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DEVELOPMENT OF
A NATIONAL STRATEGY
FOR SEWAGE DISPOSAL IN TUNISIA
PHASE II



WATER AND SANITATION
FOR HEALTH PROJECT

Operated by
CDM and Associates

Sponsored by the U.S. Agency
for International Development

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the Regional Housing and Urban Development Office,
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WASH Activity No. 456

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Prepared for the Regional Housing and
Urban Development Office,
U.S. Agency for International Development,
under WASH Activity No. 456

by

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and
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ACRONYMS

AFH	Agence Foncière de l'Habitat
AFI	Agence Foncière Immobilière
AFT	Agence Foncière de Tourisme
ENIT	Ecole Nationale des Ingénieurs de Tunis (National Engineering School)
GOT	Government of Tunisia
MOPWH	Ministry of Public Works and Housing
ONAS	Office National de l'Assainissement (National Sanitation Office of Tunisia)
NGO	Non-governmental Organization
RHUDO	Regional Housing and Urban Development Office (USAID)
SNIT	Société Nationale Immobilière Tunisienne (National Housing Authority of Tunisia)
SPROLS	Société pour la Promotion du Logement Social
SONEDE	Société Nationale d'Exploitation et de Distribution des Eaux (National Water Supply Company)
USAID	U.S. Agency for International Development
WASH	Water and Sanitation for Health Project

EXECUTIVE SUMMARY

At the request of the USAID Regional Housing and Urban Development Office (RHUDO) in Tunisia, a WASH team spent three weeks in Tunisia in January 1989 to assist the Government of Tunisia (GOT) in implementing the second phase of the "National Strategy for Sewage Disposal" initiative. During this phase, the WASH team was to assist GOT with the development of a national strategy for sewage disposal. This was considered an essential step in order to allow the country to address increasing sewage disposal problems in urban and peri-urban areas. These problems have severely impacted on priority government initiatives such as improved housing, improved public health, and environmental protection.

Moreover, the economic conjuncture in Tunisia during the 1980s has made it extremely difficult for Government to continue to finance conventional sewerage systems for urban areas. Thus, its conviction that alternative appropriate sewage disposal systems represent valid solutions for the country has been the basis for national sewage strategy development.

Prior to this phase, a mission was conducted by the WASH Engineer to make a primary assessment of sector problems and issues as well as to develop a suitable process for conducting national strategy formulation (Phase II) and a workshop on alternative sewage disposal systems (Phase III). Phase I was successfully implemented in September 1988 (see WASH Field Report No. 249) and served as the basis for this second phase.

The development of a national strategy was performed by a Tunisian Working Group assisted by the WASH team. The Tunisian Working Group was composed of Tunisian cadres from diverse sectors of Government, and the WASH team's composition included a senior sanitary engineer, a hydrologist/hydraulic engineer recruited locally by RHUDO, an institutional development expert, and a sociologist/community development expert. While the proposed plan was to have a Tunisian Working Group available on a full-time basis during the three-week period of the mission, this was not possible as most of the group members were only able to devote part of their time to this activity due to work pressure.

At the outset of the assignment the WASH team was briefed by RHUDO and the joint Tunisian/WASH group was briefed by the Ministry of Equipment and Housing. The group then jointly developed a workplan and divided into sub-groups to conduct special sector studies in the areas of service coverage, technology, institution, legislation, finance, human resource, community development, and applied research. A special sub-group was also formed to address the three proposed sewage disposal case studies: an area of Tunis with a high water table (Soukra/Choutrana), one medium-sized municipality with a sewerage system not managed by the National Sanitation Office (ONAS), and a small-sized (population 4,000) municipality with a RHUDO-financed housing project with no municipal sewerage system.

After the first two days of briefings, the Working Group spent the remainder of the first week collecting and reviewing available information, the second week conducting special interviews and studies, and the third week formulating strategies and preparing a draft strategy document of which the case studies are a part. Because of the limited time to conduct such an undertaking, it was not possible to address specific requests from the Tunisian Government such as developing specific designs to solve problems in all three case studies areas and to make an economic comparison of different sewage disposal systems. These would have required more time to conduct technical studies, develop design and specifications documents, and develop economic models applicable to Tunisia.

Due to the time limits, it was proposed that the WASH engineer return to Tunisia within one month to conduct the technical studies, develop design and specifications documents, and study costs for different alternatives. However, this assignment did not materialize. Moreover, pilot projects and a special economic study are proposed to take place as part of a national strategy.

As a result of the work performed by the group, the following conclusions were reached:

- Although appropriate technologies are widespread in Tunisia, they are inadequately understood and systems are frequently improperly constructed and maintained--a situation due to the dominance of sewerage as a national sanitation¹ solution. No institution is responsible for promotion these technologies, there are no standards and norms for their installation, and there are no designated funds for their construction, operation, and maintenance.
- Only half of the country's urban population is served by conventional sewerage and the other half is served by individual or semi-public alternatives which have not always been constructed properly. Therefore the population continues to suffer from both environmental pollution and unacceptably high levels of human waste-related disease.
- Alternative sanitation systems provide a viable complement to the country's sewerage systems if they are properly designed, constructed, and maintained. The Government of Tunisia must state clearly and unequivocally its support for these alternative sanitation options. It must reorient its financial resources to make them possible and restructure its institutions to enable proper implementation of municipal programs.

¹ Sanitation in this report refers to wastewater disposal. It is taken from the French term "assainissement" as it was used by the Tunisians during this effort.

- Increased community participation can enhance the delivery of municipal services.
- Increased private sector involvement can relieve public institutions of many responsibilities, while strengthened, better-financed municipalities can take over many of the responsibilities currently carried out by Central Government agencies. Increased education and training of central, municipal, and private professionals and technicians can improve overall program performance and can contribute to the promotion of alternative technologies.

On the basis of the above conclusions, a national strategy was formulated and a draft document was prepared. Draft policy and strategies were first prepared and submitted for comments to RHUDO and the Working Group. Based on their comments, a complete draft of the national strategy document was submitted to RHUDO and the Ministry of Equipment for additional comments. Upon receipt of comments, the final document was prepared and submitted.

This report presents a section providing information on the assignment's background and scope of work followed by a section summarizing the national strategy document, and a third section describing the proposed Phase III. The WASH Team Phase II Scope of Work and the composition of the WASH/Tunisian Working Group are appended to this report.

Chapter 1

INTRODUCTION

1.1 Background

At the request of the USAID Regional Housing and Urban Development Office (RHUDO) in Tunisia, the Water and Sanitation for Health (WASH) Project conducted an exploratory study in September 1988 with the goal of elaborating a national strategy on the subject of sewage disposal in areas not served by the Tunisian National Office of Sanitation (ONAS).

Specifically, the purpose of this exploratory study was to assess sewage disposal in urban areas not served by ONAS and establish a process for formulating a national sewage disposal strategy for the development and promotion of alternative disposal methods in Tunisia. The objectives of the exploratory study were to:

- diagnose sewage disposal alternatives currently used in Tunisia,
- recommend a process to the Ministry of Public Works and Housing (MOPWH) for formulating a national sewage disposal strategy for Tunisia, and
- refine and develop in detail the scope of work for follow-up interventions by the WASH project.

The initial WASH mission, carried out by Pierre Leger, concluded that in order to address Tunisia's critical sewage pollution problems which threaten the economy and quality of life, new alternatives must be developed which are nationally acceptable and implementable within a larger sewage disposal strategy. Such a strategy would identify and promote appropriate technologies as well as develop support systems to sustain these technologies.

The mission further concluded that this strategy should be formulated by Tunisian experts with the assistance of external consultants. Implementable strategies would be fully formulated which addressed coverage, applied technologies, operations and maintenance, sector organization, human resource development, community mobilization and participation, applied research and development, and sector financing. Finally, Leger concluded, a workshop should be held to review and adopt the proposed national strategy.

The WASH Project would provide technical assistance in all aspects of strategy formulation as well as the preparation and conduct of the workshop.

The final report of the Leger mission, Development of a National Strategy for Sewage Disposal in Tunisia: Phase I (WASH Field Report No. 249, December 1988), is available from WASH.

In January 1989, in response to a further RHUDO request for WASH assistance and according to the recommendations of the Leger mission, WASH sent a three-person team to Tunisia to assist in the formulation of a national sanitation strategy. The members of that team were Pierre Leger (Team Leader), Syada Greiss, and Ronald Parlato. Moustapha Besbes, from the Ministry of Equipment, was also a member of the team.

This team, in conjunction with their Tunisian counterparts, produced a draft strategy document entitled Projet d'Elaboration de la Strategie Nationale en Matière d'Evacuation des Eaux Usées which reports on the entire activity. Chapter 2 contains an edited, abridged, and synthesized version of the draft strategy document.

1.2 Scope of Work

The Scope of Work of this second Tunisian mission was:

- to develop the details of various alternative sewage disposal methods;
- to select from among these alternatives those most appropriate for Tunisia;
- to develop a detailed strategy to promote and implement the selected alternatives. This detailed strategy would include plans for developing technical specifications, norms and standards, institutional roles, public acceptance and educational programs, operations and maintenance considerations, and cost recovery methodologies; and
- to develop three case studies to assess, through a field study in areas representative of the country as a whole, the validity of the national sanitation strategy.

The Scopes of Work for Phases I and II are found in Appendix A.

1.3 Implementation Methodology

A joint Government of Tunisia-WASH Working Group was organized at the beginning of the mission. (A list of members of this Working Group is attached as Appendix B.) The Tunisian members--all members of the National Technical Committee on Sanitation--came not only from the MOPWH, but from other agencies as well, such as the District of Tunis, ONAS, and the Tunisian National Housing Organization. The purpose of this multi-disciplinary team composition was to

assure the broadest possible participation from agencies and sectors likely to be involved in the execution of any proposed strategy. The WASH members of the Working Group, cited above, were also from different disciplines: sanitary engineering (Leger), hydrology (Besbes), institutional development (Parlato), and community development and participation (Greiss).

The Working Group was then divided into six different subgroups: technology; operations and maintenance; institutional organization, legislation, and finance; community development and human resource development; applied research; and case studies. A WASH team member was in each of the groups.

Each subgroup was responsible for the production of an individual report.

Each subgroup met with appropriate institutions and individuals and consulted relevant background material and provided a description and analysis of the subsector under review and finally a recommended strategy.

Based on final Working Group sessions and submission of the individual subgroup reports, the WASH Team Leader prepared a single strategy document.

Chapter 2

SUMMARY OF NATIONAL SEWAGE DISPOSAL STRATEGY

2.1 National Policy

The Government of Tunisia is in the process of a major structural adjustment as a response to what it considers recent sluggish economic performance. Since 1980 there has been a decrease in the rate of growth of GDP due, among other reasons, to loss of oil, phosphate, agriculture, and industrial revenues; irregularity in tourist revenues; reduction in transfers of money from Tunisians living abroad; low levels of investment in employment; and growth in the national debt.

To energize the economy, the Government has felt it necessary to reduce the currently high levels of State intervention in the economy, to encourage more private sector involvement, and to reduce the currently high levels of State subsidies in many sectors. As a part of this reform process, institutions are being reassessed to determine how they can be restructured to better suit the changing economic climate.

These changes have had a direct bearing on the water and sanitation sector. Most immediately, the reduction in State subsidies has forced a consideration of appropriate technologies and a reassessment of coverage policies. The structural adjustment policies of Government have also necessitated a reassessment of the roles of public agencies and private sector interests.

A number of factors affecting the demand for sanitation services have been identified:

- A. **Population Growth and Distribution.** Both population growth and population distribution have affected the demand for sanitation services. In the last three decades Tunisia has experienced not only a significant increase in overall population, but a migration of that population from rural to urban areas. Furthermore, Tunisia has experienced the return of citizens working abroad.
- B. **Urban Development.** As a consequence of this rural migration and the return of Tunisian workers, urban areas have grown rapidly. The number of officially designated urban areas (*communes*) has increased from 156 to 256 in the space of ten years. The problem has been not only the rapid growth of urban populations and the inability of municipalities to provide services to keep up with this growth, but also the growth of so-called "illegal" settlements--squatter areas outside municipal jurisdictions. These communities have grown for many reasons, among them the high unemployment rate and insufficient income to purchase housing within city limits.

Government is caught in the classic dilemma: to provide needed services to these communities, thus legitimizing them, even though they fall outside of the planned community; or to ignore them, thus depriving them of needed social amenities.

- C. **Housing:** Although the supply of housing in Tunisia has grown and the housing stock has improved significantly during the last 15 years (some sources report an overall excess of housing stock), this supply has not increased equally for all socio-economic groups of the population. The poorer segments still suffer from a housing shortage. Another important housing factor relating to sanitation is housing density; urban areas, with their rapid growth in population, are becoming more dense.

- D. **Economic Development:** The Tunisian economy has performed well over the last 15 years, although as mentioned above, the current Government feels that certain structural reforms will improve economic performance. Tunisia's economic progress has been due largely to its development of tourism and manufacturing. As these industries have grown, so has the need for modern sanitation. To a large degree the Government's sanitation policy has been driven by the need to continue an expansion in these productive sectors. Sewage systems have been built primarily along the coastal regions, particularly the east coast where both tourism and manufacturing are noteworthy.

The policies of sectors closely related to sanitation directly affect both the supply of and demand for sanitation services.

2.1.1 The Housing Sector

Housing sector policy in relation to sanitation services can be characterized as follows:

- to encourage the production of low-income housing;
- to increase the density of new housing developments to use increasingly scarce land more efficiently;
- to lower the standards of housing construction--including sanitation--without compromising quality in order to use State resources more efficiently;
- similarly, to lower standards in rehabilitation projects;
- to encourage increased cost recovery, particularly in rehabilitation projects;

- to encourage private sector involvement in housing and at the same time to reduce the financial contribution of the State.

Such policies, where not only standards will be lowered but individuals required to pay an increasing proportion of costs, clearly indicate the need for alternative, appropriate sanitation technologies.

2.1.2 Regional Planning

Regional planning policy has the following major elements:

- to redress the population imbalance in the country and to encourage growth in areas other than on the coast;
- to encourage rational urban growth through the development of comprehensive municipal development plans.

The impact of these policies on the provision of sanitation services will not be immediate. As and when such changes in population and regional settlement patterns occur, the provision of sanitation services will have to follow.

2.1.3 Tourism and Industrial Development

Tourism and industrial development, as mentioned above, are key elements in the Government of Tunisia's overall economic development plan. As such, policies relating to these sectors will have a major impact on sanitation. The growth in both tourism and manufacturing clearly demand adequate sanitation not only for industrial and tourism parks, but in surrounding neighborhoods as well. In most cases, this means traditional sewerage systems, although in some areas, such as those in more remote regions (desert tourism, for example), alternative sanitation systems should be considered. In other areas, where, for example, industrial parks can be isolated, costs can be reduced by constructing sewer systems for the industrial park while considering other, less costly solutions for residential areas.

2.1.4 The Water Sector

Water sector policy has, of course, a direct bearing on sanitation. The current policy of SONEDE, the national water supply agency of the Tunisian Government, is to provide a household connection to all Tunisian families. With already high rates of household connections and expected continuing rates of expansion both in urban and rural areas, significant investment and a rapid rate of growth of sanitary facilities will be required to keep up with water supply. Unless sanitation services increase at a rapid rate, communities will suffer from inadequate wastewater disposal.

2.1.5 Health and the Environment

Health and environment policy are geared towards the protection of the individual from the noxious effects of human and industrial waste. Government agencies responsible for both public health and the environment are charged with identifying situations of risk to the individual--whether it be unhealthy levels of chemical discharge or pathogens from human waste. As such, the execution of this policy is crucial to the sanitation sector: vigorous prosecution of violators of human waste and industrial pollution is necessary to provide an impetus to sanitation reform.

2.1.6 Agriculture

Agriculture policy has a direct bearing on sanitation policy, for the Ministry of Agriculture wishes to increasingly use treated wastewater for irrigation purposes. There are already zones of the country where such wastewater has been used for fruit crops (see Case Study on Soukra/Choutrana, below).

2.1.7 The Sanitation Sector

The policy of the sanitation sector has the following elements:

- to provide sanitation services to all those families who have received a potable water supply;
- to protect all surface and subterranean water sources from untreated or poorly-treated wastewater disposal;
- to make use of wastewater, where feasible, for agriculture irrigation purposes.

In order to achieve these global objectives, the Government has established a number of more specific goals:

- to utilize appropriate technologies, particularly those which can be constructed and maintained locally;
- to strengthen institutional capacity throughout the sector;
- to reduce state subsidies and to increase the contribution of municipalities and private citizens, particularly with regard to the operation and maintenance of sanitation systems.

2.2 Coverage Strategy

2.2.1 Background

In 1974 ONAS was created for the following reasons: (1) the rapid increase in the volume of wastewater in residential, tourist, and industrial areas; (2) the health risks posed to the tourist industry because of poor environmental sanitation and hygiene; and (3) an increasing demand from the citizenry for a pollution-free environment.

ONAS was directed to intervene in urban areas, focusing on tourist areas, large urban areas, industrial zones, and the towns near the Oued Medjerda watershed.

At the present time ONAS has taken responsibility for the construction and operation of sewer systems in 49 of the 256 municipalities in the country. The rate of coverage by such systems is approximately 43 percent, with an additional 7 percent coverage added by municipal works. Approximately 1,363,000 people are served through these sewage systems.

ONAS intervention, therefore, is primarily in large towns, with populations of 20,000 or more (35 out of 69 municipalities), and/or in towns with a major tourist or manufacturing industry.

ONAS, however, has relied exclusively on municipal sewerage systems for waste disposal. Not only has it done so in the 49 municipalities for which it has taken responsibility, but it has only considered conventional sewerage in the 105 towns for which it has carried out a sanitation plan (Plan Directeur d'Assainissement). Thus, in both planning and execution, it has, until now, focused exclusively on traditional sewerage.

Towns for which ONAS has prepared a sanitation plan, however, cannot be sure whether they will in fact receive a sewer system. Since ONAS' intervention depends entirely on the availability of State resources--which, in turn, are dependent on the availability of international as well as domestic financing--it has been reluctant to advise municipalities of their likelihood of receiving a sewer system.

Lastly, although alternative technologies are in use in Tunisia, ONAS--because of its focus on sewerage--has not developed norms for them. As a result standards to govern the placement and construction of alternative systems do not exist. Alternative sanitation technologies are frequently considered temporary solutions--stop-gap measures until sewer systems are built--and not worth the investment in necessary research and development.

Few municipalities, therefore, know whether or not they will get a sewer system. In addition, there is currently no Government financial support for alternative sanitation systems nor any institution responsible for their development (see discussion below of institutional, legislative, and financial framework). Thus, despite the desirability of applying alternative technologies, there are currently few financial, legislative, or financial mechanisms for facilitating the process.

Those private sector entrepreneurs--either large land or housing developers or small-scale masons--who do install alternative sanitation systems, are not guided by any Government norms, are not subject to any State supervision, do not always install them correctly or with due consideration to environmental pollution or to functioning. As a result, costs of maintaining or operating them are often high while quality is poor. Improperly-built or -installed pits or septic tanks, for example, often require more frequent emptying.

Following are the areas of primary interest for ONAS, in order of priority:

- (a) coastal tourist areas (Grand Tunis, Hammamet, Nabeul, Sousse, Monastir, Djerba, and the Saharan region);
- (b) major metropolitan areas (Tunis, Sousse, Sfax, Gabes, etc.);
- (c) industrial areas;
- (d) towns in the Medjerda watershed area; and
- (e) poor urban areas.

These priorities should be respected in executing a national strategy.

The following criteria will be applied to determine the degree of intervention of ONAS:

- the volume of wastewater produced;
- housing density;
- economic importance of the city--the greater the economic importance, the higher the priority for intervention;
- health status--the endemicity of diseases linked with poor sanitation will be a major criterion for intervention;
- environmental impact of wastewater;
- difficulty of providing service; those areas particularly difficult to serve (given topographic, geologic, hydrologic, financial, or economic constraints) will be of a lower priority than those with fewer such constraints.

Within these priority areas, the following criteria will govern the type of sanitation system to be constructed or installed:

- in residential areas where housing density is higher than 20 dwellings per hectare or where the consumption of water is more than 30 cubic meters per trimester, a sewage system will be installed;
- where housing density is 20 dwellings per hectare or less, individual systems will be built;
- studies of local soil conditions will further indicate the type of waste disposal system to be used;
- feasibility studies will further refine the designation of sanitation technology.

ONAS will operate (i.e., construct and maintain sewage systems) in urban areas of 2,000 inhabitants or more, with a priority, as mentioned above, of towns with inhabitants of 20,000 or more. Towns of 2,000 inhabitants or less will be responsible for their own sanitation system, whether constructed by the municipality or by individual householders.

In areas designated for alternative sanitation systems, the choice of technology will be based on population density, soil conditions, proximity to water sources, household water consumption, ability to pay, and so on.

2.2.2 Strategy

The principal coverage objective is to ensure that an adequate sewage disposal system will be installed in every house in Tunisia which is connected to a piped water supply system. In order to achieve this objective, the following actions are recommended.

- In residential areas where housing density is higher than 20 dwellings per hectare or where water consumption is higher than 30 cubic meters per semester, public sewers are to be considered for installation.
- Where housing density is 20 dwellings per hectare or less, individual systems are to be considered.
- Develop for each region appropriate soil maps which should be in conformity for land use plans and ONAS master plans. Such maps will define soil characteristics and types of sanitation systems which are possible.

- Feasibility studies undertaken for sanitation projects should refine the designation of sanitation technology. Appropriate technologies should be defined for each project area.
- ONAS will assume responsibility for sewage disposal systems development for all urban areas of 2,000 inhabitants or more. However, it is called to assume management responsibility in the larger-sized communes with 20,000 inhabitants or more.
- Towns with fewer than 2,000 inhabitants will be the responsibility of local authorities (Municipal or Governorate Council services), and/or the individual.
- Ensure that sewage is properly treated using technologies which are appropriate to Tunisia. Effluents should meet national hygiene and environmental standards.
- Promote rural sanitation by requiring that all water supply projects include a sanitation component.

2.3 Supporting Elements

2.3.1 Technology Choice and Operations and Maintenance

Presently, sewage disposal in Tunisia is done through public sewerage systems with or without final treatment prior to disposal, and autonomous sewage disposal systems. Tunisia manufactures all sewer parts including sewer pipes of all kinds (PVC, concrete, asbestos) and sewer appurtenances (connection boxes, manhole covers, etc.). Thus, sewage collection systems are piped systems. Sewage disposal technologies are dilution, primary treatment units (sedimentation and digestion), and secondary units (sedimentation, digestion, and biological). The types of technologies used for public systems are stabilization ponds, aerated ponds, activated sludge plants, and trickling filter plants. For autonomous systems septic tanks, leach fields and/or cesspools are used.

Principal problems related to technologies and operations and maintenance are:

- lack of regulations and norms for all types of technologies;
- lack of basic knowledge and skills for alternative systems design, construction, operations, and maintenance;
- lack of research to determine the appropriateness of locally available technologies, and to adapt proven technologies from one part of the country to others; and
- high costs of sewage systems construction, operation, and maintenance.

Thus, GOT's objective is to give preference to affordable sanitation systems which can be properly constructed, operated, and maintained using primarily locally available resources (human and material). These specific actions are recommended:

- Select collective sanitation systems which are satisfactory to Tunisia. The choice is to be dictated by technical and economic factors. Among the technologies which are appropriate for Tunisia are proper dilution of sewage, sub-soil percolation, sedimentation and liquefaction, lagooning, and biological processes.
- Require individual systems for houses not served by a collective sewerage system. Types of systems are sub-soil percolation, sedimentation and liquefaction, and stabilization ponds.
- Adopt recommended technical norms and regulations for systems design, construction, operations, and maintenance.
- Utilize systems which allow the recovery of treated waters for agricultural purposes.
- Establish selection criteria for appropriate sewage disposal technologies in Tunisia.
- Select technologies which use local resources.
- Establish soil absorption capacity maps at 1/50,000 scale to support regional planning, and 1/10,000 or 1/5,000 to support planning at communal level.
- Ensure final disposal services availability for autonomous systems either through private services or municipal/governorate services. Municipalities must ensure proper sanitary discharge stations for hauled material.
- For communities not served by sludge-hauling services and discharge stations, specific points of discharge will need to be established and controlled by the municipality's hygiene service.
- Applied sewage technologies will be progressively evaluated and monitored in order to better adapt them to the realities of the country.

2.3.2 Institutional Development

As mentioned above, ONAS was created in 1974 in response to the increasing demand for sanitation services. ONAS, operating only in urban areas and constructing only conventional sewer systems, is responsible for the following functions:

- Preparing sanitation (sewerage) plans. Plans have been completed for 105 out of the 256 municipal areas in the country.
- Constructing sewer systems in selected municipalities (49 out of 256). Most of these municipalities have been chosen because of their priority status--they are in tourist or industrial areas, major metropolitan areas, or in the watershed area of Medjerda. Few have been chosen because of their disadvantaged status.
- Operation and maintenance of these systems.

Based on rates of population coverage, approximately 85 percent of the sewer systems operating in the country are those of ONAS. Individual municipal systems account for the remainder.

Public land and housing developers (e.g., the national housing authority--SNIT, Agence Foncière de l'Habitat--AFH, Agence Foncière de Tourism--AFT, Agence Foncière Immobilière--AFI, and the Société pour la Promotion du Logement Social--SPROLS) and private housing developers participate in the construction of conventional sewer systems, building the secondary and tertiary (household connections) systems, while ONAS (or the municipality in rare cases) takes responsibility for the primary system, treatment, and final disposal.

Institutional problems have been the following:

- Although ONAS has clearly set forth a policy concerning priority areas for sewerage, it has not specified which towns will be covered in the future. That is, once the most important towns in each priority category have been served, it is not known which towns of secondary or tertiary priority will be served next. Because of this lack of specificity, municipalities--particularly those which have a completed sanitation plan--assume they will get a sewer system, but have little idea when. As a result, commonly no municipal sanitation system of any sort is constructed.
- ONAS has indicated in the municipal sanitation plans which zones of each city will be served by sewer lines. However, the criteria for selection of such *pointes noires* have not been made clear. Therefore, there is no way of knowing

whether or not alternative, appropriate systems could be considered.

- There is no one agency or any division or section of ONAS which is specifically concerned with alternative sanitation solutions. As a result, there is no Government advocate for such solutions, no institution which can provide sanitation planning for both the towns to be served with sewers but which have large sections unserved and for the towns which will never receive sewer systems. As a result, the construction of semi-public or individual sanitation systems is done without guidance or established norms, Government quality control or supervision, or technical assistance.

The strategy recommended is to establish an institutional framework which will appropriately and rationally manage sewage disposal in Tunisia. Specifically, the following institutional roles and responsibilities are recommended:

- Give ONAS responsibility to establish technical norms for designing and constructing public systems, preparing sewage master plans and technical studies for communities of 2,000 inh. or more, managing construction for all public systems either directly or through contractual arrangements, and managing operations and maintenance of public sewage systems in communes of 20,000 inh. or more.
- Local public services (Municipal or Governorate) are to be responsible for managing sewage disposal systems for communes of less than 20,000 inh. They should also be responsible for technical studies and construction management of systems in communes of less than 2,000 inh.
- Public hygiene norms and regulations should be developed and enforced by the Ministry of Health's Department of Environmental Health, and environmental standards and regulations should be developed and enforced by the National Environmental Protection Agency.
- Private sector should be used as contractors for all types of services (e.g., design, construction, operations and maintenance) directly by government services such as ONAS and local services, and by the private sector.

An institutional study should be conducted to define required interventions in order to reinforce institutions to fulfill the roles and responsibilities proposed. The study should define structural changes, functions, implementation plans and schedules, and required resources.

2.3.3 Finance

Funds for the construction or rehabilitation of sewer systems currently come from three sources: (a) the State (45 percent); (b) foreign loans (52 percent); and (c) contributions from individuals or cash flow transfers from funds originally collected for operations and maintenance.

Funds for operations and maintenance come from fees charged to individuals, which are collected by SONEDE.

There are a number of problems with the present system:

1. Sewer systems are built based on the availability of funds. That is, as mentioned above, no advance financial planning can be done in order to determine how many towns will receive a sewer system over a particular time period.
2. No financing is requested from international donors for alternative sewer systems.
3. Individuals pay 20 Dinars (1 Dinar = \$2.50 U.S.) per linear meter of housing facade as a contribution to the construction of sewer systems. This amount is being reduced to 12 Dinars per linear meter because according to MOPWH consumers are unable to pay. Although GOT hoped that the reduction will increase the number of sewer connections, it is anticipated that the across-the-board reduction will result in fewer total revenues at a time when government subsidies are being reduced.

The following strategy is recommended:

1. GOT is to give more importance to the development of alternative sanitation systems. This is to be done by providing subsidies to the development of these systems.
2. Encourage public acceptance of alternative systems by promoting their efficiency in terms of construction and O&M costs in particular.
3. Sensitize international donors in funding alternative sewage systems as a component of all sanitation projects.
4. Obtain maximum possible participation of local governments and the private sector in financing local and/or individual sewage disposal systems.

5. Seek to recover operating and maintenance costs by applying adequate service charges to include technical assistance charges rendered to private entities.
6. Encourage small businesses to develop the capability to service the sector. This will require government to develop special small business loan programs to promote their development and sustainability.
7. Provide custom duties and tax exoneration on essential sector equipment which are not manufactured in Tunisia. Such exoneration should cover ONAS, the Technical Public Services (Municipal and Governorate), and registered private sanitation firms.
8. Conduct a sector financing study to establish levels and methods of government subsidies for supporting all types of sewage disposal systems, to develop costs recovery mechanisms, and the development of a loan program for small businesses which are operating in the sector.

2.3.4 Legislation

There are currently no norms concerning the design, construction, and operation and maintenance of alternative sanitation systems. As a result such systems often fail or are more expensive to build and to maintain than properly and appropriately built systems.

ONAS should develop such norms.

2.3.5 Human Resource Development

Other than at ONAS, personnel trained in sanitary engineering or other related disciplines are rare in the sector. The situation in related sectors is similar--with the exception of the Office of Environmental Protection.

In the private sector, there are many consulting firms whose professionals have a background in sanitary engineering. However, their experience with and knowledge about alternative sanitation options is limited.

In terms of education, there are no university degrees offered in sanitary engineering in Tunisia. There are, however, courses for lower-level technicians in sanitation. These technicians do receive training in appropriate sanitation technologies.

In summary, there exist few higher-level personnel experienced in the design and implementation of alternative sanitary systems. Those that have been trained lack the supervision and control to ensure the discipline and adherence to standards that have been developed.

The human resource development strategy, then, should be to:

1. Develop an educational and promotional campaign focused on alternative sanitation technologies for both public and private sanitation professionals using workshops, conferences, and seminars.
2. Inform the higher-level academic institutions about the importance of including alternative sanitation systems in their curricula.
3. Develop a similar promotional campaign and educational reform for technicians.
4. Promote the teaching of alternative sanitation technologies in schools of engineering and architecture.
5. Develop technical guides and other instructional material for all levels of professionals and technicians.

2.3.6 Applied Research

Up to the present time little applied research has been carried out on appropriate, alternative sanitation systems despite their widespread use in the country. Higher-level academic institutions could study the variety of technologies available--from the semi-public systems (land developments in which an internal piped system is connected to a large septic tank) constructed both by private and public developers to the individual pit latrines and septic tanks used by individual families.

The applied research strategy, then, should be as follows:

1. Encourage higher-level training institutions and research institutes to undertake applied research in sanitation technology in order to better determine the appropriateness (from a technical, economic, and social point of view) of different sanitation technologies.
2. Encourage training and research institutions to develop collaborative projects in the areas of applied sanitation technology.
3. Make public sector agencies aware of the importance of research in the establishment of norms and the continual modification of those norms, given new information.

2.3.7 Community Participation

Although the scope for community participation in the sanitation sector is wide, few communities have organized themselves for collective action and few non-governmental organizations (NGOs) have taken any initiative in this area. In fact, of the 58 NGOs existing in the country, only 4 have shown an interest in sanitation.

Environmental conditions in many of the squatter settlements, for example, are poor. There is often no drainage, no solid waste disposal, and poor disposal of human waste. Although the State has a responsibility for the provision of adequate social services to these areas just as it does for better-off areas, the community also has a role in improving its own conditions.

Populations of large residential buildings are in themselves communities. They could organize to demand better service from landlords or from property managers.

Since ONAS is many steps removed from the municipality level, community residents often feel they have little recourse if they have problems with their sanitation system. Better community organization could help to redress existing problems.

No governmental organization has taken any responsibility for community-related activities for sanitation. Few governmental organizations have any experience with sanitation-related community development and participation. Only the Ministry of Health has such experience, but it is limited to the rural areas.

The community participation strategy, therefore, should be:

1. Encourage all major institutional actors in the sector to develop community-based programs to increase the participation of the community in waste disposal.
2. Develop promotional information about alternative sanitation systems in order to provide local communities with the knowledge necessary to effect change.
3. Promote the participation of NGOs--both national and local--in the development of alternative sanitary systems for local communities.

2.4 Case Studies

Three sanitation case studies were done by WASH team members and their Tunisian counterparts during the visit to Tunisia. The purpose of the case studies was to study ways in which different technical solutions--proposed in the draft strategy--could be applied to the widely different physical conditions across the country. These case studies are considered preliminary because they provide background information to be used in more detailed studies to be carried out at a later date. These cases are typical of situations found in Tunisia.

2.4.1 Soukra/Choutrana

Soukra/Choutrana is situated in the Soukra plain near Tunis. It is characterized by its proximity to Lake Tunis and by its situation over a large water table very close to the surface.

Soukra/Choutrana is an agricultural area which has become rapidly urbanized. Despite Government attempts to control this urbanization, the area has been increasingly built up with many new residential dwellings of various types. Its present population is estimated at 40,000.

Because of the high water table, rapid urbanization and consequent high levels of water consumption, the proximity to Lake Tunis, the use of treated wastewater for irrigation (processed by ONAS and sold to the community), and a high yearly rainfall, the area is subject to flooding. The last major flood in 1982 severely damaged crops and orchards. In addition to the severe flooding, even minor flooding releases pathogens into the environment, because of inadequate or insufficient sanitation. No sewer system has been constructed, and the most common form of sanitation is the simple pit latrine or septic tank. These systems overflow when there is heavy rain.

It appears that the most appropriate sanitation solution for the zone is constructing a permanent drainage system and installing a sanitation system comprised of both a conventional ONAS sewer system, adapted especially to the zone, and alternative systems.

It is recommended, therefore, that:

1. A detailed evaluation be made of the zone to define the major determinants of the flooding problems (i.e., which of the many factors indicated above contribute most to the environmental hazards) and to propose specific solutions.
2. A sanitation plan for the zone be developed based on item 1 which details the installation of both conventional and alternative sanitation systems.
3. Emergency measures be taken to facilitate wastewater removal from those neighborhoods of particularly high risk.

2.4.2 Bou Argoub

Bou Argoub is a small town (*commune*), typical of many found in Tunisia. It is comprised of 10,000 inhabitants of which more than 4,000 are located in the center of the town. Noteworthy also are two housing developments, one by SMT and the other by SPROLS, both designed for low-income use. The town is characterized by the presence of an industrial park where the majority of the 34 industries within municipal limits are located. Many of these industries are classified as noxious and include an oil refinery, a tannery, and a battery factory.

Sanitation is carried out in a variety of ways. Most of the residences have simple pit latrines, including the SNIT development. The SPROLS development, not yet occupied, is equipped with a semi-public system whereby individual residences are connected to a piped system which empties without treatment via a municipal connector into a nearby *oued*. The industries in the industrial park remove their wastes through another municipal connector, emptying them without treatment directly into the same *oued*.

The municipality has studied the possibility of constructing a sewer system which would connect the majority of residences and industries in the city center to a sewer line which would carry wastes five kilometers away from the city, past the *oued*. This solution would simply transfer the problem to other communes.

It is recommended that all residences and commercial and industrial establishments in the center of the town be connected to a sewer line, but that all wastes be treated before discharge into the *oued*. It is also recommended that wastes coming from the industrial park also be treated before discharge into the *oued* by the same treatment plant to be built for residential wastes. Residences in less densely populated areas should be served by individual sanitary systems. Specifically, it is recommended that:

1. Prepare a sanitation plan for the municipality immediately.
2. Conduct a special study on the quantity and quality of industrial wastes in order to determine how these wastes should be treated.
3. Construct a sewage treatment plant with the possibility of both underground discharge and discharge into the *oued* of treated wastes.
4. Promote individual sanitation systems for residential areas, and designs and technical plans be provided for owners.
5. Develop the technical capacity of the municipality to enable it to better operate and maintain the system.

2.4.3 Bou Fichta

Bou Fichta is a municipality with a population of 10,000 but it has a distinctly rural character. It is not unlike many such small municipalities in the country.

Despite its small size, it has a densely populated town center. This center, in addition to residential dwellings, also has commercial establishments such as restaurants, a gas station, etc. An industrial zone is planned near the commercial area of the town.

Approximately two kilometers from the town center both SNIT and AFH have developed land. The SNIT dwellings are inhabited, while those of AFH are not yet ready.

In terms of sanitation, the town center is served by a small collector (20 dwellings connected) which discharges the untreated waste into the *oned* 500 meters from the center. All other dwellings are served by individual sanitation systems, most often pit latrines.

Because of the high water table in the center of the town (one to two meters deep), the municipality has permitted the owners of most of the soakage pits to construct them under the roadway. The municipality, however, does not allow for the discharge of gray water into the street. Thus, the soakage pits fill up quickly, requiring frequent and costly emptying. This problem is made worse by the density of the soil which is made up of clay. Because of the residential density of the zone, the current situation is untenable.

In the area of the SNIT and AFH land developments, the water table is lower (five meters). SNIT, therefore, has constructed a pit latrine within the residential property. AFH has planned for a semi-public sanitation system with septic tanks and a well. Although the septic tanks have been designed properly, the well has not, and the risk of pollution is great.

It is recommended, therefore, that:

1. On the basis of the town plan for the municipality, a sanitation plan be prepared as soon as possible.
2. A sewer system serving both the downtown and outlying SNIT and AFH developments be constructed.
3. All commercial establishments along the major highway (GP 1) obtain proper waste disposal equipment .
4. A study be made of the final waste discharge of the septic tanks (for the sewer system in item 2) and an assessment done of the feasibility of constructing leaching fields for them.
5. The human resources of the municipality be strengthened to enable it to better plan, operate, and maintain its sanitation systems.

2.5 National Sanitation Strategy Development Timetable

2.5.1 Step 1: Official Document Review

Once the draft strategy document has been sent to the MOPWH, it will be sent for review to high-level officials of all interested Government ministries which are likely to participate in its execution (e.g., ONAS, Office of Municipal Administration of the Ministry of the Interior).

2.5.2 Step 2: Finalization of the National Strategy

After submitting the draft document to the government officials, a National Commission on Sanitation Strategy, comprised of these officials, will be convened to finalize the strategy.

Three important decisions are expected from this meeting: (1) an acceptance of alternative sanitation solutions as important and equal elements in overall delivery of sewer and sanitation services; (2) an acceptance or modification of the various elements of the strategy presented in the document; and (3) a proposal for further studies to refine the strategy. Such studies should include institutional issues, finance, legislation, and the development of a plan in each of these areas.

2.5.3 Step 3: National Sanitation Seminar

A three-day seminar should be held to (1) inform professionals--engineers, architects, city planners, and others--about alternative sanitation technologies, their potential application, constraints to this application, costs, and institutional implications; and (2) provide a forum to discuss in detail the technical specifications and considerations of the various alternative systems.

The following timetable is proposed:

- | | | |
|----|--|-----------------------|
| 1. | Finalization of the draft strategy by WASH | July 1989 |
| 2. | Deliberation by Tunisian officials | September 1989 |
| 3. | Selection of a Seminar Committee | September 1989 |
| 4. | Preparation of the Seminar | Sept. - November 1989 |
| 5. | Seminar | December 1989 |
| 6. | Institutional Study | December 1989 |
| 7. | Financial Study | December 1989 |
| 8. | Legislative Study | December 1989 |
| 9. | Preparation of National Action Plan | January 1990 |

Chapter 3

PROPOSED PHASE III: NATIONAL SANITATION SEMINAR

As stated in Chapter 2, the purpose of the national seminar is to provide information about alternative sanitation technologies to interested public and private professionals in Tunisia. As has also been stated, although these technologies are widespread in Tunisia, little professional literature or training has been available concerning their design and particularly their installation, given soil, water, and other conditions. The seminar will explore these technical issues and promote the technologies as viable alternatives to conventional sewerage.

3.1 Proposed National Seminar Organization Plan

3.1.1 Timetable

(1) Program design	September 1989
(2) Recruitment of faculty	October 1989
(3) Arrange site and logistics	October - November 1989
(4) Invite participants	October - November 1989
(5) Hold seminar	December 1989

3.1.2 Program

The program will have two parts: the first will consist of a *Journée d'Information* or General Information Session where promotional information about alternative sanitation systems will be presented. The focus of this session will be on alternative solutions as viable alternatives--from the point of view of technology, service, cost, and finance--to conventional sewerage.

The second session will be in the form of work groups and will be largely technical. Its purpose will be to discuss in detail the design and application of alternative sanitation systems.

3.1.3 Participants

The participants will be non-technicians interested in the application of alternative sanitation technologies from a planning, policy, economic, or financial point of view; and engineers, architects, and other technicians interested in the technical specifications and aspects of these technologies.

Participants will come from Government ministries, educational institutions, and the private sector.

3.1.4 Seminar Planning and Organization

The seminar will be planned and organized by a Seminar Organization Committee selected by the MOPWH.

3.2 Proposed RHUDO/WASH Assistance to National Seminar

3.2.1 RHUDO/WASH Technical Services Scope of Work

In order to organize and deliver the proposed seminar, the Ministry of Equipment and Housing will need the full support of RHUDO. This support should entail at least the following:

Seminar Planning and Organization

The conduct of the seminar/workshop must be carefully planned and managed in order to meet the objectives of the conference and the expectation of its attendants. To this end, it is proposed that RHUDO provide the services of its newly-hired Training Advisor.

RHUDO's Training Advisor should work closely with the proposed Tunisian National Conference Organization Committee which has been proposed earlier. It is proposed that the Ministry of Equipment and Housing be requested to provide a counterpart to the Training Advisor in order to begin the process of developing a training specialist for the Ministry or ONAS. WASH is also available to assist RHUDO with the planning and organization of the conference.

Planning the technical aspect of the seminar will require WASH support, primarily in the planning of the content and delivery of the proposed two-day workshop on alternative disposal methods design, construction, operation, and maintenance.

Seminar Delivery

WASH assistance is recommended in the delivery of the seminar. Specifically, WASH will need to provide the services of the team's sanitary engineer and a workshop facilitator who will be responsible for organizing and conducting the two-day technical workshop. It is also recommended that RHUDO provide the support of the hydrology engineer on the team to assist with the delivery of the workshop. The sanitary engineer will also need to assist in developing the workshop program, identifying and recruiting presenters, and preparing reference material. This process should start as early as possible.

3.2.2 Other Assistance

The process of national strategy implementation will begin with this seminar/workshop. To this end, it will be necessary to provide the professional engineers, architects, and technicians from all sectors with the necessary knowledge, skills, and information to design and manage construction, operation, and maintenance of alternative systems.

Three housing development sites around Tunis (within a 30 kilometer radius) which need alternative sewage disposal methods should be chosen and used as experimental areas for the workshop. Specifically, the sites would be investigated and appropriate systems would be designed according to soil tests. This would require taking participants into the field to conduct soil tests. These participants will be divided into three groups to design the systems. It would also require adequate testing of the sites prior to the workshop.

The sanitary engineer and workshop facilitator would need to manage all aspects of this undertaking.

3.2.3 Time Requirement for RHUDO/WASH Technical Support

A. Sanitary Engineer (WASH)

Assistance with Conference Planning	2 weeks
Conference Delivery	1 week
Pre-Conference design work on 3 sites	1 week
Post-Conference Reports preparation	<u>2 weeks</u>
Total	6 weeks

B. Workshop Facilitator (WASH)

Planning - U.S.	1 week
Conference Planning	1 week
Conference Delivery	<u>1 week</u>
Total	3 weeks

C. Hydrology Engineer (RHUDO)

Assistance with Conference Planning	1 week
Conference Delivery	<u>1 week</u>
Total	2 weeks

Chapter 4

CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

The objectives of Phase II of this assignment have been achieved. Specifically, on behalf of RHUDO, WASH provided the required team of experts except the hydrology engineer, who was hired directly by RHUDO but was an integral member of the WASH team. The Ministry of Equipment and Housing selected a very good team of professionals for the National Technical Committee. This committee was given the mandate to prepare, with the WASH team's assistance, the Draft National Sewage Disposal Strategy. Finally, the entire team (national committee and WASH team members) was able to carry out a broad analysis of the sector and interrelated sectors and allowed the team to formulate the draft strategies within the prescribed three-week period.

The proposed strategies contained in the draft document have been carefully planned to address current and anticipated problems associated with the management of sewage disposal in Tunisia. It is expected that, over time, the proposed strategies will continue to be fine-tuned and expanded to respond to a changing environment. This draft document provides the Government of Tunisia with the necessary vehicle to start putting in place the framework for addressing the short- and long-term problems and issues associated with sewage disposal in the country.

The process used to formulate this national sewage disposal strategy document was quite successful. It provided the opportunity for Tunisian professionals to participate fully in the policy/strategy planning process from the outset while developing a core of national experts who could be depended upon to serve as the promoters and monitors of the application of these strategies.

It should be noted that the process did meet with some minor problems. Some of the members of the national committee, because of their job requirements, were not available at times during the three weeks. However, this is considered a normal occurrence in a process where service or division directors from different Government agencies are called upon to perform such work over a relatively long period of time. However, this problem was outweighed by the learning process which took place among the team members, primarily on strategy planning and alternative sewage disposal. Most important, the national sewage disposal strategy document is a Tunisian one.

Finally, it was clear that RHUDO's assistance has been tremendously valuable in providing the Government of Tunisia with the opportunity to address problems and constraints posed by sewage disposal management in urban development and low-cost housing development. RHUDO's active role in guiding the process has made it possible for the process to be a success.

4.2

Recommendations

While a draft national sewage disposal strategy has been prepared and officially submitted to the Ministry of Equipment and Housing, the process has just begun. The development of a successful national strategy requires that adequate discussion take place among agencies which are directly interested in sewage disposal management in order to provide feedback on the draft document and promote its adoption as a national document.

The national strategy will then need to gain approval and support for implementation. It will also need the support of professionals and technicians involved in sewage disposal management. Finally, the national strategy should result in the development of a national sewage disposal program. The resulting national program will have to be carefully planned, implemented, and managed.

In order to ensure that this process is as effective and efficient as possible, the following recommendations are made:

1. The proposed time schedule for putting in place or establishing the national strategies will need to be respected in order that a full national sewage disposal program based on these strategies be considered in the next five-year plan (1992-1996).
2. The seminar should take place within the next three months in order to maintain momentum. The value of these strategies can best be promoted within the Government of Tunisia through field implementation of model projects. Thus, the seminar will provide an opportunity to develop an understanding of the strategies as well as the required knowledge and skills from professionals and technicians.
3. The Government will need to mandate the essential institutional, legislative, and financial studies called for in the strategy document. These are necessary to provide the framework for implementing the strategies.
4. It is essential that model or pilot projects be established in order to adapt alternative technologies to regional and local situations. To this end, the three case studies (Soukra/Choutrana, Bou Argoub, Bou Fichta) present special opportunities to begin this process. These and others should be selected and funded as pilot projects. The participation of the higher educational institutions in Tunisia is essential.
5. RHUDO should give consideration to extending its support to the entire process. Its continued guidance and technical support are viewed as essential to the success of this process.

Appendix A

SCOPE OF WORK

Appendix A

SCOPE OF WORK

Tunisia: REUDO Study on Alternative Low Cost Sewage Disposal Methods

Background and Objectives

Unlike many other countries, in Tunisia there is no national combined water and sewer authority. There is a national water authority, SONEDE, which provides water service to both urban and rural areas. However, the major sewer authority, ONAS, only has legal jurisdiction to operate within legislatively mandated boundaries within certain primary and secondary cities.

Outside these boundaries, the institutional responsibilities for sewer installation and maintenance are not clear nor are there norms of systematic approaches to sewage disposal. Sewer collection systems, septic tanks and other sewage disposal systems are currently being built with no specific attention to possible future hygiene and contamination problems and with no special attention to the operation and maintenance of the system.

The objectives of this study are to examine alternatives for sewage disposal in areas not covered by ONAS, to select appropriate sewage disposal methods and to set forth a strategy to promulgate and implement the selected alternative sewage disposal methods.

Statement of Work

The study will be conducted in two separate, but interrelated phases:

Phase I: The contractor will undertake a diagnostic study of the sewer alternatives in use in Tunisia outside the service area of ONAS. On the basis of this diagnosis and other available information such as soil maps, water maps, water consumption statistics, etc., the contractor will recommend low cost alternative sewage disposal methods suitable under different environmental conditions in the various areas of the country which are not currently served by ONAS.

The purpose of this first phase is to start an interactive process with the Tunisian authorities.

To the extent possible, the contractor is to provide preliminary information and suggestions in support of the proposed alternative sewage disposal methods. Such information is intended to assist the Tunisian authorities in weighing the costs and benefits of the various alternatives.

Finally, the contractor, in consultation with RHUDO and the Tunisian authorities, will help to refine and detail the scope of work for the second phase of activities, which is outlined below. The contractor should also recommend specific qualified individuals to carry out the second phase of this program.

The level of effort for Phase I of this study is estimated to be 3 person weeks.

Phase II: The second phase is to begin after the Tunisian authorities have had the opportunity to review the recommendations provided in Phase I. The Ministry of Public Works and Housing will assign experts to work collaboratively with the contractor's team. The team and the Tunisian experts will develop the details of the various alternative sewage disposal methods so that a final selection of preferred methods (under varying circumstances) can be made. Based upon the information developed, the preferred alternatives will be selected.

The team, working collaboratively with the Tunisian experts, will then help to develop a detailed strategy to promulgate and implement the selected alternatives. This detailed strategy should include plans for developing technical specifications, norms and standards, institutional roles, public acceptance and educational programs, operations and maintenance considerations and cost recovery methodologies.

During Phase II, the team will conduct a workshop to present the various alternatives to a wider group of concerned Tunisian professionals.

The level of effort for Phase II of this study is estimated to be 9 person weeks.

Reports

The work is to commence on or about 19 September 1988 and is to be completed on or about 15 January 1989.

First Phase - At the end of the first phase, the contractor is to submit a report summarizing its findings and recommendations. The report shall be prepared in the French language. Ten copies shall be provided to RHUDO/NENA for distributions to the Ministry of Public Works and Housing and to other interested parties. The report (in French) should be sent to RHUDO/NENA within 15 days of the team's return to the U.S. A draft of the report (in English) should be provided to RHUDO/NENA prior to the consultant's departure from Tunis.

Second Phase - At the end of the second phase, the contractor is to submit a report which includes summary information on each of the sewage disposal methods considered and explains the rationale for choosing the selected alternatives. The report shall also present the full detailed strategy, outlining the steps to promulgate and implement the selected sewage disposal methods. The report shall be prepared in the French language. Ten copies shall be provided to RHUDO/NENA for distribution to the Ministry of Public Works and Housing and to other interested parties. The report should be sent to RHUDO within 15 days of the team's return to the U.S.

Together with this report, the contractor shall provide prototypical sets of regulations, norms, standards, manuals, handbooks, technical drawings, administrative notices, etc., which in its judgment will be helpful in guiding the Tunisian authorities in their efforts to institutionalize the selected sewage disposal methods.

Qualifications of Consultants

In addition to a Civil Sanitary Engineer, the individuals provided by the contractor to carry out this assignment may include an Institutional Development Specialist and/or a sociologist with prior experience in alternative sewage systems. All consultants shall be fluent in the French language and shall have had previous, relevant overseas development experience, preferably in Francophone countries.

Relationship and Responsibilities

The consultant will work closely with Samir Kanoun of RHUDO/NENA and under general direction and supervision of Alexandria Lee Panehal, Senior Housing Advisor, RHUDO/NENA. Mr. Jemal Rafrafi, Director General of the Housing at the Ministry of Public Works shall be the primary Tunisian counterpart. Other Tunisian institutions which are likely to play an important role in this assignment include: The National Sewage Authority (ONAS), selected Municipalities and the Regional Offices of the Ministry of Public Works and Housing.

Terms of Performance

The work described in the above paragraph titled, "Statement of Work," is to be performed within a total period of 16 weeks. The expected starting date is 19 September 1988. A six day work week is authorized for consultants while in the field. It is anticipated that the report required in the first phase will be submitted to RHUDO/NENA and to the Ministry of Public Works and Housing by the end of the fifth week. After the Ministry has had the opportunity to review the first phase report and upon notification by RHUDO/NENA, the contractor's team shall return to Tunisia to carry out the work of the second phase.

Appendix B

COMPOSITION OF WASH/TUNISIAN WORKING GROUP

Appendix B

COMPOSITION OF WASH/TUNISIAN WORKING GROUP

A. Tunisian members

- Mr. Touhami Hamroui, Engineer and Director of the Division of Water Resources, MOPWH
- Mr. Ali Abassi, Engineer, Division of Water Resources, MOPWH
- Miss Henda Gafsi, Urban Planner and Director, Division of the Controller, the District of Tunis
- Mr. Nejib Trabelsi, Director of Program Planning and Budget, the District of Tunis
- Mrs. Amina Ben Hadid, Architect, Chief of Service, the District of Tunis
- Mr. Farid Sakli, Engineer, Division of Research and Planning, ONAS
- Mr. M'barek Baalouch, Engineer, Director General's Office, Regional Planning, MOPWH
- Mr. Tarak Bouguerra, Architect, Director General's Office, MOPWH
- Mr. Riahi Ferjani, Engineer, SNIT, seconded to the Tunisia and Emirates Engineering Consulting firm

B. WASH members

- Pierre R. Leger, Civil and Sanitary Engineer, Team Leader
- Mustapha Besbes, Hydrologist and Director, Department of Water Resources, ENIT
- Ronald Parlato, Expert in Institutional Development and Management
- Syada Greiss, Sociologist and Expert in Community Development