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URBAN AND ENVIRONMENTAL SERVICES PROJECT
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IMPROVED LIQUID WASTE MANAGEMENT
EVALUATION REPORT

Prepared For

**United States Agency for
International Development**
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The Office of Environment and Urban Programs

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EXECUTIVE SUMMARY

The Urban and Environmental Services Project which is managed by Technical Support Services seeks to (1) instill a genuine environmental awareness at the level of Moroccan institutions, communities and individuals and create or reinforce capacities for delivering affordable, demand driven access to urban environmental amenities, particularly clean water and adequate wastewater disposal, (2) improve institutional capacities through training, the introduction of new technologies and the systematic, productive use of synergies resulting from appropriate partnerships, and (3) introduce sustainable financial mechanisms, relying increasingly on private investors, for both housing and urban environmental infrastructure and services with products palatable to investors, intermediaries and borrowers, and affordable to increased numbers of households in the lower income strata with cost recovery being the keystone of such mechanisms

In order to achieve this vision, the improved liquid waste management component of this project seeks to identify and introduce best practices in the development of liquid waste disposal systems and their management particularly in the 240 smaller and medium-sized cities of Morocco. To that end, TSS fielded a team of liquid waste management experts (international and local) to (1) evaluate the existing liquid waste collection, treatment and disposal systems in three medium-sized municipalities (AZROU, BEN GUERIR and SEFROU) in order to assess actions needed to improve the current situation, and (2) identify and conceptually design pilot activities addressing the specific problems encountered and that are relevant as best practices to be replicated by other municipalities

In July 1997, a preliminary assessment of two (BEN GUERIR and AZROU) of the three municipalities was conducted by the local expert. The outcome of this assessment was the development of a preliminary profile of liquid waste systems and management status as well as the collection of relevant documents to prepare a detailed evaluation of existing liquid waste systems. This first assessment was followed in September by a detailed field evaluation of liquid waste disposal systems in the three target municipalities and their management.

The outcome of this evaluation has drawn a clear picture of the problems and issues facing liquid waste disposal services in medium-sized municipalities and particularly those that are faced by the three target municipalities. Specifically, the evaluation has revealed that the three medium-sized municipalities which are located in three different economic regions share similar problems with their liquid waste disposal systems. The problems are organizational, structural, hydraulic, and operational. However they all have specific problems that, if effectively solved, will be able to provide model practices that would be helpful to other municipalities.

Based on the evaluation results and ensuing recommendations specific to each of the three municipalities, the team has established a list of eight distinct activities that should form best practices to be replicated in other medium-sized municipalities. These activities have been grouped in two categories, namely a management improvement category and a systems improvement category. These activities are

- Activity 1 An Awareness and Knowledge Development in Liquid Waste Disposal Management for Elected Municipal Officials This activity is conceived to take place in all three municipalities Its estimated cost is \$ 145,000 and should be implemented within a period of 6 months
- Activity 2 A Sewerage Systems and Management Knowledge and Skills Development for Municipality Technical Managers This activity is conceived to take place in all three municipalities Its estimated cost is \$ 90,000 and should be implemented within a period of 6 months
- Activity 3 A Model Management Unit Development for Medium-sized Municipalities This activity is conceived to take place in the municipalities of AZROU and SEFROU Its estimated cost is \$ 138,000 and should be implemented within a period of 18 - 21 months
- Activity 4 A Model Plan for Structuring and Privatizing Liquid Waste Disposal in Industrial Zones in Medium-sized Municipalities This activity is conceived to take place in the municipality of BEN GUERIR Its estimated cost is \$ 175,000 and should be implemented within a period of 18 months
- Activity 5 A Model Plan for On-Site Liquid Waste Disposal Using Autonomous Sewerage Systems This activity is conceived to take place in the municipality of SEFROU Its estimated cost is \$ 220,000 and should be implemented within 18 - 21 months
- Activity 6 A Model Municipal Sewage Treatment Privatization Plan This activity is conceived to take place in the municipality of AZROU Its estimated cost is \$ 810,000 and should be implemented within 18 - 21 months
- Activity 7 A Model Semi-autonomous Sewerage System for non-sewered Areas in Medium-sized Municipalities This activity is conceived to take place in the municipality of BEN GUERIR Its estimated cost is \$ 990,000 and should be implemented within 18 - 21 months
- Activity 8 A Model Storm Water Management Improvement Activity in SEFROU whose estimated cost is \$ 180,000 and should be implemented within an 18 months period

While it is understood that all eight activities may not be selected, at least the first two activities should be part of any individual or group of activities that could be selected

INTRODUCTION

Moroccan cities are experiencing rapid growth with the everlasting migration that has been taken place from rural to urban settings for some time now. As people move from one setting to the other, family follows. Hence, Morocco has seen its urban population estimated at 15.7 million grow to 54% of the country's total population (29 million). This population presently lives in 260 urban communes of which 20 have a population of 100,000 or more. The others are spread in the other 240 urban communes.

Along with this rapid growth has come the need to build economic housing as the migrants who are generally poor have built unregulated and insalubrious housing forming new neighborhoods that are not structured (no basic services). This rapid growth has also brought about aggressive municipal services that include water supply which has greatly increased coverage in the cities through piped distribution systems with high rates of connection (greater than 50% in almost all cases).

These two developments have severely impacted on the capacity of these cities to provide sanitary disposal of liquid waste. The anarchic building of unregulated houses in sensitive areas and their subsequent connection to underdeveloped sewerage systems have brought critical problems to sewerage distribution in Morocco. Unless these problems are solved, the situation will continue to worsen and pose greater threat not only to the physical environment of Morocco, but also to its social and economic environment.

To help address this acute problem facing Moroccan decision-makers at both national and local levels, the Agency for International Development (USAID) has funded the Urban and Environmental Services Project, for which Technical Support Services (TSS) acts as the institutional contractor, whose purpose is to increase the capability of municipalities, among others, to provide shelter related infrastructure and environmental services on a more sustainable basis. One of the components of this project is to the improvement of liquid waste management in small and medium-sized cities in Morocco, as this particular problem is already being addressed for the larger cities of the country. Specifically, the project's component calls for a study aiming at improving management systems of liquid waste in the municipalities of AZROU, BEN GUERIR, and SEFROU, all medium-sized municipalities and the first two (AZROU & BEN GUERIR) recently became municipalities (1992).

For that purpose, TSS has put together a team of liquid waste management experts (an international and a local consultant) to evaluate the existing liquid waste collection, treatment and disposal systems in the target municipalities. The objectives of this specific task being (1) the evaluation of the sewerage systems of all three cities in order to assess the actions needed to improve current situation, and (2) to identify and conceptually design pilot projects addressing the specific problems encountered and that are relevant as best practices to be replicated by other municipalities.

In July 1997, the local expert conducted a preliminary assessment of the situation which resulted in the collection of existing documents and information that were essential to establish a primary profile of the cities and their sewerage systems issues and problems. This first intervention was followed by a detailed assessment and analysis of the liquid waste disposal sector both at national and at the targeted cities level during the period of September 6 - 27, 1997.

This report is an outcome of the two interventions made by the TSS consultants. It is presented in two parts: Part I which presents background information, findings, conclusion and recommendations regarding the state of sewerage systems development and management in the three targeted cities, and Part II which presents a list of replicable pilot projects and their conceptual design. Reports of the state of sewerage systems development and management in each of the three target municipalities are given in Annex as well as a list of entities and persons met (Annex C), a list of reference material consulted (Annex D), and other background material relevant to the assignment (Annex A).

PART I
CURRENT SITUATION OF LIQUID WASTE SYSTEMS & THEIR MANAGEMENT IN
THE CITIES OF AZROU, BEN GUERIR, SEFROU

I 1 SECTOR OVERVIEW

An understanding of the sewerage development and management problems facing small and medium-sized municipalities in Morocco must start with an overview of national policies and strategies regarding the sector. Then that found in the three target cities can be superimposed on them to establish the problems and issues that must be addressed by this cities in order to improve their liquid waste management in particular.

I 1 1 National Liquid Waste Management

A National Strategies and Tendencies

1) Sector strategies

About half of Moroccans presently live in the 260 urban communes of the country. Of these, about 20 urban communes have population above 100,000. The growth rate of urban population in the country continues to be relatively high as there is a progressive migration of rural populations to the urban communes. Hence, urban communes are expanding at a very high rate.

The government of Morocco has made great progress in ensuring that Moroccans living in urban areas have access to water supply. Hence, the coverage rates in the country's urban areas are relatively high as well as the connection rates to the public distribution systems. However, the development of sewerage systems collecting and disposing of wastewater has not closely followed the expansion of water distribution systems. Moreover, the concentration of large numbers of people, the conveyance of their waste to point discharges, and the discharge of raw sewage in the environment have increased the risks to public health and environmental pollution.

In order to correct that situation, the government of Morocco has adopted two coverage objectives that are:

- a) Provide adequate water service to 90% of urban populations through house connections and 10% of urban population through public fountains by the year 2000. Also provide adequate sanitation to 90% of the population connected to public distribution systems through sewerage and individual systems.
- b) Provide adequate water service to 98% of urban populations through house connections and 2% of urban population through public fountains by the year 2020. Also provide adequate sanitation to all of the population connected to public distribution systems through sewerage and individual systems.

To achieve these objectives, the government of Morocco has adopted a series of strategies that can be summarized as follows

◆ **Technical strategies**

- ▶ Rehabilitate and extend existing sewerage systems to collect wastewater from houses connected to the water distribution networks
- ▶ Provide adequate treatment to wastewater conveyed by the sewerage systems prior to final disposal in the environment or re-use of treatment plant effluent
- ▶ Complement water needs through the re-use of treated effluent for agriculture and other approved usages
- ▶ Use low-cost technologies for treatment of sewage that are easy to maintain and not requiring unaffordable resources
- ▶ Prepare sewerage master plans for defining the technical, operational, institutional, and financial dispositions that can bring the most appropriate solutions at least cost to sanitation problems

◆ **Institutional strategies**

- ▶ Communes can select to transfer the management of sanitation services to the Intercommunal Autonomous Régies that are in charge of water distribution, improve their existing services, or can create or give concession or leasing to any public, mixed or private
- ▶ The transfer of sanitation management by the communes to any entity must be a contractual strategy between the communes and public or private entity whereas the overall responsibility for ensuring effective and affordable services to the communes populations
- ▶ A national master plan for sewerage will be established to serve as a reference tool to effectively develop and organize the sewerage sector
- ▶ The Administration of Hydraulics of the Ministry of Public Works is given the responsibility for setting watersheds authorities to regulate the intake and disposal of water for all types of distribution including urban distribution

◆ **Financial strategies**

- ▶ Institutions taking charge of the management of sewerage systems will need to ensure auto-financing of investments that are to be made for these systems. Thus, they are authorized to recover costs associated to the improvement and management of the systems from users, within the framework of existing regulations on tariffs
- ▶ Institutions taking charge of sewerage systems management must take steps to rationalize their management system and optimize their human and financial resources in order to reach a level of real profitability in the wastewater sector

The national strategies take account of the following criteria to support communes in improving sewerage services to their communities

- ▶ availability of complete feasibility studies and master plans for sewerage development,
- ▶ availability of environmental impact analysis of sewerage systems,
- ▶ transfer of sanitation services to an autonomous public or private entity,
- ▶ availability of audit reports on the institution requested to manage sanitation services

2) Sector tendencies

a) **Coverage tendencies**

- ▶ ONEP has established a list of small and medium-sized urban communes that it intends to improve liquid and solid wastes services (see Annex A1)
- ▶ A joint Sanitation Committee of government institutions has established a list of priority communes for intervention on the basis of urgency of sanitation actions (see Annex A2)

b) **Technological tendencies**

- ▶ The technologies of choice for wastewater treatment being promoted by the government of Morocco are extensive systems such as stabilization ponds, infiltration beds, and macrophytes treatment (wetlands) For urban settings where extensive treatments are not feasible, conventional treatment plants (activated sludge) are used. These are being promoted because of their cost and manpower needs implications.
- ▶ The acceptable level of treatment is primary which can reduce up to 50% of organic loads.
- ▶ Promoting re-use of treated effluent for irrigating specific crops.

c) **Institutional tendencies**

- ▶ Take over of sanitation services in larger cities by the 16 Régies and in mid-sized and small cities by ONEP.
- ▶ Take-over of the Régies by foreign companies.
- ▶ Take-over of treatment facilities where treated effluent re-use is allocated to golf fields, by Moroccan enterprises.

d) **Financial tendencies**

- ▶ Limiting sewerage tariffs to 1 Dh which is to be increased progressively in the future.
- ▶ Rely on national and/or international subsidies to fund the real costs of sewerage services.
- ▶ Collect first establishment dues from systems users.

B Intervening Institutions in the Sector

The main national institutions that have charges to intervene in the management of sewage disposal in urban areas are

- ▶ General Direction for Local Governments, Ministry of Interior. This entity is responsible for liquid waste oversight for all municipalities in Morocco.

- ▶ The Direction of Observation, Studies, and Coordination This direction has responsibility for monitoring the state of liquid waste disposal throughout Morocco for ensuring environmental protection
- ▶ The General Direction of Hydraulics, Ministry of Public Works This entity has responsibility for creating and overseeing the establishment of the watershed management authorities in all watersheds in Morocco
- ▶ Direction of Sanitation, National Office for Potable Water (ONEP) This entity has responsibility for managing sanitation services in municipalities where ONEP has responsibility for drinking water distribution
- ▶ COMMUNES EQUIPMENT FUND (FEC) This entity has responsibility for financing liquid waste projects in the communes of Morocco

I 1 2 Sewerage management in medium-sized municipalities

The majority of the 260 urban communes in the country can be considered as medium-sized municipalities with population ranging from 10,000 to 100,000 inhabitants. These communes are served by an established sewerage system which are directly managed by the municipality's technical services.

The problems and issues of liquid waste disposal of medium-sized municipalities in Morocco are reported by the National Sewerage Master Plan to be very similar. They can be best characterized by those found in the three target cities which are summarized below.

A Technical issues and problems

- ▶ Municipal liquid waste collection strategy is to provide sewer mains to all neighborhood closely following the water distribution system even in low population density neighborhoods that are well suited to have alternate methods of sewage disposal
- ▶ Lack of organization of the network into an efficient collection system as the systems are primarily pseudo-combined systems
- ▶ Chaotic expansion of the network resulting in the creation of incapacity for primary and secondary sewer mains to convey ever growing storm water and sewage flows

- ▶ Bad practices in the use and maintenance of sewer networks such as disposal of solid waste in the systems which result in frequent clogging of sewers, catch basins, and manholes
- ▶ Structural problems with laid sewers and appurtenances which are cracked or deteriorated without proper corrective interventions
- ▶ Hydraulic problems with poorly designed and constructed sewer lines which often causes backflow to connected houses and system overflow
- ▶ Non-existence of sewage treatment plant resulting in the disposal of raw sewage directly on the ground or in water courses (Oueds, talwegs) usually located within city limits
- ▶ The design and construction practices of autonomous systems which are essentially cesspools are poor and result in creation of secondary problems
- ▶ The cities' storm water collection systems are not properly calibrated to handle medium to high intensity rainfall causing severe periodic floodings that are avoidable

B Management issues and problems

- ▶ The elected authorities (council members) and hired professionals who are in charge of managing the sewerage services have limited or no knowledge and skills in sewerage systems development and management
- ▶ Sewerage service delivery is poorly organized and has inadequate human and material resources to perform basic operation and maintenance tasks
- ▶ The hygiene services which are responsible for the control of environmental health have limited or diagnostic capability to monitor pollution risks from sewage disposal

C Financial issues and problems

- ▶ The budget allocated to the sector by the Municipalities for staff salaries and purchase of material are generally less than 1,5% of the municipalities operation's budgets) is very low and estimated at less than one fourth of what it should be
- ▶ Those who are connected to the sewer system do not pay for services as there is no established tariff or payment procedures that are in existent other than payment for connection (payment for first establishment or PPE) practiced in some municipalities
- ▶ Many of the small and medium-sized municipalities have either attained the 40% borrowing ceiling established by FEC for a municipality to be eligible for FEC loans or lack the capacity to reimburse new loans and therefore are not eligible for new loans

D Environmental issues and problems

The environmental issues and problems caused by the current state of liquid waste disposal in the medium-sized municipalities are

- ▶ Creation of sewage pools which clog top soil and form a constant risk to public health and increase soil content of undesirable chemical and physical elements or compounds
- ▶ Contamination of water tables and nearby water supply sources (wells, springs)
- ▶ Pollution of watercourses which can be used downstream as a source of drinking water
- ▶ Contamination of food products (vegetables eaten raw) irrigated with raw sewage which results into periodic waterborne diseases outbreaks
- ▶ Creation of nuisance with the proliferation of mosquitos and development of bad odors particularly during the warm period of the year
- ▶ Diminution of real estate value in areas around sewage outfalls

I 2 LIQUID WASTE MANAGEMENT STATUS IN THE THREE TARGET CITIES

The status of liquid waste management and disposal and management in the cities of AZROU, BEN GUERIR and SEFROU is presented in the form of three individual status reports in Annex B and a summary profile of the sector is presented in Table 1 municipalities Presented hereafter is a summary of the general problems and issues being faced by these three municipalities The more specific problems of the existing systems are presented in the status reports (Annex B)

I 2 1 Sewerage master plan studies

Certain practices found with the master planning process and the content of these documents are

A Process problems and issues

The preparation of the master plan of each of the three cities is too long a process The average duration is more than 4 years SEFROU which presents the most advanced studies has already taken more than 3 years and will take a minimum of 48 months before its completion With the rapid expansion of these cities, the studies are already irrelevant in some areas by the time that they are completed Moreover, if the fact that a master plan should be up-dated every five years is accepted, as soon as these plans are finished, they enter the up-date period where the information base upon which the project is designed does not respond to reality

In the two municipalities where the master plan studies are funded by ONEP through grants, the municipalities are not involved in the process They were found to be ignorant of the studies and did not have copies of the documents produced While municipal governments are legally responsible for providing liquid waste services to the people, it is impossible for the cities technical services to improve their capacities to assume that responsibility if they are not informed about the master planning process and content In SEFROU, where the master plan studies are directly financed by the municipality, a more direct role of the OWNER in process management was observed

B Content problems and issues

The master plans are found to be strong in sewerage network assessment and studies while being extremely weak in wastewater treatment and environmental impact assessment and analysis A quick technical assessment of the three master plans revealed the following weaknesses

**MOROCCO URBAN AND ENVIRONMENTAL SERVICES PROJECT
LIQUID WASTE MANAGEMENT IMPROVEMENT COMPONENT**

TABLEAU 1 PROFILE OF THE TARGET MUNICIPALITIES

DESIGNATION	AZROU	BEN GUERIR	SEFROU
01 Province	IFRANE	KALAA DES SRAGHNAS	SEFROU
02 Economic Region	South-Center	Tensift	North-Center
03 Climate	Temperate	Arid - temperate winters	Temperate
04 Altitude in meters	1 200 - 1 800	480	800 - 900
05 Population 1997	45 000	55,300	58 000
06 Population 2015	133 000	111 000	90 000
07 Average annual precipitation in mm	833	238	654
08 Average maximum temperature ° C	25	35.6	35.7
09 Average minimum temperature ° C	7.3	5.1	4.5
10 Average annual evaporation in mm	500	2400	520
11 Number of house connections in water distribution system	6 000	5 600	5 900
12 Percent population covered	74	67	64
13 Water Production Capacity in liters per second	90	85	205
14 Annual Consumption in Mm3 in 1997	1.48	1.53	2.2
15 Annual Consumption in Mm3 in 2015	2.72	4.18	5.0
16 Per Capita daily rate in liters/day in 1997	90	60	122
17 Per Capita daily rate in liters/day in 2015	102	68	156
18 Cost per m3 of water 1 - 24 m3 in Dirhams	2 067	2.30	1.62 *
19 Cost per m3 of water 25 - 60 m3 in Dirhams	4.74	5.83	4.94 **
20 Cost per m3 of water > 60 m3 in Dirhams	6 825	8.50	6.14 ***
21 Percent population connected to the sewer system	70	64	58
22 Percent connections in 2015	90	96	85
23 Hydraulic load in 1997	3 100	2 600	3 700
24 Hydraulic load in 2015	4 800	8 200	8 400
25 BOD load in 1997	578	950	2 400
26 BOD load in 2015	320	2250	9 600
27 SS load in 1997	383	1 100	2 700
28 SS load in 2015	380	3 000	5 100
29 Total sewer length in kms.	39	40	53
30 Municipal expenditures for sewerage services in 1995	228 000 Dh	233 000	280 000 Dh
31 Attainment of FEC s 40% ceiling for borrowing	No	Yes	No
32 Capacity to borrow at FEC in 1997	None	None	None
33 Number of staff in the sewer maintenance unit	6	4	7
34 Completion status of sewerage master plan - 5 phases	Phase 2	Phase 1	Phase 3
35 Election year of present City Council	1997	1997	1997
36 Organization managing water distribution system	ONEP	ONEP	RADEEF
37 Storm water disposal problems	High	Medium	High

* Rate for 0 - 8 m3

** Rate for 8 - 20 m3

*** Rate for more than 20 m3

- ▶ Lack of sewer mains structural diagnostics in the master plan studies for BEN GUERIR and SEFROU No visual inspections by human or mechanical means were reported
- ▶ The storm water disposal network studies were not completely treated as terms of reference for these studies were not clear enough to guide them This is an area that is lacking in many, if not all, master plans that have been prepared for large, medium or small-sized cities in Morocco
- ▶ Sewerage planning was limited to development of public sewer network The integration of autonomous and semi-autonomous systems as solutions to existing problems was not well approached in the master plans
- ▶ The site selection process for locating one or several treatment facilities was very limited Many of the required technical studies of sites were not conducted to include studies of flooding, underground pollution, wind direction, land costs, treatment types (extensive or intensive), etc
- ▶ The treatment selection process is also very limited In fact, all three master plans selected the stabilization pond process as policy as opposed to being the best site-specific solution
- ▶ The design parameters for the SEFROU stabilization pond process indicate that the quality of effluent will limit the re-use of plant effluent for many types of crops (e g , vegetables)
- ▶ The plans do not present clear environmental statements regarding the present and future environments that are to be created through the improvement of existing sewerage systems
- ▶ While re-use is recommended for all three cities, only re-use in agriculture is treated In SEFROU for example, the master plan does not take into account the impact of effluent diversion to irrigation on Oued AGGAI which carry low flow during summer months Moreover, the use of treated effluent for industry, municipal functions (e g , street cleaning, parks watering, etc), fire fighting, etc , have not been studied These may have an impact on the type of treatment that could be required Generally, a treatment process is function of the type of effluent that is sought This has not been true for SEFROU

I 2 2 Sewerage systems organizations problems

The sewerage systems of the three cities have been developed primarily as combined systems even in areas where such systems are not recommended. It is understandable and acceptable to have a combined system in BEN GUERIR whose topography is relatively flat, but not so for SEFROU and AZROU which are located on mountain flanks and have steep enough slopes to have the much cheaper and more sanitary separate system. These problems need to be better addressed in the master plans than they presently are.

Another major problem is that of collection system selection. Existing systems which have reached sewer main collectors/interceptors capacities cannot accept more connections coming from new neighborhoods. Therefore, it is necessary that the wastewater collection system be organized in such a way that alternate systems (autonomous and/or semi-autonomous) are developed. While, these systems may have higher investment costs to owners, they will certainly have lower maintenance and operation cost to the owner and the city.

I 2 3 Alternate sewerage systems problems and issues

Parallel to the existing networks are alternate systems that can be found in all three cities. These systems are either autonomous (cesspools) or semi-autonomous (e.g., housing project or industrial areas). The tendency is to either eliminate or integrate these systems into the existing public sewerage system. This tendency is costly and needs to be reversed. However, new technologies for on-site treatment need to be established to improve the alternate systems and make them feasible.

I 2 4 Institutionalization problems and issues

The major issues regarding institutionalization of the sewerage systems in the three cities are the incapacity of existing municipal services to effectively manage liquid waste disposal in their cities. Their problems are organizational (both in terms of structure and human and material resources), technical (lack of sector knowledge and systems management skills), and financial. These problems are summarized hereafter.

A Organizational problems and issues

The key organizational issues and problems that limit the target cities in liquid waste management are the following:

- ▶ Neither of the three cities have an established sanitation service that has its own facility, personnel, equipment, and budget to assume technical and administrative responsibility for liquid waste disposal.

- ▶ The municipal engineers and technicians who have direct responsibility for the sewerage systems operation, maintenance, development, and management have received no previous training in the area of liquid waste disposal (collection, treatment, and disposal) Therefore are not capable of performing the tasks required from systems exploiters
- ▶ The existing materials used to maintain the systems in all three cities are rudimentary and quite limited to perform the required preventive and curative tasks that an exploiter must attend to
- ▶ The existing technical services that are in charge of the sewerage systems in the three target cities have no written operations guidelines for exploiting the systems Thus they practically respond to complaints

B Management problems and issues

The key management problems and issues encountered in the three target municipalities are the following

- ▶ The executive bodies (Presidency and Council) in charge of managing the municipalities are newly elected for a period of five years The majority of council members or executive staff (Presidents and Vice-Presidents) have had no prior orientation on municipal liquid waste systems management to allow them to understand problems and make effective decisions regarding the sector
- ▶ The executive bodies in AZROU and SEFROU are more oriented toward municipal sanitation service development than to cede the service to either ONEP (in the case of AZROU) or RADEEF (in the case of SEFROU) The key issue for this is the fear of over burdening the cost of water which is found to be already too high Also, there is a fear that the municipalities are not yet organized to regulate the sector as they are the Principal institutions that have direct ownership of the systems
- ▶ Because of its capacity to take over sewerage management in all the municipalities where ONEP is in charge of potable water distribution, the organization has established a list of priority cities which does not contain either BEN GUERIR or AZROU It is anticipated that the take over of these two cities would require at least 3 - 5 years to be complete, particularly in the case of BEN GUERIR which will not have a sewerage master plan for the next two years

- ▶ RADEEF is presently going through a privatization process which, we believe, will be completed before it takes over sewerage management in SEFROU. Moreover, RADEEF is seeking to take over both, the electrification service and the sewerage service in SEFROU as a package. Electrification being presently the responsibility of the Office National d'Electricité (ONE) will complicate the take over. Thus, it is also anticipated that it will take a few years before RADEEF would take over the sewerage service in SEFROU.
- ▶ Although the municipality of BEN GUERIR has a unique citizen involvement program in liquid waste disposal systems development and management, these are not organized and trained to perform the services effectively and on a continuous basis.

C Financial problems and issues

The key financial problems being faced by the three target municipalities are presented hereafter:

- ▶ Sectoral budget allocation which is much too low to allow proper maintenance of the system as well as its development.
- ▶ Limited direct participation by users through the payment of user fees and municipal taxes. In BEN GUERIR, there are presently no connection fees to the sewer. No special taxes are levied for sewer connection in housing development.
- ▶ Neither of the three target municipalities can qualify for FEQ loans at this time as they either have surpassed the 40% ceiling imposed by FEQ (BEN GUERIR) or do not present a capacity to repay new loans (all three municipalities).
- ▶ Revenue generation through municipal properties or activities and tax collection is reported to be limited and therefore is one of the key reasons for not being in a position to obtain new FEQ loans.

I 3 CONCLUSION AND RECOMMENDATIONS

I 3 1 Conclusion

Morocco has made great stride in addressing the problems caused by liquid waste management during a relatively short time. In less than a decade, the country has been able to identify its problems and drawn a course of actions geared to address them. However, for a country of 29 million inhabitants with 54% of the people living in urban areas that have well established water supply coverage by public potable water distribution system, the country is faced with a critical problem that could have adverse economic impact if the problem is not addressed in a relatively short-time.

The liquid waste problems of the major cities are being addressed through a concerted effort between local and national governments with support from the international community. However, the problems of more than 80% of the countries small and medium-sized municipalities still remain. While solutions to address systems and management problems are being applied to large-sized cities, these will most likely not be replicable in middle and small-sized municipalities. In fact understandable problems regarding management and financing of services for the small and medium-sized municipalities are presently considered as major constraints for applying national strategies adopted for larger municipalities to smaller and medium-sized ones.

Therefore, the need to develop pilot activities that will help establish best liquid waste management practices that can be replicated in most of the 244 municipalities where wastewater management and financing problems and issues are not presently being addressed is a critical one and should be made a priority by both the government of Morocco and the donor agencies involved in the sector.

The three cities selected to be candidates for hosting the pilot project to be part of the USAID funded Morocco Urban and Environmental Services Project present certain similarities as well as specificities that make them eligible as pilot project sites. Firstly, they all are in the process of developing sewerage master plans, even though these are at different stages of implementation. Secondly, they all have similar problems with their existing sewerage systems, even though these problems are at different degree of seriousness. Thirdly, they all have quite similar problems with the state of liquid waste services organization, resources (human, material, financial), and management styles. However they present certain specificities that are to be taken into consideration. These are

- ▶ the order of priority that can be assigned to the problems,
- ▶ the opportunity to demonstrate different types of management,
- ▶ the opportunity to promote different types of practices,
- ▶ the potential to involve different sectors of the society

In the case of BEN GUERIR, this municipality is best suited to demonstrate the following best practices

- (a) the involvement of all levels of municipal government responsible for sanitation service to take part in the master plan studies preparation as effective managers of the process,
- (b) the development of alternate liquid waste disposal systems to limit extension and expansion of the existing sewerage system,
- (c) the structuration of population involvement in the sector,
- (d) the development of private sector capacity to take over some of the services to be provided to operate and maintain the planned sewerage system, and
- (e) the organization of the sanitation service in order to facilitate a future ONEP take over of the sewerage system

In the case of AZROU, this municipality is best suited to demonstrate these best practices

- (a) the opportunity to demonstrate the capability to valorize the bi-products from sewage treatment processes,
- (b) the opportunity to demonstrate effective control of waterborne diseases transmitted by raw sewage,
- (c) the opportunity to demonstrate the development of a new sanitation service, and
- (d) the opportunity to demonstrate a cooperative arrangement with ONEP for system financial management

In the case of SEFROU, this municipality is best suited to demonstrate these best practices

- (a) the opportunity to demonstrate the development of an effective urban storm water management program,
- (b) the opportunity to demonstrate effective control of watercourse pollution through the elimination of urban raw sewage discharge in watercourses,
- (c) the opportunity to demonstrate the development of a collaborative arrangement between the city and a Regie, and

- (d) the opportunity to demonstrate the development of alternatives to public sewerage system expansion

It should be noted that these three municipalities are medium-sized and do not represent completely liquid waste problems and issues being faced by small municipalities (less than 10,000 inhabitants) which are called to expand rapidly. This issue will need to be dealt with sooner rather than later.

I 3 2 Recommendations

The following are recommendations for improving liquid waste systems development and management for small and medium-sized municipalities in general and the three target municipalities in particular. Thus, these recommendations are divided in two parts, a part addressing general problems and issues identified for small and medium-sized municipalities, and the other addressing problems and issues identified for the three target cities.

A General recommendations

- 1) **Recommendations addressing technical issues and problems**
 - ▶ Establish a national strategy for the development of alternative liquid waste disposal systems to limit the expansion of existing systems in the near future. This new strategy will help reduce investment and operation and maintenance costs as well as improve funding for the sector through better population participation.
 - ▶ Establish national guidelines for the development of new sewerage systems and expansion of existing ones regarding the type of system to select. In the case of cities or quarters built in areas where the topography is relatively flat, a combined sewer system could be envisioned. However in the case where a city or quarter is built in an area where the topography is relatively steep, only a separate sewer system should be considered.
 - ▶ A public education program should be established in all cities to change present population practices as to increasing the problems of the sewerage systems. All funding agencies (national or international) should make a public education program a requisite for funding the sector in a city.
 - ▶ Develop a list of alternate systems technologies that are suitable in Morocco and support operational research through pilot projects.

- ▶ Develop local capacities to conduct diagnostic as well as preventive and curative services for sewer networks
- ▶ Impose stricter treatment for effluent that are to be re-used in agriculture
- ▶ Develop better storm water programs through the reinforcement of terms of reference for master plan studies. The use of storm water management modeling should be introduced particularly for small and medium cities that are threatened by periodic and frequent floods
- ▶ Integrate nuisance control (odor, mosquitos, management of debris or residues) in all systems development plan

2) Recommendations addressing management issues and problems

- ▶ Establish an orientation program to educate and improved the skills of elected officials to manage the sector. The orientation program should include the development of a practical decision-making guide for elected officials and seminars/workshops to introduce and educate officials on the use the guide
- ▶ Establish a training program for municipal engineers and technicians who have direct responsibility for managing liquid waste disposal services in the municipalities. This program should provide both technical and managerial training in-country and possibly abroad to engineers and technicians as well as develop operational manuals for systems operation and maintenance
- ▶ All municipalities should develop a plan for phasing the development of an appropriate management system for the sector. Specifically, a plan for phasing ONEP or REGIE take over should be developed by each city. Where direct privatization of part or all components of the system is possible, they should also be part of the plan
- ▶ All municipalities should have an environmental health service capable of monitoring pollution and contamination problems of water and food products by sewage or poorly treated effluent. Capacities to perform tests either directly or through the private sector should be established for that purposed and personnel trained to perform the associated tasks related to environmental health control

3) Recommendations regarding financial issues and problems

- ▶ Municipal budgets for liquid waste management should be more realistic particularly if the municipality is directly responsible for exploiting the sewerage system. A minimum amount of 20,000 to 25,000 Dh per kilometers of sewers
- ▶ Better revenue generation practices to recover costs must be established in each municipality
- ▶ Tariffs to be collected which are to be tied to water usage should be carefully set to exempt those who have alternate systems. Moreover, tariffs must be established on the basis of capacity to pay. Thus special studies for each city need to be conducted prior to setting national tariffs as is done for potable water
- ▶ A special program to improve the debt management of small and medium-sized cities need to be established and managed by FEC

4) Recommendations for master plans preparation problems and issues

- ▶ A limit of 24 months should be imposed on all master plans that are to be prepared for a small or medium-sized city in order to ensure appropriateness of such plans
- ▶ A local technical review board presided by the Municipal President or First Vice-President should be established in each municipality to approve each phase of a sewerage master plan. Technical assistance will be required to support the review board
- ▶ A national training program for consulting firms that are to be involved with municipal sewerage system planning should be established. This program should target the areas where these firms are weak such as sewage treatment, environmental assessment and analysis, institutional development, and cost recovery

B Recommendations specific to the three target cities

1) AZROU

- ▶ The sewerage master plan of AZROU seems to have omitted the inclusion of several main lines which were built between 1960 and 1980 and are not visible. A special effort needs to be made to locate these lines and integrate them in the master plan.
- ▶ Municipal authorities should be integrated, as OWNERS, in the master planning review and approval process during the remaining phases. For they will have responsibility to manage the service until such time that ONEP can effectively take over the management of the system.
- ▶ Locating the sewage system on the site desired by the Municipality seems to be the best solution in both technical and financial terms. However, the fear of provincial officials of having a potential pollution point need to be verified by a special environmental assessment that could clear the site. Such an assessment will need to consider, geological, hydrological, and topographical factors as well as technical and cost factors that will help make a final decision on site selection.
- ▶ The most urgent work that needs to be performed in improving sewerage management in AZROU is the construction of the interceptor sewer that would collect the majority of the main collectors of the city and bring them to a treatment plant to also be urgently constructed.
- ▶ Because of the high dependence that the farmers have already placed on raw sewage as a reliable source of water for crops irrigation, the sewage treatment plant that needs to be constructed should be designed to have a type "A" effluent as recommended by WHO.
- ▶ AZROU presents the best opportunity to develop an effective cost recovery system based not only on user taxes and fees, but also on the sale of sewage treatment plant's bi-products. Thus, the final selection of a sewage treatment plant for AZROU should take into consideration the resale of potential bi-products. The high algal treatment plant experimented at the Agronomy Institute of Hassen II in Rabat is a potential solution for AZROU. However, a feasibility study will need to take place, before this treatment process can be selected.

- ▶ While it is understood that a study is presently being conducted regarding storm water management, the development of a storm water management model should be developed for the city. Such a model will require that proper hydrographic and rainfall measurement stations be placed in and around the city in order to obtain more reliable data. An erosion control component should be added to the storm water management program that is to be designed for the city.
- ▶ The present sewer network should be converted into a separated system with new approach to storm water management developed. Such an action requires a special study to be conducted or be integrated in the present storm water study that is specifically looking at recalibration of the city's storm water courses (SHABAA).
- ▶ The expansion of the sewerage system should be limited to existing quarters in AZROU. The use of autonomous and semi-autonomous systems in new planned quarters should be considered in order to limit rapid expansion of the existing system.
- ▶ A special municipal waste management service headed by an Engineer or Adjoint Technique, needs to be created for AZROU. This service, to be placed under the Municipal Engineer, should have its own staff and material. It needs to be organized in such a way that it can respond to the specific tasks related to sewerage system's operation and maintenance. It should be noted that a special institution development study is planned as one of the phases of the sewerage master plan studies.
- ▶ The present cost recovery system specific to sewerage management in AZROU needs to be expanded to include other potential revenue. Such a system should include appropriate sewer fees that are practiced in other cities of Morocco. A special cost recovery study is planned as one of the phases of the sewerage master plan studies.

2) BEN GUERIR

- ▶ The sewerage master plan for Ben Guerir should be completed before any more extension work be done to the system. The studies should be drawn in such a way that the completed diagnostic phase (Phase B1) be up-dated. That phase should also be reinforced by strengthening the sewer main diagnostics with visual and mechanical inspections.

- ▶ The master plan preparation process should be technically managed by ONEP, however, the decision making process should remain with the Municipal authorities. Thus, review and approval at each phase of the process should be a function of Municipal decision-makers
- ▶ More emphasis needs to be put on autonomous and semi-autonomous systems in order that network expansion be limited. To that end, the city should encourage new housing development projects to look into providing their own sewerage systems (sewer network and treatment plant). OCP's sewerage system (a semi-autonomous one) should serve as a model to such development. This is also true for the planned industrial area which is to be funded by the Municipality and OCP which should have its own sewerage system, including treatment facilities
- ▶ Oued Bouchane is the main waterway for the evacuation of storm water upstream and within municipal limits of BEN GUERIR. However, the urbanization of the city is structured in such a way that the Oued poses a threat to property and life should for high return periods rainfall. Therefore, a special study of flooding potentials and Oued calibration should be conducted to prevent future disasters as well as have a better use of the Oued as the normal storm water evacuation channel
- ▶ For each quartier that is to be structured in the future with sewerage services, a Community Association should be developed to take charge of their system. That Association will need to be structured in such a way that it can manage all sanitation services within its jurisdiction
- ▶ BEN GUERIR provides a unique opportunity to bring the liquid waste disposal sector to a Young Entrepreneur Development Program. This dynamic group of young individuals should be interested to provide private services in the waste management sector. Therefore, a special study should be made to determine the areas where Young Entrepreneurs could successfully play a role in the sewerage management sector
- ▶ A new sanitation service headed by an Engineer or Adjoint Technique should be created. This service should be placed under the Municipal Engineer in the organizational structure of the Municipality. The service should be a waste management entity handling both liquid and solid waste disposal. Thus, the service is to have two distinct units each with its own resources (manpower, material, and budget). It should be noted that a special institution development study is planned as one of the phases of the sewerage master plan studies

- ▶ A cost recovery system specific to sewerage management needs to be established in BEN GUERIR. Such a system should include appropriate sewer taxes and fees that are practiced in other cities of Morocco. A special cost recovery study is planned as one of the phases of the sewerage master plan studies.

3) SEFROU

- ▶ The expansion of SEFROU's sewerage system should be limited and the development of autonomous and semi-autonomous sewerage systems be encouraged in unsewered and new quarters.
- ▶ The present sewer network should be converted into a separated system with new approach to storm water management developed. Such an action requires a special study to be conducted or be integrated in the present storm water study that is specifically looking at recalibration of the city's storm water courses (SEGUIA).
- ▶ Because of the severity of the problems of flooding that the city endures every year, a storm water management model should be established for SEFROU. Such a model would provide an effective management tool to the city's storm water management program.
- ▶ The take over of the sewerage system of SEFROU by RADEEF presents the best technical solution for the city. Thus, all efforts must be done to encourage this take over to take place.
- ▶ Understanding that the take over of the sewerage system in SEFROU by RADEEF may not take place for several years, there is a need to develop a waste management unit as a technical municipal service to be placed under the municipal engineer. Such a unit needs to have its own resources (staff, material, and budget) in order to effectively perform the tasks for which it will have responsibility.
- ▶ The present cost recovery system specific to sewerage management in SEFROU needs to be expanded to include other potential revenue. Such a system should include appropriate sewer fees that are practiced in other cities of Morocco. A special cost recovery study is planned as one of the phases of the sewerage master plan studies.

C Recommendation specific to sewerage management for small-sized cities

- ▶ Sebt El Guardane provides a very good opportunity to establish a sewerage management pilot program that would test best and replicable practices for small-sized municipalities. Thus, it is recommended that a liquid waste assessment be made for Sebt El Guardane and that it be included as one of the sites of the pilot project.

PART II
PROPOSED LIQUID WASTE MANAGEMENT PILOT PROJECT FOR THE
DEMONSTRATION OF REPLICABLE BEST PRACTICES

II 1 PILOT PROJECT DEVELOPMENT OVERVIEW

The liquid waste disposal systems and services management assessments conducted in the three target cities (AZROU, BEN GUERIR, SEFROU) have identified a variety of problems and issues that are technical, institutional, or financial. These problems and issues are reflective of those faced by medium-sized municipalities throughout Morocco. Therefore, the implementation of a pilot project that would establish and demonstrate best practices in the improvement of liquid waste management can have a sensible impact in bringing Moroccan cities to have better liquid waste management services in the future.

The concept of developing a liquid waste management improvement pilot project for demonstrating best practices is a major objective of the Urban and Environmental Services Project. This objective can be effectively attained by grouping a number of medium-sized municipalities which present specific practices that can be improved.

The municipalities of AZROU, BEN GUERIR, SEFROU present numerous special liquid waste management problems whose resolutions could form best practices that are replicable in many other medium-sized municipalities. Thus, it is recommended that the most feasible best practices be selected from the three target municipalities to form a single pilot project. As a demonstration endeavor, criteria retained for selecting these practices are (a) all best practices will need to be technically feasible within a relatively short demonstration period, (b) that will not require heavy investment as a pilot activity, (c) that can achieve very high impact on critical liquid waste management problems within the framework of the two previous criteria.

Among the solutions recommended to resolve the critical problems encountered in the three target municipalities, the ones that best meet the retained criteria can be placed in three distinct categories which are (1) management improvement category and (2) technological improvement category. The best practices per category are:

1) Management improvement

- A decision-makers knowledge and skills development activity regarding liquid waste disposal services to take place in all three target municipalities
- A municipal staff knowledge and skills development activity regarding liquid waste disposal services to be demonstrated in all three target municipalities
- Development of a model municipal unit to provide liquid waste system operation and maintenance services to be demonstrated in AZROU

- Preparation of a privatization plan for the management of a semi-autonomous liquid waste disposal system for the planned industrial area in BEN GUERIR

2) Technological improvement

- A demonstration activity regarding the introduction of effective on-site treatment of liquid waste by an autonomous system (septic tanks) to take place in SEFROU
- A demonstration project regarding the introduction of effective semi-autonomous system as an alternative to expansion of the existing sewerage system in BEN GUERIR
- A demonstration project regarding municipal sewage treatment privatization in AZROU
- A demonstration project regarding the improvement of storm water management in urban areas to take place in SEFROU

Each specific activity is presented in more details in the following pages. These activities retained as component of the pilot project will require detailed study and design to take place prior to going to the implementation phase.

This project will be managed by TSS-MAROC and be implemented in collaboration with the Direction de l'Eau et de l'Assainissement of the Ministry of Interior.

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II 2 PILOT PRACTICES OR ACTIVITIES

ACTIVITY 1

ACTIVITY NAME: AWARENESS AND KNOWLEDGE DEVELOPMENT IN LIQUID WASTE DISPOSAL MANAGEMENT FOR ELECTED MUNICIPAL OFFICIALS

ACTIVITY LOCATION: AZROU, BEN GUERIR, SEFROU

ACTIVITY DESCRIPTION

Rationale

There are 260 municipalities in Morocco with elected Councils that have overall responsibilities for making all administrative and financial decisions for their respective municipality. While municipal councils have the responsibility to approve projects and their budgets, the executive staff of municipalities (Presidents, Vice-Presidents and Secretary Generals) must carry-out council decisions and ensure that services are satisfactorily provided to the population.

In general, council members have little or no information on liquid waste disposal systems and their development that could help them make rational decisions. Thus, it is essential that their knowledge of liquid waste disposal development and management be improved or developed.

The three target cities provide a special opportunity to start a national orientation program to strengthen the capability of elected municipal officials to become better prepared to make decisions regarding municipal liquid waste disposal systems. Each municipality has 25 member councils and key administrative staff that could benefit from such a program. Moreover, this program can be expanded to provide the same opportunity to elected officials of all 260 municipalities, once it will have been developed and tested.

Purpose and scope

The purpose of this activity will be to help elected municipal officials and key administrative staff understand wastewater disposal systems and their management in order for them to make more rational decisions and provide better oversight of the service. The specific objectives are (1) to improve the cognitive capacity of elected and key administrative officials in the targeted municipalities of liquid waste disposal systems and their management, and (2) to improve skills of targeted officials in the making of management decisions for the service.

This activity is to be limited to the Presidents, Vice-Presidents, Council members, and Secretary Generals of the three target municipalities where it is to be demonstrated that the improvement of the capabilities of municipal authorities translate into improved service

Description

The implementation of this activity entails the preparation of a Liquid Waste Management Guide for Municipal Authorities, the presentation of the guide to authorities through 3 seminars to be held in each respective city, and the organization of a general workshop which will help finalize the guide on the one hand, and on the other hand, permit the sharing of experience among the attending municipal decision-makers

Action plan

The following actions will need to be taken in order to effectively implement this activity

- ▶ Develop a guide to understand liquid waste systems, their development and management for decision-makers and administrators of municipalities
- ▶ Conduct a workshop on the subject matter in each city for introducing the guide and discuss its content (30 people maximum per seminar)
- ▶ Conduct a seminar for officials of all three cities in one location to discuss the usefulness of the guide and share experience

Required time

- ▶ Guide development 3 months
- ▶ Workshops organization and delivery 1 month
- ▶ Seminar organization and delivery 1 month

Technical Assistance

- ▶ Guide development consultant (international) 10 weeks
- ▶ Guide development consultant (national) 8 weeks
- ▶ Number of international trips (3)

Estimated cost

▶ Guide production	US\$ 5,000
▶ Seminars (to be hosted by city)	US\$ 0
▶ Workshop (90 people maximum)	US\$ 22,000
▶ Technical Assistance	US\$118,000
Total estimated cost	US\$145,000

Activity management

This activity will be organized and managed by TSS-Maroc with technical inputs from the International and Local consultants who will assume responsibility for preparing the guide. Production of the guide will be the responsibility of TSS-Maroc. A review committee with members from relevant institutions will be formed to provide feedback on the guide. The committee should include members from the Ministry of Interior, the Ministry of Environment, FEC, ANHI, ONEP, RADEEF.

ACTIVITY 2

ACTIVITY NAME SEWERAGE SYSTEMS AND MANAGEMENT
KNOWLEDGE AND SKILLS DEVELOPMENT FOR
MUNICIPALITY TECHNICAL MANAGERS

ACTIVITY LOCATION AZROU, BEN GUERIR, SEFROU

ACTIVITY DESCRIPTION

Rationale

The technical services of Moroccan municipalities are generally managed by professional engineers, architect and physicians who are required to have adequate knowledge of liquid waste disposal systems design, operation and maintenance, and who must also have adequate management skills relevant to environmental services delivery. Presently the three target municipalities have received many young professionals who have just graduated and put in management positions. Many of them have some management responsibility for environmental services including liquid waste disposal services. This is also true for the other small and medium-sized municipalities of the country. Therefore, a program to train these professionals will greatly improve the practices of sewerage management in small and medium-sized municipalities.

Purpose and scope

The purpose of this activity will be to improve the knowledge and skills of municipal engineers, architects, physicians and others whose services require a good understanding of liquid waste disposal systems development and management. The specific objectives are (1) to develop the cognitive capacity of municipal professionals in the technique of sewerage disposal and management, and (2) to improve skills of targeted professionals in the making of decisions for the service.

This activity will be limited to the professional staff of the three target municipalities.

Action plan

- ▶ Develop a technical manager's guide in liquid waste disposal systems and management
- ▶ Conduct a seminar on the subject matter for the three cities at one location (up to 20 participants)

Required time

- ▶ Guide development 3 months
- ▶ Seminar organization and delivery 1 month

Technical assistance

- ▶ Guide development consultant (international) 8 weeks
- ▶ Guide development consultant (national) 6 weeks
- ▶ Number of international trips (2)

Estimated plan

- ▶ Guide production US\$ 5,000
- ▶ Seminar (3 days) US\$ 10,000
- ▶

ACTIVITY 3

ACTIVITY NAME MODEL MANAGEMENT UNIT DEVELOPMENT FOR
MEDIUM-SIZED MUNICIPALITIES

ACTIVITY LOCATION AZROU & SEFROU

ACTIVITY DESCRIPTION

Rationale

Medium-sized municipalities do not have the human, material, and financial resources that are needed to effectively manage environmental services. Presently, the problems encountered in medium-sized municipalities are organizational in nature. Without a service that has direct responsibility for sewerage, with its own personnel that is adequately supervised, and with daily workplans, the many chores of operating and maintaining a sewerage system is not possible. For the municipalities of AZROU and SEFROU, the municipal councils would like to strengthen their sanitation unit by creating a full service that has responsibility for handling liquid waste systems operation, maintenance, and management. Therefore, this project seeks to develop a scheme that will strengthen the municipalities capabilities to manage the sector. Municipal councils of the two cities have made the commitment to provide more personnel to the sector and will need them to be trained.

Purpose and scope

The purpose of this activity will be to demonstrate that organized services for liquid waste disposal will improve the conditions of the sewerage systems in AZROU and SEFROU. The specific objectives are (1) to establish appropriate organizations at the municipalities that can operate, maintain, and manage their sewerage systems, and (2) to make the services cost efficient.

Actions

- ▶ Develop a municipal service that will be composed of three operational units that will have responsibility for liquid waste disposal systems exploitation in the municipalities of AZROU and SEFROU. A manpower development plan and an equipment acquisition plan will be developed for the service. Approval of the plan will need to be obtained from the Municipal Council.

- ▶ Develop a workplan for the unit which will include the specific tasks that will need to be performed by each employee providing operational and maintenance services to the liquid waste disposal system
- ▶ Develop and implement a training program for units personnel responsible to implement and manage the workplan.
- ▶ Establish the service and make it operational within a reasonable timeframe.

Required time

- ▶ Conduct a feasibility study for the activity 1 month
- ▶ Design an appropriate plan for a municipal liquid waste disposal service 1 month
- ▶ Prepare a workplan for the service 2 months
- ▶ Establish the services at their respective municipalities 18 months

Technical assistance

- ▶ International consultant 10 weeks
- ▶ National consultant 8 weeks
- ▶ Number of international trips (3 trips - 2 weeks each in country)

Estimated cost

▶ Sewer maintenance equipment	US\$ 20,000
▶ Technical Assistance	US\$118,000
Total	US\$138,000

Activity management

This activity will be managed by TSS-Maroc which will work in close collaboration with the Ministry of Interior

ACTIVITY 4

ACTIVITY NAME MODEL PLAN FOR STRUCTURING AND PRIVATIZING INDUSTRIAL AREAS LIQUID WASTE DISPOSAL MANAGEMENT IN A MEDIUM-SIZED MUNICIPALITY

ACTIVITY LOCATION BEN GUERIR

ACTIVITY DESCRIPTION

Rationale

The Municipality of BEN GUERIR has entered into a collaborative agreement with the Office Chérifienne de Phosphate (OCP) to develop an industrial zone which will be located South East of the city. About 27 hectares of land has been donated by OCP for this industrial zone. The construction of an industrial zone in the location selected will result in the grouping of all industrial activities in one area which abuts the OCP housing complex. This arrangement will allow that the construction of an autonomous sewer network for the zone, and the opportunity to select an on-site treatment facility or the disposal of sewer effluent either in the municipal sewer system or the OCP sewage treatment facility which is located near the zone.

This development provides a unique opportunity to demonstrate the practice of industrial liquid waste management from project planning to management concession. The advantages that are brought by this particular activity are

- (1) This is a joint venture between the largest industrial entity in Morocco (OCP) and a medium-sized municipality. Both institutions will participate in the decision-making process for the activity.
- (2) The donated land abuts the OCP complex and is quite near of the complex sewage treatment plant. A special arrangement can be made with OCP to expand its existing facility and provide treatment to the liquid waste to come from the industrial zone, or to join in the development of a new sewage treatment facility.
- (3) A liquid waste disposal plan can be established to ensure that liquid waste from future industrial plants to be located in this zone will be effectively controlled with built in required pre-treatment units.

- (4) A private entity could be interested in constructing and exploiting a sewage treatment facility to treat effluent from the industrial zone
- (5) A cost recovery method could be easily established as future occupants of the zone will have the financial means to pay for service with no subsidy envisioned

Purpose and scope

The purpose of this activity will be to demonstrate that effective planning of an industrial zone will allow medium-sized municipalities that are developing to adopt certain practices that will eliminate serious problems often encountered in municipalities with existing industrial zones. The specific objectives are (1) to establish sewage disposal guidelines for industrial entities that will occupy the new industrial zone, and (2) to ensure sustainability of the planned semi-autonomous liquid waste disposal system.

Actions

- ▶ Establish a list of potential industries that the city will seek to attract and develop liquid waste disposal guidelines for these industries. It should be noted that 62% of the 27 hectares have already been designated to applicant industries for space in the zone.
- ▶ Conduct a feasibility study for sewage from the zone to be either treated in the existing OCP plant or a new treatment facility to be built exclusively for the zone.
- ▶ Develop a plan to privatize the construction of the sewage treatment plant and the exploitation of the entire sewerage system.

Required time

- ▶ Prepare liquid waste disposal guidelines for the new industrial zone 1 month
- ▶ Conduct feasibility study for sewage treatment 1 months
- ▶ Develop privatization plan 1 month
- ▶ Recruit private entity to build treatment facility and exploit system 15 months

Technical assistance

- ▶ International consultant 14 weeks
- ▶ National consultant 12 weeks
- ▶ Number of international trips (4 trips - 75 days in-country)

Estimated cost

- ▶ Technical Assistance . US\$175,000

Activity management

This activity will be managed by TSS-Maroc which will work in close collaboration with the Ministry of Interior, the Municipality of BEN GUERIR, and OCP

ACTIVITY 5

ACTIVITY NAME MODEL PLAN FOR ON-SITE LIQUID WASTE DISPOSAL
THROUGH AUTONOMOUS SYSTEMS

ACTIVITY LOCATION SEFROU

ACTIVITY DESCRIPTION

Rationale

About 58% of the population is presently served by the existing sewer network of the city of SEFROU. This number is expected to increase to 85% by the year 2015. The non-sewered lots are presently served by autonomous systems, particularly, a cesspool. The city will need a lot of financial resources to expand the existing system with limited possibilities to acquire new financing. Therefore, there is a need to limit the expansion of that sewer system through the development of zones that can support autonomous systems providing on-site collection, treatment and disposal (e.g., septic tanks). However, to establish such systems, it is essential that specific zones be identified as capable of supporting autonomous systems (low population density and appropriate soil condition), that the autonomous systems be adequately designed, constructed, and maintained, and that private and public support/controlled services be established.

This demonstration activity provides a unique opportunity to demonstrate the practice of autonomous systems as an alternative to public sewerage systems expansion in medium-sized cities that are wrestling with growth. The particular advantages brought by this activity are

- (1) The city has already mapped out the areas that can sustain autonomous systems
- (2) The city presently has about 24,000 people living on un-sewered lots. Therefore, by improving and expanding autonomous systems technologies, they will become more popular and readily acceptable as a mean of sewage disposal. This will greatly reduce the pressure put by the population on the municipal council to expand the sewer network to unsewered areas
- (3) Private septic tank construction and cleaning services can be promoted and established to ensure systems sustainability

Purpose and scope

The purpose of this activity will be to demonstrate that effective planning of autonomous liquid waste disposal units using on-site collection, treatment and disposal technologies can greatly limit the need to expand municipal sewerage systems to unsewered areas

The specific objectives are (1) to define areas and systems which will be appropriate for on-site liquid waste disposal, (2) to develop a program that will help establish construction and maintenance guidelines for on-site liquid waste disposal systems, and (3) to develop a plan for privatizing all activities concerning the construction and maintenance of autonomous systems

Actions

- ▶ Develop a map of low population density and soil suitability of zones where autonomous systems can be easily constructed. This will require the performance of soil percolation tests in designated areas
- ▶ Prepare guidelines for design, construction, and maintenance of autonomous system(s) selected for the city
- ▶ Develop a plan to privatize the construction and maintenance of autonomous sewage disposal systems
- ▶ Develop a pilot activity in one quartier to demonstrate the construction, maintenance, and control of septic systems

Required time

- ▶ Conduct project design activity 1 month
- ▶ Prepare map of suitable zones for septic systems construction 2 months
- ▶ Prepare guidelines for design/construction/maintenance of septic tanks 2 months
- ▶ Develop privatization plan 1 month
- ▶ Construct/rehabilitate up to 100 septic systems in the selected quartier 15 months

Technical assistance

- ▶ International consultant . 16 weeks
- ▶ National consultant • 16 weeks
- ▶ Number of international trips (5 trips - 75 days in-country)

Estimated cost

▶ Map preparation (Municipality of SEFROU)	US\$ 0
▶ Rehabilitation cost for up to 50 systems (private)	US\$ 0
▶ Construction cost for up to 50 systems	US\$ 50,000
▶ Technical Assistance	US\$170,000
Total	US\$220,000

Activity management

This activity will be managed by TSS-Maroc which will work in close collaboration with the Ministry of Interior and the Municipality of SEFROU

ACTIVITY 6

**ACTIVITY NAME: MODEL MUNICIPAL SEWAGE TREATMENT
PRIVATIZATION PLAN**

ACTIVITY LOCATION. AZROU

ACTIVITY DESCRIPTION

Rationale

Medium-sized municipalities in Morocco are generally served by sewer networks but are without treatment facilities. The Government of Morocco's policy is to ensure that all cities have complete sewerage systems including the treatment of sewage using low-cost and appropriate technologies. The city of AZROU faces the same situation as those of other municipalities regarding sewage treatment. However, the problems of AZROU are even greater as the city has experienced disease outbreaks that are directly related to the practice of raw sewer effluent reuse. Thus, the city is at the head of the list to resolve the sewage treatment and reuse dilemma.

While the sewerage master plan study has proposed the use of stabilization ponds as an appropriate treatment method, it is proposed that a high algal treatment plant be used to provide an effluent that meets international standards for reuse in agriculture on the one hand, and on the other effectively control odor and pests (mosquitos).

Such a plant can be built as a demonstration unit for treatment of partial flow from the city, and in a second phase, expanded by a private entity who will be sought to provide the service.

The need for readily available irrigation water has pushed farmers to use untreated effluent from these networks directly for irrigating various crops that include vegetables. This practice has been the cause of waterborne disease outbreaks in cities where it is used.

The city of AZROU is at the top of the list of cities that have emergency sewage problems due to outbreak of such diseases as typhoid fever and cholera due to the re-use of raw sewage to irrigate agricultural crops. Therefore, AZROU presents the best case for improving health and protecting the environment through sewage treatment meeting conditions for reuse.

This demonstration activity provides a unique opportunity to demonstrate the practice of sustainable sewage treatment producing quality effluent without nuisance that are generally associated with stabilization ponds in Morocco. The particular advantages brought by this activity are:

- (1) Effluent reuse in agriculture is readily practiced in AZROU as the demand for irrigation water is high. Thus, there will be little need for sensitizing farmers to use treated and safe effluent**
- (2) The city's sewer network discharges sewage directly on land from a multitude of outfalls. Such a condition allows that a specific zone be segregated for a pilot treatment unit using the high algal treatment technology**
- (3) The Institute of Agronomy of Hassan II (IAH) in Rabat is prepared to operate and maintain the plant until it can be taken over by a private entity**

Purpose and scope

The purpose of this activity will be to demonstrate the high value and cost effectiveness of the high algal treatment process adapted to Morocco by the IAH and the impact of effective treatment on health and the environment

The specific objectives to be attained by this activity are (1) to introduce an effective and sustainable treatment process for medium-sized municipalities, (2) to demonstrate the valorization of treatment plant's bi-products in Morocco, and (3) to develop a plan for privatizing sewage treatment in a medium-sized city

Actions

- ▶ Conduct a preliminary assessment of the city's 9 sewage outfalls and surrounding areas to select those carrying sewage that will be treated by the demonstration plant and those that can receive partial treatment.**
- ▶ Design a demonstration plant using the high algal treatment process for the selected outfall(s) - 10,000 inh**
- ▶ Design temporary pre-treatment facilities for the remaining outfalls**
- ▶ Develop and implement a valorization plan for treatment facilities bi-products**
- ▶ Develop and implement a plan to privatize the exploitation of the treatment facilities.**

Anticipated duration of activity

- ▶ Conduct preliminary assessment 1 month
 - ▶ Design demonstration plant 2 months
 - ▶ Design temporary pre-treatment plant(s) 1 month
 - ▶ Construct demonstration plant 6 months
 - ▶ Develop plant bi-product valorization plan 1 month
 - ▶ Develop privatization plan 1 month
 - ▶ Conduct demonstration tests 12 months
- Total time required activity 21 months

Technical assistance

- ▶ International consultant 12 weeks
- ▶ National consultant 12 weeks
- ▶ Number of international trips (4 trips - 75 days in-country)

Estimated cost

▶ Construction cost for demonstration plant	US\$430,000
▶ Construction cost associated to pre-treatment units	US\$230,000
▶ Operation and maintenance costs for one year	US\$ 20,000
▶ Construction cost for distribution of treated effluent	US\$ 0
▶ Technical Assistance	US\$130,000
Total	US\$810,000

Activity management

This activity will be managed by TSS-Maroc which will work in close collaboration with the Ministry of Interior and the Municipality of AZROU, and the IAH

ACTIVITY 7

ACTIVITY NAME MODEL SEMI-AUTONOMOUS SEWERAGE SYSTEM FOR NON-SEWERED AREAS IN MEDIUM-SIZED MUNICIPALITIES

ACTIVITY LOCATION BEN GUERIR

ACTIVITY DESCRIPTION

Rationale

The economic housing development program funded by the Government of Morocco and supported by many donors including USAID has been rapidly growing throughout Morocco and is presently addressing the needs of small and medium-sized municipalities. Thus, a number of new urban zones in small and medium-sized cities are presently being developed by ANHI and other operators. The practice for these operators is to build their sewer network and connect the network to the municipal sewerage system where such exists. Hence, the existing sewer system, which are generally not designed to carry such flows are incapacitated and become insufficient to effectively convey liquid waste to disposal points. Moreover, the size of projected treatment facilities increase as well as cost which decrease their feasibility.

In order to better manage the development of municipal sewerage systems in small and medium-sized cities, it is essential, whenever possible, that housing projects rely on semi-autonomous sewerage systems for disposing of their liquid waste. Hence it is valuable that such a practice be demonstrated and replicated in the multitude of cities where these operators are to be found.

The city of BEN GUERIR presents such a case where ANHI is presently structuring the sewerage system in two quarters (AFRIQUIA and CHAAIBT). These two quarters have a total population of 17,400 which is expected to reach 34,000 by the year 2010. The present plan is to build an interceptor sewer that is to be connected to the existing sewer network of BEN GUERIR. Hence, this project should be modified to a semi-autonomous system with its own treatment facility.

This demonstration activity provides a unique opportunity to demonstrate the practice of sustainable liquid waste disposal through semi-autonomous sewerage system. The particular advantages brought by this activity are:

- (1) The two quarters have already been studied for development of sewer collection system and the present project can be easily modified to become a total semi-autonomous system.

- (2) The city of BEN GUERIR has a strong population participation program in liquid waste disposal activities. Therefore, the quarters population can be organized in the form of an association to assume total responsibility for managing the proposed semi-autonomous system.
- (3) There exist a dynamic Young Entrepreneur's Club sustained by the Municipality and the private sector. Therefore, the possibility of developing a private entity to manage the system for the neighborhood association is very high.

Purpose and scope

The purpose of this activity will be to demonstrate the development of semi-autonomous approaches to liquid waste disposal in small and medium-sized municipalities where housing development operators are active.

The specific objectives to be attained by this activity are (1) to demonstrate the use of appropriate technologies applicable to semi-autonomous systems, and (2) to demonstrate the possibility of privatizing semi-autonomous systems without burdening municipal services.

Actions

- ▶ Conduct a preliminary assessment of the quarters and their surrounding to determine the feasibility of constructing a treatment plant.
- ▶ Design a demonstration plant using the high algal treatment process for 20,000 inh.
- ▶ Develop and implement a valorization plan for treatment facility's bi-products.
- ▶ Develop and implement a plan to privatize the exploitation of the treatment facility.

Anticipated duration of activity

- ▶ Conduct preliminary assessment 1 week
- ▶ Design demonstration plant 2 months
- ▶ Construct demonstration plant 6 months
- ▶ Develop plant bi-product valorization plan 1 month
- ▶ Develop privatization plan 12 months
- ▶ Conduct demonstration tests 12 months

Total time required activity 21 months

Technical assistance

- ▶ International consultant • 12 weeks
- ▶ National consultant . 12 weeks
- ▶ Number of international trips (4 trips - 75 days in-country)

Estimated cost

▶ Land procurement (Municipality)	US\$ 0
▶ Construction cost for demonstration plant	US\$860,000
▶ Construction cost for distribution of treated effluent	US\$ 0
▶ Technical Assistance	US\$130,000
 Total.	 US\$990,000

Activity management

This activity will be managed by TSS-Maroc which will work in close collaboration with the Ministry of Interior and the Municipality of BEN GUERIR, OCP, and the IAH

ACTIVITY 8

ACTIVITY NAME: MODEL STORM WATER IMPROVEMENT ACTIVITY IN SEFROU

ACTIVITY LOCATION SEFROU

ACTIVITY DESCRIPTION

Rationale

Many municipalities located in mountainous areas experience severe problems with storm water evacuation. In fact the municipalities situated in the Atlas mountains receive large quantities of precipitation and are subjected to periodic floodings. The frequency of return of floodings has been reported to have greatly increased because of several changes that have taken place in land-use. Firstly, cities have expanded, thus decreasing soil permeability. Secondly, mountains have eroded because of deforestation, thus increasing the quantity and decreasing travel time of runoffs. Thirdly, areas that should be reserved for storm water channeling (thalwegs) have been constructed, thus damming runoffs. Fourthly the hydrographic network is generally not appropriately maintained.

SEFROU is one of the cities that is impacted by this problem. The city which is located in a basin, experience annual floodings which cost millions of Dirham in property damages and general clean-up. Thus, the development of a pilot activity aiming at managing storm water flows in SEFROU would be most appropriate to demonstrate certain practices that could help alleviate the problem. The particular advantages brought by this activity are

- (1) SEFROU has an on-going storm water management program that would need very little input to improve the situation
- (2) SEFROU presents the best ground for developing and implementing an effective storm water management program that can be replicated in many other municipalities of the country

Purpose and scope

The purpose of this activity will be to demonstrate the development of storm water management practices that can effectively reduce the adverse impact that these waters have on small and medium-sized cities located in mountainous areas

The specific objectives to be attained by this activity are (1) to establish a storm water monitoring system capable of providing essential information on the behavior of storm water flows through the city of SEFROU, (2) to develop a plan that will help reduce the problems caused by storm water flows, and (3) to strengthen present storm water management practices in order to mitigate annual floodings

Actions

- ▶ Conduct a detailed assessment of the city's storm water management system and program
- ▶ Establish a storm water management model that will help gather information that will be critical to strengthen existing storm water evacuation network.
- ▶ Establish a maintenance program for the existing storm water evacuation network

Anticipated duration of activity

- ▶ Conduct detailed assessment 1 month
- ▶ Establish storm water management model 17 months
- ▶ Establish maintenance program 17 months

Total time required activity 18 months

Technical assistance

- ▶ International consultants 18 weeks
- ▶ National consultant 6 weeks
- ▶ Number of international trips (6 trips - 90 days in-country)

Estimated cost

▶ Storm water management modelling	US\$ 10,000
▶ Cost associated with erosion control (Municipality)	US\$ 0
▶ Maintenance equipment costs	US\$ 10,000
▶ Technical Assistance	US\$160,000
Total	US\$180,000

Activity management

This activity will be managed by TSS-Maroc which will work in close collaboration with the Ministry of Interior, the Regional Hydraulic Direction, and the Municipality of SEFROU

ANNEXES

ANNEX A LISTS OF CITIES

**ANNEX A1 LIST OF PRIORITY CITIES FOR
LIQUID WASTE INTERVENTIONS**

ANNEXE A1

CLASSEMENT DES VILLES ET CENTRES URBAINS SELON L'URGENCE D'ACTION DANS LE SECTEUR DE L'ASSAINISSEMENT LIQUIDE

SELON LA FICHE DU MINISTERE DE L'ENVIRONNEMENT

Le classement des villes marocaines, selon leurs tailles, a été fait par ordre de priorité qui c'est basé sur les critères suivants la démographie, la santé publique, l'atteinte à l'environnement, la protection contre les inondations, la réutilisation des eaux usées et l'importance des activités économiques

I LES VILLES DE GRANDE-TAILLE (PLUS DE 100 000 HABITANTS)

01	CASABLANCA	02	FES
03	MARRAKECH	04	TANGER
05	RABAT	06	AGADIR
07	SAFI	08	KENITRA
09	MOHAMMEDIA	10	NADOR

II LES VILLES DE TAILLE-MOYENNE (20 000 - 99 000 HABITANTS)

01	AZROU	02	MARTIL
03	TAROUDANT	04	BOUZNIKA
05	ASSILAH	06	ESSAOUIRA
07	AL HOUCEIMA	08	FNIDQ
09	OUARZAZATE		

III LES PETITS CENTRES (MOINS DE 20 000 HABITANTS)

01	SAIDIA (PROVINCE DE BERKANE-TAOURIRT)
02	MEHDIA (PROVINCE DE KENITRA)
03	TIMAHDITE (PROVINCE D'IFRANE)
04	SIDI IFNI (PROVINCE D'TIZNIT)
05	EL JABHA (PROVINCE DE CHEFCHAOUEN)
06	BOUJDOUR (PROVINCE DE BOUJDOUR)
07	KALAAAT M'GOUNA (PROVINCE DE OUARZAZATE)
08	HRARA (PROVINCE DE SAFI)
09	ZEMAMRA (PROVINCE DE EL JADIDA)
10	BOUIZARKANE (PROVINCE DE GUELMIM)

FICHE

Objet Schema Directeur d'Assainissement Liquide

En se basant sur les recommandations du Schema Directeur National d'Assainissement Liquide, qui s'articule sur un certain nombre de criteres de base tels que la demographie, la sante publique, l'atteinte a l'environnement, la protection contre les inondations, la reutilisation des eaux usees et les activites economiques, ainsi que sur une analyse multi-critere approfondie, on peut classer les villes et centres urbains selon l'urgence d'action dans le secteur assainissement, comme suit

Pour la classe Grandes villes, les agglomerations suivantes se situent en tête **Casablanca, Fes, Marrakech, Tanger, Rabat, Agadir, Safi, Kenitra, Mohammedia et Nador** Il s'agit de villes sur lesquelles il y a lieu de porter une attention particuliere lors des choix d'investissement, a double titre leur statut de grandes villes, et leur classement suivant les criteres de priorite

Le premier rang occupe par **Casablanca** s'explique par l'importance du centre, capitale industrielle et economique du pays, et par les risques importants de degradation du milieu naturel

La ville de **Fes** est connue depuis plusieurs annees pour la degradation tres avancee qu'elle genere pour l'oued Sebou a travers les rejets d'eaux usees avec un caractere industriel tres marque La ville de **Marrakech** est caracterisee par le risque d'atteinte aux ressources d'alimentation en eau potable, avec une menace pour les ressources souterraines Ces deux villes sont en outre exposees a des inondations dues au ruissellement des eaux pluviales

Il est a noter que ces trois villes (Casablanca, Fes et Marrakech) ont deja connu une premiere etape de lancement de premieres tranches de travaux d'assainissement (reseaux et depollution) dans le cadre d'emprunts contractes aupres de differents bailleurs de fonds Banque Mondiale, Caisse Française de Developpement et Banque Europeenne d'Investissement L'analyse multicritere ne fait que confirmer l'urgence d'action que revêtent ces villes

Tanger porte gravement atteinte a la qualite des eaux littorales, et est aussi exposee aux risques d'inondation Les villes littorales d'**Agadir** et de **Rabat** sont classees dans les premiers rangs pour des raisons differentes, même si les deux portent atteinte de façon notable a la qualite des eaux littorales Agadir, constitue le premier pôle economique du Sud, elle est leader a l'échelle nationale aussi bien sur le plan touristique que sur le plan des produits de la pêche

La ville de **Kenitra** se trouve en aval de l'oued Sebou, elle est exposee aux inondations de l'oued Fouarat et porte atteinte a la qualite des eaux de baignade

Pour les villes moyennes, les villes suivantes apparaissent prioritaires **Azrou, Martil, Taroudant, Bouznika, Assilah, Essaouira, Al Houceima, Fnidq et Ouarzazate**

La ville d'**Azrou** se classe en tête car elle pose de graves problemes de sante (Cholera et typhoide) **Martil** est quant a elle sujette a de frequentes inondations **Taroudant** est prioritaire dans la mesure ou la reutilisation des eaux usees serait tres interessante pour ce site, qui souffre d'un manque d'eau

Les petits centres classes les dix plus prioritaires sont les suivants (donnes avec la province) **Saidia** (Berkane-Taourirt), **Mehdia** (Kenitra), **Timahdite** (Ifrane), **Sidi Ifni** (Tiznit), **El Jabha** (Chefchaouen), **Boujdour** (Boujdour), **Kalaat M'Gouna** (Ouarzazate), **Hrara** (Safi), **Zemamra** (EL Jadida) et **Bouizarkane** (Guelmim)

Ainsi, le choix des villes comme Tanger ou Marrakech (Grandes villes), Azrou ou Martil (villes moyennes) ou Saidia (petits centres) contribuerait a trouver des solutions aux problemes d'assainissement liquide non encore resolu

**ANNEX A2 LIST OF CITIES ONEP TARGET TO TAKE OVER
LIQUID WASTE MANAGEMENT SERVICES**

**PROJET DE DEVELOPPEMENT URBAIN ET DES SERVICES ENVIRONNEMENTAUX
COMPOSANTE DE L'AMELIORATION DE LA GESTION DE L'ASSAINISSEMENT LIQUIDE**

ANNEXE A2

PROGRAMME D'INTERVENTION DE L'ONEP EN MATIERE D'ASSAINISSEMENT LIQUIDE

CENTRE	PROVINCE	DIRECTION REGIONALE	POPULATION 1996	TAILLE DES MENAGES - 1996
TAROUDANT	TAROUDANT	DR 1	61 600	5
GUELMIM	GUELMIM	DR 1	80 500	5
SIDI MOKHTAR	CHICHAOUA	DR 2	9 700	5
OUARZAZATE	OUARZAZATE	DR 2	44 200	6
KALAAT M GOUNA	OUARZAZATE	DR 2	13 500	6
BEN SLIMANE	BEN SLIMANE	DR 3	39 600	5
EL GARA	SETTAT	DR 3	16 700	5
BEN AHMED	SETTAT	DR 3	19 800	5
OUAOULZEGHT	AZILAL	DR 3	7 800	5
AZILAL	AZILAL	DR 3	20 400	5
AFOURER	AZILAL	DR 3	12 900	5
KHOURIGBA	KHOURIGBA	DR 3	158 000	6
BOUJADAD	KHOURIGBA	DR 3	34 200	5
OUED ZEM	KHOURIGBA	DR 3	76 800	5
DAR EL GUEDDARL	SIDI KACEM	DR 4	5 900	6
TAOUNATE	TAOUNATE	DR 5	27 500	5
AL HOCEIMA	AL HOCEIMA	DR 5	57 700	5
OUTAT EL HAJ	BOULEMANE	DR 5	11 300	5
BOUARFA	FIGUIG	DR 6	20 900	5
ZAIO	NADOR	DR 6	28 400	5
ALAAROUI	NADOR	DR 6	30 800	6
TAFOGHALT	BERKANE - TAOURIRT	DR 6	1 800	7
TAOURIRT	BERKANE TAOURIRT	DR 6	63 200	6
BOUHDILA	BERKANE - TAOURIRT	DR 6	11 400	6
S SLIMANE CHAA	BERKANE - TAOURIRT	DR 6	17 300	6
BERKANE	BERKANE - TAOURIRT	DR 6	81 000	5
RISSANI	ERRACHIDIA	DR 7	17 700	6
AIN TAOUJDATE	EL HAJEB	DR 7	17 800	5
M RIRT	KHENIFRA	DR 7	28 200	5
KHENIFRA	KHENIFRA	DR 7	65 100	5
AMALOU IGHTRIBEN	KHENIFRA	DR 7	25 300	5
SMARA	SMARA	DR 8	30 900	7

ANNEX B LIQUID WASTE MANAGEMENT ASSESSMENT REPORTS

ANNEX B1 THE CITY OF AZROU

ANNEXE B1

LIQUID WASTE MANAGEMENT ASSESSMENT REPORT - AZROU

I GENERAL INFORMATION

1.1 Geographic & Climatic Information

The municipality of AZROU is located in the Province of IFRANE in the SOUTH - CENTER Economic Region. It is situated at 17 kms East of IFRANE, the seat of the Province. The city is located in the North-West quadrant of the MIDDLE-ATLAS region of Morocco at an altitude between 1200 - 1800 m. It has slopes which varies from 1/500 m/m to 1/15 m/m. Hence, it is built on the flank of the Atlas mountains and slopes toward a plateau.

The climate of the region is temperate with cold winters. Annual precipitation (rain and snow) averages to about 833 mm with monthly averages of 100 - 135 mm for the months of December and January as well as an average monthly precipitation of 90 mm during the months of February, March, and April. Summer months are relatively dry with the minimum precipitation recorded at an average of 44 mm/month. About 72% of precipitation occur between November and May.

Regarding temperature registered in AZROU, it has average maximal and minimal of 25°C to 7,3°C. However, temperature falls below 0°C during the winter months (December, January, and February).

Prevailing winds in the winter are from the West and are generally humid. In the summer months, they are from the East and are very hot.

Evapotranspiration represents about 60% of AZROU's rainfall.

The only origin of groundwater comes from the infiltration of rainfall and snow that infiltrates in the calcareous Karst to reappear in the periphery of the Middle-Atlas "tabular".

1.2 Urban Characteristics of AZROU

The city of AZROU is a relatively new municipality as it changed from a rural commune to a municipality in 1992. It has always been an important population center in this part of Morocco as it was used as the winter homes of herders roaming Western Morocco with their cattle. Herders would come to AZROU to obtain goods and sell their products before climbing the Atlas mountains with their herds during the warmer seasons.

AZROU represents an important tourist crossroad as many parts of Eastern and Southern Morocco are only attainable through the city. European and North African tourists can be observed in the city during all months of the year.

MOROCCO URBAN & ENVIRONMENTAL SERVICES PROJECT **AN B1 - 2**
AZROU IMPROVED LIQUID WASTE MANAGEMENT ASSESSMENT REPORT

Commerce is the main occupation of the people of AZROU which employs 76% of the population. People involved with commerce in AZROU are primarily in the wholesale of agricultural products, the sale of construction material, and retail stores. The only industrial activities in AZROU are the production of wood products as there are many sawmills in the city, and the production of handicraft goods.

Although AZROU is an important tourist stop, its tourist infrastructure is rather limited. The city only has 4 hotels of 4, 3, 2 and 1 stars respectively and a total of 120 beds. During the hot summer months, many Moroccans go to AZROU for vacation.

Agriculture constitutes the principal productive activity in the region. The total agricultural land area surrounding AZROU is 22,800 hectares. There are also 21,600 hectares of forest land surrounding the city. The main agricultural crops produced in the region are cereals (16,500 ha), vegetables (250 ha), fodder (1,400 ha) and the practice of fallowing (1,965 ha).

As to its demography, AZROU's population has grown from 14,000 in 1960 to about 54,000 presently. This population can be increased to 50% during the summer months. The city's population is expected to double in about 20 years (2015) with a growth rate that was determined to be 3.6% in 1994 and will diminish to 3% by 2015.

The people of AZROU live in 8 quarters which spread over a total surface area of 769 hectares. Of these 769 hectares, about 60% is open space, 27% buildings, and 13% other spaces including parks. There are four types of houses reported in AZROU: villas, apartments, continued houses, and mixed houses. Population densities vary from 480 persons/ha to 770 persons/ha. During the summer months, the population can be increased to as much as 50%.

In 1994, the city had 8,614 families and 5,890 land parcels which occupied a total area of 45 ha. The soil occupation of these 45 ha was 37 ha with 84 ha of floor space. Because of the high demand for space, rental of space varies from a little bit over 9 Dh/m² to about 19 Dh/m².

The city is managed by a new municipal council that was elected in 1997 and is headed by a Municipal President, two Vice-Presidents, and a Secretary General. The city's technical services are managed by a Municipal Engineer responsible for all services that are of public works and environmental nature, a Civil Engineer who has charge for the city's urbanization, and two Public Health physicians who take charge of environmental health services.



1 3 Water Supply and Wastewater disposal services

1 3 1 Water Supply services

AZROU water distribution is the responsibility of the National Potable Water Office (ONEP). The town is supplied by two springs with total flow of 55 liters per second (lps) and a deep well which yields 25 lps. Water produced by these units are stored in two reservoirs with a total capacity of 4,000 m³.

There are two separate water distribution networks in AZROU, a lower network which provides total coverage to all parcels situated between the altitudes of 1,225 and 1,266 meters (the largest part of the city), and 1,267 and 1,310 meters.

The estimated water consumption for 1997 is about 4,060 m³/day and the coverage of the population is 74%. It is projected that the water consumption rate in the year 2015 will attain 7,450 m³/day with a population coverage rate of 95%.

As to water tariff, it is presently set at 2 067 Dh per m³ for those consuming between 1 and 24 m³ per trimester, 4 74 Dh/m³ for those consuming between 25 - 60 m³ per trimester, and 6 825 Dh/m³ for those consuming more than 60 m³ per trimester.

1 3 2 Wastewater disposal

A Sewage disposal

The disposal of sewage in the municipality of AZROU is done either through the public or municipal sewerage system and autonomous systems for these areas that have no access to the municipal sewerage network. The present situation of the two systems are described below.

1) The municipal sewerage system

The municipality of AZROU is served by a combined sewer network which collect wastewater from the entire city except for one housing development that has a separate sewers for sewage and storm water collection.

The sewer network is composed of 9 main lines collecting sewage from secondary and tertiary lines in the quarters covered by the system. The total length of the network is about 39 kms. It is composed of 13 kms of visitable sewers, 170 ml of rectangular pipes, and about 36.5 kms of non-visitable pipes. More than 75% of the network is composed of small sewers (ϕ 300 & ϕ 400).

The city has been divided into 9 watersheds draining wastewater and storm water through the nine primary collectors to their final points of disposal covering a total surface area of 275 hectares. The 9 outfalls are situated in the western/south western areas of the city. All the outfalls can be intercepted by a 3 kms interceptor sewer and brought to one location.

The hydraulic loads projected for AZROU are about 3,100 m³/day in 1997, 3,400 m³/day in 2000 and 4,800 m³/day by the year 2015. The composition of raw sewage from the city was measured to be COD as 1,478 mg/l (including the slaughter house) and 812 mg/l (without the slaughter house), BOD as 578 mg/l (including the slaughter house) and 278 mg/l (without the slaughter house), MES as 383 mg/l (including the slaughter house) and 239 mg/l (without the slaughter house), and Salinity as 1,350 mg/l (including the slaughter house) and 1,150 mg/l (without the slaughter house). As to the content of heavy metals in the sewage, they have been found to be in very low concentrations and are below European standards.

The discharges from the sewer outfalls are used directly and indirectly (mixed with spring water) by farmers to irrigate their fields. Presently about 250 hectares are being irrigated with raw sewage from the outfalls. These include cereals (62% of the land area), vegetables which include tomatoes, mint, zucchini, cucumbers, onions, pepper, cabbage, egg-plants (10%) and others (28%). The use of raw sewage has been blamed for episodic breakout of typhoid fever. Because of this danger, strict control is conducted by the municipal hygiene service which often seizes products from land that is irrigated by raw sewage.

The management of the wastewater system is the responsibility of the municipality of AZROU. Services provided by the municipality is simple maintenance. These services are managed by the Municipal Engineer who heads a technical municipal services and assigns a squad to perform work on the system. The Municipal Engineer is assisted by a Technician who provides the day to day management of the sector. The Technician heads a squad composed of a caporal (foreman) and 6 égoutiers (field agents). The squad has no diagnostic or mechanical equipment for maintenance, no service vehicles, and no protection clothing and material. The material used is quite rudimentary.

The city's wastewater master plan studies started in 1989, but were stopped in 1992 at the time that AZROU became a municipality. However, the master plan studies were then started over in 1994 with funding from ONEP. Phase I and II of the studies which entails the assessments of the sewerage system, the environment, effluent re-use possibilities, urban development, industrial pollution, and the identification of alternatives for sewerage system's rehabilitation and development have been completed. The consulting firm conducting these

studies are presently completing Phase III of the studies which entails the conduct of comparative technical and cost analyses of the alternatives for selecting the alternative that is to be retained. This study has been delayed as the city has not yet agreed on a site for the treatment plant.

As to the funding of the sector, the Municipality has spent a total of 1 137,620 Dh during the past five years for salaries and material, an average of 228,000 Dh per year. The municipality collects a connection tax which is based on street cover. The ratio between the municipality's development budget for 1994 and its total expenditures for network maintenance (sewer pipes, construction material, disinfectants) was less than 1% (0.9%).

The Municipality presently collects no other taxes and tariff from the system's users.

2) Autonomous systems

Presently about 75% of the population is connected to the municipal sewer network. The remaining 25% of the population are served by a cesspool. These cesspools are a form of septic tanks where wastewater is discharged in a percolation well permitting the release of water underground.

B Storm water disposal

The disposal of storm water is a crucial problem for AZROU. The city's location at the feet of the Atlas Mountains makes it vulnerable to run-off from the higher altitudes of these mountains. Storm water coming from the interior and exterior basins of AZROU are evacuated through a system of 6 natural basins (thalweg or chaâbas) or the existing sewer network which is structured as a combined system. Some of the chaâbas are partially calibrated, while others are left in their natural state (not lined or covered).

There are no precipitation measurement stations in AZROU and no model has been established to design an effective storm water disposal system for the city. It should be noted that several studies have been or are being conducted on the storm water problems of AZROU. Water run-off from the city will either infiltrate the ground in the valley or proceed to Oued TIGRIGRA which is a tributary of Oued SEBOU.

II AZROU WASTEWATER DISPOSAL SECTOR PROBLEMS AND CONSTRAINTS

2 1 Wastewater disposal system

2 1 1 Wastewater collection

A Organizational problems

The sewer network is not well organized as its development to date has not been planned. For example, the system is neither separate or combined, it is a pseudo-combined system with areas having separate collection of sewage and storm water, areas which has combined collection of both types of waters, and areas where the system is designed to be a combined system, but has no ability to admit storm water.

However, with the present master plan, the sewer network is expected to be better organized and its development structured.

B Coverage problems

The present system does not provide coverage to 25% of the population living in 2 quarters and some islands in the other quarters of the city. The city calls

C Clogging problems

About 4 kms of sewer pipes and appurtenances are clogged. The clogging problem is primarily due to certain practices of the population, i.e., disposal of solid waste in the sewers, the carriage of eroded debris by storm waters, and the lack of preventive and curative maintenance by the Municipality.

D Hydraulic overloading problems

About one kilometers of sewer pipes have been identified as being undersized and are therefore insufficient to carry their design flow. These pipes are weaknesses in the system and are often the cause of overflow.

E Physical problems

- ▶ About 460 manholes have been reported as being deteriorated and need rehabilitation,
- ▶ one hundred and seventy five (175) catch basins are either deteriorated or

clogged,

2 1 2 Wastewater treatment

The sewerage system has no treatment facility and therefore causes many environmental and public health problems in the city. These are

- ▶ Soil and underground pollution in the TIGRIGRA valley, a major watershed of Oued SEBOU. Many springs are threatened.
- ▶ Contamination of agricultural crops produced in the wastewater disposal area.
- ▶ Outbreaks of waterborne diseases (cases of typhoid fever and cholera have been reported).
- ▶ Mosquito and odor problems can be found in the general areas surrounding raw sewage outfalls.

All these are factors that heavily impact real estate in the lower part of the city, where future urban expansion is probable.

2 1 3 Storm water disposal

The city faces grave problems of floods due to large quantities of run-off that use the streets to convey storm water coming from surrounding hills to the valley. The accumulation of flood water in the city perimeter is usually due to clogged or dammed storm water passages. Moreover, the degree of erosion of surrounding hills slopes cause debris to be carried down by run-off water, and for water retention upstream of the city is very low.

Another major problem with storm water management is the absence of a rain and hydrographic stations around the city. Rainfall data used for the master plan were those of the city of IFRANE which is too far to provide reliable data. Hence, many of the works that are being constructed run the risk of being miscalculated.

Finally, the network of chaâbas crossing the city need to be organized in order to improve storm water disposal.

2 2 Wastewater Management

2 2 1 Organization

The municipality does not have the organizational structure to effectively manage the existing wastewater system. The present unit is not structured to respond to the work that need to be done for such a system. Moreover, it does not have the work force to effectively perform the required tasks of operating and maintaining a 39 kms sewerage system, nor does it have the equipment to do so.

2 2 2 Sector administration

AZROU's city managers are fortunate to have an agricultural engineer and a past entrepreneur as its first Vice-President and day to day manager of the technical services of the city. The Vice-President also has a very good knowledge of the sewerage system as he constructed many of the mains of the city's system. However, the Municipal Engineer, Physicians, and other technicians and workers responsible to manage and maintain the system have had no training in wastewater management or maintenance.

While the President and the Vice-President may have knowledge of wastewater disposal processes, newly elected members of the municipal council do not have such knowledge and would need to be trained in wastewater system's management. Hence, there is an urgent need to ensure that the municipal decision-makers (elected or hired/nominated) be properly trained to deal with the specific requirements of wastewater system's management.

2 2 3 Sector financing

The average annual expenditures for operation and maintenance of the existing sewer system per km of sewers for the past five years in the city's wastewater system has been very low (5,000 Dh). It roughly represents one fourth of the amount that a system of this size should cost for operation and maintenance.

III CONCLUSION & RECOMMENDATIONS

3.1 Conclusion

With a length of 39 kms, the wastewater disposal system in AZROU is an important infrastructure for the city. It presently collects wastewater (domestic, administrative and industrial) produced in most quarters in the city. The sewer network itself is in good condition with a few lines and appurtenances that need to be unclogged, rehabilitated or replaced/reinforced. The main problem with the network has been its inability to collect and discharge storm water effectively in the Oued. These storm water problems are due to factors outside of the hydraulics of the present combined sewer network. In fact they are due to erosion of surrounding hills that clog culverts and other appurtenances. There is a need to establish a strong erosion control as well as a rainfall measurement station in AZROU itself to provide reliable data in the future.

There is at present a multitude of sewer outfalls which are almost in the same area down slope from the city. These outfalls discharge raw sewage on the ground that either infiltrate the grounds or remain above ground. The raw sewage is then used to irrigate agricultural lands in the valley. This practice is directly related to the various outbreaks of waterborne diseases in the region. Thus, the system poses a threat to public health as well as the pollution of groundwater (particularly the many springs that can be found in the region).

In terms of sector management, there is a good team of managers that run the municipality of AZROU. They are conscientious of the problems and are eager to address them. They are also fortunate to have, as the day to day city manager, an experienced engineer who has built many of the sewer lines of the city's system. However, the engineering and medical staff who has been given charge of managing municipal services have limited knowledge and skills in wastewater management to do so.

The present organization, staffing and equipment at the municipality to deal with wastewater problems are not nearly enough to have a service capable of operating and maintaining a 39 kms sewerage system that is in full expansion. Qualified support staff to the present technical managers of the system are needed to provide the basic services required by such a system. An effective organization for such a service requires at least direction that needs to be provided by a trained and experienced municipal or sanitary/hydraulic engineer, a team or unit that handles civil works (expansion and rehabilitation either as comptroller or implementor as well as sewer connections implementation or supervision), and a team or unit that manages functional maintenance of the system (systems inspection, cleaning and unclogging).

The sewerage master plan which started in 1995 has taken too long to be completed. Only two of five phases have been completed to-date. The master plan was found to be very strong in network assessment and analysis, very weak in off-site assessment and analysis, and very weak in environmental assessment and analysis.

The present financial resources that the municipality has been using are not enough to improve the system or its management capability. Already, without a treatment scheme, the municipality does not provide the funds necessary to perform limited services by a much reduced staff. Therefore, new funds must be acquired through the levy of appropriate taxes and tariffs, the sale of treatment by-products, grants, government (central, provincial, and/or local) subsidies, and/or loans.

As to the institutionalization of wastewater services management, the city's policy and strategy is to reinforce the municipality in order to have its own wastewater management service. Once it will have developed a qualified management team, it would like to consider contracting with a private firm or ONEP to take over the management of the service, and this under the control of the city's technical management team.

3.2 Recommendations

The major actions that is needed to be taken to improve wastewater disposal services in the municipality of AZROU

3.2.1 Improve the knowledge and skills of municipal decision-makers in liquid wastes management

This recommendation aims at providing the municipal decision-makers the knowledge and guide that they need to effectively manage such services whether they are to be directly provided by a municipal service under their management or by other entity(ies). Specifically, this recommendation calls for the development of a wastewater management guide for municipal decision-makers, the development of a limited seminar for municipal decision-makers to test the guide.

3.2.2 Intercept all sewer outfalls and built an effective treatment unit for the system

This recommendation aims at addressing the present critical problems posed by the sewage disposal practices. An urgent study will need to be made specifically for the off-site component of the system even before the master plan studies are terminated. The study should include a special hydrogeological study to respond to the fear that many decision-makers have about the contamination of springs in the region. Moreover, a special study should also be conducted on the re-use of the treatment plant's by-products.

3 2 3 Improve and encourage the construction of autonomous and semi-autonomous systems

This recommendation aims at addressing the problems of coverage as well as sewerage system developmental problems in the city. To that end, it is found that the city must delineate areas that are appropriate to built autonomous and semi-autonomous disposal systems and encourage the people living in these areas as well as housing developers to do so. Cesspools must be abandoned as a technology and be replaced by septic systems.

3 2 4 Improve storm water disposal

This recommendation aims at addressing the problem of storm water disposal in the city. Specifically, it calls for the reinforcement of existing sewers and chaâbas that collect and transport storm water from the city and the development of better databases that could help planning and design of effective storm management structures. Hence, a storm management model should be developed for the city to help them address the problem. Such a model would require the immediate installation of at least one measurement station in AZROU.

3 2 5 Improve the physical state of the wastewater system

This recommendation aims at addressing the problems posed by the current state of the system. Specifically, it calls for the rehabilitation and expansion of the existing network. The recommendations made in the sewerage master plan which is presently being prepared for the city should be followed.

3 2 6 Develop a management scheme for the improved wastewater system

This recommendation aims at establishing the most appropriate management scheme for the municipality. The first step will be for the municipal council to come to an agreement on the types of management schemes that they will accept. The second step will be to have the consulting firms responsible for the master plan studies to immediately start on the Institutional study that is included in their terms of reference. Should this be too lengthy, special institutional and cost recovery studies feasibility should be implemented immediately.

The third step will be to establish the management scheme once fully approved by the appropriate authorities.

3 2 7 Improve wastewater disposal services delivery at the municipality

This recommendations aim at improving the basic services that are presently being furnished by the municipality. This will be done through the improvement of the capability

(knowledge and skills) of existing staff in areas such as problems detection, work scheduling and supervision, sewer network functionality improvement

3 2 8 Improve sector financing

This recommendation aims at improving revenue available to the sector. The first step will be to define the types of revenue that are available to the sector. The second step will be to conduct a cost reduction study in order to increase system's efficiency. The third step will be to establish a model that could study system's efficiency and profitability.

ANNEX B2 THE CITY OF BEN GUERIR

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ANNEXE B2

LIQUID WASTE MANAGEMENT ASSESSMENT REPORT - BEN GUERIR

I GENERAL INFORMATION

1.1 Geographic & Climatic Information

The municipality of BEN GUERIR is located in the Province of KALAA DES SRAGHNA in the TENSIFT Economic Region. It is situated 70 kms North of MARRAKECH on Principal Route 7 and 57 kms West of the City of KALAA DES SRAGHNA the seat of the Province. The city is at a crossroad for both roads connecting CASABLANCA and the cities of MARRAKECH and AGADIR in South Morocco on one the hand, and the cities of SAFI and KALAA on the other hand, and for trains to MARRAKECH and SAFI.

The climate of the region is arid with temperate winters. Annual rainfall varies from a recorded maximum of 393 mm and a recorded minimum of 84 mm with an average of 238 mm. Annual temperature varies from a maximum of 35.6 °C (July) to a minimum of 5.1 °C (January). Annual average evaporation is 2400 mm. Prevailing winds are those blowing North/North-West in the winter months (December - March) and West in the summer months (June - September).

1.2 Urban Characteristics of BEN GUERIR

BEN GUERIR is a relatively new municipality. It was elevated from the rank of rural commune to a municipality in 1992. The reason for this has been threefold, firstly, the population of BEN GUERIR went from 4,325 people in 1960 to 47,080 at the last census held in 1994. Thus, it has become a mid-sized city whose 1997 population is estimated at about 58,000 inhabitants. Secondly, the city is the heart of the economy of a relative large region draining farmers and others from a radius of 50 kms from the town. Thirdly, two major institutions are located within 15 kms of the city, the Office Chérifienne de Phosphates (OCP) located within 5 kms SW of the city center which has a population of about 3,000 inhabitants, and an important military base located at 15 kms South of the city.

The city is composed of 20 quartiers including the OCP development which has recently been integrated to the municipality of BEN GUERIR. The population density of the 19 quartiers comprising the city ranges from 350 to about 100 inhabitants per hectare. Because of the relatively small time for this population center to grow tenfold, the city has been developed in an anarchic way. In fact, the city's extension has not obeyed any development plan. Other than the proliferation of clandestine quartiers that have grown overnight, the city has some very spacial constraints to its extension that include railroad tracts and the river Bouchane, a dry river that only conveys water during the rainy season. Nonetheless, a new urban master plan has been developed for the city and its population is projected to reach 111,000 (133,00 reported by the Municipality) by the year 2015.

The city is characterized basically by three types of houses which are villas, apartments, economic houses (spontaneous, traditional and planned) It has a commercial zone grouping stores, gas stations, cafés, public baths, banks, etc It also has administrative buildings that include government buildings, schools, health clinics, mosques, and other buildings such as ONEP's city headquarter, the ONCF city's headquarter, etc

BEN GUERIR is considered as being economically deprived About one third of the population is unemployed and most of the employed people work independently Other than those who work directly for the OCP, most people are in commerce as the city is a major stopping place for trains, buses, trucks and cars going North, South, East or West The urban master plan calls for the development of an industrial zone which will be a collaborative undertaking by the city, the OCP and the Ministry of Commerce and Industry More than 80% of the 27 hectare industrial zone has already been committed to future investors Finally, the banking sector has begun to integrate BEN GUERIR which presently has three national banks offices, the Banque Populaire, the Banque de Credit Agricole, and the Banque Marocaine du Commerce Extérieur (BMCE)

In the peri-urban area can be found agricultural and animal farm lands Agricultural crops grown in BEN GUERIR include wheat, and other cereals as well as some vegetables Animals farms raise primarily cattle and sheep There is a plan to build one of the largest chicken farm in Morocco which will be located on 15 hectares of land

Administratively, a new Municipal President (Mayor) was elected in the summer of 1997 (the second Mayor to occupy that office) The mayor is assisted by two Vice-Presidents and a Secretary General who are political appointees There is also a Municipal Council composed of 25 members who have just been elected

The city's technical services are managed by a Municipal Engineer responsible for all services that are of public works and environmental nature, and a Municipal Architect who has charge for the city's urbanization

As for popular movements, the city has several private not-for profit organizations that are mostly youth related sports clubs, youth clubs and a young entrepreneur's club The latter is a special initiative of the business community and the municipality of BEN GUERIR The club is promoted by the city's Municipal Engineer who is a young man trained Industrial as an Industrial Engineer The club is under the management of a Management Committee composed of business leaders in the Municipality and members of the Municipal Governments For a youth to be a member, he/she must have a project idea for which a feasibility study will be made, local or office space provided for a period of five years, and assistance is given to obtain a loan Since it start in July 1994, there

have been 83 projects studied, for which 10 have obtained mix government and private loans

The municipal receipts have grown from 14 million Dh in 1989 when the commune was rural to a total of 35.2 million Dh in 1994. Total expenses have also grown from 7 million Dh in 1989 to 28.2 MDh in 1993. In 1994, total expenditures were 22.4 million Dh. It should be noted that the operations component of the budget has also grown from 3.1 MDh (44% of total expenditures) in 1989 to 9.8 MDh (35% of total expenditures) in 1993, 13.9 MDh in 1994 (72% of total expenditures) and 16.9 MDh in 1995.

1.3 Water Supply and Wastewater disposal services

1.3.1 Water Supply services

BEN GUERIR is one of the municipal centers in Morocco that is served by the Office National d'Eau Potable (ONEP). The city water supply comes from three deep wells located at about 15 km south of BEN GUERIR whose total production capacity is 85 liters per second. These wells actually are producing an average of 70 l/s. Well water are pumped to three reservoirs of which two of 1,000 m³ each are semi-buried and one of 500 m³ is an elevated reservoir. The distribution system is about 51 kms long composed of asbestos pipes of diameters ranging from 60 - 400 mm. The distribution system serves 6,500 building connections, 2 public fountains, 21 fire hydrants, 7 watering faucets, and 3 water meters.

The number of connections in 1997 is reported to be 5,600 of which most are house/building connections. The annual increase in the number of connections to the distribution network has been 177 for 1994 - 1995, 200 for 1995 - 1996, and 403 for 1996 - 6/1997.

The volume of water distributed during the last three years (1994 - 1996) went from 983,161 m³ in 1994, 814,503 m³ in 1995, and 930,590 m³ in 1996. On the basis of the average yearly consumption for these three years, the present water consumption of the people of BEN GUERIR has been estimated to be about 58 liters/capita/day (lcd) for those served by house connections and 4 lcd for those using public fountains. It should be noted that there exists about 426 wells in the area used for domestic purpose of which 156 are public wells and 270 are private wells.

The long-term objectives of ONEP are to increase water consumption to 66 lcd for the connected population and 10 lcd for those using public fountains by 2010 and to 70 lcd and 15 lcd respectively by 2020.

Actually, BEN GUERIR's water needs are estimated to be 51 l/s in average with an hourly maximum of 67 l/s. These needs will increase to 92 l/s and 120 l/s respectively in 2005 and 212 l/s and 276 l/s respectively by the year 2020. Present production capacity will not be enough to satisfy these demands before the year 2005 is attained. Thus, new water sources development are expected for BEN GUERIR.

Administratively, ONEP has a municipal water distribution center (office) in BEN GUERIR which depends on the regional directorate of ONEP located in MARRAKECH. The center's organizational structure is composed of three operational units, an administrative unit headed by a center chief assisted by an office employee and three cashiers, a distribution unit whose personnel consists of a plumber and three non-specialized workers, and a production unit whose personnel consists of two pumpists. Hence, the total number of personnel working in the center is 11.

As to water tariff, it is presently set at 2,30 Dh per m³ for those consuming between 1 and 24 m³ per trimester, 5,83 Dh for those consuming between 25 - 60 m³ per trimester, and 8,50 m³ for those consuming more than 60 m³ per trimester. It should be noted that these rates have doubled since 1991 when these three categories were priced at 1,24 Dh/m³, 2,83 Dh/m³, and 4,19 per m³ respectively.

It is reported by ONEP that only one rate is presently used (2,30 Dh/m³) for all consumers due to complaints of the population regarding the high cost of water.

1.3.2 Wastewater disposal

The disposal of sewage in the municipality of BEN GUERIR is done either through the public or municipal sewerage system, the semi-public system of the OCP compound, and autonomous systems for these areas that have no access to the municipal sewerage network. The present situation of these three systems are described below.

A The municipal sewerage system

The municipality of BEN GUERIR is served by a sewer network whose establishment began in the late 1950s. The sewer network has been developed as a combined sewer conveying both sewage and storm water. Its content flows completely by gravity as there presently is no pumping or lift station on the network.

The network is composed of 14 main (primary) sewers which are drained by an interceptor sewer ending at an outfall located downstream of the city at about 2 kms from the center of the city. The interceptor sewer line is about 3.85 kms long and is composed of sewers of 300 mm, 600 mm, 600 mm and an ovoid section (T-150).

The main or primary sewer lines have a total length of 19.93 kms and are made of visitable sewers (about 2.0 kms of ovoid sewers) and non-visitable sewers (about 16.9 kms with diameters ranging from 200 mm - 800 mm). Secondary and tertiary sewers form the rest of the system with an estimated length of 16.6 kms with pipe diameters of 200 - 400 mm. Thus the total length of the network is estimated to be about 40 kms.

It was estimated that 64% of the people in the 19 quarters were connected to the sewer network. The connection rates varied from 0% in 6 quarters to 100% in 7 quarters. Also, only one quarter had a connection rate below 50% (21%).

It should be noted that since 1992, the municipality has been relying on the city's population to extend the sewer network and increasing coverage to its quarters. The municipality provides the pipes which are purchased from reliable vendors and the population provides labor and other construction materials. The direct involvement of the people in constructing the existing network dates from before 1992, however, it was formalized in 1993. Between 1993 and 1997, about 5 kms of sewers have been laid in this manner. Prior to 1993, over 11 kms of sewers were clandestinely laid by the population. Also each household or user of the network is directly responsible to build his own sewer connection.

Raw sewage flows directly in a natural ditch that takes water downstream to the dry river bed of Bouchane. Thus, there is no treatment applied to the raw sewage other than natural decomposition over the length of the area crossed.

Based on analyses carried out in 1992 on wastewater characterization, flows measurements indicated raw sewage coming out of the outfall at an average rate of 27 l/s and maximum and minimum flows at 41 l/s and 11 l/s respectively. The characteristics of the waste is indicated by its Biochemical Oxygen Demand (BOD), its Chemical Oxygen Demand (COD), its suspended solids concentration (SS), and its content in toxic material (lead, mercury, etc.). Its average BOD content was found to be about 320 mg/l, its COD 480 mg/l, its ss 380 mg/l, and its content in heavy metals which were below recommended standards with the exception of Nickel whose concentrations were found to be relatively high. Hence the sewage produced in BEN GUERIR has been found to be a domestic sewage primarily which is highly organic, thus highly biodegradable.

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It is estimated that the city will produce about 3,700 m³ of raw sewage with BOD and SS loads of 1,100 kg/day and 1,100 kg/day respectively by the year 2000, and 6,600 m³ of raw sewage with BOD and SS loads of 2,000 kg/day and 2,400 kg/day respectively by the year 2010

The management of the wastewater system is the responsibility of the municipality of BEN GUERIR. Services provided by the municipality is simple oversight and maintenance. These services are managed by the Municipal Engineer who has a unit composed of a technician, a foreman, 2 field agents and a seasonal worker. The unit has no diagnostic or mechanical equipment for maintenance, no service vehicles, and no protection clothing and material.

The sewerage master plan started in 1991 was interrupted in 1992, as soon as the city changed status from a rural to an urban commune. The reason for this was to allow an urban development master plan be produced before a sewerage master plan was prepared. The urban development master plan is presently ready, but funds are no longer available for terminating the sewerage master plan.

As to the funding of the sector, a loan was given by the Fonds d'Equipement Communal (FEC) for 6,032,772 Dh in 1992 to support the funding of the sewer system's extension. The municipality has already used most of the loan. Presently, the remaining amount on the loan which is to be used during 1997 -1998 is 1.15 million Dirhams. The city has attained the FEC's 40% lending capacity ceiling, and has no capacity to repay new loans.

During the last five years, the budget attributed to the sector by the municipality has been as follows:

<u>Year</u>	<u>Construction in Dh</u>	<u>Maintenance in Dh</u>	<u>Total in Dh</u>
1992	1,659,972	70,000	1,729,972
1993	948,713	70,000	1,018,713
1994	948,713	110,000	1,058,713
1995	948,713	100,000	1,048,713
1996	376,661	140,000	516,661

The manpower cost which is not included above has been in average 120,142 Dh/year. The city has also spent an average of 10,000 Dh/yr for environmental control activities directly related to the wastewater system. During the past five years, it has spent a total of 40,000 Dh for maintenance equipment. Thus, the average annual expenditure for the wastewater system has been about 233,000 Dh/year which represents roughly 1.4% of

the municipal budget (Reference year 1995 - budget 16,917,464 Dh) Expenditure represents an average of 4 Dh/person/year or about 1 Dh/m³ of sewage produced/year The city presently collects no taxes or tariff from the system's users

B The OCP Sewerage system

The OCP compound is integrated to the municipal area It is a well structured community of about 3,000 people who work directly for the OCP The compound is composed of about 600 quarters which are all connected to the compound's sewerage system

Wastewater from the compound's quarters are collected through a sanitary sewer system that conveys liquid wastes to a compact activated sludge system The wastewater is then treated and evacuated through an unlined ditch flowing by gravity downstream

The system is well operated and maintained and has developed no visible problems The wastewater disposal system is managed by a qualified engineer who is assisted by a team of workers

C Autonomous systems

Presently at BEN GUERIR, it is reported that the existing sewer network only cover about 64% of the households Most of the households not served by the public sewerage system use an autonomous system, generally, a cesspool The cesspools are a form of septic tank where wastewater is discharged in a percolation pit underground The areas not served by the existing public network have been reported as not having appropriate soil conditions to support final disposal by percolation Many reported cases of effluent runoff posing structural problems to the foundation of surrounding constructions have been registered by the municipality, but these problems have not been technically assessed

II BEN GUERIR'S WASTEWATER DISPOSAL SECTOR PROBLEMS AND CONSTRAINTS

2 1 Wastewater disposal system

2 1 1 Wastewater collection

The sewer network is relatively new (40 years old) with most of its pipes being laid in the past 20 years. However, the network presently faces serious structural and functional problems that are due to a number of factors that can be easily corrected if the cause of the problem is to be stopped. The structural and functional problems which have been reported by an assessment conducted by an engineering firm in 1992

A Organizational problems

The public network has been structured to function as a combined sewer, however, it has serious constraints in operating as such. One of these constraints is the fact that the interception and conveying of storm water to the Bouchane river which runs through BEN GUERIR are absent. This is due to the fact that the network is not properly equipped with appropriate accessories such as storm water inlets and storm water outfalls.

Another constraint is the modality of construction system which has been conducted directly by the population. The lack of hydraulic knowledge has caused the system not to be properly calibrated for receiving both sewage and storm water.

A third constraint is the present state of pavement of the municipal road network. A large percentage of roads are not paved and storm water collection cannot perform normally in such a situation which causes the system to be obstructed with such carriages as silts and other debris.

A key problem is the lack of a strategic plan that can indicate the type of sewers (separate or combined) to be applied in each quartier. Some lend themselves to separate conveyance of storm water and sewage, while others could best be served by a combined sewer.

B Functional problems

During the 1992 assessment findings which is believed to have worsened, the following were major functional problems with the existing network.

- ▶ absence of flow in some pipes due to the absence of connections upstream,
- ▶ obstruction of pipes (over 2 kms) and manholes (over 75 units),
- ▶ about 9 kms (22.5%) of the network registered to be undersized, including the entire length of the interceptor sewer (3.85 kms),
- ▶ conveyance of parasite waters due to pipe leakage (joints and cracks),
- ▶ absence of basic accessories such as overflow weirs,
- ▶ all of the house connections that have been realized by the population are poorly constructed and should be redone as they are constraints to flow

C Physical problems

- ▶ poor construction practices of manholes, storm water catchments, and pipes,
- ▶ uncontrolled quality of material used in the construction of the network,
- ▶ absence of routine inspection of system's elements and rehabilitation activities

Most, if not all of these problems are due to poor engineering and construction practices and are correctable

2.1.2 Wastewater treatment

The sewerage system has no treatment facility and therefore causes many environmental and public health problems in the city. These are

- ▶ Pollution of wells which are located along the river Bouchane and the canal that conveys raw sewage to the river bed downstream of the city. The city had to establish a wells disinfection program whereas all the 426 wells within city limits are disinfected by chlorinated lime every week

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- ▶ Mosquito production which is a major nuisance for the city. The municipality has also established a mosquito control program that uses insecticides and larvicide in high volumes
- ▶ Uncontrolled use of raw effluent by farmers for irrigating all types of crops including vegetables
- ▶ Odor problems in the general surroundings of effluent and its course downstream

All these are factors that heavily impact real estate which surrounds the final outfall of sewage and the ditch in which it flows downstream

2 1 3 Final disposal of the public system's effluent

The effluent that comes from the public sewerage system is raw sewage. These effluents are partially used by farmers who are located around or downstream from the sewer outfall. Hence there is evidence of partial re-use of the system's effluent for agricultural purposes. This practice is dangerous as it poses great risks to public health and particularly to farmers and their immediate families who are directly or indirectly in contact with raw sewage. Moreover, the potential for contaminating drinking water from neighboring wells and foodstuff produced by fields irrigated with raw sewage is great.

2 1 4 OCP effluent disposal

Although sewage coming from the OCP compound is treated, there has been no effort made to organize a re-use scheme that could be of help to local farmers. The valorization of the plant's by-products could help support agricultural activities in a relatively poor commune.

2 1 5 Autonomous waste disposal

In the areas not served by the public system, wastewater effluent from autonomous systems flows on the ground to reach the bed of Oued Bouchane. For these systems using a cesspool, raw sewage easily infiltrates the soil and runs off through cracks to contaminate underground water sources. Biological analyses of all wells in the area conducted by the Ministry of Health indicated that all the wells were contaminated and needed to be regularly chlorinated.

It should also be noted that the technology of constructing reliable septic tanks with effective percolation fields or wells is not developed in BEN GUERIR

2 2 Wastewater Management

2 2 1 Organization

The municipality is not presently organized as an institution that can effectively manage the existing wastewater system. It does not physically have a service that has responsibility for wastewater management. It only has a municipal work unit which only handles citizen complaints regarding the need to unblock an obstructed pipe or to build a much needed line.

The staffing of the unit that is employed to address problems with the sewer network is representative of the level of intervention that is made in the system. There are only five personnel to direct, supervise, and carry out all the tasks that are necessary to manage a 40 kms system that is in full expansion. Thus, the organization for sewage management is at absolute minimum, not to say non-existent. The present staff lacks proper qualifications to effectively perform the services that are needed by a wastewater disposal system.

As to the tools needed to perform maintenance and diagnostic work on the system, what exist is completely rudimentary and inappropriate to address the problem of a system that is almost totally made of non-visitable sewers.

2 2 2 Sector administration

The executive and professional staff at the municipality have the responsibility to make all decisions regarding municipal policies, strategies, and management of programs that need to be planned or are established for wastewater disposal in the city. However, being newly elected or hired, these managers do not have the training and experience to deal with the daily requirements of managing such a system. Therefore, decisions are either made erroneously, such as implicating the population in sewer construction without proper guidance and training, or not made at all. Hence, there is an urgent need to ensure that the municipal decision-makers (elected or hired/nominated) be properly trained to deal with the specific requirements of wastewater system's management.

Another administrative issue is that of the absence of a master plan adapted to the new urban development plan of the city to guide the rehabilitation and development of the existing system. Although the planning process started in the early 1990s, only part 1 (system's diagnostic) of a four parts process was executed by ONEP's consultants. The planning process was stopped as the new municipality decided to carry out a new urban development master plan study. Now that the new urban development master plan has been prepared, the city is ready to have the wastewater master plan study be executed. However, the funds that were available in 1992 at ONEP are no longer available. Therefore, ONEP is seeking new funds (donation) to continue the study.

Finally, a major handicap in improving the capacity of the municipality to effectively manage services that are provided in the sector is the lack of organized work planning and cost accounting. The work planning process that could provide direction to the maintenance unit at the municipal park is non-existent. Moreover, the budgeting process for the sector is also not effectively practiced.

2.2.3 Sector financing

Most of the funding available for operation, maintenance, rehabilitation and improvement of the wastewater system at BEN GUERIR comes from the FEC loan. In fact, the FEC loan constitutes 92.5% of all expenditures made for the city's wastewater system. The municipality has only been able to contribute an average of 98,000 Dh (1.95 Dh/person/year or 11 Dh/m³/yr) to the system.

The average annual expenditures for operation and maintenance of the existing sewer system per km of sewers for the past five years in the city's wastewater system has been very low (5,000 Dh). It roughly represents one fourth of the amount that a system of this size should cost for operation and maintenance.

Finally, the funds that have been invested in the system will not have an appreciable impact on the improvement of the system as most of the work funded is questionable and may have to be done over.

III CONCLUSION & RECOMMENDATIONS

3.1 Conclusion

The wastewater disposal system in BEN GUERIR can be considered as an important infrastructure for the city. It presently is 40 kms long collecting more than 60% of domestic liquid wastes, and more than 90% of industrial and commercial wastes produced in the city. Moreover, the system is in full expansion as requests for coverage is a daily happening. This is understandable as the urbanization (conversion of empty lands to urban neighborhoods) rate is very high and the soil conditions in the city does not lend itself to support autonomous sewage disposal systems (septic tanks and percolation fields).

The physical state of the sewerage system presents a lot of problems that are structural on the one hand and operational on the other hand. Presently, the structure of the system has not been well defined specifying the type of collection systems that would best fit in each neighborhood. An attempt was made by the liquid waste master plan study to define the possible solutions for structuring the system, but the work was not completed as the studies were stopped. Thus, it is critical in order for the system to continue to expand that it be properly structured.

Another structural problem is that of network effluent treatment before final disposal. A treatment system is critical to this network in order to protect public health and the environment as well as to give value to a resource that is much needed to support agricultural development in an agricultural region.

Concerning the operational problems faced by the existing network, the first problem is the construction practices that are presently employed to build the expansions to the system. While it is remarkable to obtain material and labor contribution from the benefiting population, the need for specialized workmanship in defining and implementing construction parameters that are critical to the system is not found among lay people. The consequences of using the population to perform the work requiring skilled workers have greatly affected the physical integrity of the system.

Many of the existing sewer mains are clogged and need to be cleaned, other mains have been found to be insufficient to convey their respective flows. Critical to the system is the fact that the interceptor sewer is already insufficient to carry existing flows. Thus a large part of the system will need to be recalibrated.

Regarding the physical state of the sewers, because of the low diameter of most of the sewer pipes, they could not be visited for inspection. However, it will be necessary to do so in the very near future, as the present indication of parasitic waters (high minimum flow) indicate pipe leakage.

As to the final disposal of effluent, it is regrettable that both the effluent of the public system and that of the semi-public system are not valorized. Revenue from these effluent could help the city reduce operational and maintenance costs.

Autonomous systems are not properly designed and integrated in the total wastewater disposal system of the city. This should be explored and addressed in order to provide the city with the capacity to limit expansion of the sewer network which is becoming expensive to maintain.

Regarding the land and water pollution being caused by the existing system, it is imperative that they be effectively dealt with in order to minimize environmental degradation and public health concerns.

In terms of sector management, it is understandable that the municipality of BEN GUERIR is a young one (about 5 years old) and it does not have the systems and resources that most of the established municipalities have to manage services. The President of the Municipality, Council members, and the Architectural & Engineering staff are dynamic and eager to address the problems of the sector, but they were found to lack basic knowledge regarding the technical, administrative, and financial aspects of wastewater systems management to allow them to make key decisions and perform their job effectively.

The present organization, staffing and equipment at the municipality to deal with wastewater problems are not nearly enough to have a service capable of operating and maintaining a 40 kms sewerage system that is in full expansion. Qualified people engineers and/or technicians, as well as skilled workers are needed to provide the basic services required by such a system. An effective organization for such a service requires at least direction that needs to be provided by a trained and experienced municipal or sanitary/hydraulic engineer, a team or unit that handles civil works (expansion and rehabilitation either as controller or implementor as well as sewer connections implementation or supervision), and a team or unit that manages functional maintenance of the system (systems inspection, cleaning and unclogging). Such an organization would require a distinct service that would be quite similar to the ONEP service at BEN GUERIR. It must also have appropriate equipment to conduct the basic inspection, operation, and maintenance work that the system requires.

The present financial resources that the municipality has been using are not enough to improve the system or its management capability. Already, without a treatment scheme, the municipality cannot provide the funds necessary to perform limited services by a much reduced staff. Therefore, new funds must be acquired through the levy of appropriate taxes and tariffs, the sale of treatment bi-products, grants, government (central, provincial, and/or local) subsidies, and loans.

It is understood that the sewerage master plan had to be stopped in 1993 to give time for the development of an urban development master plan. However, that plan is presently final and the planning process must resume immediately. Such a process will require that an up-dated assessment of conditions (physical and hydraulic) in the system be firstly conducted before re-examining the technical options that can be taken to have an effective system.

As to the institutionalization of wastewater services management, it is potentially feasible that a qualified autonomous entity such as ONEP or a newly created entity take over most, if not all, of the management responsibilities from the municipality. The young entrepreneur's club provides a distinct opportunity to the municipality to use that program to establish young and dynamic entrepreneurs from the region who could effectively provide basic services that are being provided by the population or for services that will be needed for an effective wastewater system.

ONEP could be interested to take over the sewerage system's management from the municipality provided that outside technical and financial support could be provided to accomplish this feat. Even if ONEP were to take over management of the sewerage system from the municipality, the use of the young entrepreneur's club should still be made.

3.2 Recommendations

In order to address the problems that have been identified with the sewerage system of BEN GUERIR, the following actions need to be taken:

3 2 1 Improve the knowledge and skills of municipal decision-makers in liquid wastes management

This recommendation aims at providing the municipal decision-makers the knowledge and guide that they need to effectively manage such services whether they are to be directly provided by a municipal service under their management or by other entity(ies) Specifically, this recommendation calls for the development of a wastewater management guide for municipal decision-makers, the development of a limited seminar for municipal decision-makers to test the guide

3 2 2 Improve the physical state of the wastewater system

This recommendation aims at addressing the problems posed by the current state of the system Specifically, it calls for structuring and improving the existing network and the construction of an appropriate treatment plant The first recommended action will be to perform a limited assessment of the system in order to up-date the information collected in 1992 The second step will be to prepare a rehabilitation plan for the sewer network that can be immediately implemented while the master plan is being prepared The third step will be to conduct feasibility studies for a treatment facility

3 2 3 Improve and encourage the construction of autonomous and semi-autonomous systems

This recommendation aims at addressing the problems of coverage as well as sewerage system developmental problems in the city To that end, it is found that the city must delineate areas that are appropriate to built autonomous and semi-autonomous disposal systems and encourage the people living in these areas as well as housing developers to do so Cesspools must be abandoned as a technology and be replaced by septic systems

3 2 4 Develop a management scheme for the improved wastewater system

This recommendation aims at establishing the most appropriate management scheme for the municipality The first step will be for the municipal council to agree with the philosophy that the system be totally or partially managed or serviced by an entity other than the municipality depending on the technical, financial and administrative feasibility of the management options The second step will be to conduct a feasibility study that would establish the recommended management scheme for the system The third step will be to establish the management scheme once fully approved by the appropriate authorities

3 2 5 Improve wastewater disposal services delivery at the municipality

This recommendations aim at improving the basic services that are presently being furnished by the municipality. This will be done through the improvement of the capability of existing staff in areas such as problems detection, work scheduling and supervision, sewer network functionality improvement.

3 2 6 Improve sector financing

This recommendation aims at improving revenue available to the sector. The first step will be to define the types of revenue that are available to the sector to include the integration of untreated or treated wastewater from OCP. To that end, a special study will need to be conducted to determine the feasibility of integrating treatment and/or final disposal of wastewater produced by the OCP compound. The second step will be to conduct a cost reduction study in order to increase system's efficiency. The third step will be to establish and monitor revenue and expenditures in order to determine the profitability of established money generating practices.

ANNEX B3 THE CITY OF SEFROU

ANNEXE B3

LIQUID WASTE MANAGEMENT ASSESSMENT REPORT - SEFROU

I GENERAL INFORMATION

1.1 Geographic & Climatic Information

The municipality of SEFROU is located in the Province of SEFROU in the NORTH-CENTER Economic Region. It is situated 28 kms East of FEZ and is the seat of the new SEFROU Province. It is in the ATLAS region of Morocco. The city is located between altitudes of 800 - 900 meters on both sides of Oued AGGAY, a tributary of Oued SEBOU.

The climate of the region is temperate with cold and wet winters. Annual precipitation which is in the form of rain and snow is 654 mm. The number of rainy days in a year vary from 57 to 70 days.

Annual average temperature varies from a maximum of 35.7 °C (July) to a minimum of 4.5 °C (January). Annual average evaporation is reported at 520 mm per year. Prevailing winds are those blowing North/North-East.

1.2 Urban Characteristics of SEFROU

The municipality of SEFROU has been an established city for more than a century. Its population first estimated in 1888 was reported to be about 3,000 inhabitants. In 1960, the city had a population of 21,500 inhabitants, in 1982, 38,800 and in 1994, about 54,200 inhabitants. Presently, the population of the city is estimated at 58,100 inhabitants, thus making it a mid-sized city. The city's population is projected to attain 64,000 by the year 2000 and about 90,000 by 2015.

The city is composed of 11 quartiers with surface areas ranging from 2,6 hectares to a little over 100 hectares. The densities found in these quartiers range from 30 to about 1070 persons/hectare. Four of the 11 quartiers have population densities greater than 300 persons/ha and the others less than that number.

SEFROU is characterized by the type of houses that it contains. They are villas, apartment buildings (at least 3 stories with several apartments on each floor), economic buildings (at least 3 stories with only one apartment per floor), non-regulatory houses, traditional houses, semi-rural houses, and slums. The city is expanding in four directions: North-East, East, North and South-East. It has an industrial area in the Southern part of the city of 36 hectares which contains small handicraft units, two oil factories, two tanneries of which one is presently closed, construction material shops, and the souk. A new industrial zone is planned in the Northern part of the city.

The city's administrative offices and social services are grouped primarily in its center. Many commercial establishments are also located in the city center to include stores, professional offices, movie houses, cafés, etc.

At the outskirts of the city are the famous quarries of SEFROU which produces sands, gravel, and stones distributed nationally.

Administratively, a new Municipal Council was elected in the summer of 1997 and the Council's executives (President, Vice-Presidents, Secretary General) were selected. The administration is liaised to the governor's office by a Pasha.

The city's technical services are managed by a Municipal Engineer responsible for all services that are of public works and environmental nature, and a Municipal Architect who has charge for the city's urbanization.

1 3 Water Supply and Wastewater disposal services

1 3 1 Water Supply services

SEFROU is supplied by three types of water systems, a municipal piped-water system managed by the Régie Autonome d'Eau et d'Electricité de Fez (RADEEF) since 1973 provides coverage to more than 32,000 people, a Seguia system which is an old system built at least 5 centuries ago (whose extensive distribution system is not known) that supplies water presently used to wash clothes, to at least 70% of the dwellings in the Medina, and an autonomous/semi-autonomous system composed of dug wells which are primarily located in the parts of the city that are not presently served by the RADEEF distribution network.

The municipal water system is supplied by two deep wells and 2 capped springs operated by the Office National Eau Potable (ONEP). These four units produce a total of 205 liters per second which are pumped in 4 reservoirs with a total storage capacity of 7,200 m³. The reservoirs feed a distribution network that covers most of the quarters.

Water production by ONEP has been quite constant during the past 12 years to about 3.1 million m³ per year. As to the distribution of water, the annual consumption from the municipal system is about 2.2 million m³. The projected consumption volumes for the years 2000 and 2015 are 2.7 million m³/year and 5 million m³/year. These translate into consumption rates of 110 l/pers /day in 1997, 122 l/p/d in 2000, and 156 l/p/d by the year 2015. The connection rate to the distribution system is expected to increase to 96% by the year 2000.

As to water tariff, it is presently set at 2 30 Dh per m³ for those consuming between 1 and 24 m³ per trimester, 5,83 Dh for those consuming between 25 - 60 m³ per trimester, and 8 50 m³ for those consuming more than 60 m³ per trimester. It should be noted that these rates have doubled since 1991 when these three categories were priced at 1,24 Dh/m³, 2,83 Dh/m³, and 4,19 per m³ respectively}

1 3 2 Wastewater disposal

A. Sewage disposal

The disposal of sewage in the municipality of SEFROU is done either through the public or municipal sewerage system and autonomous systems for these areas that have no access to the municipal sewerage network. The present situation of the two systems are described below

1) The municipal sewerage system

The municipality of SEFROU is served by a combined sewer network which collect wastewater from the central part of the city primarily. The system whose installation started in 1924, no longer responds to the city's need as the latter is expanding outward

The sewer network is composed of 10 main lines collecting sewage from secondary and tertiary lines in the quarters covered by the system. The total length of the main or primary collectors is about 12 kms. Secondary and tertiary lines make up the remaining 41 kms of sewer lines in the distribution network

Eight of the 10 primary collectors discharge their content directly in the Oued AGGAY, while the two others discharge their content on the ground and in a Seguia. Many sewers built directly by the population discharge also in either Oued AGGAY or in a Seguia

The network is composed of about 2 kms of pipes of visitable diameters (1000 mm or greater or ovoid sewers) and about 51 kms of pipes of non-visitable diameters (200 - 800 mm). The system's appurtenances include over 1,000 manholes and about 420 catch basins. It flows completely by gravity and therefore has no pumping station

It is reported that about 60% of the people living in the city limits are connected to the sewer network. The connection rates are expected to reach 80% by the year 2015. The hydraulic, BOD and SS loads are presently estimated at about 3,100 m³/day, 578 mg/l, and 383 mg/l respectively. The projected hydraulic load, BOD and SS for 2015 are 4,800 m³/day, 320 mg/l, and 380 mg/l respectively. The high BOD rate is primarily due to an abattoir that has high BOD concentration. However, it is expected that a pre-treatment

process will be used to reduce that BOD load in the future. The limited analyses conducted provided BOD varied from 210 to 680 mg/l and suspended solids from 225 to 880. The Oued AGGAY's waters had BOD and SS concentrations of 90 and 142 mg/l respectively downstream from the sewer outfalls. As to the content of heavy metals in the sewage, they have been found to be in very low concentrations and are below European standards.

Presently, farmers in the area use wastewater to irrigate their fields. They use the waters of Oued AGGAY that conveys almost only wastewater during the dry season. The calculated yearly deficit of water for irrigation in the area is about 750 mm. The main crops grown in the SEFROU region are fruits (cherries), olives, cereals, vegetables, salads, etc.

The management of the wastewater system is the responsibility of the municipality of SEFROU. Services provided by the municipality is simple maintenance. These services are managed by the Municipal Engineer who heads a technical municipal services and assigns a squad to perform work on the system. The Municipal Engineer is assisted by a Technician who provides the day to day management of the Municipal Park. He is reported to spend 30% of his time on wastewater management activities. The squad responsible to maintain the system is composed of a caporal (foreman) and 6 égoutiers (field agents). This squad is reinforced by other municipal park workers assigned to other tasks during emergency situations (flooding streets clean-ups). The unit has no diagnostic or mechanical equipment for maintenance, no service vehicles, and no protection clothing and material.

SEFROU's sewerage master plan is presently at its end with only the last two phases to be completed. It should be noted that the Municipality paid for the master plan itself with a loan obtained from FEQ in 1993. However, it has taken over 3 years for these studies to be nearing their end.

As to the funding of the sector, the Municipality has spent a total of 540,000 Dh during the past five years for maintenance, an average of 108,000 Dh per year. To this amount should be added the staff salaries of 172,000 Dh. Thus the total annual maintenance cost of the municipality is about 280,000 Dh. The municipality also benefitted of a FEC loan for the amount of 3,080,000 Dh to fund the master plan study. That study, which started in 1993 is expected to be fully completed within the next three months. Presently three of the five phases of the master plan have been completed. The last two phases which are being implemented in parallel, are almost at their end. Preliminary reports are to be submitted to the Municipality within by the end of September 1997.

The Municipality presently collects no taxes or tariff from the system's users.

2) The Segua system

Although built as a system serving the town and irrigation of land, the Segua are also used to convey storm water and in some instances wastewater to agricultural fields

3) Autonomous systems

Presently at SEFROU, it is reported that the existing sewer network only cover about 76% of the population. Most of the households not served by the public sewerage system use an autonomous system, generally, a wet pit. The wet pits are a form of septic tank where wastewater is discharged in a percolation well underground. Based on master plan study conducted in the area, the city will continue to have such systems of sewage disposal beyond the year 2015.

B Storm water disposal

The city of SEFROU receives an average of 565 mm of rain per year. It is located in a basin as it is surrounded by hills. The city is crossed by Oued AGGAY which separates it in two halves. Thus, storm waters come from both halves to reach the bed of Oued.

Floods are created by both, river swellings and surface flows from the surrounding hills. The city has 7 watersheds, of these, only five are considered to cause flooding problems to the city. Because of the barrenness of the surrounding hills, storm waters carry large quantities of debris (rocks, sand, gravel) that clog street and create dams stopping the flow to the Oued.

To ensure that storm water from the city's watersheds are safely disposed of, the city rely on a number of works that protect it against flooding. The sewer system is designed to convey storm water to the Oued, two canals have been built to by-pass the city and discharge downstream of the city in Oued AGGAY, and the streets are used to carry storm waters to the Oued. Two dams have already been built to diminish water velocity. Culverts have been re-sized, and trees have been planted on the flank of the hills to control erosion.

The Seguas are also used to convey storm water to the agricultural fields, thus serve as storm water sewers.

II SEFROU WASTEWATER DISPOSAL SECTOR PROBLEMS AND CONSTRAINTS

2 1 Wastewater disposal system

2 1 1 Wastewater collection

The sewer network does not have structural problems, it was designed to be a combined system, but the adopted policy is to extend it in new areas as a unitary system. Among the major problems that have been detected are

A Coverage problems

The present system does not provide coverage to about 40% of the population living in 5 neighborhoods. No program exists to improve coverage in non-sewered areas by effective septic tanks.

B Clogging problems

More than a kilometer (1,170 m) of sewers are reported to be clogged. The clogging problem is principally due to solid waste being discharged in the system by the population, carriage of debris by storm waters, lack of preventive and curative maintenance.

C Hydraulic overloading problems

About 780 m of sewers have been found to be undersized. This situation adds to the problems of street and house floodings during the rainy season.

D Physical problems

- ▶ deteriorated and/or clogged manholes (28)
- ▶ deteriorated and/or clogged catch basins
- ▶ absence of routine inspection of system's elements and rehabilitation activities

2 1 2 Wastewater treatment

The sewerage system has no treatment facility and therefore causes many environmental and public health problems in the city. These are

- ▶ Pollution of Oued AGGAY, a tributary of Oued SEBOU

- ▶ Pollution of wells which are used for water supply
- ▶ Mosquito production which is a major nuisance for the city
- ▶ Uncontrolled use of raw effluent by farmers for irrigating all types of crops including vegetables
- ▶ Odor problems in the general surroundings of effluent and its course downstream

All these are factors that heavily impact real estate which are along the Oued

2 1 3 Oil factory solid waste treatment

One of the waste produced by the oil manufacturing plants located in SEFROU is the "margine" or the remains of pressed olives. These are presently evacuated as solid waste.

2 1 4 Final disposal of the public system's effluent

The effluent that comes from the public sewerage system is raw sewage. These effluent are partially used by farmers who are located around or downstream from the sewer outfalls, the Oued and the Seguias. This practice is dangerous as it poses great risks to public health and particularly to farmers and their immediate families who are directly or indirectly in contact with raw sewage. Moreover, the potential for contaminating drinking water from neighboring wells and foodstuff produced by fields irrigated with raw sewage is great.

2 1 5 Storm water disposal

The city faces grave problems of floods due to large quantities of run-off that use the streets to convey storm water coming from surrounding hills to the river bed. The main road between FEZ and SEFROU (RP 20) is often flooded and clogged by debris for days after heavy rains. The reasons for these are

- ▶ barren hills favoring erosion of soil and rocks
- ▶ clogged storm structures (culverts, catch basins, etc)

While the city of SEFROU is served by several precipitation measurement and hydrographic stations, the development of a storm water management model for the city has not yet taken place. Many of the works that are being constructed run the risk of being miscalculated.

2 2 Wastewater Management

2 2 1 Organization

The municipality does not have the organizational structure to effectively manage the existing wastewater system. The present unit is not structured to respond to the work that need to be done for such a system. Moreover, it does not have the work force to effectively perform the required tasks of operating and maintaining the a 53 km sewerage system, nor does it have the equipment to do so.

2 2 2 Sector administration

The executive and professional staff at the municipality have the responsibility to make all decisions regarding municipal policies, strategies, and management of programs that need to be planned or are established for wastewater disposal in the city. However, being newly elected or hired, these managers do not have the training and experience to deal with the daily requirements of managing such a system. Therefore, decisions are either made erroneously, such as implicating the population in sewer construction without proper guidance and training, or not made at all. Hence, there is an urgent need to ensure that the municipal decision-makers (elected or hired/nominated) be properly trained to deal with the specific requirements of wastewater system's management.

2 2 3 Sector financing

The average annual expenditures for operation and maintenance of the existing sewer system per km of sewers for the past five years in the city's wastewater system has been very low (5,000 Dh). It roughly represents one fourth of the amount that a system of this size should cost for operation and maintenance.

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III CONCLUSION & RECOMMENDATIONS

3.1 Conclusion

With a length of 53 kms, the wastewater disposal system in SEFROU is an important infrastructure for the city. It presently collects wastewater (domestic, administrative and industrial) produced in most quarters in the city. The sewer network itself is in good condition with a few lines and appurtenances that need to be unclogged, rehabilitated or replaced/reinforced. The main problem with the network has been its inability to collect and discharge storm water effectively in the Oued. These storm water problems are due to factors outside of the hydraulics of the present combined sewer network. In fact they are due to erosion of surrounding hills that clog culverts and other appurtenances. There is a need to establish a strong erosion control as well as a rainfall measurement station in SEFROU itself to provide reliable data in the future.

As to the pollution of the Oued AGGAY, a tributary of Oued SEBOU, it should be stopped as soon as possible. It is a major source of water for irrigation, animals and human beings downstream. Therefore, all sewage from the municipal system needs to be intercepted and treated before final disposal. With a water deficit for irrigation during the dry season, treated effluent from SEFROU should be valorized. The project to treat margine at FEZ should be replicated in SEFROU.

In terms of sector management, there is a good team of managers that run the municipality of SEFROU. They are consciencous of the problems and are eager to address them. However, they lack the knowledge and skills in wastewater management to do so.

The present organization, staffing and equipment at the municipality to deal with wastewater problems are not nearly enough to have a service capable of operating and maintaining a 53 kms sewerage system that is in full expansion. Qualified people (engineers and/or technicians, as well as skilled workers) are needed to provide the basic services required by such a system. An effective organization for such a service requires at least: direction that needs to be provided by a trained and experienced municipal or sanitary/hydraulic engineer, a team or unit that handles civil works (expansion and rehabilitation either as comptroller or implementor as well as sewer connections implementation or supervision), and a team or unit that manages functional maintenance of the system (systems inspection, cleaning and unclogging). Such an organization would require a distinct service that would be quite similar to the RADEEF service at SEFROU. It must also have appropriate equipment to conduct the basic inspection, operation, and maintenance work that the system requires.

The present financial resources that the municipality has been using are not enough to improve the system or its management capability. Already, without a treatment scheme, the municipality does not provide the funds necessary to perform limited services by a much reduced staff. Therefore, new funds must be acquired through the levy of appropriate taxes and tariffs, the sale of treatment by-products, grants, government (central, provincial, and/or local) subsidies, and/or loans.

As to the institutionalization of wastewater services management, RADEEF is interested to take over that service from the municipality and the municipal authorities seem to be in favor of such a take over. However, RADEEF will only take the service over if they are also given in concession the management of the electricity distribution system of the city which presently is managed by the Office National d'Electricité (ONE).

3.2 Recommendations

In order to address the critical problems and issues regarding the existing wastewater disposal system in the municipality of SEFROU, the following recommendations are made:

3.2.1 Improve the knowledge and skills of municipal decision-makers in liquid wastes management

This recommendation aims at providing the municipal decision-makers the knowledge and guide that they need to effectively manage such services whether they are to be directly provided by a municipal service under their management or by other entity(ies). Specifically, this recommendation calls for the development of a wastewater management guide for municipal decision-makers, the development of a limited seminar for municipal decision-makers to test the guide.

3.2.2 Improve storm water disposal

This recommendation aims at addressing the problem of storm water disposal in the city. Specifically, it calls for the reinforcement of existing sewers and canals that collect and transport storm water from the city to Oued AGGAY, and the development of better databases that could help planning and design of effective storm management structures. Hence, a storm management model should be developed for the city to help them address the problem. Such a model would require the immediate installation of at least two measurement stations in SEFROU.

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3 2 3 Improve and encourage the construction of autonomous and semi-autonomous systems

This recommendation aims at addressing the problems of coverage as well as sewerage system developmental problems in the city. To that end, it is found that the city must delineate areas that are appropriate to built autonomous and semi-autonomous disposal systems and encourage the people living in these areas as well as housing developers to do so. Cesspools must be abandoned as a technology and be replaced by septic systems.

3 2 4 Improve the physical state of the wastewater system

This recommendation aims at addressing the problems posed by the current state of the system. Specifically, it calls for the rehabilitation and expansion of the existing network and the construction of an appropriate treatment plant. The recommendations made in the sewerage master plan which has been developed for the city should be followed. The first recommended action will be to prepare the final project and bid documents for the first phase of the master plan.

3 2 5 Develop a management scheme for the improved wastewater system

This recommendation aims at establishing the most appropriate management scheme for the municipality. The first step will be for the municipal council to come to an agreement with RADEEF, or decide on another management scheme defined by the master plan. The second step will be to conduct a feasibility study that would establish the recommended management scheme for the system. The third step will be to establish the management scheme once fully approved by the appropriate authorities.

3 2 6 Improve wastewater disposal services delivery at the municipality

This recommendations aim at improving the basic services that are presently being furnished by the municipality. This will be done through the improvement of the capability of existing staff in areas such as problems detection, work scheduling and supervision, sewer network functionality improvement.

3 2 7 Improve sector financing

This recommendation aims at improving revenue available to the sector. The first step will be to define the types of revenue that are available to the sector. The second step will be to conduct a cost reduction study in order to increase system's efficiency. The third step will be to establish a model that could study system's efficiency and profitability.



ANNEX C LIST OF DOCUMENTS CONSULTED

ANNEXE C

Liste des documents consultés

- 01 Schéma Directeur de Distribution d'Eau et d'Assainissement de la ville de BEN GUERIR, Etude d'Assainissement Mission B1 Investigations Préliminaires, Données de Base, Société Centrale d'Équipement du Territoire du Maroc
- 02 Etude de Faisabilité de la Viabilisation en Réseau d'Assainissement du Secteur Formant les Quartiers Charibat et Ifriquia à BEN GUERIR, B S Ingénierie S A R L, Janvier 1997
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- 05 Etude du Schéma Directeur d'Assainissement Liquide de la Ville d'AZROU, Missions A ET B, Groupement SETRAGEC SA et ADI, Juin - Septembre 1995
- 06 Monographie de la Municipalité de BEN GUERIR, Municipalité de BEN GUERIR, Août 1996
- 07 Création de Cellule, de Commission Locale, de Club des Jeunes Entrepreneurs de BEN GUERIR, Municipalité de BEN GUERIR
- 08 Stratégie de Restructuration de la Municipalité de BEN GUERIR, Municipalité de BEN GUERIR, Juin 1996
- 09 Un Vrai Engagement pour Mobiliser les Jeunes de BEN GUERIR, Municipalité de BEN GUERIR, Mars 1995
- 10 Monographie Environnementale de la Région Economique Centre-Nord, Ressource Ingénierie, Juillet 1997
- 11 Evaluation des Systèmes de Gestion des Déchets à MEKNES, AZROU et SEFROU, J A DOHRMAN & Sefiane BENYAHIA, Juin 1997
- 12 Certaines Mesures Prises pour Promouvoir l'Investissement à BEN-GUERIR, Municipalité de BEN GUERIR, Novembre 1994
- 13 Utilisation des Eaux Usées Traitées en Agriculture, Recueil des Lois, Décrets et Arrêtés, Ministère de l'Agriculture, Maroc, Octobre 1995

- 14 Textes Portant sur la Réorganisation du Fonds d'Equipement Communal, Fonds d'Equipement Communal, Août 1992
- 15 Ensemble pour le Développement de notre ville, Municipalite de BEN GUERIR, 1996
- 16 Plan Directeur de l'Eau Potable de SEFROU, Marsellaise des Eaux & ISKANE, 1993
- 17 Guide des Procédures de Financement, Fonds d'Equipement Communal, Janvier 1996
- 18 Tarification de l'Assainissement Cas de Khemfra et M'Rirt, Office National de l'Eau Potable, Avril 1997
- 19 Dossier de Prise en Charge du Service Assainissement d'AZILAL, Office National de l'Eau Potable, Avril 1996
- 20 Dossier de Prise en Charge du Service Assainissement de M RIRT, Office National de l'Eau Potable, Mars 1996
- 21 Station d'Epuration Expérimentale IAV Hassan II - Caracteristiques et Avantages des Composantes de la Filière d'Epuration, Institut Agronomique et Vétérinaire Hassan II, Juillet 1997

ANNEX D LIST OF PERSONS AND INSTITUTIONS VISITED

ANNEXE D
LISTE DES PERSONNES ET INSTITUTIONS RENCONTREES

TSS-MOROCCO

M Farouk TEBBAL, Chief of Party
Mohamed CHRAIBI, Planning Specialist
Samir KANMOUN, Consultant
James DOHRMAN, Consultant
Alison MASSA, Consultant

USAID-MOROCCO

Tina DOOLEY-JONES, Chief, Office of Environment and Urban Programs
Amy OSBORN, Acting Chief, Office of Environment and Urban Programs
Tahar BERRADA, Housing Advisor
Alan HURDUS, Environmental Program Officer

CHEMONIX - WRS PROJECT

Mario KIRBI, Chief of Party
Redoine CHOUKRALLAH, Coordinator

MINISTERE DE L'INTERIEUR

Ahmed KAWNI, Directeur de la Direction de l'Eau et de l'Assainissement

MINISTERE DE L'ENVIRONNEMENT

Mehdi CHALABI, Division de la Programmation et du Suivi des Projets

OFFICE NATIONAL DE L'EAU POTABLE

Ahmed Segten, Chef de la Division Assainissement
Abdelghani HIDAOUI, Chef de la Zone Sud de la Division Assainissement
M BOUTAHAR, Chef de la Zone Nord de la Division Assainissement
Abdelhaziz STILI, Responsable de la Région Assainissement DR 1
Mohamed LASRI, Service Commercial, Direction Commerciale et de Maintenance

FONDS D'EQUIPEMENT COMMUNAL

Mostafa MOUHASSABI, Chef de Service Evaluation
Hayat ZAIDI, Cadre Supérieur
Mohammed AKHIYAT, Chef du Département Suivi et Supervision
Hassen RAPMAWI, Chef de Service Evaluation

ISKANE

Abderrhamane AFFLA, Directeur d'ISKANE

VILLE D'AZROU

Driss GUESSAB, Président

Driss BOUARICH, Vice-Président

Mohamed LOTFI, Conseiller Communal

Rachid SENNAOUI, Ingénieur Municipal

Abdellatif MGHARI, Medecin Chef du Bureau d'Hygiène

Mohamed DAABI, Secrétaire Général de la Municipalité

Abdelouahab LAMBATTEN, Technicien d'Assainissement

Mohamed BAHRI, Technicien d'Assainissement

VILLE DE BEN GUERIR

Municipalité

Bouchta KARIMI, 1er Vice-Président

Mohamed FERTAT, 2eme Vice-Président

Touhami MOUHIB, Ingénieur Municipal

Abdelkrim BENZAHAR, Ingenieur des Espaces Verts

Abderrahim LEFNESTA, Secrétaire Général de la Municipalité

Kendil Soumaya ALAOUI, Ingénieur Cite OCP

VILLE DE SEFROU

Hichami Hafid ALAOUI, President

Mohammed AZLAL, Directeur Provincial de l'Agriculture

Mohammed EZZAHRAOUI, Délégué de la RADEEF

Driss GUEDDARI, Chef de l'ONEP SEFROU

Abdelmajid BEN ABBAS, Ingénieur Conseil EWI-MAROC

Ahmed HADRAOUI, Ingénieur Conseil PROMO CONSULT

Ali GUIRI, Chef de la Division de l'Urbanisme de la Province de SEFROU

Abdelsselam MOKTADI, Ingénieur d'Etat de la Municipalite

Mohamed BEKALI, Vétérinaire de SEFROU

Ahmed Ahmed CMRIF, Membre du Conseil Municipale de SEFROU

Houcine BEROUGUI, Membre du Conseil Municipale de SEFROU

Kadem Abdelaziz ALAOUI, Membre du Conseil Municipale de SEFROU

Matmata HADOU, Membre du Conseil Municipale de SEFROU

Abderrahmane Said ALAOUI, KAID Chef de 1er Arrondissement

Ahmed HOUSSA, Urbaniste de la Municipalité de SEFROU