.54)

a) Installer I qualifications

(1) One (1) year experience under an Installer I or Installer II

(2) Complete Installer I training course

(3) Pass Installer I exam

b) Installer I is qualified to install, construct, alter, extend or repair standard OSSFs described in 285.91

c) Installer II qualifications
   (1) Have Installer I certificate
   (2) Have two (2) years experience
   (3) Complete Installer II training course
   (4) Pass Installer II examination

d) An Installer II is qualified to install, construct, alter, extend, or repair all types of OSSFs.

e) All applicants for certification as a site evaluator or designated representative shall be required to pass an examination covering the field of OSSF installation, construction, repair, operation, disposal, planning, maintenance, soil evaluation, and program administration

f) Designated Representative Qualifications
   (1) Each individual appointed, employed or compensated by a permitting authority having duties or responsibilities for the regulation of OSSFs shall be required to take designated representative training and pass an exam

g) Site Evaluator Qualifications
   (1) Must have two (2) years experience and possess an Installer II certificate, designated representative certificate, registered sanitarian certificate, or professional engineering certificate
   (2) Must complete site evaluator training course
   (3) Must pass site evaluator exam

h) A site evaluator is qualified to conduct preconstruction site evaluation which includes performing soil analysis, a site survey, and determine suitability of a site for a specific OSSF

3. Certificates/Renewal Applications (Subchapter F; 285.56)
   a) The installer, designated representative, or site evaluator shall inform the Executive Director of any change in address or phone number
   b) It is the responsibility of the installer, designated representative, or site evaluator to make sure the renewal fee along with proof of continuing educational course requirements are returned to Executive Director by August 31 of each year
4. Duties and Responsibilities (Subchapter F; 285.58)
   a) Duties of Installer
   b) Duties of Designated Representative
   c) Duties of Site Evaluator
5. Training (Subchapter F; 285.59)
   a) An individual holding an installer, designated representative, and/or site evaluator certificate must successfully complete a minimum of eight (8)

hours of continuing education training approved by the Executive Director prior to August 31 of each year in order to renew their certificate

6. Apprentice Program (Subchapter F; 285.60)
   a) Installer must agree to accept responsibility for apprentice
   b) Installer must submit a registration form and annual fee to register an apprentice
   c) Installer must make statement that he or she accepts financial responsibility for the activities of the apprentice performed on behalf of the installer

APPENDIX B

Comparison of Old and New
OSSF Rules

SECTION 285.3 GENERAL REQUIREMENTS

Subject	Old Rule	New Rule
Exclusions	Not addressed or vague	Must permit under Chapter 26 TWC and Chapter 305 (Consolidated Permits): – 1 or more systems that produce more than 5,000 gallons/day/property – Any system that produces non-domestic wastewater – Any surface discharge into waters/ adjacent to waters of the state

SECTION 285.4 FACILITY PLANNING

Subject	Old Rule	New Rule
Manufactured housing communities or multi-unit residential developments served by a sewage collection system for on-site disposal		– Require submission of sewage disposal plan (address replacement area) – Maximum sewage production = 5,000 gallons/day for property
Site evaluation	Heavy reliance upon the percolation test	Utilize multiple site characteristics for evaluation criteria
Small lots or tracts	– Designed by an RS/PE – Replacement area required	– Design requirements based upon system type – Replacement area not addressed
Subdivision/ development review	No specifics regarding the content of planning materials submitted	– Planning materials must include: – overall site plan – topographic map – 100-year floodplain map – soil survey – location of water wells – OSSF system types – Replacement area

SECTION 285.5 SUBMITTAL REQUIREMENTS FOR PLANNING MATERIALS

Subject	Old Rule	New Rule
Submittal of planning materials by RS or PE	– Innovative design – Lower acreage – Mobil home/ multi-unit – Variance requests – As required by AAs	– Proprietary and non-standard – Manufactured housing communities and multi-unit – PE only when not exempted by Engineering Practice Act – Surface irrigation – Cluster systems
Review of non-standard planning materials	Not addressed	– TNRCC review of initial non-standard planning material – Subsequent designs reviewed by AA

SECTION 285.6 CLUSTER SYSTEMS

Subject	Old Rule	New Rule
General	Not addressed	Used only when lot size, location or soil condition prohibit use of standard system
Design	Not addressed	In accordance with Chapter 317 (Design Criteria for Sewage Systems)
Permits	Not addressed	Each family must be individually permitted
Maintenance/ ownership	Not addressed	– Each permittee must be party to binding agreement for: – Ownership – Maintenance
Property ownership	Not addressed	– Cluster system site owned or perpetual access by all parties – Affidavit added to real property deed as part of application

SECTION 285.7 ADDITIONAL APPLICATION REQUIREMENTS FOR SURFACE IRRIGATION SYSTEMS

Subject	Old Rule	New Rule
Maintenance company	Addressed by policy	Maintenance company requirements part of definition: – At least 1 individual has Installer II or Class D certification – Certified by appropriate manufacturer

SECTION 285.10 DELEGATION TO AUTHORIZED AGENTS

Subject	Old Rule	New Rule
Relinquishment of AA Delegation	Not addressed	– AA must inform TNRCC of intent to relinquish 30 days prior to publishing notice – AA must publish intent to relinquish and hold meeting – TNRCC shall establish date of relinquishment
Revocation of AA Delegation	Criteria vague	Criteria formalized

SECTION 285.20 APPLICATION REQUIREMENTS GENERAL (TNRCC ADMINISTERED PROGRAM AREAS)

Subject	Old Rule	New Rule
Permit transferability	Assess a new permit application fee	Permit transfers automatically without fee to a new owner

SECTION 285.21 FEES (TNRCC ADMINISTERED PROGRAM AREAS)

Subject	Old Rule	New Rule
Permit application fees	Permit fee per system: – $100 individual facility – $250 professionally planned	Permit fee per system: – $200 individual facility – $400 professionally planned
Reinspection fee	Not addressed	Equal to ½ permit application fee and assessed to installer

SECTION 285.30 SITE EVALUATION

Subject	Old Rule	New Rule
Soil evaluation	Percolation test	Soil texture and structure analysis
Soil depth below excavation	4 feet for standard systems	2 feet for standard systems
Soil depth to restrictive horizon	4 feet for standard systems	2 feet for standard systems
Soil depth to groundwater	4 feet for standard systems	2 feet for standard systems
Flood hazard	Confusing, but said all of the system must be constructed out of the flood-prone area and not within areas subject to inundation or erosion by flood waters	Any sites within the 100- year floodplain on a FEMA map or from a study prepared by a PE must demonstrate that the flooding will not damage the OSSF and the OSSF will not contaminate the environment, and must address tank floatation

SECTION 285.31 SETBACK AND SEPARATION REQUIREMENTS

Subject	Old Rule	New Rule
Private water well/drainfield	150 feet	100 feet
Streams, etc./ septic tanks	75 feet	50 feet
Property lines/ septic tanks	10 feet	5 feet
Sharp slopes/ septic tanks	5 feet	0 feet with supports
Swimming pools/ septic tanks	15 feet	5 feet
Streams, etc./ disposal area	75 feet	75 feet, but 50 with secondary treatment and disinfection
Sharp slopes/ disposal area	50 feet	25 feet
Drip irrigation/ foundations	Not addressed	Up to, but not under
Special setbacks for drip irrigation loaded at an Ra less 0.1 gal/feet. sq.	Not addressed	25 feet to streams, etc. 10 feet to sharp slopes

SECTION 285.32 CRITERIA FOR SEWAGE TREATMENT SYSTEMS

Subject	Old Rule	New Rule
Septic tank sizing	3 x daily flow	Homes are essentially the same. However, certain homes may end up with smaller tanks such as a 4 bedroom home with low-flow fixtures (1,000 gallons now) Larger flows will end up with less than 3 x daily flows
Septic tank outlet filters	Not addressed	Approved by ED
Inlet submergence	Six inches	Not addressed
Separation between top of inlet/ outlet and tank top	Visible separation not greater than 1 inch	Not addressed
Separation between baffle top and tank top	Visible separation not greater than 1 inch	Gap
Fittings on baffle of two-compartment precast tanks	Grouted in place prior to installation	Not addressed
Diameter of outlet	Not addressed	Minimum of 3 inches
First tank volume	At least ½ to 1/3 of total waste flow in first tank	At least ½, except if there are three tanks, then at least 1/3 of total volume, but no less than 500 gallons
Location of inspection/ clean out ports	Directly over inlet and outlets	Not directly over
Diameter of inspection/ clean out ports	10 inches	At least 12 inches and large enough to provide maintenance and equipment removal
Precast concrete tanks	Prior approval	No prior approval, but shall conform to ASTM designation C 1227-93, Standard Specification for Precast Concrete Septic tanks (Materials and Manufacture Section and Structural Design Requirements Section)
Backfill material for tanks	Allowed gravel up to 1 ½ inch diameter	Sand, sandy loam, clay loam or pea gravel
Pretreatment tanks	Not addressed	Structural requirements
Testing of proprietary treatment systems which do not fit under NSF standard 40	Approved by the ED	Approved by ED but the process is outlined in much greater detail

SECTION 285.33 CRITERIA FOR SEWAGE DISPOSAL SYSTEMS

Subject	Old Rule	New Rule
Standard system terminology	Trenches and beds	Excavations
Sizing theory	Area = bottom area	Area = bottom + sidewall
Loading rates	Not available	Different than Old Rules
Commercial system sizing	A = 1.25Q/Ra	A = Q/Ra (texture based)
Drip irrigation	No formal policy	A = Q/Ra (texture based), Area is calculated based on 4 sq. feet. per emitter. However, just like spray irrigation, overlapped area is only counted once even though it is acceptable to have overlapped areas
Spray irrigation	Policy statement	A = Q/Ra (climate based) Use the same map. However, you may now use the isopleth to the left of the location resulting in smaller application areas
Low pressure dosing	Use NC state manual	A = Q/Ra (texture based) However, the linear feet of trench (less than 1 foot wide) is equal to A/3
ET beds	A = 31,000 (1+B)/(Evap.- .5 rainfall) for residential systems A = 310Q/(Evap - .5 rainfall) for commercial systems	A = 1.6Q/Ret ET sizes have generally increased (see handout)

SECTION 285.33 cont. CRITERIA FOR SEWAGE DISPOSAL SYSTEMS

Subject	Old Rule	New Rule
Pumped Effluent Systems	No such thing	Outlined in new rules. Basically, this is a non-professionally designed LPP system. However, due to the fact that the system is not professionally designed, system sizing erred on the conservative side
Leaching chambers	Only proprietary approvals with 40% reduction	All leaching chambers approved with 40% reduction
Soil substitution	Not addressed	In 1a soils or highly fractured rock, 24 inches of soil may be substituted on bottom and sides to allow standard installation
Drainfields following secondary treatment and disinfection	Not addressed	May be installed in 1a soils and fractured rock. System is sized as Class III soils. Maintenance requirements for spray systems apply.
Spray irrigation timers	Not required	Required to spray at night if spray area is closer than 20 feet to property line
Excavation depth	36 inches	36 inches or 6 inches below soil freeze depth. However, areas drier than 26 inches annual rainfall may use trenches up to 5 feet deep
Distance between excavations	(3 x trench width) or 5 feet	3 feet
Excavation width minimum	Not addressed	1.5 feet
Porous media	Not available	Can now use crushed tires between 0.75 and 2.0 inches
Backfill	For trenches greater than 24 inches, sand is used as backfill up to the top	Regardless of trench depth, backfill is Type 1b or II soils
Drainline	Not available	Can no longer use ASTM D 2729 or ASTM F 789
Drainline length	75 feet maximum	150 feet maximum
Drainfields on irregular terrain	16 inch drop from tank to trench bottom	12 inch drop
Spacing between distribution lines in large excavations	6 to 12 feet	4 feet

SECTION 285.34 OTHER REQUIREMENTS

Subject	Old Rule	New Rule
Pipe from home to septic tank	Used to allow SDR 35	Does not allow SDR 35
Pipe slope to septic tank	¼ inch per foot	1/8 inch per foot
Pipe slope after septic tank	1/8 inch per foot	Not addressed, but still need 12 inches to excavation bottom
Clean out	Within 3 feet of home	Two-way clean out between home and tank
Pump tank alarms	Just says high-water alarm	Audio and visual high-water alarm
Storage above alarm	– Residential - 10 minutes pump time – Commercial (flow < 500 gpd) one day	1/3 day flow regardless of flow or type of facility
Duplex pump requirements	> 500 gpd	> 1,000 gpd
Electrical wiring	Hard wired connections	Done according to National Electric Code
Holding tanks	Temporary and permanent	No distinction between temporary and permanent. However, holding tanks may only be installed where no other methods of sewage disposal are available
Holding tank record keeping	Copies sent in to the permitting authority	Copies retained for five years
Composting toilets	Allowed NSF approved and others approved by ED	Only NSF approved units
Abandoned tanks	Not addressed	Owner's responsibility to pump, collapse and fill

SECTION 285.36 ABANDONED TREATMENT, HOLDING, AND PUMP TANKS

Subject	Old Rule	New Rule
Properly abandon a tank	Not addressed	– Remove wastewater by a licensed transporter – Fill tank with appropriate material

SECTION 285.39 OSSF MAINTENANCE AND MANAGEMENT PRACTICES

Subject	Old Rule	New Rule
Maintenance/ management/ water conservation	Installer should provide the owner with this information	Installer shall provide the owner with this information

SECTION 285.40 OSSFS ON THE RECHARGE ZONE OF THE EDWARDS AQUIFER

Subject	Old Rule	New Rule
Minimum separation distances	Not available	Added reference to Chapter 213 regarding geologic assessment

SECTION 285.80 TREATMENT AND DISPOSAL OF GREY WATER

Subject	Old Rule	New Rule
Grey water	Addressed by policy	Demarcates line of authority between the Plumbing Board and TNRCC

Note: For a comparison of the certification requirements in the new rule versus the old rule, consult the certification guidance documents.

APPENDIX C

Approved List of On-Site Aerobic Wastewater Treatment Units

TEXAS NATURAL RESOURCE CONSERVATION COMMISSION
APPROVED LIST OF ON-SITE AEROBIC WASTEWATER TREATMENT UNITS

Revised August 27, 1997

The following list of on-site aerobic wastewater treatment units are approved for use in Texas in accordance with the 30 Texas Administrative Code §285.32(b)(4).

MANUFACTURER *Name & Address*	**TREATMENT UNIT** *Model Number*	**PRETREATMENT/ TRASH TANK REQUIRED** *(?)*	**APPROVED CAPACITY** *Gallons Per Day*
Aquarobic International 508 Kendrick Lane Front Royal, VA 22630 (540) 635-5200	54291-5-115 54291-6 54291-7 54291-7.5 54291-8 54291-9 54291-10 54291-11 54291-12 54291-13 54291-14 54291-15 F54291-5-S F54291-6-S F54291-7-S F54291-7.5-S F54291-8-S F54291-9-S F54291-10-S F54291-11-S F54291-12-S F54291-13-S F54291-14-S F54291-15-S	YES (for all models)	500 600 700 750 800 900 1,000 1,100 1,200 1,300 1,400 1,500 500 600 700 750 800 900 1,000 1,100 1,200 1,300 1,400 1,500
Bio-Microbic, Inc. 8271 Melrose Drive Lenexa, KS 66214 (913) 492-0707	23-001-750 23-001-1100 23-001-1350	NO (for all models)	500 750 900
Clearstream Systems, Inc. P.O. Box 9337 Beaumont, TX 77709 (409) 755-1500	500 N, NC 600 N, NC 750 N, NC 1,000 N, NC 1,500 N, NC	YES (for all models)	500 600 750 1,000 1,500

MANUFACTURER *Name & Address*	**TREATMENT UNIT** *Model Number*	**PRETREATMENT/ TRASH TANK REQUIRED** *(?)*	**APPROVED CAPACITY** *Gallons Per Day*
Clearwater Ecological Systems, Inc. P.O. Box 886 Moss Beach, CA 94038-0886 (415) 728-9191	CWW-450	YES (for all models)	450
Multi-Flo, Inc. Consolidated Treatment Systems 1501 Commerce Center Drive Franklin, OH 45005 (513) 746-2727	FBT-0.5 FBT-0.6 FBT-0.75 FBT-1.0 FBT-1.5	NO (for all models)	500 600 750 1,000 1,500
Nyadic, Inc. 1501 Commerce Center Drive Franklin, OH 45005 (513) 746-2727	M-6A-F & M-6A M-8A-F & M-8A M-1050A-F & M-1050A M-1200A M-2000A-F & M-2000A	NO (for all models)	500 600 800 1,000 1,500
Delta Fiberglass & Environmental Products, Inc. P.O. Box 969 Denham Springs, LA 70726 (504) 665-1666	DF 40 C, F, CC, CA, FF DF 50 C, F, CC, CA, FF DF 50A C, F, CC, CA, FF DF 60 C, F, CC, CA, FF DF 75 C, F, CC, CA, FF DF 100 C, F, CC, CA, FF DF 100A C, F, CC, CA, FF DF 100B C, F, CC, CA, FF DF 150 C, F, CC, CA, FF	YES (for all models)	400 500 500 600 750 1,000 1,000 1,000 1,500
Ecological Tanks, Inc. 2247 Hwy. 151 North Downsville, LA 71234 (318) 644-0397	Aqua Safe AS 500 AS 600 AS 750 AS 1000 AS 1500	YES (for all models)	500 600 750 1,000 1,500
Hydro-Action, Inc. P.O. Drawer 160 Kountze, TX 77625 (409) 246-3749	G-500 G-900 G-1000 G-1100 G-1500	YES (for all models)	500 900 1,000 1,100 1,500
Jet, Inc. 750 Alpha Drive Cleveland, OH 44143 (216) 461-2000	J-500 (previously 353) J-750 J-1000 J-1250 J-1500	NO	500 750 1,000 1,250 1,500

MANUFACTURER *Name & Address*	**TREATMENT UNIT** *Model Number*	**PRETREATMENT/ TRASH TANK REQUIRED** ***(?)***	**APPROVED CAPACITY** *Gallons Per Day*
Klargester, Inc. c/o Waste Water Solution International, Inc. 3239 Old Fence Road Ellicot City, MD 21042 (412) 480-0272	BF-1-450 BF-2-700 BF-3-1100 BF-4-1500 BC-1-450 BC-1-500 BC-1-600	YES (for all models)	450 700 1,100 1,500 450 500 600
McGrew Construction Co., Inc. 3508 Industrial Drive Bossier City, LA 71112 (318) 746-5122	CA 500 CAFO 500 (Fiberglass tank) CA 750 CA 1000	YES NO YES YES	500 500 750 1,000
Murphy, Cormier, Gen. Con., Inc. 2885 Highway 14 E Lake Charles, LA 70605 (318) 474-2804	HOOT 500 HOOT 1000	YES (for all models)	500 1,000
Norweco, Inc. Firelands Ind. Park 220 Republic Street Norwalk, OH 44857 (419) 668-4471	Singular 950-600 GPD Singular 950-750 GPD Singular 950-1000 GPD Singular 950-1250 GPD Singular 950-1500 GPD Singular 960-500 GPD Singular 960-750 GPD Singular 960-1000 GPD Singular 960-1250 GPD Singular 960-1500 GPD	NO (for all models)	600 750 1,000 1,250 1,500 500 750 1,000 1,250 1,500
Southern Manufacturing P.O. Box 3615 Port Arthur, TX 77640 (409) 962-4501	S.M. 500	YES (for all models)	500
Thomas, Inc. 2507 Hwy. 20 Sedro Woolley, WA 98284 (360) 856-0550	TRD-1000-500 TRD-1000-600 TRD-1000-700 TRD-1000-800 TRD-1000-900 TRD-1000-1000	YES (contact TNRCC prior to approval)	500 600 700 800 900 1,000

APPENDIX D

Existing Available Educational Materials

APPENDIX E

List of OSSF Installers
in
Nueces, San Patricio, Aransas, and Refugio Counties

APPENDIX F

Classification of Shellfish Harvesting Area Maps

Insert Corpus Christi and Nueces Bays Drawings

Insert Copano, Aransas, Mesquite and Redfish Bays Drawings

APPENDIX G

Literature Review

Literature Review

In attempt to determine the potential problems and pollutant loading issues associated with OSSFs, various publications and sources which have previously addressed these issues were reviewed. An abbreviated summary of these findings is indicated below.

- "Investigation of Selected Public Health Issues in the Corpus Christi Bay National Estuary Program Study Area," CCBNEP-11, November 1996.

This report examined selected public health issues associated with the uses of the CCBNEP study area waters, specifically the risks associated with consumption of seafood, diseases, and accidents associated with swimming and boating. The categories of risk included: oyster consumption, consumption of toxic substances in seafood, disease contraction directly from the water, disease contraction from insects associated with water, and water related accidents. Of these categories, water-related accidents appear to have the greatest risk. Relative to potential impacts from OSSFs, the TDH does monitor swimming areas for FC levels. According to current criteria of the state, their data indicates that these areas are suitable for contact recreation. However, it was stated that higher medians and the occurrence of several very high FC and fecal streptococcus concentrations at all of the sampling points indicate possible contamination due to sanitary sewer overflow. The limitations of the study that warrants further investigation include 1) information on diseases and injuries associated with water use, 2) relatively limited data on near-shore quality in the Gulf of Mexico portion of the study area, 3) availability of suitable management measures for dealing with pathogens, and 4) standardization of tissue sampling.

- "Characterization of Non-point Sources and Loadings to the Corpus Christi Bay National Estuary Program Study Area," CCBNEP-05, January 1996.

The general objective of this report was to help define NPS pollution within the CCBNEP study area. This investigation provided a general overview of possible NPS pollution sources and related impacts to the CCBNEP study area. The work was directed at NPS pollutants originating from surface runoff and airborne pollutants, and was designed to provide loading estimates for geographic comparisons rather than absolute NPS loadings. Literature and existing data were reviewed with respect to eight (8) categories of land use and several pollutant parameters. Land use categories include: industrial, commercial, transportation, residential, agricultural cropland and pastureland, rangeland, marinas, and undeveloped/open areas. Event Mean Concentrations (EMCs) were developed from 1992-1993 data obtained from the City of Corpus Christi National Pollution Discharge Elimination System (NPDES) permitting process, and United States Geological Survey (USGS) stream gauging stations. These NPS of pollution contribute to loadings of receiving waters within the CCBNEP study area. Fecal coliform EMCs exceeded the TSWQSs for the following categories: residential, commercial, industrial, transportation, and rangeland. The EMCs ranged from 37 to 53,000 colonies per 100 ml, with the transportation category exhibiting the highest. It was concluded that the EMCs provided an important

first step in quantifying runoff water quality in the area; but updating runoff volumes and land use category information will greatly improve the accuracy of loadings to receiving waters.

- "Effect of Sampling Frequency on the Assessment of Fecal Coliform Bacteria Densities in Streams," Texas Natural Resource Conservation Commission, AS-105/SR, April 1996.

This study examined the effect of sampling frequency on the assessment of stream FC levels. Data was gathered to assess whether single samples collected on a quarterly or longer interval accurately reflect stream FC densities. Six stream stations were sampled five to six times during a 30-day period in Summer 1994. Five stream stations were sampled six times during a 30-day period in Winter 1994-1995. The range of densities around each station geometric mean varied from 765 to 18,840 colonies/100 ml. During both sampling periods, each station had at least one sample with a density greater than the 400 colonies/100 ml TSWQS, and at least one sample with a density less than that value. It was surmised that FC concentrations are strongly influenced by stormwater runoff. In addition, samples collected on an infrequent basis do not provide an adequate measure of FC density and variability, particularly in NPS impacted waters; small quantities of samples collected over a longer period of time may be erroneous. It was recommended that in order to obtain a better assessment of contamination, a more thorough understanding of FC and other pathogen indicators in NPS impacted waters is necessary.

- "Fecal Coliform/Water Quality Investigation of Ingleside on the Bay Canal System and Adjacent Waters of Corpus Christi Bay," Texas Natural Resource Conservation Commission, AS-103, April 1996.

This investigation documented surface water quality conditions within the Ingleside on the Bay canal system and near-shore area. The primary purpose of this investigation was to document existing surface water quality, under a variety of post- meteorological conditions, in the study area and to compare documented water quality with TSWQS criteria established for Corpus Christi Bay and adjacent waters. It was determined that the general water quality complied with the TSWQSs for recreational use. However, FC densities at two sampling stations indicated violations for shellfish harvesting use. The collected data indicated higher FC densities were present in the canals following heavy rainfall events, but diminished over a short period of time. It was stated that bacteriological densities measured in the canals were higher than typically observed in estuarine surface waters, but could be expected in an area such as this that has rather limited water circulation. The use of on-site sewage systems by the canal residents is likely to contribute to the observed bacteriological densities.

- "An Assessment of Water Quality Standards Attainment: St. Charles Bay, Oso Bay, and Upper Laguna Madre"; Reigel, Dave; Surface Water Quality Monitoring Section; Texas Natural Resource Conservation Commission, Region 14; August, 1995.

This study was conducted in response to the 1992 State of Texas Water Quality Inventory 305(b) Report listing several coastal segments within Region 14 as "water quality limited" due to "significant violations of water quality standards established by the TSWQS" for FC bacteriological densities. The primary goal in this study was to determine if in fact some of the coastal segments, particularly St. Charles Bay, Oso Bay, and Upper Laguna Madre, have FC densities in excess of the criteria for their designated uses, as described in the TSWQS. The study determined that there were no "significant violations" of the TSWQSs for the three study segments and that classification of these segments for contact recreation was fully supported. Examining dissolved oxygen (DO) criteria, the exceptional quality aquatic habitat use designation is fully supported in St. Charles Bay, and partially supported in both Oso Bay and Laguna Madre near Bird Island. According to methodologies described in the 305(b) report, it appears that the most appropriate classifications of all three study segments are effluent limited.

- "The State of Texas Water Quality Inventory, 1996." Surface Water Quality Monitoring Program of the Texas Natural Resource Conservation Commission. SFR-50. 13th Edition, December 1996.

This report was prepared by the Texas Natural Resource Conservation Commission (TNRCC) and submitted to the United States Environmental Protection Agency (EPA) biennially on even-numbered years in accordance with Section 305 (b) of the Clean Water Act. The report described the status of Texas waters based on historical surface and groundwater quality data, enabling the public, local government, state agencies, the Texas Legislature, the EPA, and Congress to become better informed and to comprehensively evaluate one of our most valuable resources. The report provided descriptions of the TSWQS, TNRCC's Surface Water Quality Monitoring (SWQM) Program, the Public Drinking Water Program, and the protection of instream uses. The report includes an assessment of the extent to which the state's water provide for healthy aquatic communities, recreation in and on the water, and safe public water supplies.

Of importance to this study is surface water quality. In order to assess surface water quality for this report, compliance with the TSWQS and other screening criteria was evaluated. Support of "aquatic life uses" was determined by evaluating historical data for dissolved oxygen and toxic substances in water. FC data were used to determine support of the contact, noncontact, and oyster water uses. The methodology used to evaluate "support of the aquatic life use" also changed in 1996 to include evaluation of FC data from classified bays rather than interpretation of bay closure maps produced by the TDH. Four years of recent SWQM data for parameters which are protective of assigned uses (i.e. aquatic life and contact recreation) were compared to established criteria. The number of criteria exceedances were divided by the total number of measurements for each parameter and expressed as a percentage. The percent exceedance values were compared to rating criteria that were used to determine if a "use" was supported, partially supported, or not supported. For other "uses" (i.e., fish consumption and public water supply) support was based on issuance of advisories or closures; their types and duration were established as rating criteria. The number of miles, acres, or square miles within each "use support category" was then totaled to provide statewide status information. For the

1996 reporting cycle, 224 classified streams and river segments, were classified and assigned designated uses by the TNRCC. Approximately 69% of the stream and river miles fully supported their overall uses, 9% partially supported their uses, and 22% did not support their uses. Overall, streams and rivers had approximately a 3% improvement since 1994. Major causes for use nonsupport were identified as elevated levels of fecal coliform and metals in water, and depressed levels of dissolved oxygen. Major sources contributing to use impairments were domestic wastewater point sources, unknown sources, agricultural runoff, and urban runoff.

- "Coastal Pollution from Septic Tank Drainfields," Duda, Alfred M. and Cromartie, Kenneth D. Journal of Environmental Engineering Division, Vol. 108 No. 6, November/December 1982, pp. 1265-1279.

Wet weather and dry weather sampling is utilized to monitor densities of coliform bacteria in waters draining residential areas of coastal North Carolina. The bacterial levels are compared to different densities of unsewered residences in each watershed and the limitations of the developed soils for assimilating septic tank effluent. An analysis of the data implicates septic tank drainfields installed in unsuitable soils as a major source of contamination of these shellfish waters. In order to reduce the threat to public health and the multimillion dollar economic loss to the fishing industry, several options are presented for rehabilitating concentrations of failing septic tank systems and for modifying over-designed drainage systems that carry the contamination directly to shellfish waters. In addition, several common sense management practices that minimize the delivery of bacterial contamination to estuarine waters are suggested for use in siting future coastal residential development.

- "Ground-Water Pollution by Septic Tank Drainfields," DeWalle, Foppe B., and Schaff, Russell M., Journal of the Environmental Engineering Division. Vol. 106, No. 3, May/June 1980, pp. 631-646.

This study included the evaluation of 386 groundwater samples to determine the effect of septic tank drainfield leaching on groundwater quality. The calcium carbonate type groundwater showed lower correlation coefficients between its main parameters in unsewered areas than in sewered areas. The negative correlation between calcium and sodium, the significant increase of calcium with time and with decreasing well depth points to a cation exchange in which sodium from sewage effluent is exchanged by calcium. The increase of calcium, chloride and nitrate with time was most significant in unsewered areas served by septic tanks. Highest nitrate and coliform concentrations were noted in the winter during maximum infiltration.

- "Septic Tank-Soakpit Systems in Dar es Salaam, Tanzania," Gondwe, E., Mwanuzi, F. L., Mbwette, T.S.A., Journal of Environmental Engineering. Vol. 123, No. 1. January 1997, pp. 93-95.

This paper discusses the impact of septic tank-soakpit systems widely used on the shallow unconfined aquifer at Sinza Ward in the city of Dar es Salaam, Tanzania. Sinza is a hot climate, high-density area

with household plots of limited area. From investigations on the shallow aquifer at Sinza, the groundwater was observed to have the same quality as the septic tank effluent, thus indicating that the groundwater was heavily contaminated by the septic effluent. This suggests that the septic tank-soakpit systems failed to sufficiently treat the domestic wastewater effluent.

- "Impacts on a Sand Aquifer from an Old Septic System: Nitrate and Phosphate," Harman, J.; Robertson, W.D.; Cherry, J.A.; and Zanini, L.; Groundwater; Vol. 34 No. 6, November/December 1996, pp. 1105-1114.

The present study focuses on the ground-water impacts of a 44 year old septic system at an elementary school in Ontario, Canada, located in an unconfined sand aquifer. It was related that while there are a large number of conventional septic systems in place, very few detailed studies have been conducted to determine the impact on groundwater quality. Studying an older system, such as this, allows a better assessment of the long-term capacity of the subsurface to attenuate the sewage-derived contaminants. At this site, the majority of the sewage is black water (i.e., toilet waste) with little dilution by wash water. As a result, the concentrations of most solutes in effluent from this system are elevated compared to those of most domestic systems, with the exception of phosphates, which are expected to be higher in a system containing wash water. Due to the site's relatively high groundwater flow velocity, combined with the concentrated effluent and the septic system's long period of use, this system provided a near worst case scenario for evaluating solute transport in septic system plumes. The primary inorganic constituents of concern for contamination of groundwater from septic system effluent are nitrate and phosphate. It was determined that nitrate concentrations exceeded the drinking water limit and were higher than those commonly found in plumes from single family septic systems. It was determined that the phosphate concentrations appear to be significantly attenuated in the unsaturated zone, resulting from mineral precipitation reactions. However, the remaining phosphates in the groundwater zone appear to travel relatively unattenuated for a distance of 60 m, due to active adsorption being fully utilized in the immediate vicinity of the septic system. Beyond this distance, the concentration decreases abruptly, resulting from active adsorption of phosphate occurring, thus limiting its further mobility in the groundwater zone. The observations in this study suggest that septic systems can be significant contributors of phosphates to nearby surface-water bodies. "These observations suggest that over time the capacity of soils to attenuate septic system phosphates can be consumed, allowing phosphate to advance at a slow, but potentially significant rate." It is felt that septic tanks probably contribute to the large numbers (30%) of domestic groundwater wells in the area that are contaminated with nitrate.

- "EPA Gulf of Mexico Program Takes Regional Perspective on Near Coastal On-Site Wastewater Issues", Texas On-Site Insights, Vol. 5, No. 4, January, 1997, p. 3.

This report summarizes a meeting of on-site wastewater professionals throughout the Gulf of Mexico region. The first part of the report compares state on-site wastewater management programs throughout the region in such areas as: the level of flows that constitute on-site systems, how systems are

regulated, methods used for site evaluation and final inspection, setbacks to surface water, the distance systems must be separated from groundwater formations, minimum lot sizes, regulation of black and grey water, special rules for flood-prone areas, and many others. The other part of the report explains what conference attendees identified as the most important issues concerning onsite wastewater in the region. They ranked the contaminants they felt threaten shellfish harvesting areas in the Gulf of Mexico and these were as follows: fecal coliform, pathogens, toxic substances, nitrogen, sewage, heavy metals, and agricultural runoff. The final agenda item was a listing and prioritizing of the "features in the on-site wastewater regulatory program" that they felt are most important to improve shellfish harvesting areas. Top responses included: lifespan inspection, maintenance and monitoring, required use of water conserving fixtures, mandatory homeowner/home buyer education when homes are bought and sold, establishment of performance-based standards, mandatory use of repair permits with state oversight, and flexibility provided from state and local governments to allow homeowners to use alternative technologies. These recommendation were sent to the governors of the gulf states and to state on-site wastewater regulatory agencies.

- "Water Quality Impacts From On-Site Waste Disposal Systems to Coastal Areas Through Groundwater Discharge", Harris, P.J.; Environmental Geology, Vol. 26, 1995, pp. 262-268.

This report summarizes research studies linking on-site waste disposal systems (OSDS) to pathogen and nutrient concentrations in groundwater with the potential to impact coastal embayments. It stated that few studies connect OSDS to coastal water quality. Most studies examined pathogen and nutrient impacts to groundwater and omitted estimations of contaminants discharged to surface water. The majority of studies focused on nitrogen, with little information on pathogens and even less on phosphorus. Nitrogen discharged from OSDS poses the greatest threat to water quality. In addition, vertical distance of septic tank infiltration system from the water table, septic system design, and siting remain the key components in minimizing potential impacts from OSDS for control of pathogens and nutrients. It concludes by stating that additional study is needed on the viability and transport of pathogens and nutrients through the groundwater aquifer and across the groundwater/surface water interface, as well as in the design of septic systems to prevent contaminants impacting nearby water quality.

- "Sanitary Surveys in Mason County", Glasoe, Stuart; and Tompkins, Mark, Puget Sound Notes, No. 39, June 1996.

To protect water quality from the potential effects of failing on-site systems, local residents and officials have undertaken a number of important actions in recent years. Probably the most visible and controversial of these has been the inspection of on-site sewage systems, often called sanitary surveys, around the shellfish waters of North Bay, Totten Inlet, Little Skookum Inlet, and Lower Hood Canal in the state of Washington. These studies were designed to identify failing septic systems by establishing statistically valid failure criteria based on a monitoring strategy that assesses episodic failure. The research indicated that fecal coliform monitoring should be repeated approximately at weekly intervals

and the geometric mean concentration calculated following each new sample. This geometric mean should be compared to criteria that are adjusted according to the number of samples collected. The criteria establish failure, non-failure and "suspect" sites. Only sites that are "suspect" need to be resampled.

- "On-Site Septic Systems", Publication of Puget Sound Department of Health.

This report studies on-site septic systems (more accurately referred to as on-site sewage systems) and their effects on beaches and shellfish. It reports that there are more than 450,000 systems in the Puget Sound basin, more than 10,000 added each year, and thousands of these systems are failing. Bacterial contamination from these failing systems is one of the most significant causes of restrictions on shellfish harvesting in that area. It gives important information on how to protect beaches and shellfish from failing on-site septic systems through measures including better system locating, design, and operation/maintenance.

- "The Greenwich Bay Initiative", Biennial Review, NBEP 1997.

This report investigates FC bacteria levels in Greenwich Bay, a 4.9 square mile embayment of Narragansett Bay, Rhode Island, one of the east coast's most productive shellfish areas. Since FC bacteria is an indicator of sewage contamination, the bay had to be closed to shellfishing in order to protect public health in 1992. Typically such closures are very short, on the order of a maximum of two weeks; however FC levels did not return to acceptable limits within a reasonable time frame. To protect the public health, the Rhode Island Department of Environmental Management indefinitely closed the bay waters until they could be reclassified as permanently closed or open only on a dry weather basis. This action resulted in many year round "quahoggers" (commercial shrimp fishermen) facing serious financial crisis, some of which received public assistance and others left the business altogether. In an effort to resolve this crisis, extensive sampling was conducted during both the wet (April) and dry (June) seasons in 1993. It was determined that of the numerous streams, storm drains and pipes tested, well over 90% of the FC loading was a result of the top ten sources. The data collected was used to model pollution trends in relation to storm events. In their December 1993 report, the Food and Drug Administration concluded that the bay must be closed within six hours of a half inch or more of rain. Since the bay's shellfishing was such a valuable resource, state officials developed a special protocol for managing this area and permitting shellfish harvesting during dry weather. More extensive sampling was conducted, and it was concluded that several restrooms in an urban mill complex had direct discharges to a stream that eventually flowed into the bay, and runoff from a manure storage pile at a dairy farm was flowing to a small tributary into the Hardig Brook watershed, (which contributed 50-90% of the bacterial loading to the bays). To repair the situation, the restrooms at the mill were connected to an existing sewer line, and interim best management practices were developed and implemented at this dairy farm, as well as other farming operations in the area. The success of these investigations prompted other research efforts such as nutrient budgets and eelgrass restoration, remediation efforts

such as marina pumpout facilities and an alternative technology septic system pilot project, and public outreach programs. The Greenwich Bay Initiative is continuing its efforts on restoring water quality, so shellfish harvesting can be conducted in both wet and dry weather periods.

APPENDIX H

Telephone Conversation Log

Telephone Conversation Log

In order to characterize other agency programs that involve OSSFs, communications were held with the following agencies and program offices. The communications included requests of available data on nutrient and bacteriological data; on-going studies or reports related to FC or similar type data; and known, suspected or opinions of surface or groundwater impacts that may be related to OSSFs.

- *TNRCC Information Resources and Publications:* Raw surface water quality data reports, 1996 State of Texas Water Quality Inventory [305 (b)], and two publications (AS-103 and AS-105/SR) on FC testing and analysis were obtained.

- *TNRCC Water Quality Modelling:* Staff indicated that over the next two years, a TNRCC study is planned which will include significant sampling and examination of various procedures for determining appropriate test methods for quantifying coliform densities. It was also mentioned that at some of the monitoring stations, water samples are collected downstream of bridges and related road crossings due to the high incidence of pigeons and bats congregating at these locations. Wastes from wastes these animals can be deposited in the water, potential resulting in high waste loadings. If water samples are collected downstream of these structures, potentially high (false positives) FC concentrations can be corrected for when developing stream water quality data. Water quality samples should be collected up- and down stream of pollutant sources to better isolate the primary source.

- *TDH Seafood Safety Division (Corpus Christi and Austin offices):* The Corpus Christi office provided maps identifying shellfish harvesting restricted areas in the CCBNEP study area. NEI was referred to the Austin office, who have provided us with the water quality data (particularly fecal coliform) that was utilized in assembling the shellfish harvesting maps. Maps indicating bacteriological sampling stations and the approved/restricted shellfish harvesting areas are included in Appendix F.

- *Natural Resource Conservation Service:* Charles Bayer, principal investigator for NPS report for CCBNEP-05 report, was responsible for the publication of the report. He related that the water quality data that was utilized in the report was not data that they collected, but rather received it from other agencies and entities. He mentioned that they received some data for septic tank systems, but it was difficult to determine the locations for the systems. In addition, the coliform databases that they accessed were not in a format where one could determine the sample locations.

- *United States Geological Survey (USGS):* Marshall Jennings, principal investigator for CCBNEP-05 report, provided technical support for the production of this report. He related that the USGS is not involved in large scale collection of water quality, but

occasionally perform small test studies in isolated areas of major stream segments. He related that they currently have an agricultural runoff demonstration project for the CCBNEP. It was mentioned that if pilot testing is desired to be completed in this area, the USGS would be interested in assisting setting up the test stations.

- *Espey, Huston & Associates:* Dr. Paul Jensen, principal investigator for CCBNEP-11 report, indicated that he conducted a bacteriological study in Sussox County, Delaware in the 1970s. In this particular study, the water flows were so small, that they did not find any indications of bacteriological loading. He indicated that he was involved with the Galveston Bay NEP study (GBNEP-21), and there are sections that address FC and other bacteriological testing.

- *Gulf of Mexico Program:* Mr. Fred Kopfler administers this program, under the auspices of the EPA, provided a copy of the 1993 Gulf of Mexico Conference proceedings, a shellfish challenge plan, and a brochure on constructed wetlands for animal wastes. He related that a study conducted in Mississippi found elevated loadings of fecal coliform in a bayou that were just too numerous to count. It was discovered that a small trailer park a significant distance away from their sampling point was discharging raw sewage directly into a drainage ditch, which eventually flowed into the bayou. He was also involved in a study in Florida, in a location where the groundwater was only two feet below the ground surface. The study revealed a significant presence of sewage in the groundwater.

APPENDIX I

List of Colonias and Rural Subdivisions
in
Nueces County

RURAL SUBDIVISIONS WITH NO PUBLIC WATER AND NO PUBLIC SEWER SERVICE

Public Works ID #	Name	Age	Est. Population	Source	% of Residents with Low/ Moderate Income Levels*
22	Broad Acres	20	604	Nueces County	
41	Country Club Estates	10	120	Nueces County	
45	Dos Palomas	15	150	Nueces County	
47	Fiesta Ranch	10	300	TCDP Survey	71.32%
49	Golden Acres	20	300	Nueces County	
61	Horseshoe Bend	20	40	Nueces County	
62	Indian Trails	10	320	Nueces County	
65	La Paloma Estates	15	200	Nueces County	
68	Lindgreen River Lots	20	60	Nueces County	
69	London Community 1 & 2	15	100	Nueces County	
71	Los Escondido	15	600	Nueces County	
72	Lost Creek	15	142	TCDP Survey	80%
91	Nye and Peterson Farm Tracts	15	80	Nueces County	
97	Rancho Amistad	5	40	Nueces County	
10	Rio Encinos 1 & 2	30	80	Nueces County	
92	Petronilla Acres #1	8	267	TCDP Survey	66%
118	Riverside Addition 1, 2, & 3	30	400	Nueces County	
135	Sandy Hollow Addition 1 & 2	20	500	Nueces County	
132	San Petronilla Estates 1 & 2	10	480	Nueces County	
133	San Petronilla Estates #5	15	400	Nueces County	
137	Santa Clara Subdivision	10	32	Nueces County	
148	Tierra Grande	15	135	TCDP Survey	87%
149-151	Tierra Verde	10	400	Nueces County	
153	Twin Lakes	25	60	Nueces County	
165	Wright Place	20	200	Nueces County	

RURAL SUBDIVISIONS WITH NO PUBLIC SEWER SERVICE

Public Works ID #	Name	Age	Est. Population	Source	% of Residents with Low/ Moderate Income Levels*
29	Calallen Acres 1 & 2	30	160	Nueces County	
36	Cindy Park	8	200	Nueces County	
48	First Colony	15	600	Nueces County	
98	Rancho Banquete	20	368	TCDP Survey	76%
123	Riverview Tract	30	340	Nueces County	
92(b)	Quail Valley 1, 2, 3, & 4	20	200	Nueces County	
122	Riverside Suburban Acres	20	500	Nueces County	
144	Suburban Acres 1 & 2	20	222	TCDP Survey	86%
140	Spring Gardens	15	457	TCDP Survey	84%

* Determined by TDOHCA survey

APPENDIX J

A Guide for Management
of Septic Tank Systems for
Homeowners

APPENDIX K

A Guide for Management
of Septic Tank Systems for
Local Governments