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Private Participation in Environmental Services (PPES)

MARKET STUDY: PRIVATE PARTICIPATION IN THE LIQUID WASTE SECTOR IN TUNISIA

Final

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Acronyms

BOT	Build-Operate-Transfer
ECU	European Currency Unit
IRR	Internal Rate of Return
GOT	Government of Tunisia
O&M	Operations and Maintenance
ONAS	National Sanitation Agency
TD	Tunisian Dinar

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1 Executive Summary

In response to the current orientation of the Government of Tunisia (GOT) toward greater private sector participation in the financing and delivery of environmental services, this study seeks to determine the scenarios for private sector intervention in liquid waste that are likely to perform well in the Tunisian context, as well as the total market value of each of those scenarios over the next 20 years.

A preliminary analysis of the liquid waste sector and the orientations and preferences of private firms led to the definition of public sector, private sector, and user criteria for private sector intervention. In addition, the study team identified the five components of hypothetical "model markets" for private wastewater services: contract type, works, actors, tasks, and means. An overlay of these components with the data gathered in the preliminary analysis yielded five potentially successful model markets: service contracts for sewer networks, service contracts for sewage treatment plants, management contracts for sewage treatment plants, BOT (Build-Operate-Transfer) for sewer networks, and BOT for sewage treatment plants.

In order to test the validity of each model market, the study team gathered additional information through field surveys. The private sector survey revealed the preferences and capacities of Tunisian and foreign firms to respond to new liquid waste markets. It was found that local firms: prefer 3-5 year contracts; are interested in providing services for areas with at least 20,000 inhabitants; prefer service contracts and BOT to management contracts; would like to associate with a foreign firm; and see administrative/contractual aspects as the largest constraint to market development.

The public sector survey focused on current service costs for the three main types of liquid waste works: networks, pumping stations, and treatment plants. Analysis of the financial and technical records of the National Sanitation Office (ONAS) revealed that the majority of indirect costs for operations and maintenance (O&M) are incurred at the central office; that O&M costs for low-income networks are generally higher than those for middle- and high-income networks; that O&M costs for treatment plants vary greatly with type of treatment and size; and that there is a negative correlation between maintenance cost and treatment plant size.

The financial information gained through the public sector survey was combined with the principal findings of the private sector survey in the construction of cash flow analyses for each of the model markets. The primary indicator for market feasibility for the public sector was savings on costs; for private firms, rate of return determined which markets are potentially attractive. For the users, improvement in service quality is the meter for acceptability of the different options. Those markets which respond to the criteria of all three groups, and which therefore hold promise in the Tunisian context, are listed below with their potential values in 1994 Tunisian Dinars over the period 1995-2015:

Table 1
Viable Markets for Private Participation in the Liquid Waste Sector

Model market	Value (1995-2005, TD '000s)
Service contract for network	38,102
Service contract for treatment plant	23,175
Management contract for treatment plant	49,903
BOT for treatment plant	55,370

2 Objectives

GOT is increasingly oriented toward greater private sector participation in the delivery of environmental services. As one of the primary actors in the sector, ONAS is interested in involving the private sector in operations, maintenance, and financing of liquid waste facilities.

For several years, ONAS has employed private sector firms to implement the bulk of its studies and to carry out the construction of new facilities; however, ONAS is still performing all O&M activities with its own staff. The increasing O&M workload, especially as a result of current plans to take charge of and equip with treatment facilities all built-up areas across the country, has encouraged ONAS to look to the private sector to provide some of these services. Such a move would enable ONAS to focus on system development and to free up human and financial resources for its investment programs.

This study therefore seeks to determine the scenarios for private sector intervention in liquid waste that are likely to perform well in the Tunisian context, as well as the total market value of each of those scenarios over the next 20 years.

The findings of this study will inform the development of a national strategy on private sector participation in the liquid waste field.

The study was financed through HG-005, Private Participation in Environmental Services (PPES). In addition to budget support for GOT programs in this field, this GOT/USAID program provides grant funding for technical assistance which will facilitate increased private sector involvement in the financing and delivery of environmental services.

3 Terms of Reference

To attain the objectives mentioned in the above section, the terms of reference of the study identify two tasks: a market study on the role of the private sector in the liquid waste field and a cost and revenue study for liquid waste services.

The first task is the identification of the forces of supply and demand. The current and future size of potential markets will be identified and profiles of future private firms likely to participate in the sector will be defined. In addition, the study will describe the types of tasks likely to be transferred to the private sector, as well as the most suitable levels of private sector participation for the purposes of both ONAS and municipal governments.

Private sector participation in environmental services could take several forms, ranging from contracting out O&M activity to the granting of concessions, whereby the public entity sells to a private company the exclusive right to operate and maintain a given facility. This analysis of potential contracts will bear in mind the nature of the facilities (sewage treatment plant, sewer network, alternative wastewater systems, etc.) and the uses the facilities will be put to (tourist, industrial, domestic, etc.).

The experiences of other countries with private participation will be looked into, allowing ONAS and the municipalities to have a wider view of service delegation.

The profitability of each type of private sector participation will be assessed. Certain important parameters, such as the minimum length of contract for each type of private sector involvement, will be defined.

An analysis of costs and revenues for O&M services related to liquid waste will allow ONAS and the concerned municipalities to assess and appreciate the financial advantages to be gained from private participation in certain activities. In the short term, this analysis will allow the relevant public entity to analyze, with full knowledge of the financial base data, the services tenders coming from the private sector. Moreover, it will allow the private sector to assess the difficulties and constraints of the activities for which their services are required and better evaluate both potential profitability and level of risk.

The scope of the present study also includes the examination of liquid water services in two municipalities for which ONAS is not responsible in order to define the O&M costs and to evaluate the feasibility of greater private sector involvement in service delivery.

4 Context

4.1 Liquid Waste in Tunisia and the Role of ONAS

In the 1960s, municipal governments were exclusively responsible for liquid waste service delivery in Tunisia. In 1974, GOT, in an effort to improve liquid waste services nationally, created the National Sanitation Agency[1] (ONAS).

ONAS is a semi-autonomous agency under the Ministry of the Environment and Regional Planning. Since its creation, ONAS has been responsible for the management, operation, and maintenance of all liquid waste facilities in areas under its control. In 1993, its prerogatives were extended to include all forms of water pollution control.

Today, ONAS is responsible for O&M of liquid waste facilities in 83 of the largest of the 253 existing municipalities, the population of which represents 74 percent of the total urban population. ONAS provides services to 537,000 consumers.

In the other 170 small municipalities, the local governments continue to be responsible for O&M of liquid waste facilities. In these towns, ONAS nevertheless participates in the development of studies and the execution of new projects for the central government, the municipalities, or third parties.

At present, ONAS operates and maintains some 5,600 km of liquid waste and storm water network, 256 pumping stations and 39 sewage treatment plants throughout the country, particularly in coastal areas. These sewage treatment plants treat 96 million cubic meters of water annually, or 74 percent of all liquid waste in the towns under its control. The average treatment efficiency of ONAS plants is 93 percent. In 1993, plants operated at an average of 94 percent of total capacity.

Sewage treatment processes include activated sludge and lagoons. Within these categories, there are a number of variations: medium load, light load (with or without oxidation channels), and heavy load (lagoons optional). The sludge is usually treated aerobically, apart from a few cases where it is treated anaerobically. In one case, the gases are recuperated and used to heat the digestors of the plant.

Little treated water is recycled; only 20 percent of the volume is used again in agriculture. There is a marked difference from one station to another in quantity of sludge reuse.

Liquid waste is collected in combined wastewater/stormwater networks in older urban areas, and in separate networks in the vast majority of the areas that have recently been developed or fitted out with liquid waste networks.

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[1] *Office national d'assainissement*

Where there are no sewer networks, liquid waste is generally discharged into cesspools. Certain towns also have communal septic tanks.

To operate and maintain its network, ONAS uses mechanical and manual means. Ninety-eight percent of network O&M is mechanized, as compared to 36 percent for related works (manholes, drains, etc.).

Every year, ONAS extends its network by some 170 km and rehabilitates approximately 30 km.

4.2 Current Role of the Private Sector

In Tunisia, the private sector has long participated in activities related to liquid waste services. ONAS contracts out to the private sector practically all the large and medium liquid waste studies and employs private enterprises to extend networks and build liquid waste facilities, such as sewage treatment plants and pumping stations. Training programs are generally carried out by the private sector. Even the rehabilitation of facilities is done by private companies.

In the O&M field, private sector participation to date is limited, with ONAS maintaining its own facilities with its own equipment and personnel. This explains why ONAS staff is becoming so large (3,424 in 1993). ONAS occasionally calls on the private sector for one-time maintenance tasks.

Since ONAS is not authorized to intervene inside private property, the private sector currently fills this gap, operating and maintaining private liquid waste networks and facilities, such as internal networks for hotels and industries. The private sector also provides services in public buildings such as schools, hospitals, and government offices. Specialized firms also empty cesspools, septic tanks, and grease pits for private clients.

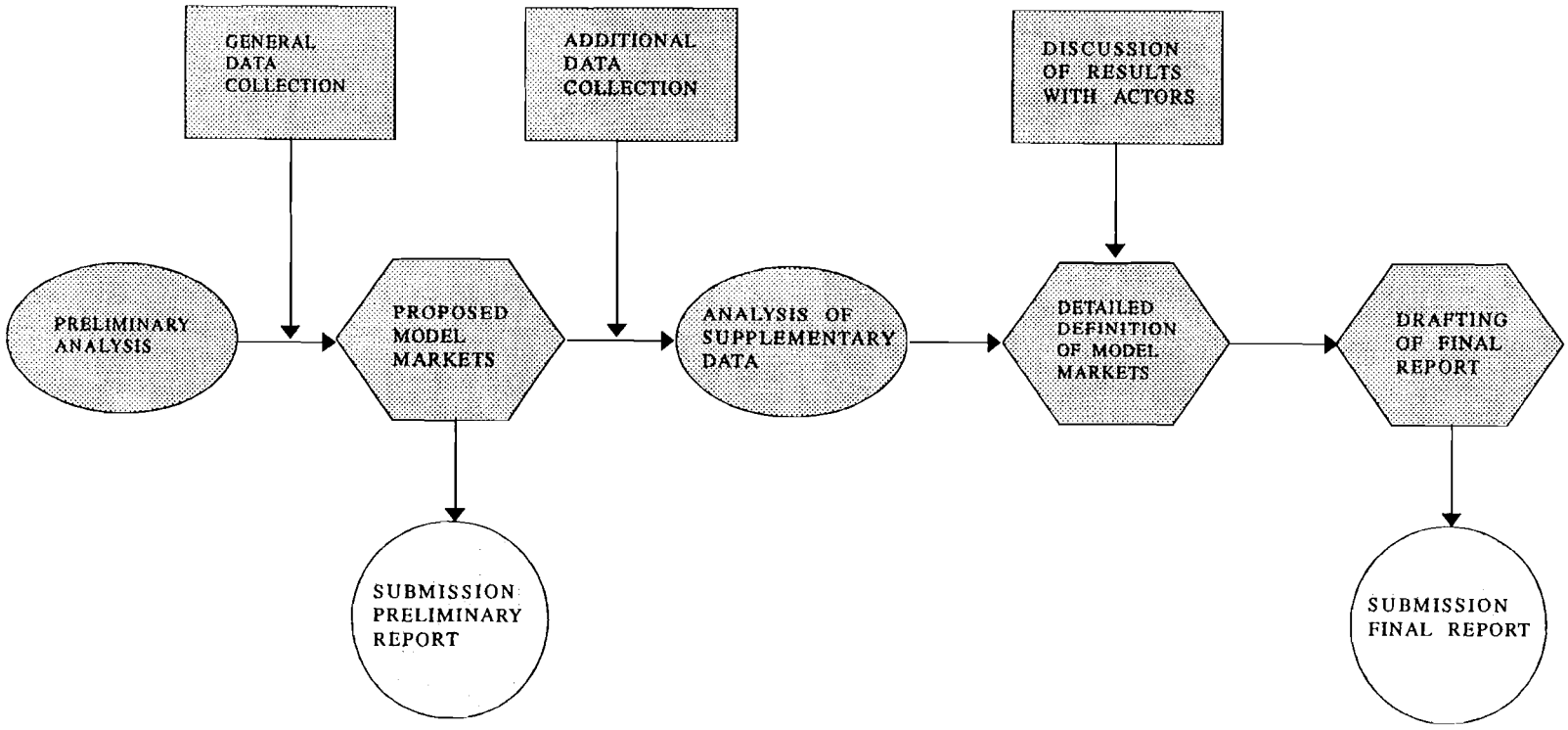
5 Methodology

The methodology employed in this study is essentially the scientific method adapted to the conditions of market analysis (see Figure 1).

The first phase of the study includes a preliminary analysis of the current liquid waste in Tunisia and the present role of the private and public sector actors in this field. This analysis led to the definition of criteria for delegating services to the private sector. These criteria set out those conditions in which the public sector entities, private sector firms, and users would be willing and able to participate in such an initiative. On the basis of these criteria, a certain number of model markets were proposed, each representing a hypothesis of financial, economic, institutional, and technical feasibility.

The study's second phase included collection and analysis of specific data relating to the proposed hypotheses. These data were obtained through two surveys, one for the public

Figure 1
Methodology



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sector and the other for the private sector. The data assembled in the surveys allowed the team to prepare financial analyses and thus test the validity of each of the model contracts. At the end of this phase of the work, a final selection of model contracts for liquid waste services delegation was made.

The market study's third and final phase concerns the presentation of the conclusions to the various actors in the sector. At a series of meetings with the public bodies and the private companies, the team of specialists elicited the reactions and opinions of the major players with a view to better defining the true features of model markets and/or the parameters concerned in the implementing of each of these markets. The present report takes into account the data obtained at these meetings.

It is worth noting that in this market, unlike in traditional liquid waste markets, the demand comes from the public sector (ONAS and the municipalities), while private firms represent the supply.

6 Model Markets

6.1 Criteria

The criteria set out the conditions under which the public bodies, private companies and users are willing and able to participate in the implementation of private sector contracts for liquid waste services.

6.1.1 Public Sector

For the public body, each contract with a private firm must satisfy the following criteria:

- **Reduction of service costs:** delegating certain O&M liquid waste jobs to one or many private companies must bring about a general reduction of service costs. That is, the sum to be paid to the private company to provide a given service must be less than the cost currently incurred by the public body.
- **Improved output:** the efficiency of a private company operating under competitive conditions must lead to an appreciable improvement in the output presently achieved by the public body in its O&M activities.
- **Improved service quality:** the private company entrusted with a contract must be able to provide a better service than its public sector counterpart.
- **Specialization of human resources:** delegating certain repetitive tasks to a private company must lead to increased specialization within the state body's staff in such functions as design, planning, management, and quality control.
- **Mobilization of additional capital:** transfer to one or more private companies of part of the responsibility for financing large investments in the liquid waste field must lead to the mobilization of new capital to be used to improve liquid waste services in Tunisia.

- **Increased financial independence of ONAS:** private sector participation aimed at reducing O&M costs and mobilizing additional private capital must diminish the public body's financial dependence on central government transfers.

The satisfaction of all these criteria would clearly increase public sector interest in entrusting liquid waste contracts to the private sector. However, bearing in mind the features and constraints of certain contracts, it would seem difficult, perhaps impossible, to meet all of the criteria simultaneously. In this case, the number of criteria satisfied and the degree of satisfaction will inform the definition of the model market.

6.1.2 Private Sector

A private company's willingness to offer its services in this field will depend on a certain number of criteria:

- **Profitability:** the specific conditions of a given contract must allow the private enterprise to generate an acceptable profit margin.
- **Predictability:** the generation of service and/or management contracts must be done in a context of detailed knowledge of the condition of the facilities to be operated, tasks to be carried out, required returns, and any other condition affecting private sector responsibilities over the entire duration of the contract.
- **Durability:** each model market must meet the above mentioned criteria over the medium- and long-term in order for the private firm to make the necessary investments.

6.1.3 Users

The criteria for the viability of private sector participation from the point of view of the users are the following:

- Improved service quality
- Speed of service delivery
- Cost stability/reduction

Meeting each of the above mentioned criteria (for the public sector, private firm, and user) is central to the successful implementation of any program of increased private sector participation. These criteria will therefore be used to evaluate each of the model markets.

6.2 Components

Each model market brings into play five main components which encompass all aspects of the subject: contract type, works, actors, tasks, and means. This section details each of these components.

6.2.1 Contract Type

The contract type governs the relationship between the various actors participating in the provision of liquid waste services. It specifically sets out the roles and responsibilities of the public and private parties and distributes between them the various tasks (programming, financing, execution, O&M, billing, etc.) associated with liquid waste facilities. The type of contract, which can range from a contracting out to a BOT, must correspond to the Tunisian context, in this case to that of ONAS and the municipalities.

This section defines a certain number of contract types commonly used in various countries around the world. A more exhaustive discussion of the experience of other countries with private sector participation in the liquid waste field is given in Annex C.

Service Contracts

Service contracts involve "contracting out" of specific O&M activities to the private sector for a period of a few years. The public entity sets out performance criteria for the execution of specific activities, assesses tenders from private firms, monitors the contractors, and pays them the agreed price for their services. This price may be based on a fixed fee, unit price, or on other bases defined in the contract. To operate this type of contract most profitably, it is important to award contracts on a competitive basis; however, unsolicited bids may be compared with those coming from public agencies.

Management Contracts

Management contracting seeks to apply private sector management practices to the public sector. In practice, this means handing over the execution of entire projects or parts of projects to private firms, thus freeing public managers from administrative or institutional constraints on O&M functions.

Management contracts extend private sector responsibility beyond the individual activities, thus encompassing a wide range of O&M and upkeep functions, usually for a period of between 10 and 20 years. In the management contract approach, the entrepreneur/contractor is compensated at least partially as a function of performance and risk assumed.

Lease Contract

In a lease contract, the private firm pays the public owner for exclusive rights to operate a given facility. In this case, the private enterprise bears sole responsibility for all the commercial risks. However, the private firm is not responsible for making any major investments.

Concession

As with lease contracts, a concession involves a private enterprise paying the public owner for the exclusive right to operate and maintain a given facility and assume all commercial risks. In addition, the contractor is responsible for financing specific extensions, rehabilitations, and replacements of assets as specified in the contractual agreement. These assets will be turned over to the public body at the end of the concession contract. The contractor's financial compensation is based on service charges, which are specified in the contract and can be renegotiated during implementation. The concession holder is responsible for billing consumers. Concessions normally last 15 to 30 years, depending on the lifespan (depreciation schedule) of the investment.

BOT (Build-Operate-Transfer)

BOT is a form of concession which is used for the construction of new facilities. The public authorities hand over to a private entrepreneur responsibility for financing, building, and operating and maintaining a given facility. At the end of the contractual period, which extends over a 15-30 year period (usually corresponding to the depreciation schedule of the facility), the contractor must turn over the facilities to the public authority. In most cases, the private company is responsible for billing consumers.

Turnkey Contract

In turnkey arrangements, the public entity transfers to a private firm the responsibility to finance and build a given facility. After construction, the firm operates the facility during an initial period to verify that all equipment if functioning properly and to train public sector personnel in operations and maintenance. At the end of the period (often one year), the facility is turned over to the public authority.

Joint Venture

Joint ventures involve shared ownership and control of infrastructure through minority private participation. This approach allows for the introduction of outside capital without sacrificing direct public control over service management and facility operation. In addition, joint ventures facilitate the transfer of expertise from the private sector to the public sector.

Privatization (Divestiture)

Full privatization is essentially the transfer of ownership shares in public enterprises to private interests. This usually involves transfer of personnel from the public agency to the newly created private company. The public sector generally retains regulatory functions and is responsible for ensuring a minimum level of service quality.

6.2.2 Works

In order to quantify the different markets for private sector intervention in the liquid waste sector, it is necessary to have a precise understanding of the total range of existing and planned liquid waste works in Tunisia.

In cities with populations greater than 2,000, the total length of wastewater and stormwater networks is 6,300 km, of which 5,600 km (89 percent) are located in cities where ONAS is active. 77.2 percent of this network is wastewater, while 14.7 percent is combined and 8.1 percent is stormwater only.

ONAS operates the large majority of the country's 256 pumping stations, of which the total power is 6,000 kw. ONAS also operates all 39 sewage treatment plants, with a total treatment capacity of 158,790 kg of BOD_5/day.

Additional liquid waste facilities include skimming ponds and oueds.

While the older parts of the network have deteriorated substantially, overall condition is fairly good, and the annual rate of rehabilitation is low (.48 percent, or 27 out of 5,600 km).

To determine future liquid waste infrastructure needs, ONAS has drafted the "Feasibility Study 2001" encompassing all Tunisian municipalities with over 2,000 residents, excluding the built-up areas of Greater Tunis, Greater Sousse, Greater Sfax, Greater Gabès, and Greater Bizerte, for which specific studies in the Liquid Waste Master Plan have been carried out.

These studies have identified projects which are scheduled for implementation by the year 2001. This would required sizeable funds and an implementing capacity that is far greater than the one that exists. Full implementation is therefore more likely to take place over a 20-year period, corresponding to an annual implementation rate of 275 km annually.

Given these hypotheses, the liquid waste network over the period 1995-2015 will almost double with the addition of 5,500 km of piping. The number of sewage treatment plants will be increased by 111, treating 326,000 kg of BOD_5 per day; the number of pumping stations will be increased by 173, with total capacity equal to 8,000 kw.

This means that total liquid waste facility stock in 2015 will comprise 11,800 km of pipeline, 150 sewage treatment plants, and 429 pumping stations.

Annex B contains tables of existing liquid waste facilities by municipality, as well as projected investments over the 20-year period.

6.2.3 Actors

There are two groups of actors who could become involved in liquid waste service delegation: the first includes the public entities, i.e., ONAS and the municipalities; the second is made up of private firms (Tunisian, foreign, or a with elements of both), whose specific profile will be defined in a later section of this document.

6.2.4 Tasks

It is necessary to identify the tasks ONAS currently carries out for O&M of the liquid waste network, pumping stations, and sewage treatment plants in order to define future distribution of tasks between public and private sector organizations.

The O&M tasks relating to the network concern cleaning, masonry work, maintenance of equipment and rolling stock, and administrative and technical/administrative tasks. The bulk of these tasks is carried out by the center (smallest administrative unit), but some are done at either the district or department level, or at the level of the head office.

The following is a list of the main tasks associated with network O&M:

Cleaning

- Systematic cleaning (liquid waste and rain water)
- Cleaning on receipt of a complaint (unblocking network pipes or connection boxes, during the working day or on days of rest and at night)
- Cleaning or occasional intervention (hygiene campaign, cleaning for official occasions, emergency unblocking and cleaning in rainy weather, rainwater pumping)

Masonry Work

- Connections
- Repair
- Rehabilitation
- Small-scale extensions

Study, Analysis, and Closed-Circuit Camera Inspection

- Study for small extension
- Study for large extension
- Closed circuit camera network inspection for monitoring or study
- Analysis of industrial discharge

Equipment Maintenance

- Upkeep and repair of rolling stock
- Upkeep and repair of special equipment for cleaning or pumping tools

Technical/Administrative Tasks

- Measurement for connections
- Quotation for connections
- Inspection and receipt of work done by third parties
- Survey of illicit connections
- Fee payment research
- ONAS-SONEDE liaison file

Administrative Tasks

- Relations and meetings with local, regional, or national authorities
- Receipt of complaints
- Customer relations
- Staff check-in
- Daily, monthly, and yearly reports
- Management of local premises and filekeeping
- Security
- Paying of wages
- Staff management
- Budget

O&M tasks associated with pumping stations include:

Equipment Maintenance

- Upkeep of electro-mechanical and hydraulic equipment (lubricating, oil change, cleaning of canvas sheet and of grating)
- Electric upkeep
- Transformer unit upkeep
- Generating set upkeep
- Meter reading
- Upkeep of building and fence (paintwork, green areas, etc.)
- Maintenance of electro-pumps
- Maintenance of generating set

Administrative Tasks

- Staff check-in
- Daily, monthly, and yearly reports
- Security
- Payment of wages

- Staff management

The O&M tasks associated with sewage treatment plants are the following:

Equipment Maintenance

- Upkeep of electro-mechanical and hydraulic equipment (lubricating, oil change)
- Maintenance of electro-mechanical and hydraulic equipment
- Upkeep of the pre-treatment area (cleaning of pond, sand filter and grating, removal of sand and oil, etc.)
- Electrical upkeep
- Upkeep of transformer unit
- Upkeep of building and fence (paintwork, green areas, etc.)
- Meter reading
- Mosquito removal (for lagoons)
- Weeding (for lagoons)
- Upkeep of drying layers, clearing and dumping of dried sludge

Analysis and Measurement

- Laboratory analysis
- Flow measurement

Administrative Tasks

- Relations and meetings with the local, regional, and national authorities: National Health Ministry, Ministry of the Environment, the ANPE National Environment Protection Agency, Ministry of Agriculture, the Regional Agricultural Development Commission, etc.
- Relations with consumers of treated water and sludge
- Staff check-in
- Daily, monthly, and yearly reports
- Management of local premises and filekeeping
- Security
- Payment of wages
- Budget
- Staff management

The bulk of these tasks can be handed over to the private sector, but the precise list depends on the type of contract. Relations with the national, regional, and local authorities will probably remain public sector tasks. Moreover, it must be noted that new tasks will be

created for the public bodies, especially those concerning management of contracts and supervision of the services provided by the private enterprise.

6.2.5 Means

In order for the various actors to implement public service delegation programs, it is vital that they possess sufficient information on the financial and material means available to private firms. The fiscal and financial incentives offered by the various financing programs (credit lines, advantages given by the Investment Code and the Anti-pollution Fund, etc.) will make liquid waste contracts much more attractive to and feasible for private sector firms and will allow ONAS to contract for services at the lowest possible cost.

Fiscal and Financial Means

Private firms that invest in sectors related to environmental protection and enhancement will be exempt from customs duties, VAT on imported equipment which has no locally-made equivalent, and VAT on locally made equipment.

With respect to financial advantages, certain credit lines provided by Western industrialized countries to stimulate local investment and encourage partnership arrangements offer preferential interest rates. The following table illustrates the advantages and conditions of these credit lines.

Table 2
Credit Lines

Source	Amount	Foreign Interest Rate[8]	Tunisian Dinar Rate[8]	Term (years)	Limits
Tuniso-Belgian[1]	TD 2,700,000	5.00%	8.00%		540,000
E.C.I.P.[2]	ECU 4,500,000			5.0	20% Total
Tuniso-Walloon[3]	TD 810,000	4.00%	7.00%		161,987
Tuniso-French[4]	FF 17,000,00	5.00%	8.00%	10.0	50% Total
PROPARCO[5]	TD 15,500,000	9.00%	12.00%	12.0	30% Total
Italian Line for SMEs[6]	TD 40,000,000		10.00%	10.0	
Italian Joint Venture[7]	TD 60,000,000	4.75%	7.75%	6.5	

Notes:
1. Procurement of Belgian material, new equipment, services, and formation of working capital.
2. Financing capital requirements with EU countries. Maximum one million TD per project.
3. Acquisition of Walloon material, new equipment and services.
4. The "Bérégovoy" line: Four years deferred amortization for financing acquisition of French goods (new) and services and financing start-up working capital requirements.
5. The PROPARCO company (*Promotion et de participation pour la coopération économique*) is a majority-owned subsidiary of the *Caisse Française de Développement* (French Development Fund). The method of setting the price of the good or service is based on profitability of the project, not on parent-company capital gains. Amortization is deferred for one to five years. These loans are used primarily for acquisition of French goods and services, in addition to a considerable share of local costs.
6. For financing Italian goods and services intended for Tunisian small and medium enterprises. The grace period is two years.
7. For financing Italian goods and services to be used by Italian enterprises. The grace period is two years.
8. Foreign interest rate includes no exchange guarantee; TD rate includes exchange guarantee.

In the context of a joint venture arrangement for a liquid waste project, firms may also use the venture capital lines offered by the European Investment Bank. With an budget of US$ 4.5 million, this line will cover all complementary financing and also provides a supplement for equity requirements. The complementary financing part is interest-free and is repaid in the form of dividends when the enterprise starts making profits.

The loan may reach ECU 1,000,000 for the Tunisian or European firm. It has a maximum 20-year term with a 5-year grace period.

This review demonstrates that there are several alternatives which can considerably reduce financing costs, thus improving the profitability of private firms active in the liquid waste sector.

Equipment

In an effort to facilitate private sector intervention in the liquid waste field, and to allow ONAS to reduce its O&M fleet, ONAS could make some of its equipment available to private firm(s) on a rental or hire-purchase basis. Such a measure would fill an existing gap in the local equipment rental market: Tunisian leasing companies supply specialized O&M equipment (e.g., jet truck, extractor) only with associated operating personnel. Other leasing companies offer the same equipment without personnel but at very high interest rates (around 18 percent).

6.3 Preliminary Selection of Model Markets

On the basis of the information collected during the preliminary analysis, the team proposed a number of model markets for private sector intervention in the liquid waste field. Each of these model markets has the potential to meet public sector, private sector and user criteria and therefore be viable in the Tunisian context.

Each model market represents a working hypothesis (See Figure 2). For example, Model Market 1 can be expressed as follows: "This model market, as defined by its five components, meets public sector, private sector and user criteria; it is therefore financially, economically, institutionally and technically viable." The hypothesis will be tested during the second phase of the study, following the collection of additional information.

For every model market related to sewerage network, it has been assumed that the private firm will provide O&M services for both the wastewater and stormwater systems. In the case of towns in which ONAS is active, this means that the private firm will contract with ONAS for both systems, and the local government will reimburse ONAS for expenses related to stormwater system O&M.

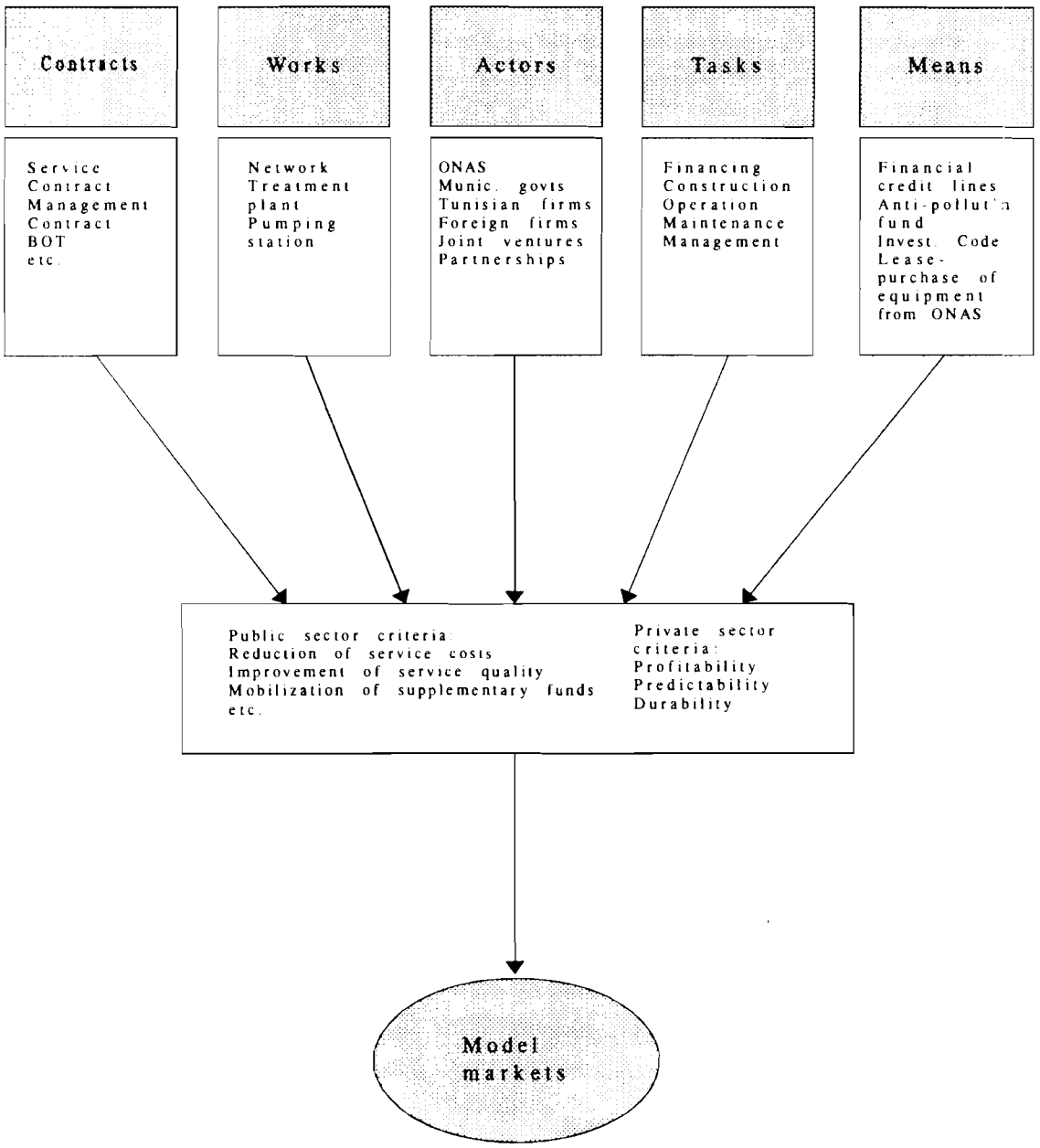
6.3.1 Model Market 1

Service Contract: Network

In this type of market, the public entity hires a private firm to provide operations and maintenance of a sewer network for a period of several years (to be defined). This contract applies to O&M of collection networks for domestic, tourist or industrial liquid waste, pumping and transfer stations, and overflow works. As noted above, this contract concerns both wastewater networks and rainwater networks. The private company is responsible for personnel costs, energy costs and the replacement of minor spare parts (to be defined in the contract). Different options exist for equipment acquisition, including rental and hire-purchase of ONAS equipment, as described above. Setting user fees, billing, and public relations remain the responsibility of the public entity.

ONAS or the concerned municipality establishes the contract conditions and the performance requirements for the execution of specific tasks to be carried out by the private contractor.

Figure 2
Composition of Model Markets



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After issuing the call for tenders, the public entity evaluates the bids by comparing them with current service costs, selects the contractor, monitors the activities of the private firm and pays the agreed price for the services. Prices may be based on a lump sum payment, unit prices, or any other arrangement specified in the contract. In order to maximize the benefits of this form of intervention, contracts should be awarded on a competitive basis.

This type of contract can also be applied to individual or collective industrial liquid waste collection systems. In this case, the contract can be signed between a specialized private firm and the group of industrial companies concerned.

6.3.2 Model Market 2

Service Contract: Sewage Treatment Plant

In this type of market, the public entity hires a private firm to provide operations and maintenance of a sewage treatment plant for a period of several years (to be defined). The contract includes O&M of sewage treatment plants and the pumping stations which service them. The private company is responsible for personnel costs, energy costs and the replacement of minor spare parts (to be defined in the contract). Setting user fees, billing and public relations remain the responsibility of the public entity.

In this approach, the public contractant (ONAS) will set out in the conditions of contract performance criteria for specific tasks, O&M requirements and effluent requirements. After issuing the call for tenders, the public entity evaluates the bids by comparing them with current service costs, selects the contractor, monitors the activities of the private firm and pays the agreed price for the services. Prices may be based on a lump sum payment, unit prices (such as the price per cubic meter of treated water or per kilogram of BOD_5 eliminated), or any other arrangement specified in the contract. In order to maximize the benefits of this form of intervention, contracts should be awarded on a competitive basis.

This type of contract can also be applied to individual or collective industrial liquid waste pre-treatment plants. In this case, the contract can be signed between a specialized private firm and the group of industrial companies concerned.

6.3.3 Model Market 3

Management Contract: Sewage Treatment Plant

In this type of market ONAS hands over the management of a sewage treatment plant to a private company for a period of several years (to be defined). The company will bear responsibility for O&M of the plant, replacement of spare parts (whatever their value), renewal of outworn equipment, and covering energy costs, including electric power. The private company must provide the equipment necessary for carrying out these tasks. Setting user fees, billing and public relations remain the responsibility of the public entity.

In the conditions of contract, ONAS will set out performance criteria for carrying out specific tasks, O&M requirements and effluent requirements. After issuing the call for tenders, the public entity evaluates the bids by comparing them with current service costs, selects the contractor, monitors the activities of the private firm and pays the agreed price for the services. Prices may be based on a lump sum payment, unit prices (such as the price per cubic meter of treated water or per kilogram of BOD_5 eliminated), or any other arrangement specified in the contract. In order to maximize the benefits of this form of intervention, contracts should be awarded on a competitive basis.

This type of contract can also be applied to individual or collective industrial liquid waste pre-treatment plants. In this case, the contract can be signed between a specialized private firm and the group of industrial companies concerned.

6.3.4 Model Market 4

Build-Operate-Transfer (BOT): Network

In this market, ONAS hands over to a private company responsibility for financing and construction of a new sewer network or extension of an existing network, and gives the firm the exclusive right to operate and manage the network for a period of several years (to be defined). Setting user fees, billing and public relations remain the responsibility of the public entity. At the end of the contract, the private company turns the facility over to the public body (ONAS or the concerned municipality).

In the BOT contract, ONAS and the private company may provide financing jointly. Financial compensation of the private contractor will be based on a lump-sum payment, unit prices or other arrangements.

This kind of contract may also apply to industrial liquid waste collection systems. In this case, the contract can be signed between a specialized private firm and the group of industrial companies concerned.

6.3.5 Model Market 5

Build-Operate-Transfer (BOT): Sewage Treatment Plant

In this type of market, ONAS hands over to a private company responsibility for financing and constructing a new sewage treatment plant or extension of an existing plant, and grants the firm the exclusive right to operate the plant for a period of several years (to be defined). Setting user fees, billing and public relations remain the responsibility of the public entity. At the end of the contract, the private company turns the facility over to the public body (ONAS or the concerned municipality).

In the BOT contract, joint financing between ONAS and a private company may be envisaged. Financial compensation of the private contractor will be based on a lump-sum

payment, the price of a cubic meter of treated water, the quantity of BOD_5 eliminated, or any other reference written into the contract.

This kind of contract may also apply to industrial liquid waste pre-treatment plants. In this case, the contract can be signed between a specialized private firm and the group of industrial companies concerned.

Table 3 summarizes the components of each of the five model markets retained for further study.

Table 3
Proposed Model Markets

Model Market	Contract Type	Works	Actors		Tasks	Means	
			Demand	Supply		Financial	Equipment
1	Service contract	Sewerage network	ONAS Municipality Group of industrial companies	Large networks: Tunisian firm Tuniso-foreign partnership Small networks: Tunisian firm/ cooperative	O&M	Existing financial and fiscal advantages	Partnership: purchase Small Tunisian firm: rental or hire-purchase of ONAS' material
2	Service contract	Sewage treatment plant	ONAS Group of industrial companies	Tunisian firm Tuniso-foreign partnership	O&M Minor spare parts replacement	Existing financial and fiscal advantages	Purchase
3	Management contract	Sewage treatment plant	ONAS Group of industrial companies	Tunisian firm Tuniso-foreign partnership	O&M Spare parts replacement Renewal of equipment	Existing financial and fiscal advantages	Purchase
4	BOT (Build-Operate-Transfer)	Sewerage network	ONAS Municipality Group of industrial companies	Tunisian firm Tuniso-foreign partnership Joint venture	Construction O&M Renewal of equipment	Existing financial and fiscal advantages	Purchase
5	BOT (Build-Operate-Transfer)	Sewage treatment plant	ONAS Group of industrial companies	Tunisian firm Tuniso-foreign partnership Joint venture	Construction O&M Renewal of equipment	Existing financial and fiscal advantages	Purchase

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7 Field Surveys

In order to test the validity of each of the model markets, additional data was collected through two surveys, one of the private sector and one of the public sector. The private sector survey was carried out on a sample of Tunisian and international firms likely to be interested in pursuing new opportunities in the liquid waste services market in Tunisia. The public sector survey was implemented in a number of ONAS regional offices as well as in two cities for which ONAS is not responsible.

7.1 Private Sector Survey

7.1.1 Methodology

The objective of this survey is to assess the capacity and willingness of Tunisian and foreign enterprises to enter the liquid waste services market.

At the start of this study, three local enterprises with knowledge of the liquid waste treatment sector and direct experiences as ONAS contractors were visited in order to develop an idea of the types of data that would facilitate the definition of private sector concerns, preferences and conditions for market entry.

Taking into account the lessons of these interviews, a survey questionnaire was produced and sent to a sample of 32 Tunisian enterprises. This questionnaire was then translated into English and sent to 15 foreign enterprises.

After the preliminary results of the market study had been viewed, several of the most capable and interested local companies who seemed interested in this operation were visited. The information collected in these interviews allows the team to refine its conclusions on the components and scope of the different model markets.

The sample selection was to guided by the need to identify operators having the technical or financial potential to enter this sector. The targeted sample of 32 enterprises (see Annex E) includes the following sectors:

- Public works and liquid waste enterprises
- Mechanical equipment manufacturers
- Suppliers and sales representatives of liquid waste treatment equipment
- Septic tank maintenance companies
- Security and technical assistance companies
- Retraining companies
- Groups of private investors

With the exception of the private investors, which were included because of their financial capacity and the diversification of their investments, these enterprises had been in either direct or indirect contact with ONAS or with the environmental services field.

The foreign firms were chosen for their experience with the types of contracts found in the different model markets, and for their knowledge of the liquid waste field in Tunisia. The 15 firms include French, German, Swedish, Dutch, Danish, English, Canadian and American enterprises (see Annex F).

The questionnaire for the Tunisian firms (see Annex D) addresses the following issues:

- General information: the type of firm, capital structure, experience, as well as its technical and human capacities.
- Financial information: gross revenue and annual growth rates indicate the ability of the firms to enter this new market without large-scale restructuring.
- Preliminary steps and preparation: information on staff retraining, contacts in the field, etc., indicate the type and extent of advance work that companies have already undertaken.
- Conditions for market entry: financial rate of return threshold, market size, type and length of contract, etc., define the conditions under which private firms are willing to enter the liquid waste market.

These issues were also addressed in the questionnaire for the foreign firms. Given that the surveyed enterprises are already specialists in this field, however, questions on staff qualifications, technical capacity and experience in this sector were deleted.

7.1.2 Survey Results

Fifty-seven percent of local firms responded to the questionnaire. This rate, considered high in the Tunisian context, reflects the targeted nature of the sample. All but one of the public works and liquid waste enterprises demonstrated interest in the liquid waste collection and treatment markets. On the other hand, approximately 25 percent of the firms responded negatively; four out of the six negative responses came from groups of private investors with little or no previous contact with ONAS. The results, summarized below, are presented in detail in Tables 4, 5 and 6.

Three- to five-year contracts are preferred by 60 percent of respondents. None of the enterprises is interested in contracts for less than three or more than ten years. Almost 75 percent of surveyed enterprises is interested in networks and stations serving more than 20,000 residents.

The main obstacle to market development was identified as the contract conditions and clauses to be established by the public entity.

Service contracts and BOT contracts were chosen by 50 percent of enterprises. Only 30 percent of respondents was interested in management contracts.

Even though most firms did not reveal the financial criteria for investment on the questionnaires, an internal rate of return (IRR) of 15 percent can be identified as a threshold based on interviews and informal communications.

Over 50 percent of the enterprises has already started to make preparations to enter this market. This preparation involves contact with the concerned authorities, preliminary market studies, participation in specialized activities and contact with potential foreign partners.

Eighty percent of concerned respondents believe that a partnership with a specialized foreign company is necessary or at least preferable.

The response rate of the foreign companies is low compared with that of their Tunisian counterparts: only three out of 15 firms responded. This may be an indication that the Tunisian market is still relatively unknown to the international private sector community.

On the basis of the received responses, and after interviews with a foreign company set up in Tunisia (SEE), a number of conclusions can be drawn. Unlike local companies, foreign companies prefer long-term contracts and are not interested in small municipalities. Although they seem to dominate the sector, they believe that a partnership with local enterprises is necessary. With the exception of the SEE, interested foreign companies have as yet taken no steps to penetrate the Tunisian market.

It is important to bear in mind that the main objective of this survey is not to identify the maximum number of local and foreign companies interested in participating in the liquid waste sector, but rather to determine the willingness of several operators judged most appropriate to penetrate this market. On the basis of interviews and responses to the questionnaires, the following conclusions can be drawn:

- The liquid waste sector is attractive to a significant number of private operators. Although some enterprises are more able and better equipped, others seem ready to restructure rapidly in order to participate and to get a respectable share of the market. Consequently, competition will be open and tenders very competitive.
- Technical and financial criteria are not obstacles which particularly preoccupy potential operators. However, the type of contract, the conditions for awarding the contract, the state of existing facilities, and the definition of the scope of work are identified as obstacles by most respondents.
- The most interested private operators envision having access to ONAS' human resources if this operation takes place. They seem to be aware of the qualifications of ONAS' specialists and technicians and would be ready to hire and retrain them to help them adapt to a new work environment.

- Partnership with foreign operators is unanimously accepted and will constitute a competitive advantage for all applicants. Both local and foreign companies favor this association.

7.2 Public Sector Survey

The public sector survey involved the two primary public sector actors in the liquid waste field, i.e., ONAS and a targeted sample of municipalities in which ONAS is not active.

7.2.1 The ONAS Survey

The objective of this survey is to define the real costs of O&M on ONAS collection networks, treatment plants and pumping stations. It also forms the basis of the financial analysis of the different model markets, as well as the analysis of ONAS costs, revenues and subsidies (see Annex H).

The questionnaire (see Annex G) makes the distinction between the following independent units:

- ONAS center (network);
- Sewage treatment plant;
- Pumping station.

The costs of an independent unit include:

- Personnel;
- Transport and travel expenses;
- Work done and services performed;
- Goods consumed;
- Energy, including electrical power;
- Various production costs;
- Other costs.

To determine a center's O&M costs, it is necessary to add to direct costs the indirect costs associated with the main office, the regional office and the district office.

The main difficulty was determining how to allocate these various indirect costs between three types of works: networks, plants, and pumping stations. It is believed that the amount of time spent by the maintenance team from a regional office on each of the three types of works could be a good allocation key for these indirect costs. This approach has therefore been adopted for the various costs identified below.

Approximately 80 percent of main office costs are related to O&M. These costs have been allocated between the various regional offices in proportion to their own budgets. Main office

expenses relating to each branch are then allocated between the three facilities (networks, plants and pumping stations), according to the above mentioned allocation key. These various expenses are then allocated between the various centers according to network piping length, size of plants (kg of BOD_5 eliminated/day) and power of pumping stations (kwh).

With respect to the regional level, costs which require allocation to the different centers include:

- Expenses of the maintenance division such as:
  - cost of spare parts for rolling stock and other equipment;
  - cost of external contracting out for the same rolling stock and instruments;
  - labor costs.
- The administrative division includes expenses of staff assigned to the administrative division (secretariat, office workers, administrators, etc.).
- Miscellaneous costs: insurance costs (network, equipment, buildings, etc.) and various taxes.
- Development department: the staff of this department carries out or supervises the department's major studies (major network extension, treatment plant study, etc.). Its contribution to the O&M service is minimal; expenses of its staff working on O&M should be approached separately.
- O&M management administrative staff: manager, assistant, secretary, etc.

Since district offices have very little personnel (often a district head with one secretary), these costs are not accounted for in the analysis.

Survey Results

The results of the survey conducted in eight ONAS centers (three in Greater Tunis, two in the south and three in central Tunisia) are given in the Table 7. The main findings are:

- The average O&M costs for the network are approximately 3 TD per linear meter (m). This cost varies between 2 TD/m and 3.7 TD/m for different centers;
- The sample used, even though it may not enable any definitive conclusions to be drawn, shows that the O&M costs of a low-income center (Mellassine) are markedly higher than those of a middle- or high-income center (El Menzah);
- Indirect costs make up between 17 percent and 32 percent of total cost, indicating that ONAS' heavy administrative structure raises service costs substantially;
- The largest share of indirect costs are associated with the main office (60 percent to 70 percent of total indirect costs);

The survey results related to sewage treatment plants are presented in Table 8 and summarized below:

- The average O&M cost of a sewage treatment plant is approximately .16 TD/kg BOD_5 eliminated, and varies from .06 to .25 TD/kg BOD_5 eliminated;

- Indirect costs account for between 13 and 43 percent of total costs;
- The direct costs vary widely as a function of the type of treatment and the size of the station;
- There is a negative correlation between maintenance cost and the size of the plant.

Finally, Table 9 presents the survey results related to pumping stations:

Table 9
Annual Cost of Operations and Maintenance for Pumping Stations (TD, 1993)

Costs	Sfax Ville		Gabes		Monastir		Average
	TD	TD/kwh	TD	TD/kwh	TD	TD/kwh	DT/kwh
DIRECT COSTS							
Personnel	70,000	149	20,000	179	4,660	117	148
Spare parts/contracting	16,000	34	5,971	53	720	18	35
Electricity	15,000	32	11,545	103	6,390	160	98
Miscellaneous	2,000	4		0	830	21	8
Sub-total	103,000	219	37,516	335	12,600	315	290
INDIRECT COSTS							
Admin: main office	128,540	273	30,631	273	11,875	297	281
Maintnce: dept.	65,524	139	49,143	439	6,889	172	250
Admin personnel: dept.	7,450	16	5,588	50	783	20	28
Admin: dept.	13,086	28	9,814	88	1,376	34	50
Design: dept.	9,265	20	6,949	62	994	25	36
Laboratory	0		0		0		
Admin: district	3,024	6	1,665	15	1,573	39	20
Sub-total	226,890	483	103,790	927	23,491	587	666
TOTAL	329,890	702	141,306	1,262	36,091	902	955
Indirect costs/total	69%		73%		65%		70%
Main office/indirect costs	56.65%		29.51%		50.55%		42.26%
Total kwh in the center	470		112		40		
Cost/kwh	702		1,262		902		955

7.2.2 Survey of Non-ONAS Municipalities

The survey of non-ONAS municipalities included two cities: Haouaria and Hergla.

Incorporated in 1966, the municipality of Haouaria is situated in the Cap-Bon area, southeast of Tunis. The municipality covers 4,200 hectares. The population of Haouaria has grown from 5,221 in 1975 to 9,500 in 1994. The number of housing units has grown from 1,336 in 1984 to 2,300 in 1994. The rate of connection is 95 percent for electricity and 80 percent for water.

Economic activities include approximately 100 commercial establishments, three industrial installations (textiles), and a large natural gas pumping plant.

The existing liquid waste network is a combined system (wastewater and stormwater). With an average annual growth rate of 3 percent, the network has expanded from 5,538 m in 1984 to 7,500 m in 1994. The rate of connection to the sewer network is about 65 percent (49 percent in 1982). Those areas which are not connected are either equipped with cesspools (30 percent), or lack any kind of liquid waste disposal system (5 percent).

The water table is quite shallow and the ground permeable; the relatively high number of cesspools (some 700) therefore constitutes a danger to local residents, who continue to use water from the aquifer.

Current network performance is less than satisfactory: overflows have been recorded in certain points due to the small size of the network and to pipes clogged with sand.

Maintenance of the network (unblocking, small scale rehabilitation) is paid for by the municipality, which lacks the human and material means to carry out preventative upkeep. The municipality owns only one tractor, which it uses to empty the cesspools and septic tanks.

The fee for septic tank emptying is 1 TD/m3 (paid by the private individual). Given average cesspool capacity of 8 m3 and an average emptying rate of twice a year, the council's income is estimated at 11,200 TD/year.

Costs are broken down in the following way:

Direct costs:	
Personnel	2,520 TD
Maintenance	1,000 TD
Fuel	500 TD
Spare parts	1,000 TD
Other	500 TD
Indirect costs:	11,225 TD
TOTAL	16,745 TD

Municipal investment in the field of liquid waste cleaning is negligible, given its low budget, and is restricted to small connections, sometimes sharing costs with individuals.

According to the local authorities, prospects for private sector intervention in liquid waste action in their municipality are limited, considering the municipality's size and financial means.

The Municipality of Hergla, located in of the governorate of Sousse, was incorporated in 1966. The municipality covers 2,940 ha. and its population has grown from 6,000 in 1984 to approximately 9,000 in 1994, an average growth rate of four percent yearly. With 960 housing units, Hergla has a fairly dense settlement pattern. The rates of connection to the electricity network and the drinking water network are 100 percent.

Economic activities include sixty commercial establishments and 13 industrial units.

The municipality of Hergla is unusual in having several liquid waste facilities:

- Municipal combined network: 2,500 ml.;
- A 1,100 m ONAS network for the medina (90 housing units), built in 1989;
- Individual cesspools;
- Communal cesspools;
- Open drains;
- Communal septic tanks.

The rate of connection to the network (municipality or other) is 70 percent and to the small open drains 30 percent. Each housing unit has its own cesspool for sewage and is connected to the network for domestic grey water. The municipal trenches are used as main sewers, collecting liquid waste from the open drains.

There are also a number of septic tanks linked to the communal cesspools in the SNIT[2] estate, whose network was built by a private firm. These cesspools are also emptied by the local council.

Hergla has a hygiene problem as it only has one piece of equipment for emptying septic tanks, which operates 18 hours/day. The cesspools overflow on a fairly frequent basis. In addition, water from the buffer pond, which collects liquid waste from the network and is emptied by a tractor-drawn tank, often overflows and pollutes the beach.

Maintenance of the network (unblocking, small scale rehabilitation) is paid for by the local council, which lacks the human and material means to carry out preventative upkeep.

Drainage costs are 0.4 TD/m3 (paid by the private individual). Given an average cesspool capacity of 8 m3 and an average emptying rate of twice yearly, the council's income is estimated at 4,480 TD/year.

[2]*Société nationale touristique tunisienne*

Costs are broken down in the following way:

Direct costs:	
Personnel	11,700 TD
Fuel	6,000 TD
Spare parts	1,000 TD
Other	500 TD
TOTAL	19,200 TD

O&M costs therefore amount to four times the fees collected from private individuals.

According to local officials, prospects for private sector intervention in the liquid waste sector in their municipality are fairly limited, given the municipality's size and financial resources.

8 Final Selection of Model Markets

8.1 Introduction

The data collected through the public sector and private sector surveys were used to test the financial soundness of each of the model markets. Detailed information on ONAS operating methods as well as the private sector O&M practices in other countries allowed the analysts to make assumptions on the productivity gains which can be attained through transfer of service provision responsibility to a private company. Financing terms take into account the results of research on the financial and fiscal advantages available to the participants in the sector as well as the preferred length of contracts. Finally, the BOT contract allocation keys reflect the proportions of the different investment components in ONAS waste treatment plants. This analysis will provide the financial indicators which, combined with the qualitative aspects, will determine the potential performance of the different model markets.

8.2 Financial Analysis Methodology

The approach adopted to simulate provisional operating accounts of the private sector for the different model markets, and consequently, the different calculations of the internal rate of return on the net operating income or net cash flow, can be summarized as follows:

1. Calculation of private sector costs by applying the estimated hypothetical productivity increases to current ONAS costs;
2. Calculation of debt service (interest, principal repayment) based on the nature of the investment, the financing structure and the credit terms;
3. Determination of compensation (payment to the private firm) by multiplying the total operating costs by a coefficient (>1) in order to attain an internal rate of return on net cash flow of 15 percent (the threshold for private sector entry into the sector):
4. Calculation of the net operating income, taxable income, and after tax income;

5. Calculation of net cash flow using the following formula: net cash flow = net operating income (adjusted for inflation) - interest payment - taxes - principal repayment;
6. Calculation of internal rates of return (IRR).

IRR on net operating income is calculated without inflation, while IRR on net cash flow is calculated in real terms.

A series of assumptions were used to carry out the financial analysis. These assumptions, which relate to productivity gains, financial terms, current technologies, and other conditions which will affect the performance of private sector firms in the liquid waste market in Tunisia, are discussed below.

8.2.1 Productivity Increases

In order to evaluate the potential productivity increases resulting from the transfer of O&M responsibilities to the private sector, the team of specialists analyzed the O&M budgets of a number of different treatment plants and collection networks. The following plants, which utilize different treatment technologies, were included in the survey: Choutrana, Cherguia, Côtière-Nord, Grombalia, Sud-Méliane, Sousse, Monastir, Sfax, and Hammamet. The collection networks at Melassine, El Khadra, Menazeh, Gabès, Kébira, Sousse, Hammamet, and Monastir were also surveyed; in some cases, the study team was able to observe cleaning and unblocking activities in progress.

Three principal parameters guided the productivity gain analysis: personnel expenses, energy, and maintenance. The analysts also took into account the relationship between facility size and the magnitude of increased productivity.

Personnel

In order to project gains related to personnel expenses, the analysts classified the ONAS personnel at each plant and center. During site visits, a brief examination of personnel needs was carried out in collaboration with local managers. The analysts then determined the personnel a private operator would need to carry out the same scope of work. Specific and diverse tasks were assigned to each employee, resulting in a smaller overall number. As a result of the increased scope of each employee, salaries would rise. Table 10 shows the results of this analysis for the SE-1, SE-2, and SE-3 treatment plants in the Nabeul-Hammamet region:

Table 10
Productivity Gains in the Area of Personnel: SE-1, SE-2, and SE-3

	ONAS							Private Firm		
Position	**SE-1**	**SE-2**	**SE-3**	**Pumping Station**	**Total**	**Unit cost**	**Total cost**	**Number**	**Unit cost**	**Total cost**
Plant foreman	1	1	1	0	3	9,750	29,250	1	13,000	13,000
Operator	1	1	1	0	3	7,150	21,450	3	8,000	24,000
Full time worker	3	3	3	0.5	9	4,550	42,870	6	5,500	33,000
Part time worker	2	3	2	0	10	1,800	12,600	6	2,000	12,000
Caretaker	1	1	1	0	7	1,800	5,400	3	2,000	6,000
Total	8	9	8	0.5	25.5	--	111,930	19	--	88,000

In this case, the cost savings is 20 percent. The savings for all of the facilities analyzed ranged from 15 to 27 percent, including higher salaries. In general, the higher percentages correspond to the large facilities where the private operator would benefit from economies of scale.

Although employee absenteeism ran as high as 25 percent in some plants and centers, the authors of the analysis preferred to be conservative in their estimates, and therefore did not take this into account.

Energy

With respect to electrical consumption, the specialists observed a number of operational deficiencies in mechanical equipment, in particular pumps and aerators, which consume more than 90 percent of the energy needed to operate treatment systems and pumping stations. Energy was routinely wasted through poor starter adjustment, continuous operation of the pumps, and the absence of alternating aeration techniques. Much of the equipment is also worn out; replacement would reduce energy consumption considerably.

It was estimated that energy consumed over a period of four to six hours during the day can be recovered by concentrating aeration efforts during peak hours and by shutting off the pumps for short periods throughout the night. For the pumping stations, better adjustment of starter controls would decrease electrical consumption.

The private firm would therefore realize savings of 20 percent by year three of operation.

Maintenance

The potential productivity increases resulting from improved maintenance are associated with the rolling stock used in the operation and maintenance of the facilities and the acquisition of replacement parts.

The operations reports of the plants and centers reveal many worn out or broken down vehicles, as well as long delays for repair. It is not uncommon for equipment to be out of service for 25, 35, or even 50 days as a result of breakdowns, a missing part, or unavailability of the maintenance team.

The private firm will maximize the use of equipment and establish a maintenance program that increases the operational return of its fleet. Spare parts will be readily available and repairs will be carried out promptly. The analysts estimate that downtime for repairs will not exceed five percent of the working life of the vehicles. For the projects analyzed, this represents a productivity increase of about 20 percent over the current ONAS performance. It should take the firm two years to attain this increase.

The following table summarizes the productivity increases by line item.

Table 11
Productivity Gains

	Year				
Productivity gains	**1**	**2**	**3**	**4**	**5**
Personnel expenses (small and medium-sized facilities)	90%	85%	85%	85%	85%
Personnel expenses (large facilities)	90%	85%	80%	80%	80%
Electric power	90%	85%	80%	80%	80%
Maintenance	90%	85%	80%	80%	80%

8.2.2 Financing Terms

Public entities generally benefit from more favorable financing conditions than the private sector firms. These terms result from government guarantees and the credits granted by bilateral development assistance agencies.

These advantages were taken into account during the definition of financing terms for public and private sector operators involved in liquid waste service delivery. For the purposes of comparison, the same financing structure (proportion of equity to credit) was retained for both groups. Loan terms were set at five years in both cases (public and private).

Experiences in other countries have shown this to be an optimal period for service contracts (see Annex C). The following table summarizes the assumptions on financing terms:

Table 12
Financing Terms

Financing terms	ONAS	Private
Financing structure		
Equity	30%	30%
Credit	70%	70%
Credit terms		
Operating reserve	10%	15%
(3 months of direct expenses)		
Interest rate (medium/long term)	7%	12%
Term (years)	5	5
Grace period (years)	4	1

8.2.3 Inflation and Taxes

For the purposes of this analysis, a minimum inflation rate of five percent per year was retained for supplies and other direct costs. Additionally, private enterprises working in the liquid waste treatment sector are subject to a ten percent tax rate since they are involved in environmental protection.

8.2.4 Technological Choices

The financial analysis was produced for types of technology adopted by ONAS for its existing facilities. Based on ONAS input, it was assumed that these technological choices will hold good for future projects. Financial analyses were for small and medium-size activated sludge treatment plants and on medium-size lagoon treatment plants. Small plants handle up to 1,000 kg BOD_5 per day, while medium-size plants can process up to 10,000 kg BOD_5 per day. Since there are few existing or planned large treatment plants, this size was not included in the analysis. The treatment processes of the concerned plants are as follows:

- Activated sludge process followed by a lagoon system;
- Low-load activated sludge process with prolonged aeration phase;
- Lagoon system.

With respect to networks, the following uses and socioeconomic characteristics were examined in the financial analysis:

- Residential low-income
- Residential, middle- and high-income
- Mixed with high concentration of tourist activity
- Mixed with high concentration of industrial activity

The pumping stations which transfer wastewater between different sections of the network were included in the network model market analyses. The pumping stations which transfer wastewater to treatment plants were integrated into the plant model market analyses.

8.2.5 BOT (Build-Operate-Transfer) Contracts

A preliminary financial analysis of this kind of contract showed the clear disadvantage of this approach for the private sector due to gap between public and private sector interest rates. In order to test fully the potential of this contract mechanism, joint financing (50 percent public, 50 percent private) was introduced in the sensitivity analysis.

8.2.6 Allocation Keys

Breakdown of Treatment Plant Investment

The following percentages were retained for the different components of sewage treatment plant investment:

- Structures 35%
- Fixed equipment 60%
- Land acquisition and development 5%

Private Sector Overhead

After consultation with private enterprises, it was established that the administrative expenses relating to provision of O&M services represent the following percentages of total operating costs:

- Main office expenses 3%
- Local administration 12%

Depreciation

For service and management contracts, the private company must take on a minimum of appropriate equipment and tools. Depreciation periods for the different types of equipment are:

- Vehicles . . . . . 5 years
- Tools . . . . . 3 years
- Structures . . . . . 40 years
- Fixed equipment . . . . . 10 years

Investment

For liquid waste facilities management contracts, the private enterprise must have an equipment replacement fund in its O&M budget. This fund was assessed at five percent per

year of the value of fixed and movable equipment (excluding structures) associated with a pumping station, sewage treatment plant or network.

Return on Investment

It was established through contact with private firms that the minimum return on investment that a private firm operating in the liquid waste sector would accept is approximately 15 percent (IRR on net cash flow, inflation-adjusted). Contracts which could not reach this performance level were seen as not attractive to the private sector.

Units

The units used to compare total O&M costs of the facilities considered in this study are the following:

- Sewage treatment plants . . . . . kg of BOD_5 eliminated per day
- Networks . . . . . meter of pipeline
- Pumping stations . . . . . KW consumed

8.3 Results of the Financial Analysis

Based on the assumptions stated above and the ONAS cost information collected through the survey, cash flow analyses were generated for hypothetical private firms involved in each of the model markets. Annex A presents two tables for each model market. The first is ONAS' operating account, and the second is a cash flow analysis of a hypothetical private firm delivering the same service. For each model market, compensation paid to the private contractor was adjusted to attain an internal net rate of return of 15 percent on the project. Since all of the model markets therefore satisfy the most important criteria of the private sector (profitability), they can all be provisionally retained. Furthermore, improvements in service quality and reaction speed can be written into the contract conditions, thereby potentially enabling the market models to fulfill user criteria. At this point, each operation needs to be examined from the public sector's perspective. Table 12 presents the different levels of savings obtained through the model markets which involve sewerage networks:

Table 13
Savings by Model Market (Networks)

Model market	Savings
1a. Service contract: residential network, low-income district	19%
1b. Service contract: residential network, middle and upper income district	22%
1c. Service contract: mixed network with high concentration of tourist activity	19%
1d. Service contract: mixed network with high concentration of industrial activity	18%
4. BOT	-49%

These savings take into account the public sector costs of contract management. The service contract, in the case of all four network types, can result in acceptable savings for ONAS. The BOT arrangement, however, would cost 1.5 times more than direct public sector service delivery. The savings obtained from the sewage treatment plant model markets further undermine the financial feasibility of BOT contracts in the Tunisian context:

Table 14
Savings by Model Market (Sewage Treatment Plants)

Model market	Savings
2a. Service contract: small activated sludge treatment plant	7%
2b. Service contract: medium activated sludge treatment plant	11%
2c. Service contract: medium lagoon treatment plant	21%
2a. Management contract: small activated sludge treatment plant	6%
2b. Management contract: medium activated sludge treatment plant	7%
2c. Management contract: medium lagoon treatment plant	11%
5a. BOT: medium activated sludge treatment plant	-1%
5b. BOT: medium lagoon treatment plant	-1%

For ONAS, all of the service and management contracts generate substantial savings, the service contracts being particularly advantageous. The BOT contract, however, does not reduce service costs for the public entity. As is the case for the networks, the failure of the BOT model market is due to the gap between the different financing conditions (especially the interest rate) to which the different operators have access.

In order to test the validity of the BOT model market under different financial conditions, the sensitivity analysis looks first at the sources of financing for Build-Operate-Transfer projects. Investment financing which combines equal government and private sector contributions was considered for the four different facilities.

Table 15
Sensitivity Analysis (Sources of Financing)

Model market	Savings
4. BOT (joint venture): network	-6.4%
5a. BOT (joint venture): small activated sludge treatment plant	19%
5b. BOT (joint venture): medium activated sludge treatment plant	19%
5c. BOT (joint venture): medium lagoon treatment plant	23%

The results show that BOTs are only financially viable for sewage treatment plants when government and private financing is used. With respect to networks, the BOT arrangement is not viable in the Tunisian context.

Tables 15 and 16 present the results of a variation in interest rates, equipment procurement methods and contract length.

Table 16
Sensitivity Analysis (Interest Rate)

	Savings by interest rate		
Model Market	**9%**	**11%**	**13%**
1a. Service contract: residential network, low-income district	20%	19%	19%
1b. Service contract: residential network, middle to upper income district	23%	22%	22%
1c. Service contract: mixed network with high concentration of tourist activity	20%	19%	18%
1d. Service contract: mixed network with high concentration of industrial activity	19%	18%	18%
2a. Service contract: small activated sludge treatment plant	8%	7%	7%
2b. Service contract: medium activated sludge treatment plant	11%	11%	10%
2c. Service contract: medium lagoon treatment plant	21%	21%	20%
2a. Management contract: small activated sludge treatment plant	6%	6%	5%
2b. Management contract: medium activated sludge treatment plant	7%	7%	7%
3a. Management contract: medium lagoon treatment plant	12%	11%	11%
3a. BOT: medium activated sludge treatment plant	3%	-1%	-6%
3b. BOT: medium lagoon treatment plant	-3%	-1%	-5%

Table 17
Sensitivity Analysis (Other Variables)

Model Market	**Savings**
1a. Service contract (lease-purchase of ONAS equipment): residential network	23%
1a. Service contract (5-year contract): residential network	13%
2b. Service contract (5-year contract): medium activated sludge treatment plant	10%
2c. Service contract (5-year contract): medium lagoon treatment plant	21%

On the basis of these results, the viable model markets for private sector participation in the liquid waste sector in Tunisia are the following:

Model Market 1
Service Contract: Network
1a: Residential network, low-income district
1b: Residential network, middle- to upper-income district
1c: Mixed network with high concentration of tourist activity
1d: Mixed network with high concentration of industrial activity

Model Market 2
Service Contract: Treatment Plant
2a: Small load activated sludge
2b: Medium load activated sludge
2c: Medium load lagoon

Model Market 3
Management Contract: Treatment Plant
3a: Small load activated sludge
3b: Medium load activated sludge
3c: Medium load lagoon

Model Market 5
BOT (Joint Venture): Treatment Plant
5a: Small load activated sludge
5b: Medium load activated sludge
5c: Medium load lagoon

8.4 The BOT Contract

The poor performance of the BOT model markets stems from the discrepancy between the interest rates to which the operators in question have access. While ONAS borrows money from the IBRD and other donors at seven percent, private firms must take out loans from Tunisian commercial banks at around 12 percent. However, there are international aid programs which could help overcome this problem and render BOTs financially feasible in Tunisia:

- Enhanced Credit Program (USAID). This program, approved by the U.S. Congress at the end of 1994, seeks to support development efforts in four areas: economic growth, the environment, population and health, and democracy. The Enhanced Credit Program (ECP) widens the range of borrowers to include local governments, parastatals, and private companies. Environmental infrastructure heads the list of recommended projects. With commercial interest rates in the United States currently at around 8.3 percent, the ECP could prove valuable for the development of concession arrangements in Tunisia.

- Loan guarantees (IBRD). The World Bank offers two types of loan guarantees that could benefit a private firm in the context of a Build-Operate-Transfer contract. Late maturity guarantees extend the term of the loan and, therefore, increase the attractiveness of a given project to potential investors. Contract compliance guarantees accorded by the Bank for private firms cover all noncommercial risks; in the case of a failure on the part of ONAS to provide the volume of wastewater specified in the contract, for example, the Bank would reimburse project investors for any corresponding loss. In both cases, the GOT counter-guarantees investment in the project in question.

8.5 Other Aspects of Private Sector Participation

For ONAS, financial considerations are not the only reason for moving toward greater private sector participation. Site visits and numerous interviews held with ONAS management at the central, regional and local levels, as well as with O&M staff, have identified a number of problems associated with current operations and maintenance of liquid waste facilities.

The following service improvements, listed by type of facility, provide an indication of the types of changes that ONAS could write into contracts with private firms and therefore attain through greater private sector participation.

Networks:

- Faster response to user complaints;
- Preventative upkeep to reduce blocking and unpleasant odors caused by rotting solid waste thrown into the network;
- Immediate repair of broken pipes, reducing side-effects and inconvenience for users;
- Programmed draining and cleaning of networks in areas where there is a large seasonal variation in load and flow (e.g., tourist areas), reducing accumulation of waste or deposits in the pipes;
- Extending the life span of networks by preventative upkeep and systematic reduction of overflow and blocking problems.

Pumping stations:

- Improving and optimizing operation of pumps by reactivation and adjustment of start-up systems and automatic cut-off systems;
- Reduction of energy consumption by optimal adjustment of start-up and cut-off controls;
- Increasing the lifespan of pumps by a preventative upkeep program and optimal adjustment;
- Introducing controls and telemetric supervision according to economic justification.

Treatment plants:

- Improvement in conditions for supervision of efficiency of sewage treatment plants by a improved control of the biological procedures in operation (contractual obligation for operational yield);
- Better O&M procedures during overload periods, and introduction of sludge removal measures to reduce the effects of biological imbalances that cause smells and other environmental nuisances;
- Reduction of energy consumption by introducing programmed alternating day/night treatment procedures;
- Increasing the life-span of mechanical equipment and accessories by improving existing preventative upkeep programs;
- Training all plant staff and assigning varied and complementary tasks to them;
- Introducing a management and reuse program for sludge.

Through the contracting process, ONAS can require the private sector firm to attain service levels, meet O&M requirements and ensure the viability of existing equipment. This arrangement would allow ONAS to play the role of guarantor of high-quality liquid waste services.

Private sector participation is also likely to allow ONAS to stabilize or possibly even reduce the size of its rapidly growing staff, anticipating that a fair number of its specialized workers might well be interested in, and taken on by, private enterprises.

Another positive aspect of private sector participation is the possibility of having funds earmarked for replacement, rehabilitation and renewal of equipment for the various liquid waste facilities. This creation of these funds must be specified in the contract. Under the laws and regulations governing its operations, ONAS does not have the authority to create such a fund after a certain number of years. This practice is current in France and has allowed many municipalities to provide better liquid waste services.

9 Potential Value of Liquid Waste Markets

The market for private sector participation in the liquid waste sector depends to a large extent on the pace at which the public sector transfers service provision responsibility to private firms. While the recommendation of an optimal pace is beyond the scope of this study, it is nevertheless useful to gain an overall understanding of the potential volume of the market. It is therefore assumed, for the purposes of this calculation, that the relevant public entities will turn to the private sector for liquid waste service provision under the conditions described in the viable model markets. Each of the viable model markets is therefore applied to existing facilities (as of 1995) and planned facilities (for the year 2015). The facilities in question are described in Section 6.2.2 and detailed in Annex B. The following table

summarizes the values of each of the model markets in 1994 Tunisian Dinars over the period 1995-2005:

Table 18
Viable Markets for Private Participation in the Liquid Waste Sector

Model Market	Value (TD)		
	1995	**2005**	**Total**
1. Service contract: network	18,207,000	19,895,000	38,102,000
2. Service contract: treatment plant	10,321,350	12,853,815	23,175,165
3. Management contract: treatment plant	22,218,000	27,685,140	49,903,140
5. BOT: treatment plant	—	55,370,280	55,370,280

10 Conclusion

The financial and technical analyses generated in this study clearly show that service contracts and management contracts for sewer networks and sewage treatment plants have the capacity to provide acceptable returns on investment and therefore meet the criteria of private sector firms. At the same time, these forms of private sector intervention are likely to generate substantial advantages for public entities involved with liquid waste service provision.

The comparison of public sector and private sector O&M performance indicates that substantial savings can be obtained by private enterprises through better management, leaner staffing, and better operation of equipment. A conservative assessment of increased productivity results in an acceptable return on investment for the private enterprise and considerable savings for ONAS, even after contract management costs are accounted for.

In addition, the study has shown that greater private sector participation can bring about substantial improvements in service quality. Since private firms are free from burdensome administrative procedures, they are able to respond more quickly to the needs of customers. Private firms can also be required, through conditions of contract, to provide higher service levels than those currently in place.

Finally, delegating service and management to the private sector has the potential to free ONAS from the repetitive, low-skill tasks that generally characterize operations and maintenance activity. This would allow ONAS to focus its energies on planning and supervising the delivery of quality liquid waste services in Tunisia.

ANNEXES

ANNEX A

Financial Analysis of Model Markets

Model Market 1a : Service Contract - Network

- Length 100 Km
- Usage Residential, lower-middle income

Current ONAS Costs

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS	344,335	344,335	344,335	344,335	344,335	344,335	344,335	344,335	344,335	344,335
Administration - main office	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022
Maintenance division - department	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249
Admin. personnel - department	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409
Administration - department	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050
Design & planning - department	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345
Administration - district	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784
Insurance on heavy equipment	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933
Depreciation	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000
Interest on loan	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971
Total	506,099	506,099	506,099	506,099	506,099	506,099	506,099	506,099	506,099	506,099

Provisional Costs for ONAS (DT)

Payments to the contractor	0	0	0	0	0	0	0	0	0	0
Administration - district	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784
Costs of contract management	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507
Total	25,291	25,291	25,291	25,291	25,291	25,291	25,291	25,291	25,291	25,291
Savings (%)	95.0%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

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Model Market 1a : Service Contract - Network

- Length 100 Km
- Usage Residential, lower-middle income

Productivity Gains	1	2	3	4	5
Personnel	90%	85%	85%	80%	80%
Sub-contracting	90%	90%	90%	90%	90%
Replacement parts	90%	90%	90%	90%	90%
Consumables	100%	100%	100%	100%	100%
Electricity	95%	90%	90%	90%	90%

Financial Parameters	ONAS	Private
Equity contribution	60%	30%
Loan	40%	70%
Interest rate	7%	11%
Term	15	10
Grace period	4	1

Depreciation	Cost (DT)	Duration
Heavy equipment	264000	10
Other material (tools, light vehicles)	53000	5

Inflation	5%
Taxes	10%

General Costs for the Private Firm (%)

1 Technical director	15000
1 Accountant	6000
1 Secretary + 1 general assistant	6000
General expenses	6000
Total	33000
Maintenance : 1 mechanic + 1 electrician	9000

Provisional Costs for Operations and Maintenance (DT)

Year	1	2	3	4	5	6	7	8	9	10
Personnel	243,822	230,776	230,776	217,731	217,731	217,731	217,731	217,731	217,731	217,731
Transportation	458	458	458	458	458	458	458	458	458	458
Sub-contracting	4,951	4,951	4,951	4,951	4,951	4,951	4,951	4,951	4,951	4,951
Replacement parts	26,077	26,077	26,077	26,077	26,077	26,077	26,077	26,077	26,077	26,077
Consumables	21,087	21,087	21,087	21,087	21,087	21,087	21,087	21,087	21,087	21,087
Electricity	16,540	15,669	15,669	15,669	15,669	15,669	15,669	15,669	15,669	15,669
Miscellaneous	1,590	1,590	1,590	1,590	1,590	1,590	1,590	1,590	1,590	1,590
Operating reserve	11,795	11,273	11,273	10,784	10,784	10,784	10,784	10,784	10,784	10,784
Administration - main office	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000
Total Costs	359,319	344,881	344,881	331,346	331,346	331,346	331,346	331,346	331,346	331,346
Revenue	408,546	392,130	392,130	376,741	376,741	376,741	376,741	376,741	376,741	376,741
Net operating income	49,227	47,249	47,249	45,394	45,394	45,394	45,394	45,394	45,394	45,394
NOI (inflation-adjusted)	49,227	49,611	52,092	52,550	55,177	57,936	60,833	63,875	67,068	70,422
Depreciation	37,000	37,000	37,000	37,000	37,000	26,400	26,400	26,400	26,400	26,400
Interest on loan	24,409	24,409	21,697	18,985	16,273	13,561	10,848	8,136	5,424	2,712
Taxable income	-12,182	-11,798	-6,605	-3,435	1,905	17,976	23,584	29,338	35,244	41,310
Taxes						1,798	2,358	2,934	3,524	4,131
After tax income	-12,182	-11,798	-6,605	-3,435	1,905	16,178	21,226	26,404	31,720	37,179
Repayment of principal		24,650	24,650	24,650	24,650	24,650	24,650	24,650	24,650	24,650
Net cash flow	24,818	552	5,745	8,915	14,255	17,928	22,976	28,154	33,470	38,929
IRR (NOI)	9.7%									
IRR (Net cash flow)	15.0%									

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Model Market 1b : Service Contract - Network

- Length 100 Km
- Usage Residential, upper-middle income

Current ONAS Costs

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS	174,123	174,123	174,123	174,123	174,123	174,123	174,123	174,123	174,123	174,123
Administration - main office	71,542	71,542	71,542	71,542	71,542	71,542	71,542	71,542	71,542	71,542
Maintenance division - department	31,816	31,816	31,816	31,816	31,816	31,816	31,816	31,816	31,816	31,816
Admin. personnel - department	3,588	3,588	3,588	3,588	3,588	3,588	3,588	3,588	3,588	3,588
Administration - department	6,363	6,363	6,363	6,363	6,363	6,363	6,363	6,363	6,363	6,363
Design & planning - department	4,569	4,569	4,569	4,569	4,569	4,569	4,569	4,569	4,569	4,569
Administration - district	5,139	5,139	5,139	5,139	5,139	5,139	5,139	5,139	5,139	5,139
Insurance on heavy equipment	3,016	3,016	3,016	3,016	3,016	3,016	3,016	3,016	3,016	3,016
Depreciation	37,000	37,000	37,000	37,000	37,000	26,400	26,400	26,400	26,400	26,400
Interest on loan	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971
Total	343,127	343,127	343,127	343,127	343,127	332,527	332,527	332,527	332,527	332,527

Provisional Costs for ONAS (DT)

Payments to the contractor	251,214	242,037	242,037	233,550	233,550	233,550	233,550	233,550	233,550	233,550
Administration - district	5,139	5,139	5,139	5,139	5,139	5,139	5,139	5,139	5,139	5,139
Costs of contract management	21,462	21,462	21,462	21,462	21,462	21,462	21,462	21,462	21,462	21,462
Total	277,815	268,638	268,638	260,151	260,151	260,151	260,151	260,151	260,151	260,151
Savings (%)	22.0%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

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Model Market 1b : Service Contract - Network

- Length 100 Km
- Usage Residential, upper-middle income

Productivity Gains	1	2	3	4	5
Personnel	90%	85%	85%	80%	80%
Sub-contracting	90%	90%	90%	90%	90%
Replacement parts	90%	90%	90%	90%	90%
Consumables	100%	100%	100%	100%	100%
Electricity	95%	90%	90%	90%	90%

Financial Parameters	ONAS	Private
Equity contribution	60%	30%
Loan	40%	70%
Interest rate	7%	11%
Term	15	10
Grace period	4	1

Depreciation	Cost (DT)	Duration
Heavy equipment	264000	10
Other material (tools, light vehicles)	53000	5

Inflation	5%
Taxes	10%

General Costs for the Private Firm (%)	
1 Technical director	15000
1 Accountant	6000
1 Secretary + 1 general assistant	6000
General expenses	6000
Total	33000
Maintenance : 1 mechanic + 1 electrician	9000

Provisional Costs for Operations and Maintenance (DT)

Year	1	2	3	4	5	6	7	8	9	10
Personnel	127,554	120,967	120,967	114,381	114,381	114,381	114,381	114,381	114,381	114,381
Transportation										
Sub-contracting	3,987	3,987	3,987	3,987	3,987	3,987	3,987	3,987	3,987	3,987
Replacement parts	13,305	13,305	13,305	13,305	13,305	13,305	13,305	13,305	13,305	13,305
Consumables	6,600	6,600	6,600	6,600	6,600	6,600	6,600	6,600	6,600	6,600
Electricity	10,177	9,641	9,641	9,641	9,641	9,641	9,641	9,641	9,641	9,641
Miscellaneous	1,525	1,525	1,525	1,525	1,525	1,525	1,525	1,525	1,525	1,525
Operating reserve	6,118	5,851	5,851	5,604	5,604	5,604	5,604	5,604	5,604	5,604
Administration - main office	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000
Total Costs	202,266	194,877	194,877	188,043	188,043	188,043	188,043	188,043	188,043	188,043
Revenue	251,214	242,037	242,037	233,550	233,550	233,550	233,550	233,550	233,550	233,550
Net operating income	48,948	47,160	47,160	45,506	45,506	45,506	45,506	45,506	45,506	45,506
NOI (inflation-adjusted)	48,948	49,518	51,994	52,679	55,313	58,079	60,983	64,032	67,234	70,595
Depreciation	37,000	37,000	37,000	37,000	37,000	26,400	26,400	26,400	26,400	26,400
Interest on loan	24,409	24,409	21,697	18,985	16,273	13,561	10,848	8,136	5,424	2,712
Taxable income	-12,461	-11,891	-6,703	-3,305	2,041	18,118	23,735	29,496	35,410	41,483
Taxes						1,812	2,373	2,950	3,541	4,148
After tax income	-12,461	-11,891	-6,703	-3,305	2,041	16,307	21,361	26,546	31,869	37,335
Repayment of principal		24,650	24,650	24,650	24,650	24,650	24,650	24,650	24,650	24,650
Net cash flow	24,539	459	5,647	9,045	14,391	18,057	23,111	28,296	33,619	39,085
IRR (NOI)	9.7%									
IRR (Net cash flow)	15.0%									

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Model Market 1c : - Service Contract - Network

- Length 100 Km
- Usage Tourist

Current ONAS Costs

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS	167,495	167,495	167,495	167,495	167,495	167,495	167,495	167,495	167,495	167,495
Administration - main office	59,512	59,512	59,512	59,512	59,512	59,512	59,512	59,512	59,512	59,512
Maintenance division - department	29,992	29,992	29,992	29,992	29,992	29,992	29,992	29,992	29,992	29,992
Admin. personnel - department	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374	3,374
Administration - department	5,997	5,997	5,997	5,997	5,997	5,997	5,997	5,997	5,997	5,997
Design & planning - department	4,323	4,323	4,323	4,323	4,323	4,323	4,323	4,323	4,323	4,323
Administration - district	6,076	6,076	6,076	6,076	6,076	6,076	6,076	6,076	6,076	6,076
Insurance on heavy equipment	3,472	3,472	3,472	3,472	3,472	3,472	3,472	3,472	3,472	3,472
Depreciation	37,000	37,000	37,000	37,000	37,000	26,400	26,400	26,400	26,400	26,400
Interest on loan	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971
Total	323,212	323,212	323,212	323,212	323,212	312,612	312,612	312,612	312,612	312,612

Provisional Costs for ONAS (DT)

Payments to the contractor	245,159	237,614	237,614	230,068	230,068	230,068	230,068	230,068	230,068	230,068
Administration - district	6,076	6,076	6,076	6,076	6,076	6,076	6,076	6,076	6,076	6,076
Costs of contract management	17,854	17,854	17,854	17,854	17,854	17,854	17,854	17,854	17,854	17,854
Total	269,089	261,543	261,543	253,997	253,997	253,997	253,997	253,997	253,997	253,997
Savings (%)	19.2%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

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Model Market 1c : - Service Contract - Network

- Length 100 Km
- Usage Tourist

Productivity Gains	1	2	3	4	5
Personnel	90%	85%	85%	80%	80%
Sub-contracting	90%	90%	90%	90%	90%
Replacement parts	90%	90%	90%	90%	90%
Consumables	100%	100%	100%	100%	100%
Electricity	95%	90%	90%	90%	90%

Financial Parameters	ONAS	Private
Equity contribution	60%	30%
Loan	40%	70%
Interest rate	7%	11%
Term	15	10
Grace period	4	1

Depreciation	Cost (DT)	Duration
Heavy equipment	264000	10
Other material (tools, light vehicles)	53000	5

Inflation	5%
Taxes	10%

General Costs for the Private Firm (%)	
1 Technical director	15000
1 Accountant	6000
1 Secretary + 1 general assistant	6000
General expenses	6000
Total	33000
Maintenance : 1 mechanic + 1 electrician	9000

Provisional Costs for Operations and Maintenance (DT)

Year	1	2	3	4	5	6	7	8	9	10
Personnel	115,222	109,320	109,320	103,419	103,419	103,419	103,419	103,419	103,419	103,419
Transportation										
Sub-contracting	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375	2,375
Replacement parts	7,661	7,661	7,661	7,661	7,661	7,661	7,661	7,661	7,661	7,661
Consumables	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400	21,400
Electricity	9,891	9,891	9,891	9,891	9,891	9,891	9,891	9,891	9,891	9,891
Miscellaneous	2,982	2,982	2,982	2,982	2,982	2,982	2,982	2,982	2,982	2,982
Operating reserve	3,988	3,841	3,841	3,693	3,693	3,693	3,693	3,693	3,693	3,693
Administration - main office	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000
Total Costs	196,521	190,472	190,472	184,423	184,423	184,423	184,423	184,423	184,423	184,423
Revenue	245,159	237,614	237,614	230,068	230,068	230,068	230,068	230,068	230,068	230,068
Net operating income	48,639	47,142	47,142	45,645	45,645	45,645	45,645	45,645	45,645	45,645
NOI (inflation-adjusted)	48,639	49,499	51,974	52,839	55,481	58,256	61,168	64,227	67,438	70,810
Depreciation	37,000	37,000	37,000	37,000	37,000	26,400	26,400	26,400	26,400	26,400
Interest on loan	24,409	24,409	21,697	18,985	16,273	13,561	10,848	8,136	5,424	2,712
Taxable income	-12,770	-11,910	-6,723	-3,145	2,209	18,295	23,920	29,690	35,614	41,698
Taxes						1,829	2,392	2,969	3,561	4,170
After tax income	-12,770	-11,910	-6,723	-3,145	2,209	16,465	21,528	26,721	32,052	37,528
Repayment of principal		24,650	24,650	24,650	24,650	24,650	24,650	24,650	24,650	24,650
Net cash flow	24,230	440	5,627	9,205	14,559	18,215	23,278	28,471	33,802	39,278
IRR (NOI)	9.7%									
IRR (Net cash flow)	15.0%									

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Model Market 1d : Service Contract - Network

- Length	100 Km
- Usage	Industrial

Current ONAS Costs

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS	247,168	247,168	247,168	247,168	247,168	247,168	247,168	247,168	247,168	247,168
Administration - main office	63,475	63,475	63,475	63,475	63,475	63,475	63,475	63,475	63,475	63,475
Maintenance division - department	29,990	29,990	29,990	29,990	29,990	29,990	29,990	29,990	29,990	29,990
Admin. personnel - department	3,380	3,380	3,380	3,380	3,380	3,380	3,380	3,380	3,380	3,380
Administration - department	5,998	5,998	5,998	5,998	5,998	5,998	5,998	5,998	5,998	5,998
Design & planning - department	4,308	4,308	4,308	4,308	4,308	4,308	4,308	4,308	4,308	4,308
Administration - district	3,520	3,520	3,520	3,520	3,520	3,520	3,520	3,520	3,520	3,520
Insurance on heavy equipment	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468	3,468
Depreciation	37,000	37,000	37,000	37,000	37,000	26,400	26,400	26,400	26,400	26,400
Interest on loan	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971
Total	404,278	404,278	404,278	404,278	404,278	393,678	393,678	393,678	393,678	393,678

Provisional Costs for ONAS (DT)

Payments to the contractor	319,224	308,918	308,918	299,829	299,829	299,829	299,829	299,829	299,829	299,829
Administration - district	3,520	3,520	3,520	3,520	3,520	3,520	3,520	3,520	3,520	3,520
Costs of contract management	19,043	19,043	19,043	19,043	19,043	19,043	19,043	19,043	19,043	19,043
Total	341,786	331,481	331,481	322,392	322,392	322,392	322,392	322,392	322,392	322,392
Savings (%)	18.3%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

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Model Market 1d : Service Contract - Network

- Length 100 Km
- Usage Industrial

Productivity Gains	1	2	3	4	5
Personnel	90%	85%	85%	80%	80%
Sub-contracting	90%	90%	90%	90%	90%
Replacement parts	90%	90%	90%	90%	90%
Consumables	100%	100%	100%	100%	100%
Electricity	95%	90%	90%	90%	90%

Financial Parameters	ONAS	Private
Equity contribution	60%	30%
Loan	40%	70%
Interest rate	7%	11%
Term	15	10
Grace period	4	1

Depreciation	Cost (DT)	Duration
Heavy equipment	264000	10
Other material (tools, light vehicles)	53000	5

Inflation	5%
Taxes	10%

General Costs for the Private Firm (%)

1 Technical director	15000
1 Accountant	6000
1 Secretary + 1 general assistant	6000
General expenses	6000
Total	33000
Maintenance : 1 mechanic + 1 electrician	9000

Provisional Costs for Operations and Maintenance (DT)

Year	1	2	3	4	5	6	7	8	9	10
Personnel	144,319	136,801	136,801	129,284	129,284	129,284	129,284	129,284	129,284	129,284
Transportation										
Sub-contracting	19,117	18,110	18,110	18,110	18,110	18,110	18,110	18,110	18,110	18,110
Replacement parts	20,585	20,585	20,585	20,585	20,585	20,585	20,585	20,585	20,585	20,585
Consumables	15,100	15,100	15,100	15,100	15,100	15,100	15,100	15,100	15,100	15,100
Electricity	29,706	29,706	29,706	29,706	29,706	29,706	29,706	29,706	29,706	29,706
Miscellaneous	3,020	3,020	3,020	3,020	3,020	3,020	3,020	3,020	3,020	3,020
Operating reserve	5,796	5,583	5,583	5,395	5,395	5,395	5,395	5,395	5,395	5,395
Administration - main office	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000
Total Costs	270,643	261,906	261,906	254,200	254,200	254,200	254,200	254,200	254,200	254,200
Revenue	319,224	308,918	308,918	299,829	299,829	299,829	299,829	299,829	299,829	299,829
Net operating income	48,580	47,012	47,012	45,629	45,629	45,629	45,629	45,629	45,629	45,629
NOI (inflation-adjusted)	48,580	49,363	51,831	52,821	55,462	58,235	61,147	64,205	67,415	70,786
Depreciation	37,000	37,000	37,000	37,000	37,000	26,400	26,400	26,400	26,400	26,400
Interest on loan	24,409	24,409	21,697	18,985	16,273	13,561	10,848	8,136	5,424	2,712
Taxable income	-12,829	-12,046	-6,866	-3,164	2,190	18,275	23,899	29,668	35,591	41,673
Taxes						1,827	2,390	2,967	3,559	4,167
After tax income	-12,829	-12,046	-6,866	-3,164	2,190	16,447	21,509	26,701	32,032	37,506
Repayment of principal		24,650	24,650	24,650	24,650	24,650	24,650	24,650	24,650	24,650
Net cash flow	24,171	304	5,484	9,186	14,540	18,197	23,259	28,451	33,782	39,256
IRR (NOI)	9.7%									
IRR (Net cash flow)	15.0%									

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Market Model 1a : Service Contract (rental of ONAS equipment) - Network

- Length 100 Km
- Usage Residential, lower-middle income

Current ONAS Costs

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS	344,335	344,335	344,335	344,335	344,335	344,335	344,335	344,335	344,335	344,335
Administration - main office	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022
Maintenance division - department	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249
Admin. personnel - department	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409
Administration - department	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050
Design & planning - department	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345
Administration - district	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784
Insurance on heavy equipment	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933
Depreciation	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000	37,000
Interest on loan	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971	5,971
Total	506,099	506,099	506,099	506,099	506,099	506,099	506,099	506,099	506,099	506,099

Provisional Costs for ONAS (DT)

Payments to the contractor	386,673	371,768	371,768	357,795	357,795	357,795	357,795	357,795	357,795	357,795
Administration - district	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784
Costs of contract management	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507
Total	411,964	397,059	397,059	383,086	383,086	383,086	383,086	383,086	383,086	383,086
Savings (%)	23.2%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

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Market Model 1a : Service Contract (rental of ONAS equipment) - Network

- Length 100 Km
- Usage Residential, lower-middle income

Productivity Gains	1	2	3	4	5
Personnel	90%	85%	85%	80%	80%
Sub-contracting	90%	90%	90%	90%	90%
Replacement parts	90%	90%	90%	90%	90%
Consumables	100%	100%	100%	100%	100%
Electricity	95%	90%	90%	90%	90%

Financial Parameters	ONAS	Private
Equity contribution	60%	30%
Loan	40%	70%
Interest rate	7%	11%
Term	15	10
Grace period	4	1

Depreciation	Cost (DT)	Duration
Other material (tools, light vehicles)	53000	5

Inflation	5%
Taxes	10%

Rental of ONAS equipment for 26400TD/year (10% of purchase price)

General Costs for the Private Firm (%)

1 Technical director	15000
1 Accountant	6000
1 Secretary + 1 general assistant	6000
General expenses	6000
Total	33000
Maintenance : 1 mechanic + 1 electrician	9000

Provisional Costs for Operations and Maintenance (DT)

Year	1	2	3	4	5	6	7	8	9	10
Personnel	243,822	230,776	230,776	217,731	217,731	217,731	217,731	217,731	217,731	217,731
Transportation	458	458	458	458	458	458	458	458	458	458
Sub-contracting	4,951	4,951	4,951	4,951	4,951	4,951	4,951	4,951	4,951	4,951
Replacement parts	14,363	14,363	14,363	14,363	14,363	14,363	14,363	14,363	14,363	14,363
Consumables	21,087	21,087	21,087	21,087	21,087	21,087	21,087	21,087	21,087	21,087
Electricity	16,540	15,669	15,669	15,669	15,669	15,669	15,669	15,669	15,669	15,669
Rental of ONAS equipment	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400	26,400
Miscellaneous	1,590	1,590	1,590	1,590	1,590	1,590	1,590	1,590	1,590	1,590
Operating reserve	12,345	11,824	11,824	11,334	11,334	11,334	11,334	11,334	11,334	11,334
Frais de siège et de gestion	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000	33,000
Total Costs	374,556	360,118	360,118	346,583	346,583	346,583	346,583	346,583	346,583	346,583
Revenue	386,673	371,768	371,768	357,795	357,795	357,795	357,795	357,795	357,795	357,795
Net operating income	12,117	11,650	11,650	11,212	11,212	11,212	11,212	11,212	11,212	11,212
NOI (inflation-adjusted)	12,117	12,232	12,844	12,979	13,628	14,310	15,025	15,776	16,565	17,393
Depreciation	10,600	10,600	10,600	10,600	10,600	13,462	17,097	21,713	27,575	35,021
Interest on loan	4,076	4,076	3,623	3,170	2,718	7,442	6,989	5,960	4,932	3,904
Taxable income	-2,559	-2,444	-1,379	-791	311	-6,594	-9,060	-11,897	-15,942	-21,531
Taxes										
After tax income	-2,559	-2,444	-1,379	-791	311	-6,594	-9,060	-11,897	-15,942	-21,531
Repayment of principal		4,117	4,117	4,117	4,117	4,117	9,345	9,345	9,345	9,345
Net cash flow	8,041	4,039	5,104	5,692	6,794	2,752	-1,308	471	2,288	4,145
IRR (NOI)	-3.2%									
IRR (Net cash flow)	15.1%									

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Market Model 1b : Service Contract (5 years) - Network

- Length	100 Km
- Usage	Residential, upper-middle income

Current ONAS Costs

Year	1	2	3	4	5
DIRECT COSTS	174,123	174,123	174,123	174,123	174,123
Administration - main office	71,542	71,542	71,542	71,542	71,542
Maintenance division - department	31,816	31,816	31,816	31,816	31,816
Admin. personnel - department	3,588	3,588	3,588	3,588	3,588
Administration - department	6,363	6,363	6,363	6,363	6,363
Design & planning - department	4,569	4,569	4,569	4,569	4,569
Administration - district	5,139	5,139	5,139	5,139	5,139
Insurance on heavy equipment	0	0	0	0	0
Depreciation	37,000	37,000	37,000	37,000	37,000
Interest on loan	5,072	5,072	5,072	5,072	5,072
Total	339,212	339,212	339,212	339,212	339,212

Provisional Costs for ONAS (DT)

Payments to the contractor	279,935	269,709	269,709	260,252	260,252
Administration - district	5,139	5,139	5,139	5,139	5,139
Costs of contract management	21,462	21,462	21,462	21,462	21,462
Total	306,537	296,310	296,310	286,853	286,853
Savings (%)	13.2%				

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

BEST AVAILABLE DOCUMENT

Market Model 1b : Service Contract (5 years) - Network

- Length 100 Km
- Usage Residential, upper-middle income

Productivity Gains	1	2	3	4	5
Personnel	90%	85%	85%	80%	80%
Sub-contracting	90%	90%	90%	90%	90%
Replacement parts	90%	90%	90%	90%	90%
Consumables	100%	100%	100%	100%	100%
Electricity	95%	90%	90%	90%	90%

Financial Parameters	ONAS	Private
Equity contribution	60%	30%
Loan	40%	70%
Interest rate	7%	11%
Term	7	5

Depreciation	Cost	Duration
Heavy equipment	264000	10
Other material (tools, light vehicles)	53000	5

Inflation	5%
Taxes	10%

General Costs for the Private Firm (%)

1 Technical director	15000
1 Accountant	6000
1 Secretary + 1 general assistant	6000
General expenses	6000
Total	33000
Maintenance : 1 mechanic + 1 electrician	9000

Provisional Costs for Operations and Maintenance (DT)

Year	1	2	3	4	5
Personnel	127,554	120,967	120,967	114,381	114,381
Transportation					
Sub-contracting	3,987	3,987	3,987	3,987	3,987
Replacement parts	13,305	13,305	13,305	13,305	13,305
Consumables	6,600	6,600	6,600	6,600	6,600
Electricity	10,177	9,641	9,641	9,641	9,641
Miscellaneous	1,525	1,525	1,525	1,525	1,525
Operating reserve	6,118	5,851	5,851	5,604	5,604
Administration - main office	33,000	33,000	33,000	33,000	33,000
Total Costs	202,266	194,877	194,877	188,043	188,043
Revenue	279,935	269,709	269,709	260,252	260,252
Net operating income	77,670	74,833	74,833	72,209	72,209
NOI (inflation-adjusted)	77,670	78,574	82,503	83,590	87,770
Depreciation	37,000	37,000	37,000	37,000	37,000
Interest on loan	23,189	18,551	13,913	9,275	4,638
Taxable income	17,481	23,023	31,590	37,315	46,132
Taxes	1,748	2,302	3,159	3,732	4,613
After tax income	15,733	20,721	28,431	33,584	41,519
Repayment of principal	44,380	44,380	44,380	44,380	44,380
Net cash flow	8,353	13,341	21,051	26,204	34,139
IRR (NOI)	22.8%				
IRR (Net cash flow)	15.1%				

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Model Market 2a : Service Contract - Wastewater Treatment Plant

Type of treatment :			Activated sludge							
Size :			Small							
Quantity of BOD (kg) eliminated daily :			1000							
Current ONAS costs										
Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	30672	30672	30672	30672	30672	30672	30672	30672	30672	30672
Maintenance	3620	3620	3620	3620	3620	3620	3620	3620	3620	3620
Electricity	39558	39558	39558	39558	39558	39558	39558	39558	39558	39558
Replac. parts/sub-contracting	1263	1263	1263	1263	1263	1263	1263	1263	1263	1263
Operating reserve	2257	2257	2257	2257	2257	2257	2257	2257	2257	2257
Miscellaneous (vehicles / tools)	15180	3180	3180	3180	15180	3180	3180	3180	3180	3180
Sub-total	92550	80550	80550	80550	92550	80550	80550	80550	80550	80550
INDIRECT COSTS										
Administration - main office	11455	11455	11455	11455	11455	11455	11455	11455	11455	11455
Maintenance division - dept.	8904	8904	8904	8904	8904	8904	8904	8904	8904	8904
Admin. personnel - dept.	1012	1012	1012	1012	1012	1012	1012	1012	1012	1012
Administration - dept.	1778	1778	1778	1778	1778	1778	1778	1778	1778	1778
Design & planning - dept.	1272	1272	1272	1272	1272	1272	1272	1272	1272	1272
Regional laboratory	456	456	456	456	456	456	456	456	456	456
Admininstration - district	1049	1049	1049	1049	1049	1049	1049	1049	1049	1049
Depreciation	9333	9333	9333	6000	6000	11912	11912	11912	7658	7658
Interest on investment	1960	1568	1176	784	392	1960	1568	1176	784	392
Sub-total	37220	36828	36436	32711	32319	39799	39407	39015	34369	33977
Total	**129771**	**117379**	**116987**	**113261**	**124869**	**120349**	**119957**	**119565**	**114919**	**114527**
Provisionnal costs for ONAS										
Payments to contractor	106974	102015	98978	98978	98978	98978	98978	98978	98978	98978
Cost of contract management	3437	3437	3437	3437	3437	3437	3437	3437	3437	3437
Total	110410	105451	102415	102415	102415	102415	102415	102415	102415	102415
Savings	7%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - seat"

BEST AVAILABLE DOCUMENT

Model Market 2a : Service Contract - Wastewater Treatment Plant

Type of treatment :	Activated sludge
Size :	Small
Quantity of BOD (kg) eliminated daily :	1000

Productivity Gains	1	2	3	4	5
Personnel (small & med. plants)	90%	85%	85%	85%	85%
Personnel (large plants)	90%	85%	80%	80%	80%
Electricity	90%	85%	80%	80%	80%
Maintenance Division	90%	85%	80%	80%	80%

Financial Parameters	ONAS	Private
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	5	5
Grace period	2	1

Depreciation	Cost	Duration
Vehicles	30000	5
Tools	10000	3

Inflation	5%
Taxes	10%

General Costs for the Private Firm (%)

Main off. (% direct costs)	3%
Local admin. (% total)	12%

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	27605	26071	26071	26071	26071	26071	26071	26071	26071	26071
Maintenance	3620	3620	3620	3620	3620	3620	3620	3620	3620	3620
Electricity	35602	33624	31646	31646	31646	31646	31646	31646	31646	31646
Replac. parts/sub-contracting	1263	1263	1263	1263	1263	1263	1263	1263	1263	1263
Operating reserve	2673	2673	2673	2673	2673	2673	2673	2673	2673	2673
Miscellaneous	3180	3180	3180	3180	3180	3180	3180	3180	3180	3180
Sub-total	73943	70431	68453	68453	68453	68453	68453	68453	68453	68453
INDIRECT COSTS										
Administration - main office	2486	2486	2486	2486	2486	2486	2486	2486	2486	2486
Maintenance division - dept.	8014	7569	7123	7123	7123	7123	7123	7123	7123	7123
Administration personnel - dept.	0	0	0	0	0	0	0	0	0	0
Administration - dept.	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0
Laboratory	913	913	913	913	913	913	913	913	913	913
Admin. - district (private - local)	10243	9768	9477	9477	9477	9477	9477	9477	9477	9477
Sub-total	21655	20735	19999	19999	19999	19999	19999	19999	19999	19999
Total Expenses	**95598**	**91166**	**88452**	**88452**	**88452**	**88452**	**88452**	**88452**	**88452**	**88452**
Revenue	106974	102015	98978	98978	98978	98978	98978	98978	98978	98978
Net operating income	11376	10849	10526	10526	10526	10526	10526	10526	10526	10526
NOI (inflation-adjusted)	11376	11391	11052	11605	12185	12794	13434	14106	14811	15551
Depreciation	9333	9333	9333	6000	6000	11912	11912	11912	7658	7658
Interest on loan	3080	3080	2310	1540	770	3931	3145	2359	1572	786
Before tax cash flow	-1037	-1022	-591	4065	5415	-3049	-1623	-165	5581	7108
Tax loss carryforward	-1037	-2059	-2651	1414	5415	-3049	-4672	-4837	744	7108
Taxes	0	0	0	141	541	0	0	0	74	711
Repayment of principal	0	7000	7000	7000	7000	7147	7147	7147	7147	7147
After tax cash flow	8296	1311	1742	2923	3873	1716	3142	4600	6017	6907
IRR (NOI)	11%									
IRR (Net cash flow)	15%									

BEST AVAILABLE DOCUMENT

Model Market 2b : Service Contract - Wastewater Treatment Plant

Type of treatment :			Activated sludge							
Size :			Medium							
Quantity of BOD eliminated daily :			5000							
Current ONAS costs										
Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774
Maintenance	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596
Electricity	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675
Replac. parts/sub-contracting	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656
Operating reserve	6658	6658	6658	6658	6658	6658	6658	6658	6658	6658
Miscellaneous (vehicles / tools)	21622	6622	6622	6622	21622	6622	6622	6622	6622	6622
Sub-total	272981	257981	257981	257981	272981	257981	257981	257981	257981	257981
INDIRECT COSTS										
Administration - main office	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304
Maintenance division - dept.	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339
Admin. personnel - dept.	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888
Administration - dept.	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829
Design & planning - dept.	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867
Regional laboratory	2281	2281	2281	2281	2281	2281	2281	2281	2281	2281
Admininstration - district	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703
Depreciation	11333	11333	11333	8000	8000	14465	14465	14465	10210	10210
Interest on investment	2450	1960	1470	980	490	2450	1960	1470	980	490
Sub-total	153996	153506	153016	149192	148702	157127	156637	156147	151402	150912
Total	**426976**	**411486**	**410996**	**407173**	**421683**	**415107**	**414617**	**414127**	**409383**	**408893**
Provisionnal costs for ONAS										
Payments to contractor	346729	336289	329749	329749	304499	329749	329749	329749	329749	329749
Cost of contract management	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491
Total	370220	359781	353240	353240	327990	353240	353240	353240	353240	353240
Savings	11%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - seat"

BEST AVAILABLE DOCUMENT

Model Market 2b : Service Contract - Wastewater Treatment Plant

Type of treatment :	Activated sludge
Size :	Medium
Quantity of BOD eliminated daily :	5000

Productivity Gains	1	2	3	4	5
Personnel (small & med. plants)	90%	85%	85%	85%	85%
Personnel (large plants)	90%	85%	80%	80%	80%
Electricity	90%	85%	80%	80%	80%
Maintenance Division	90%	85%	80%	80%	80%

Financial Parameters	ONAS	Prive
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	5	5
Grace period	2	1

Depreciation	Cost	Duration
Vehicles	40000	5
Tools	10000	3

Inflation	5%
taxes	10%

General Costs for the Private Firm (%)

Main off. (% direct costs)	3%
Local admin. (% total)	12%

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	60097	56758	56758	56758	56758	56758	56758	56758	56758	56758
Maintenance	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596
Electricity	63608	60074	56540	56540	56540	56540	56540	56540	56540	56540
Replac. parts/sub-contracting	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656
Operating reserve	8909	8909	8909	8909	8909	8909	8909	8909	8909	8909
Miscellaneous	6622	6622	6622	6622	-15000	6622	6622	6622	6622	6622
Sub-total	246487	239614	236081	236081	214459	236081	236081	236081	236081	236081
INDIRECT COSTS										
Administration - main office	8648	8648	8648	8648	8648	8648	8648	8648	8648	8648
Maintenance division - dept.	37205	35138	33071	33071	33071	33071	33071	33071	33071	33071
Administration personnel - dept.	0	0	0	0	0	0	0	0	0	0
Administration - dept.	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0
Laboratory	4563	4563	4563	4563	4563	4563	4563	4563	4563	4563
Admin. - district (private - local)	35628	34555	33883	33883	31289	33883	33883	33883	33883	33883
Sub-total	86043	82904	80164	80164	77570	80164	80164	80164	80164	80164
Total Expenses	**332530**	**322518**	**316245**	**316245**	**292029**	**316245**	**316245**	**316245**	**316245**	**316245**
Revenue	346729	336289	329749	329749	304499	329749	329749	329749	329749	329749
Net operating income	14199	13772	13504	13504	12470	13504	13504	13504	13504	13504
NOI (inflation-adjusted)	14199	14460	14179	14888	15632	16414	17234	18096	19001	19951
Depreciation	11333	11333	11333	8000	8000	14465	14465	14465	10210	10210
Interest on loan	3850	3850	2888	1925	963	4914	3931	2948	1965	983
Before tax cash flow	-984	-723	-42	4963	6670	-2964	-1161	683	6825	8758
Tax loss carryforward	-984	-1708	-1750	3213	6670	-2964	-4125	-3442	3383	8758
Taxes	0	0	0	321	667	0	0	0	338	876
Repayment of principal	7000	7000	7000	7000	7000	8934	8934	8934	8934	8934
After tax cash flow	3349	3610	4291	5641	7003	2566	4370	6214	7763	9159
IRR (NOI)	11%									
IRR (Net cash flow)	15%									

BEST AVAILABLE DOCUMENT

Model Market 2c : Service Contract - Wastewater Treatment Plant

Type of treatment :			Lagoon							
Size :			Medium							
Quantity of BOD (kg) eliminated daily :			3000							
Current ONAS costs										
Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	47300	47300	47300	47300	47300	47300	47300	47300	47300	47300
Maintenance	947	947	947	947	947	947	947	947	947	947
Electricity	13702	13702	13702	13702	13702	13702	13702	13702	13702	13702
Replac. parts/sub-contracting	6130	6130	6130	6130	6130	6130	6130	6130	6130	6130
Operating reserve	2128	2128	2128	2128	2128	2128	2128	2128	2128	2128
Miscellaneous (vehicles / tools)	17035	2035	2035	2035	17035	2035	2035	2035	2035	2035
Sub-total	87242	72242	72242	72242	87242	72242	72242	72242	72242	72242
INDIRECT COSTS										
Administration - main office	34841	34841	34841	34841	34841	34841	34841	34841	34841	34841
Maintenance division - dept.	33291	33291	33291	33291	33291	33291	33291	33291	33291	33291
Admin. personnel - dept.	3785	3785	3785	3785	3785	3785	3785	3785	3785	3785
Administration - dept.	6648	6648	6648	6648	6648	6648	6648	6648	6648	6648
Design & planning - dept.	4719	4719	4719	4719	4719	4719	4719	4719	4719	4719
Regional laboratory	1369	1369	1369	1369	1369	1369	1369	1369	1369	1369
Admininstration - district	1991	1991	1991	1991	1991	1991	1991	1991	1991	1991
Depreciation	11333	11333	11333	8000	8000	14465	14465	14465	10210	10210
Interest on investment	2450	1960	1470	980	490	2450	1960	1470	980	490
Sub-total	100428	99938	99448	95625	95135	103559	103069	102579	97835	97345
Total	**187670**	**172180**	**171690**	**167867**	**182377**	**175801**	**175311**	**174821**	**170077**	**169587**
Provisionnal costs for ONAS										
Payments to contractor	128401	122471	119516	119516	119516	119516	119516	119516	119516	119516
Cost of contract management	10452	10452	10452	10452	10452	10452	10452	10452	10452	10452
Total	138853	132923	129968	129968	129968	129968	129968	129968	129968	129968
Savings	21%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - seat"

BEST AVAILABLE DOCUMENT

Model Market 2c : Service Contract - Wastewater Treatment Plant

Type of treatment :	Lagoon
Size :	Medium
Quantity of BOD (kg) eliminated daily :	3000

Productivity Gains	1	2	3	4	5
Personnel (small & med. plants)	90%	85%	85%	85%	85%
Personnel (large plants)	90%	85%	80%	80%	80%
Electricity	90%	85%	80%	80%	80%
Maintenance Division	90%	85%	80%	80%	80%

Financial Parameters	ONAS	Prive
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	5	5
Grace period	2	1

Depreciation	Cost	Duration
Vehicles	40000	5
Tools	10000	3

Inflation	5%
Impots	10%

General Costs for the Private Firm (%)

Main off. (% direct costs)	3%
Local admin. (% total)	12%

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	42570	40205	40205	40205	40205	40205	40205	40205	40205	40205
Maintenance	947	947	947	947	947	947	947	947	947	947
Electricity	12332	11647	10961	10961	10961	10961	10961	10961	10961	10961
Replac. parts/sub-contracting	6130	6130	6130	6130	6130	6130	6130	6130	6130	6130
Operating reserve	2401	2401	2401	2401	2401	2401	2401	2401	2401	2401
Miscellaneous	2035	2035	2035	2035	2035	2035	2035	2035	2035	2035
Sub-total	66414	63364	62679	62679	62679	62679	62679	62679	62679	62679
INDIRECT COSTS										
Administration - main office	2973	2973	2973	2973	2973	2973	2973	2973	2973	2973
Maintenance division - dept.	29962	28297	26633	26633	26633	26633	26633	26633	26633	26633
Administration personnel - dept.	0	0	0	0	0	0	0	0	0	0
Administration - dept.	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0
Laboratory	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738
Admin. - district (private - local)	12250	11685	11403	11403	11403	11403	11403	11403	11403	11403
Sub-total	47923	45693	43746	43746	43746	43746	43746	43746	43746	43746
Total Expenses	**114338**	**109057**	**106426**	**106426**	**106426**	**106426**	**106426**	**106426**	**106426**	**106426**
Revenue	128401	122471	119516	119516	119516	119516	119516	119516	119516	119516
Net operating income	14064	13414	13090	13090	13090	13090	13090	13090	13090	13090
NOI (inflation-adjusted)	14064	14085	13745	14432	15154	15911	16707	17542	18419	19340
Depreciation	11333	11333	11333	8000	8000	14465	14465	14465	10210	10210
Interest on loan	3850	3850	2888	1925	963	4914	3931	2948	1965	983
Before tax cash flow	-1120	-1099	-476	4507	6191	-3467	-1689	130	6244	8147
Tax loss carryforward	-1120	-2218	-2694	1813	6191	-3467	-5155	-5026	1218	8147
Taxes	0	0	0	181	619	0	0	0	122	815
Repayment of principal	0	8750	8750	8750	8750	8934	8934	8934	8934	8750
After tax cash flow	10214	1485	2107	3576	4822	2064	3842	5660	7398	8793
IRR (NOI)	10%									
IRR (Net cash flow)	15%									

BEST AVAILABLE DOCUMENT

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Model Market 3a : Management Contract - Wastewater Treatment Plant

Type of treatment :	Activated sludge
Size :	Small
Quantity of BOD (kg) eliminated daily :	1000

Current ONAS costs

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	30672	30672	30672	30672	30672	30672	30672	30672	30672	30672
Maintenance	3620	3620	3620	3620	3620	3620	3620	3620	3620	3620
Electricity	39558	39558	39558	39558	39558	39558	39558	39558	39558	39558
Replac. parts/sub-contracting	1263	1263	1263	1263	1263	1263	1263	1263	1263	1263
Operating reserve	1957	1957	1957	1957	1957	1957	1957	1957	1957	1957
Miscellaneous	3180	3180	3180	3180	3180	3180	3180	3180	3180	3180
Sinking fund	157439	129439	129439	129439	157439	129439	129439	129439	129439	129439
Sub-total	237689	209689	209689	209689	237689	209689	209689	209689	209689	209689
INDIRECT COSTS										
Administration - main office	11455	11455	11455	11455	11455	11455	11455	11455	11455	11455
Maintenance division - dept.	8904	8904	8904	8904	8904	8904	8904	8904	8904	8904
Amin. personnel - dept.	1012	1012	1012	1012	1012	1012	1012	1012	1012	1012
Administration - dept.	1778	1778	1778	1778	1778	1778	1778	1778	1778	1778
Design & planning - dept.	1272	1272	1272	1272	1272	1272	1272	1272	1272	1272
Regional laboratory	913	913	913	913	913	913	913	913	913	913
Administration - district	1049	1049	1049	1049	1049	1049	1049	1049	1049	1049
Depreciation	9333	9333	9333	6000	6000	11912	11912	11912	7658	7658
Interest on investment	1960	1568	1176	784	392	1960	1568	1176	784	392
Sub-total	37677	37285	36893	33167	32775	40255	39863	39471	34825	34433
Total	**275366**	**246974**	**246582**	**242856**	**270464**	**249944**	**249552**	**249160**	**244514**	244122
Provisionnal costs for ONAS										
Payments to contractor	240864	236223	233381	233381	233381	233381	233381	233381	233381	233381
Cost of contract management	3437	3437	3437	3437	3437	3437	3437	3437	3437	3437
Total	244301	239660	236818	236818	236818	236818	236818	236818	236818	236818
Savings	6%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - seat"

BEST AVAILABLE DOCUMENT

Model Market 3a : Management Contract - Wastewater Treatment Plant

Type of treatment :	Activated sludge
Size :	Small
Quantity of BOD (kg) eliminated daily :	1000

Productivity Gains	1	2	3	4	5
Personnel (small & med. plants)	90%	85%	85%	85%	85%
Personnel (large plants)	90%	85%	80%	80%	80%
Electricity	90%	85%	80%	80%	80%
Maintenance Division	90%	85%	80%	80%	80%

Financial Parameters	ONAS	Private
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	5	5
Grace period	2	1

Depreciation	Cost	Duration
Vehicles	30000	5
Tools	10000	3

Inflation	5%
Taxes	10%

General Costs for the Private Firm (%)	
Main off. (% direct costs)	3%
Local admin. (% total)	12%

Invest.	WWT Plant	Pump. station
Construction	35%	35%
Equipment	60%	65%
Land	5%	

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	27605	26071	26071	26071	26071	26071	26071	26071	26071	26071
Maintenance	3620	3620	3620	3620	3620	3620	3620	3620	3620	3620
Electricity	35602	33624	31646	31646	31646	31646	31646	31646	31646	31646
Replac. parts/sub-contracting	1263	1263	1263	1263	1263	1263	1263	1263	1263	1263
Operating reserve	2673	2673	2673	2673	2673	2673	2673	2673	2673	2673
Miscellaneous	3180	3180	3180	3180	3180	3180	3180	3180	3180	3180
Sinking fund	116495	116495	116495	116495	116495	116495	116495	116495	116495	116495
Sub-total	190437	186926	184948	184948	184948	184948	184948	184948	184948	184948
INDIRECT COSTS										
Administration - main office	5981	5981	5981	5981	5981	5981	5981	5981	5981	5981
Maintenance division - dept.	8014	7569	7123	7123	7123	7123	7123	7123	7123	7123
Admin. personnel - dept.	0	0	0	0	0	0	0	0	0	0
Admin. - dept.	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0
Laboratory	913	913	913	913	913	913	913	913	913	913
Admin. - district (private - local)	24641	24167	23876	23876	23876	23876	23876	23876	23876	23876
Sub-total	39549	38629	37893	37893	37893	37893	37893	37893	37893	37893
Total Expenses	**229986**	**225555**	**222841**	**222841**	**222841**	**222841**	**222841**	**222841**	**222841**	**222841**
Revenue	240864	236223	233381	233381	233381	233381	233381	233381	233381	233381
Net operating income	10878	10669	10540	10540	10540	10540	10540	10540	10540	10540
NOI (inflation-adjusted)	10878	11202	11067	11621	12202	12812	13452	14125	14831	15573
Depreciation	9333	9333	9333	6000	6000	11912	11912	11912	7658	7658
Interest on loan	3080	3080	2310	1540	770	3931	3145	2359	1572	786
Before tax cash flow	-1535	-1211	-576	4081	5432	-3031	-1604	-145	5601	7129
Tax loss carryforward	-1535	-2746	-3322	759	5432	-3031	-4635	-4781	821	7129
Taxes	0	0	0	76	543	0	0	0	82	713
Repayment of principal	0	7,000	7,000	7,000	7,000	7,147	7,147	7,147	7,147	7,147
After tax cash flow	7798	1122	1757	3081	4432	1734	3161	4619	6112	7640
IRR (NOI)	10%									
IRR (Net cash flow)	15%									

BEST AVAILABLE DOCUMENT

Model Market 3b : Management Contract - Wastewater Treatment Plant

Type of treatment :		Activated sludge								
Size :		Medium								
Quantity of BOD (kg) eliminated daily :		5000								
Current ONAS costs										
Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774
Maintenance	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596
Electricity	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675
Replac. parts/sub-contracting	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656
Operating reserve	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283
Miscellaneous	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622
Sinking fund	384852	349852	349852	349852	384852	349852	349852	349852	349852	349852
Sub-total	642458	607458	607458	607458	642458	607458	607458	607458	607458	607458
INDIRECT COSTS										
Administration - main office	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304
Maintenance division - dept.	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339
Amin. personnel - dept.	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888
Administration - dept.	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829
Design & planning - dept.	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867
Regional laboratory	4563	4563	4563	4563	4563	4563	4563	4563	4563	4563
Administration - district	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703
Depreciation	11333	11333	11333	8000	8000	14465	14465	14465	10210	10210
Interest on investment	2450	1960	1470	980	490	2450	1960	1470	980	490
Sub-total	156277	155787	155297	151473	150983	159408	158918	158428	153684	153194
Total	**798735**	**763245**	**762755**	**758932**	**793442**	**766866**	**766376**	**765886**	**761142**	760652
Provisionnal costs for ONAS										
Payments to contractor	709259	699052	692658	692658	692658	692658	692658	692658	692658	692658
Cost of contract management	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491
Total	732750	722543	716149	716149	716149	716149	716149	716149	716149	716149
Savings	7%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - seat"

BEST AVAILABLE DOCUMENT

Model Market 3b : Management Contract - Wastewater Treatment Plant

Type of treatment :	Activated sludge
Size :	Medium
Quantity of BOD (kg) eliminated daily :	5000

Productivity Gains	1	2	3	4	5
Personnel (small & med. plants)	90%	85%	85%	85%	85%
Personnel (large plants)	90%	85%	80%	80%	80%
Electricity	90%	85%	80%	80%	80%
Maintenance Division	90%	85%	80%	80%	80%

Depreciation	Cost	Duration
Vehicles	40000	5
Tools	10000	3

Inflation	5%
Taxes	10%

Conditions de financement	ONAS	Private
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	5	5
Grace period	2	1

General Costs for the Private Firm (%)	
Main off. (% direct costs)	3%
Local admin. (% total)	12%

Invest.	WWT Plant	Pump. station
Construction	35%	35%
Equipment	60%	65%
Land	5%	

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	60097	56758	56758	56758	56758	56758	56758	56758	56758	56758
Maintenance	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596
Electricity	63608	60074	56540	56540	56540	56540	56540	56540	56540	56540
Replac. parts/sub-contracting	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656
Operating reserve	8909	8909	8909	8909	8909	8909	8909	8909	8909	8909
Miscellaneous	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622
Sinking fund	314867	314867	314867	314867	314867	314867	314867	314867	314867	314867
Sub-total	561354	554482	550948	550948	550948	550948	550948	550948	550948	550948
INDIRECT COSTS										
Administration - main office	18094	18094	18094	18094	18094	18094	18094	18094	18094	18094
Maintenance division - dept.	37205	35138	33071	33071	33071	33071	33071	33071	33071	33071
Admin. personnel - dept.	0	0	0	0	0	0	0	0	0	0
Admin. - dept.	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0
Laboratory	4563	4563	4563	4563	4563	4563	4563	4563	4563	4563
Admin. - district (private - local)	74546	73473	72801	72801	72801	72801	72801	72801	72801	72801
Sub-total	134407	131267	128528	128528	128528	128528	128528	128528	128528	128528
Total Expenses	**695761**	**685749**	**679476**	**679476**	**679476**	**679476**	**679476**	**679476**	**679476**	**679476**
Revenue	709259	699052	692658	692658	692658	692658	692658	692658	692658	692658
Net operating income	13498	13304	13182	13182	13182	13182	13182	13182	13182	13182
NOI (inflation-adjusted)	13498	13969	13841	14533	15260	16023	16824	17665	18548	19476
Depreciation	11333	11333	11333	8000	8000	14465	14465	14465	10210	10210
Interest on loan	3850	3850	2888	1925	963	4914	3931	2948	1965	983
Before tax cash flow	-1686	-1215	-380	4608	6297	-3356	-1572	252	6372	8283
Tax loss carryforward	-1686	-2900	-3280	1328	6297	-3356	-4927	-4675	1697	8283
Taxes	0	0	0	133	630	0	0	0	170	828
Repayment of principal	0	8,750	8,750	8,750	8,750	8,934	8,934	8,934	8,934	8,934
After tax cash flow	9648	1369	2203	3858	5547	2175	3959	5783	7649	9559
IRR (NOI)	10%									
IRR (Net cash flow)	15%									

BEST AVAILABLE DOCUMENT

Model Market 3c : Management Contract - Wastewater Treatment Plant

Type of treatment :		Lagoon								
Size :		Medium								
Quantity of BOD (kg) eliminated daily :		3000								
Current ONAS costs										
Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	37492	37492	37492	37492	37492	37492	37492	37492	37492	37492
Maintenance	694	694	694	694	694	694	694	694	694	694
Electricity	11928	11928	11928	11928	11928	11928	11928	11928	11928	11928
Replac. parts/sub-contracting	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166
Operating reserve	1423	1423	1423	1423	1423	1423	1423	1423	1423	1423
Miscellaneous	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651
Sinking fund	204621	169621	169621	169621	204621	169621	169621	169621	169621	169621
Sub-total	262975	227975	227975	227975	262975	227975	227975	227975	227975	227975
INDIRECT COSTS										
Administration - main office	30936	30936	30936	30936	30936	30936	30936	30936	30936	30936
Maintenance division - dept.	29201	29201	29201	29201	29201	29201	29201	29201	29201	29201
Amin. personnel - dept.	3320	3320	3320	3320	3320	3320	3320	3320	3320	3320
Administration - dept.	5832	5832	5832	5832	5832	5832	5832	5832	5832	5832
Design & planning - dept.	4141	4141	4141	4141	4141	4141	4141	4141	4141	4141
Regional laboratory	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738
Administration - district	1848	1848	1848	1848	1848	1848	1848	1848	1848	1848
Depreciation	11333	11333	11333	8000	8000	14465	14465	14465	10210	10210
Interest on investment	2450	1960	1470	980	490	2450	1960	1470	980	490
Sub-total	91799	91309	90819	86996	86506	94930	94440	93950	89206	88716
Total	**354774**	**319284**	**318794**	**314971**	**349481**	**322906**	**322416**	**321926**	**317181**	316691
Provisionnal costs for ONAS										
Payments to contractor	285315	280694	278276	278276	278276	278276	278276	278276	278276	278276
Cost of contract management	9281	9281	9281	9281	9281	9281	9281	9281	9281	9281
Total	294596	289975	287557	287557	287557	287557	287557	287557	287557	287557
Savings	11%									

* The cost of contract management is estimated to be 30% of the costs of "Administration - seat"

BEST AVAILABLE DOCUMENT

Model Market 3c : Management Contract - Wastewater Treatment Plant

Type of treatment :	Lagoon
Size :	Medium
Quantity of BOD (kg) eliminated daily :	3000

Productivity Gains	1	2	3	4	5
Personnel (small & med. plants)	90%	85%	85%	85%	85%
Personnel (large plants)	90%	85%	80%	80%	80%
Electricity	90%	85%	80%	80%	80%
Maintenance Division	90%	85%	80%	80%	80%

Financial Parameters	ONAS	Private
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	5	5
Grace period	2	1

Depreciation	Cost	Duration
Vehicles	40000	5
Tools	10000	3

Inflation	5%
Taxes	10%

General Costs for the Private Firm (%)	
Main off. (% direct costs)	3%
Local admin. (% total)	12%

Invest.	WWT Plant	Pump. station
Construction	35%	35%
Equipment	60%	65%
Land	5%	

Year	1	2	3	4	5	6	7	8	9	10
DIRECT COSTS										
Personnel	33743	31869	31869	31869	31869	31869	31869	31869	31869	31869
Maintenance	694	694	694	694	694	694	694	694	694	694
Electricity	10735	10139	9542	9542	9542	9542	9542	9542	9542	9542
Replac. parts/sub-contracting	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166
Operating reserve	1950	1950	1950	1950	1950	1950	1950	1950	1950	1950
Miscellaneous	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651
Sinking fund	152659	152659	152659	152659	152659	152659	152659	152659	152659	152659
Sub-total	206598	204127	203530	203530	203530	203530	203530	203530	203530	203530
INDIRECT COSTS										
Administration - main office	7068	7068	7068	7068	7068	7068	7068	7068	7068	7068
Maintenance division - dept.	26281	24821	23361	23361	23361	23361	23361	23361	23361	23361
Admin. personnel - dept.	0	0	0	0	0	0	0	0	0	0
Admin. - dept.	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0
Laboratory	2738	2738	2738	2738	2738	2738	2738	2738	2738	2738
Admin. - district (private - local)	29122	28650	28404	28404	28404	28404	28404	28404	28404	28404
Sub-total	65209	63277	61570	61570	61570	61570	61570	61570	61570	61570
Total Expenses	**271807**	**267404**	**265101**	**265101**	**265101**	**265101**	**265101**	**265101**	**265101**	**265101**
Revenue	285315	280694	278276	278276	278276	278276	278276	278276	278276	278276
Net operating income	13509	13290	13176	13176	13176	13176	13176	13176	13176	13176
NOI (inflation-adjusted)	13509	13954	13834	14526	15252	16015	16816	17656	18539	19466
Depreciation	11333	11333	11333	8000	8000	14465	14465	14465	10210	10210
Interest on loan	3850	3850	2888	1925	963	4914	3931	2948	1965	983
Before tax cash flow	-1675	-1229	-387	4601	6290	-3363	-1580	244	6364	8273
Tax loss carryforward	-1675	-2903	-3290	1311	6290	-3363	-4943	-4699	1664	8273
Taxes	0	0	0	131	629	0	0	0	166	827
Repayment of principal	0	8,750	8,750	8,750	8,750	8,934	8,934	8,934	8,934	8,934
After tax cash flow	9659	1354	2197	3851	5540	2167	3951	5774	7640	9550
IRR (NOI)	10%									
IRR (Net cash flow)	15%									

BEST AVAILABLE DOCUMENT

Model Market 4a : BOT - Network

- Length 100 Km
- Usage Residential, lower-middle income

Current ONAS Costs

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935
Administration - main office	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022
Maintenance division - departme	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249
Admin. personnel - department	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409
Administration - department	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050
Design & planning - department	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345
Administration - district	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784
Insurance on heavy equipment	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933
Depreciation	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750
Interest on loan	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435
Total	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913

Provisional Costs for ONAS (DT)

Payments to the contractor	1439321	1385165	1385165	1331009	1331009	1331009	1331009	1331009	1331009	1331009	1331009	1331009	1331009	1331009	1331009
Administration - district	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784
Costs of contract management	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507
Total	1464611	1410456	1410456	1356300	1356300	1356300	1356300	1356300	1356300	1356300	1356300	1356300	1356300	1356300	1356300
Savings (%)	-49.0%														

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

BEST AVAILABLE DOCUMENT

Model Market 4a : BOT - Network

- Length 100 Km
- Usage Residential, lower-middle income

Productivity Gains	
Personnel	80%
Sub-contracting	90%
Replacement parts	90%
Consumables	100%
Electricity	90%

Financial Parameters	ONAS	Private
Equity contribution	60%	30%
Loan	40%	70%
Interest rate	7%	11%
Term	15	10
Grace period	4	1

Depreciation	Cost (DT)	Duration
Networks - construction	7150000	40
Fixed equipment - O & M	544000	10
Other equip. (tools, light vehicles)	53000	5

Inflation	5%
Taxes	10%

Invest.	Pump. stat.
Construct.	35%
Fixed Equip.	65%

General Costs for the Private Firm (%)	
1 Technical director	15000
1 Accountant	6000
1 Secretary + 1 general assistant	6000
General expenses	6000
Total	33000
Maintenance : 1 mechanic + 1 electricia	9000

Provisional Costs for Operations and Maintenance (DT)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Personnel	243822	230776	230776	217731	217731	217731	217731	217731	217731	217731	217731	217731	217731	217731	217731
Transportation	458	458	458	458	458	458	458	458	458	458	458	458	458	458	458
Sub-contracting	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951
Replacement parts	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077
Consumables	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087
Electricity	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540
Miscellaneous	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590
Operating reserve	7863	7537	7537	7211	7211	7211	7211	7211	7211	7211	7211	7211	7211	7211	7211
Administration - main office	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000
Total Costs	355388	342016	342016	328644	328644	328644	328644	328644	328644	328644	328644	328644	328644	328644	328644
Revenue	1439321	1385165	1385165	1331009	1331009	1331009	1331009	1331009	1331009	1331009	1331009	1331009	1331009	1331009	1331009
Net operating income	1083933	1043149	1043149	1002365	1002365	1002365	1002365	1002365	1002365	1002365	1002365	1002365	1002365	1002365	1002365
NOI (inflation-adjusted)	1083933	1095306	1150072	1160363	1218381	1279300	1343265	1410428	1480949	1554997	1632747	1714384	1800103	1890108	1984614
Depreciation	243750	243750	243750	243750	243750	233150	233150	233150	233150	233150	178750	178750	178750	178750	178750
Interest on loan	566693	566693	526215	485737	445259	404781	364303	323825	283347	242868	202390	161912	77276	51518	25759
Taxable income	273490	284863	380107	430876	529372	641369	745812	853453	964453	1078978	1251606	1373722	1544077	1659841	1780105
Taxes	27349	28486	38011	43088	52937	64137	74581	85345	96445	107898	125161	137372	154408	165984	178011
After tax income	246141	256377	342096	387788	476435	577232	671231	768108	868008	971081	1126446	1236350	1389669	1493857	1602095
Repayment of principal		368000	368000	368000	368000	368000	368000	368000	368000	368000	368000	368000	368000	368000	368000
Net cash flow	489891	132127	217846	263538	352185	442382	536381	633258	733158	836231	937196	1047100	1200419	1304607	1412845
IRR (NOI)	13%														
IRR (Net cash flow)	15%														

BEST AVAILABLE DOCUMENT

Model Market 4a : BOT(Joint Venture) - Network

- Length 100 Km
- Usage Residential, lower-middle income

Current ONAS Costs

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935	335,935
Administration - main office	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	65,022	23,632
Maintenance division - departme	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249	30,249
Admin. personnel - department	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409	3,409
Administration - department	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050	6,050
Design & planning - department	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345	4,345
Administration - district	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784
Insurance on heavy equipment	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933	3,933
Depreciation	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750	243,750
Interest on loan	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435	221,435
Total	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	919,913	878,523

Provisional Costs for ONAS (DT)

Payments to the contractor	899131	865301	865301	831470	831470	831470	831470	831470	831470	831470	831470	831470	831470	831470	831470
Administration - district	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784	5,784
Costs of contract management	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	19,507	7,090
	110,718	110,718	110,718	110,718	110,718	110,718	110,718	110,718	110,718	110,718	110,718	110,718	110,718	110,718	110,718
Total	1035140	1001309	1001309	967478	967478	967478	967478	967478	967478	967478	967478	967478	967478	967478	955061
Savings (%)	-6.4%														

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

BEST AVAILABLE DOCUMENT

Model Market 4a : BOT(Joint Venture) - Network

- Length 100 Km
- Usage Residential, lower-middle income

Productivity Gains	
Personnel	80%
Sub-contracting	90%
Replacement parts	90%
Consumables	100%
Electricity	90%

Conditions de financement

Schéma de financement	ONAS	Privé
Fonds propres	30%	30%
Crédits	70%	70%
Conditions de crédit		
Taux (moyen-long terme)	7%	11%
Durée	15	15
Différé	4	1

Depreciation	Cost (DT)	Duration
Networks - construction	3575000	40
Fixed equipment - O & M	272000	10
Other equip. (tools, light vehicles	26500	5

Inflation	5%
Taxes	10%

Invest.	Pump. stat.
Construct.	35%
Fixed Equip.	65%

Frais généraux de l'entreprise privée

1 Directeur technique	15000
1 financier/administratif	6000
1 secrétaire + 1 huissier	6000
Frais généraux	6000
Total	33000
.Maintenance : 1 méca. + 1 éléctricie	9000

Provisional Costs for Operations and Maintenance (DT)

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Personnel	243822	230776	230776	217731	217731	217731	217731	217731	217731	217731	217731	217731	217731	217731	217731
Transportation	458	458	458	458	458	458	458	458	458	458	458	458	458	458	458
Sub-contracting	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951	4951
Replacement parts	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077	26077
Consumables	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087	21087
Electricity	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540	16540
Miscellaneous	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590	1590
Operating reserve	7863	7537	7537	7211	7211	7211	7211	7211	7211	7211	7211	7211	7211	7211	7211
Administration - main office	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000	33000
Total Costs	355388	342016	342016	328644	328644	328644	328644	328644	328644	328644	328644	328644	328644	328644	328644
Revenue	899131	865301	865301	831470	831470	831470	831470	831470	831470	831470	831470	831470	831470	831470	831470
Net operating income	543743	523285	523285	502826	502826	502826	502826	502826	502826	502826	502826	502826	502826	502826	502826
NOI (inflation-adjusted)	543743	549449	576921	582084	611188	641747	673834	707526	742903	780048	819050	860003	903003	948153	995560
Depreciation	121875	121875	121875	121875	121875	116575	116575	116575	116575	116575	89375	89375	89375	89375	89375
Interest on loan	283347	283347	263107	242868	222629	202390	182151	161912	141673	121434	101195	80956	38638	25759	12879
Taxable income	138522	144227	191939	217340	266683	322782	375108	429039	484654	542038	628480	689671	774989	833019	893306
Taxes	13852	14423	19194	21734	26668	32278	37511	42904	48465	54204	62848	68967	77499	83302	89331
After tax income	124670	129805	172745	195606	240015	290504	337597	386135	436189	487835	565632	620704	697491	749717	803975
Repayment of principal		184000	184000	184000	184000	184000	184000	184000	184000	184000	184000	184000	184000	184000	184000
Net cash flow	246545	67680	110620	133481	177890	223079	270172	318710	368764	420410	471007	526079	602866	655092	709350
IRR (NOI)	13%														
IRR (Net cash flow)	15%														

BEST AVAILABLE DOCUMENT

Model Market 5b : BOT - Wastewater Treatment Plant

Type of treatment :	Activated sludge														
Size :	Medium														
Quantity of BOD (kg) eliminated daily :	5000														
Current ONAS costs															
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS															
Personnel	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774
Maintenance	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596
Electricity	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675
Replac. parts/sub-contracting	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656
Operating reserve	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283
Miscellaneous	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622
Sinking fund	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079
Sub-total	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685
INDIRECT COSTS															
Administration - main office	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304
Maintenance division - dept.	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339
Amin. personnel - dept.	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888
Administration - dept.	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829
Design & planning - dept.	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867
Regional laboratory	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650
Administration - district	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703
Depreciation	815532	815532	815532	812198	812198	804198	804198	804198	804198	804198	102040	102040	102040	102040	102040
Interest on investment	573875	551038	526603	500456	472480	442545	410515	376242	339571	300332	258347	213423	165354	113920	58886
Sub-total	1530988	1508151	1483715	1454235	1426259	1388324	1356294	1322021	1285350	1246111	501968	457044	408975	357542	302508
Total	**2139673**	**2116836**	**2092400**	**2062920**	**2034944**	**1997009**	**1964979**	**1930706**	**1894035**	**1854796**	**1110653**	**1065729**	**1017660**	**966226**	**911192**
Provisionnal costs for ONAS															
Payments to contractor	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174
Cost of contract management	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491
Total	2015665	2015665	2015665	2015665	2015665	2015665	2015665	2015665	2015665	2015665	2015665	2015665	2015665	2015665	2015665
Savings	0%														

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

BEST AVAILABLE DOCUMENT

Model Market 5b : BOT - Wastewater Treatment Plant

Type of treatment :	Activated sludge
Size :	Medium
Quantity of BOD (kg) eliminated daily :	5000

Productivity Gains	
Personnel (small & med. plants)	85%
Personnel (large plants)	80%
Electricity	80%
Maintenance Division	80%

Depreciation	Cost	Duration
Vehicles	40000	5
Tools	10000	3
Equipment	7021579	10
Construction	4081611	40

General Costs for the Private Firm (%)	
Main off. (% direct costs)	3%
Local admin. (% total)	12%

Financial Parameters	ONAS	Private
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	15	15
Grace period	4	1

Inflation	5%
Taxes	10%

Invest.	WWT Plant	Pump.station
Construction	35%	35%
Equipment	60%	65%
Land	5%	

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS															
Personnel	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758
Maintenance	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596
Electricity	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540
Replac. parts/sub-contracting	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656
Operating reserve	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519
Miscellaneous	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622
Sinking fund	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525
Sub-total	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215
INDIRECT COSTS															
Administration - main office	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178
Maintenance division - dept.	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071
Admin. personnel - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Admin. - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laboratory	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650
Admin. - district (private - local)	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894
Sub-total	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793
Total Expenses	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**
Revenue	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174	1992174
Net operating income	1293165	1293165	1293165	1293165	1293165	1293165	1293165	1293165	1293165	1293165	1293165	1293165	1293165	1293165	1293165
NOI (inflation-adjusted)	1293165	1357824	1425715	1497000	1571850	1650443	1732965	1819613	1910594	2006124	2106430	2211751	2322339	2438456	2560379
Depreciation	815532	815532	815532	812198	812198	804198	804198	804198	804198	804198	102040	102040	102040	102040	102040
Interest on loan	856907	856907	795699	734491	673284	612076	550869	489661	428453	367246	306038	244830	183623	122415	61208
Before tax cash flow	-379273	-379273	-318065	-253524	-192317	-123109	-61901	-694	60514	121721	885087	946295	1007502	1068710	1129917
Tax loss carryforward	-379273	-758546	-1076611	-1330135	-1522452	-1645561	-1707463	-1708157	-1647643	-1525921	-640835	305460	1007502	1068710	1129917
Taxes	0	0	0	0	0	0	0	0	0	0	0	30546	100750	106871	112992
Repayment of principal	0	556433	556433	556433	556433	556433	556433	556433	556433	556433	556433	556433	556433	556433	556433
After tax cash flow	436259	-55516	73583	206076	342134	481934	625664	773520	925708	1082445	1243959	1379942	1481533	1652737	1829747
IRR (NOI)	9%														
IRR (Net cash flow)	15%														

BEST AVAILABLE DOCUMENT

Model Market 5c : BOT - Wastewater Treatment Plant

Type of treatment :		Lagoon													
Size :		Medium													
Quantity of BOD (kg) eliminated daily		3000													
Current ONAS costs															
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS															
Personnel	37492	37492	37492	37492	37492	37492	37492	37492	37492	37492	37492	37492	37492	37492	37492
Maintenance	694	694	694	694	694	694	694	694	694	694	694	694	694	694	694
Electricity	11928	11928	11928	11928	11928	11928	11928	11928	11928	11928	11928	11928	11928	11928	11928
Replac. parts/sub-contracting	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166
Operating reserve	1423	1423	1423	1423	1423	1423	1423	1423	1423	1423	1423	1423	1423	1423	1423
Miscellaneous	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651
Sinking fund	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626
Sub-total	228981	228981	228981	228981	228981	228981	228981	228981	228981	228981	228981	228981	228981	228981	228981
INDIRECT COSTS															
Administration - main office	30936	30936	30936	30936	30936	30936	30936	30936	30936	30936	30936	30936	30936	30936	30936
Maintenance division - dept.	29201	29201	29201	29201	29201	29201	29201	29201	29201	29201	29201	29201	29201	29201	29201
Amin. personnel - dept	3320	3320	3320	3320	3320	3320	3320	3320	3320	3320	3320	3320	3320	3320	3320
Administration - dept.	5832	5832	5832	5832	5832	5832	5832	5832	5832	5832	5832	5832	5832	5832	5832
Design & planning - dept	4141	4141	4141	4141	4141	4141	4141	4141	4141	4141	4141	4141	4141	4141	4141
Regional laboratory	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190
Administration - district	1848	1848	1848	1848	1848	1848	1848	1848	1848	1848	1848	1848	1848	1848	1848
Depreciation	402059	402059	402059	398726	398726	390726	390726	390726	390726	390726	49473	49473	49473	49473	49473
Interest on investment	279498	268376	256475	243740	230115	215535	199936	183244	165383	146273	125824	103945	80533	55483	28680
Sub-total	759025	747903	736002	719934	706309	683729	668129	651437	633577	614466	252765	230886	207474	182424	155621
Total	**988006**	**976883**	**964982**	**948915**	**935289**	**912710**	**897110**	**880418**	**862558**	**843447**	**481746**	**459866**	**436455**	**411405**	**384601**
Provisionnal costs for ONAS															
Payments to contractor	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567
Cost of contract management	9281	9281	9281	9281	9281	9281	9281	9281	9281	9281	9281	9281	9281	9281	9281
Total	916848	916848	916848	916848	916848	916848	916848	916848	916848	916848	916848	916848	916848	916848	916848
Savings	0%														

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

BEST AVAILABLE DOCUMENT

Model Market 5c : BOT - Wastewater Treatment Plant

Type of treatment :	Lagoon
Size :	Medium
Quantity of BOD (kg) eliminated daily :	3000

Productivity Gains	
Personnel (small & med. plants)	85%
Personnel (large plants)	80%
Electricity	80%
Maintenance Division	80%

Depreciation	Cost	Duration
Vehicles	40000	5
Tools	10000	3
Equipment	3412528	10
Construction	1978916	40

General Costs for the Private Firm (%)	
Main off. (% direct costs)	3%
Local admin. (% total)	12%

Financial Parameters	ONAS	Private
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	15	15
Grace period	4	1

Inflation	5%
Taxes	10%

Invest.	WWT Plant	Pump.station
Construction	35%	35%
Equipment	60%	65%
Land	5%	

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS															
Personnel	31869	31869	31869	31869	31869	31869	31869	31869	31869	31869	31869	31869	31869	31869	31869
Maintenance	694	694	694	694	694	694	694	694	694	694	694	694	694	694	694
Electricity	9542	9542	9542	9542	9542	9542	9542	9542	9542	9542	9542	9542	9542	9542	9542
Replac. parts/sub-contracting	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166	5166
Operating reserve	1835	1835	1835	1835	1835	1835	1835	1835	1835	1835	1835	1835	1835	1835	1835
Miscellaneous	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651	1651
Sinking fund	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095
Sub-total	212851	212851	212851	212851	212851	212851	212851	212851	212851	212851	212851	212851	212851	212851	212851
INDIRECT COSTS															
Administration - main office	7152	7152	7152	7152	7152	7152	7152	7152	7152	7152	7152	7152	7152	7152	7152
Maintenance division - dept.	23361	23361	23361	23361	23361	23361	23361	23361	23361	23361	23361	23361	23361	23361	23361
Admin. personnel - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Admin. - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laboratory	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190
Admin. - district (private - local)	29466	29466	29466	29466	29466	29466	29466	29466	29466	29466	29466	29466	29466	29466	29466
Sub-total	62169	62169	62169	62169	62169	62169	62169	62169	62169	62169	62169	62169	62169	62169	62169
Total Expenses	**275020**	**275020**	**275020**	**275020**	**275020**	**275020**	**275020**	**275020**	**275020**	**275020**	**275020**	**275020**	**275020**	**275020**	**275020**
Revenue	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567	907567
Net operating income	632547	632547	632547	632547	632547	632547	632547	632547	632547	632547	632547	632547	632547	632547	632547
NOI (inflation-adjusted)	632547	664174	697383	732252	768865	807308	847673	890057	934560	981288	1030352	1081870	1135963	1192762	1252400
Depreciation	402059	402059	402059	398726	398726	390726	390726	390726	390726	390726	49473	49473	49473	49473	49473
Interest on loan	417443	417443	387626	357809	327991	298174	268356	238539	208722	178904	149087	119270	89452	59635	29817
Before tax cash flow	-186955	-186955	-157138	-123987	-94170	-56353	-26535	3282	33100	62917	433987	463804	493622	523439	553257
Tax loss carryforward	-186955	-373911	-531049	-655036	-749206	-805559	-832094	-828812	-795712	-732795	-298808	164996	493622	523439	553257
Taxes	0	0	0	0	0	0	0	0	0	0	0	16500	49362	52344	55326
Repayment of principal	0	271067	271067	271067	271067	271067	271067	271067	271067	271067	271067	271067	271067	271067	271067
After tax cash flow	215104	-24336	38690	103376	169806	238067	308250	380451	454771	531316	610198	675034	726082	809716	896189
IRR (NOI)	9%														
IRR (Net cash flow)	15%														

BEST AVAILABLE DOCUMENT

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Model Market 5a : BOT (Joint Venture) - Wastewater Treatment Plant

Type of treatment : Activated sludge

Size : Small

Quantity of BOD (kg) eliminated daily : 1000

Current ONAS costs

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS															
Personnel	57792	57792	57792	57792	57792	57792	57792	57792	57792	57792	57792	57792	57792	57792	57792
Maintenance	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240
Electricity	76758	76758	76758	76758	76758	76758	76758	76758	76758	76758	76758	76758	76758	76758	76758
Replac. parts/sub-contracting	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Operating reserve	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741	3741
Miscellaneous	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160
Sinking fund	130094	130094	130094	130094	130094	130094	130094	130094	130094	130094	130094	130094	130094	130094	130094
Sub-total	283467	283467	283467	283467	283467	283467	283467	283467	283467	283467	283467	283467	283467	283467	283467
INDIRECT COSTS															
Administration - main office	16160	16160	16160	16160	16160	16160	16160	16160	16160	16160	16160	16160	16160	16160	16160
Maintenance division - dept.	11805	11805	11805	11805	11805	11805	11805	11805	11805	11805	11805	11805	11805	11805	11805
Amin. personnel - dept.	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342	1342
Administration - dept.	2358	2358	2358	2358	2358	2358	2358	2358	2358	2358	2358	2358	2358	2358	2358
Design & planning - dept.	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690
Regional laboratory	730	730	730	730	730	730	730	730	730	730	730	730	730	730	730
Administration - district	1613	1613	1613	1613	1613	1613	1613	1613	1613	1613	1613	1613	1613	1613	1613
Depreciation	309273	309273	309273	305940	305940	297940	297940	297940	297940	297940	37753	37753	37753	37753	37753
Interest on investment	213867	205356	196249	186505	176079	164924	152987	140214	126548	111925	96278	79536	61623	42455	21945
Sub-total	558838	550327	541221	528144	517718	498562	486625	473853	460186	445563	169729	152987	135074	115906	95396
Total	**842305**	**833795**	**824688**	**811611**	**801185**	**782029**	**770092**	**757320**	**743654**	**729030**	**453197**	**436455**	**418541**	**399373**	**378864**
Provisionnal costs for ONAS	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509
Payments to contractor	101648	97603	93275	88644	83688	78386	72713	66642	60147	53196	45760	37803	29288	20178	10430
Cost of contract management	4848	4848	4848	4848	4848	4848	4848	4848	4848	4848	4848	4848	4848	4848	4848
Total	664005	659960	655631	651000	646045	640743	635069	628999	622503	615553	608116	600159	591645	582535	572787
Savings	19%														

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

BEST AVAILABLE DOCUMENT

Model Market 5a : BOT (Joint Venture) - Wastewater Treatment Plant

Type of treatment :	Activated sludge
Size :	Small
Quantity of BOD (kg) eliminated daily :	1000

Productivity Gains	
Personnel (small & med. plants)	85%
Personnel (large plants)	80%
Electricity	80%
Maintenance Division	80%

Depreciation	Cost	Duration
Vehicles	40000	5
Tools	10000	3
Equipment	2601871	10
Construction	1510119	40

General Costs for the Private Firm (%)	
Main off. (% direct costs)	3%
Local admin. (% total)	12%

Financial Parameters	ONAS	Private
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	15	15
Grace period	4	1

Inflation	5%
Taxes	10%

Invest.	WWT Plant	Pump station
Construction	35%	35%
Equipment	60%	65%
Land	5%	

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS															
Personnel	49123	49123	49123	49123	49123	49123	49123	49123	49123	49123	49123	49123	49123	49123	49123
Maintenance	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240	7240
Electricity	61406	61406	61406	61406	61406	61406	61406	61406	61406	61406	61406	61406	61406	61406	61406
Replac. parts/sub-contracting	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683	1683
Operating reserve	4710	4710	4710	4710	4710	4710	4710	4710	4710	4710	4710	4710	4710	4710	4710
Miscellaneous	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160	6160
Sinking fund	123589	123589	123589	123589	123589	123589	123589	123589	123589	123589	123589	123589	123589	123589	123589
Sub-total	253912	253912	253912	253912	253912	253912	253912	253912	253912	253912	253912	253912	253912	253912	253912
INDIRECT COSTS															
Administration - main office	7923	7923	7923	7923	7923	7923	7923	7923	7923	7923	7923	7923	7923	7923	7923
Maintenance division - dept.	9444	9444	9444	9444	9444	9444	9444	9444	9444	9444	9444	9444	9444	9444	9444
Admin. personnel - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Admin. - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laboratory	730	730	730	730	730	730	730	730	730	730	730	730	730	730	730
Admin. - district (private - local)	32641	32641	32641	32641	32641	32641	32641	32641	32641	32641	32641	32641	32641	32641	32641
Sub-total	50738	50738	50738	50738	50738	50738	50738	50738	50738	50738	50738	50738	50738	50738	50738
Total Expenses	**304650**	**304650**	**304650**	**304650**	**304650**	**304650**	**304650**	**304650**	**304650**	**304650**	**304650**	**304650**	**304650**	**304650**	**304650**
Revenue	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509	557509
Net operating income	252859	252859	252859	252859	252859	252859	252859	252859	252859	252859	252859	252859	252859	252859	252859
NOI (inflation-adjusted)	252859	265502	278777	292716	307352	322719	338855	355798	373588	392268	411881	432475	454099	476804	500644
Depreciation	309273	309273	309273	305940	305940	297940	297940	297940	297940	297940	37753	37753	37753	37753	37753
Interest on loan	159732	159732	148323	136914	125504	114095	102685	91276	79866	68457	57047	45638	34228	22819	11409
Before tax cash flow	-216147	-216147	-204737	-189994	-178585	-159176	-147766	-136357	-124947	-113538	158059	169468	180878	192287	203697
Tax loss carryforward	-216147	-432293	-637031	-827025	-1005610	-1164786	-1312552	-1448909	-1573856	-1687393	-1529335	-1359866	-1178988	-986701	-783004
Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment of principal	0	103722	103722	103722	103722	103722	103722	103722	103722	103722	103722	103722	103722	103722	103722
After tax cash flow	93127	2047	26732	52080	78125	104903	132448	160800	190000	220088	251111	283115	316148	350262	385512
IRR (NOI)	5%														
IRR (Net cash flow)	15%														

BEST AVAILABLE DOCUMENT

Model Market 5b : BOT (Joint Venture) - Wastewater Treatment Plant

Type of treatment :	Activated sludge														
Size :	Medium														
Quantity of BOD (kg) eliminated daily	5000														
Current ONAS costs															
Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS															
Personnel	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774	66774
Maintenance	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596
Electricity	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675	70675
Replac. parts/sub-contracting	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656
Operating reserve	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283	6283
Miscellaneous	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622
Sinking fund	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079	351079
Sub-total	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685	608685
INDIRECT COSTS															
Administration - main office	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304	78304
Maintenance division - dept.	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339	41339
Amin. personnel - dept.	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888	3888
Administration - dept.	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829	6829
Design & planning - dept.	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867	4867
Regional laboratory	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650
Administration - district	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703	2703
Depreciation	815532	815532	815532	812198	812198	804198	804198	804198	804198	804198	102040	102040	102040	102040	102040
Interest on investment	573875	551038	526603	500456	472480	442545	410515	376242	339571	300332	258347	213423	165354	113920	58886
Sub-total	1530988	1508151	1483715	1454235	1426259	1388324	1356294	1322021	1285350	1246111	501968	457044	408975	357542	302508
Total	**2139673**	**2116836**	**2092400**	**2062920**	**2034944**	**1997009**	**1964979**	**1930706**	**1894035**	**1854796**	**1110653**	**1065729**	**1017660**	**966226**	**911192**
Provisionnal costs for ONAS	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046
Payments to contractor	272652	261802	250192	237770	224478	210256	195038	178755	161332	142690	122742	101399	78561	54124	27977
Cost of contract management	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491	23491
Total	1673190	1662340	1650730	1638308	1625016	1610794	1595576	1579293	1561870	1543227	1523280	1501936	1479098	1454662	1428515
Savings	20%														

* The cost of contract management is estimated to be 30% of the costs of "Administration - main office"

BEST AVAILABLE DOCUMENT

Model Market 5b : BOT (Joint Venture) - Wastewater Treatment Plant

Type of treatment :	Activated sludge
Size :	Medium
Quantity of BOD (kg) eliminated daily :	5000

Productivity Gains	
Personnel (small & med. plants)	85%
Personnel (large plants)	80%
Electricity	80%
Maintenance Division	80%

Depreciation	Cost	Duration
Vehicles	40000	5
Tools	10000	3
Equipment	7021579	10
Construction	4081611	40

General Costs for the Private Firm (%)	
Main off. (% direct costs)	3%
Local admin. (% total)	12%

Financial Parameters	ONAS	Private
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	15	15
Grace period	4	1

Inflation	5%
Taxes	10%

Invest.	WWT Plant	Pump.station
Construction	35%	35%
Equipment	60%	65%
Land	5%	

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS															
Personnel	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758	56758
Maintenance	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596	54596
Electricity	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540	56540
Replac. parts/sub-contracting	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656	52656
Operating reserve	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519	8519
Miscellaneous	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622	6622
Sinking fund	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525	333525
Sub-total	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215	569215
INDIRECT COSTS															
Administration - main office	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178	18178
Maintenance division - dept.	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071	33071
Admin. personnel - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Admin. - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laboratory	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650	3650
Admin. - district (private - local)	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894	74894
Sub-total	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793	129793
Total Expenses	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**	**699008**
Revenue	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046	1377046
Net operating income	678038	678038	678038	678038	678038	678038	678038	678038	678038	678038	678038	678038	678038	678038	678038
NOI (inflation-adjusted)	678038	711940	747537	784914	824159	865367	908636	954068	1001771	1051859	1104452	1159675	1217659	1278542	1342469
Depreciation	815532	815532	815532	812198	812198	804198	804198	804198	804198	804198	102040	102040	102040	102040	102040
Interest on loan	428453	428453	397850	367246	336642	306038	275434	244830	214227	183623	153019	122415	91811	61208	30604
Before tax cash flow	-565947	-565947	-535343	-501406	-470802	-432198	-401594	-370991	-340387	-309783	422979	453583	484186	514790	545394
Tax loss carryforward	-565947	-1131894	-1667237	-2168643	-2639445	-3071643	-3473237	-3844228	-4184615	-4494398	-4071419	-3617837	-3133651	-2618860	-2073466
Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment of principal	0	278216	278216	278216	278216	278216	278216	278216	278216	278216	278216	278216	278216	278216	278216
After tax cash flow	249585	5270	71471	139452	209301	281113	354985	431021	509328	590020	673217	759043	847631	939118	1033649
IRR (NOI)	5%														
IRR (Net cash flow)	15%														

BEST AVAILABLE DOCUMENT

Model Market 5c : BOT (Joint Venture) - Wastewater Treatment Plant

Type of treatment :	Lagoon
Size :	Medium
Quantity of BOD (kg) eliminated daily :	3000

Current ONAS costs

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS															
Personnel	71016	71016	71016	71016	71016	71016	71016	71016	71016	71016	71016	71016	71016	71016	71016
Maintenance	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560
Electricity	17991	17991	17991	17991	17991	17991	17991	17991	17991	17991	17991	17991	17991	17991	17991
Replac. parts/sub-contracting	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461
Operating reserve	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550	2550
Miscellaneous	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963
Sinking fund	220626	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626	170626
Sub-total	325168	275168	275168	275168	275168	275168	275168	275168	275168	275168	275168	275168	275168	275168	275168
INDIRECT COSTS															
Administration - main office	74301	74301	74301	74301	74301	74301	74301	74301	74301	74301	74301	74301	74301	74301	74301
Maintenance division - dept.	43180	43180	43180	43180	43180	43180	43180	43180	43180	43180	43180	43180	43180	43180	43180
Amin. personnel - dept.	4910	4910	4910	4910	4910	4910	4910	4910	4910	4910	4910	4910	4910	4910	4910
Administration - dept.	8623	8623	8623	8623	8623	8623	8623	8623	8623	8623	8623	8623	8623	8623	8623
Design & planning - dept.	6118	6118	6118	6118	6118	6118	6118	6118	6118	6118	6118	6118	6118	6118	6118
Regional laboratory	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190
Administration - district	2338	2338	2338	2338	2338	2338	2338	2338	2338	2338	2338	2338	2338	2338	2338
Depreciation	402059	402059	402059	398726	398726	390726	390726	390726	390726	390726	49473	49473	49473	49473	49473
Interest on investment	279498	268376	256475	243740	230115	215535	199936	183244	165383	146273	125824	103945	80533	55483	28680
Sub-total	823218	812095	800194	784127	770501	747922	732322	715630	697769	678659	316958	295078	271667	246617	219813
Total	**1148386**	**1087264**	**1075362**	**1059295**	**1045669**	**1023090**	**1007490**	**990798**	**972938**	**953827**	**592126**	**570246**	**546835**	**521785**	**494982**
Provisionnal costs for ONAS															
Payments to contractor	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768
Cost of contract management	132823	127537	121882	115830	109355	102427	95013	87081	78593	69512	59794	49397	38271	26367	13629
Total	22290	22290	22290	22290	22290	22290	22290	22290	22290	22290	22290	22290	22290	22290	22290
Savings	823881	818595	812940	806888	800413	793485	786071	778139	769651	760570	750852	740455	729329	717425	704687

* The cost of contract manageme 23%
to be 30% of the costs of "Administration - seat"

BEST AVAILABLE DOCUMENT

Model Market 5c : BOT (Joint Venture) - Wastewater Treatment Plant

Type of treatment :	Lagoon
Size :	Medium
Quantity of BOD (kg) eliminated daily :	3000

Productivity Gains	
Personnel (small & med. plants)	85%
Personnel (large plants)	80%
Electricity	80%
Maintenance Division	80%

Depreciation	Cost	Duration
Vehicles	40000	5
Tools	10000	3
Equipment	3412528	10
Construction	1978916	40

General Costs for the Private Firm (%)	
Main off. (% direct costs)	3%
Local admin. (% total)	12%

Financial Parameters	ONAS	Private
Equity contribution	30%	30%
Loan	70%	70%
Operating reserve	10%	15%
Interest rate	7%	11%
Term	15	15
Grace period	4	1

Inflation	5%
Taxes	10%

Invest.	WWT Plant	Pump.station
Construction	35%	35%
Equipment	60%	65%
Land	5%	

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
DIRECT COSTS															
Personnel	60364	60364	60364	60364	60364	60364	60364	60364	60364	60364	60364	60364	60364	60364	60364
Maintenance	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560	1560
Electricity	14393	14393	14393	14393	14393	14393	14393	14393	14393	14393	14393	14393	14393	14393	14393
Replac. parts/sub-contracting	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461	8461
Operating reserve	3290	3290	3290	3290	3290	3290	3290	3290	3290	3290	3290	3290	3290	3290	3290
Miscellaneous	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963	2963
Sinking fund	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095	162095
Sub-total	253127	253127	253127	253127	253127	253127	253127	253127	253127	253127	253127	253127	253127	253127	253127
INDIRECT COSTS															
Administration - main office	8696	8696	8696	8696	8696	8696	8696	8696	8696	8696	8696	8696	8696	8696	8696
Maintenance division - dept.	34544	34544	34544	34544	34544	34544	34544	34544	34544	34544	34544	34544	34544	34544	34544
Admin. personnel - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Admin. - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Design and planning - dept.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Laboratory	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190
Admin. - district (private - local)	35827	35827	35827	35827	35827	35827	35827	35827	35827	35827	35827	35827	35827	35827	35827
Sub-total	81257	81257	81257	81257	81257	81257	81257	81257	81257	81257	81257	81257	81257	81257	81257
Total Expenses	**334384**	**334384**	**334384**	**334384**	**334384**	**334384**	**334384**	**334384**	**334384**	**334384**	**334384**	**334384**	**334384**	**334384**	**334384**
Revenue	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768	668768
Net operating income	334384	334384	334384	334384	334384	334384	334384	334384	334384	334384	334384	334384	334384	334384	334384
NOI (inflation-adjusted)	334384	351103	368658	387091	406446	426768	448106	470512	494037	518739	544676	571910	600505	630531	662057
Depreciation	402059	402059	402059	398726	398726	390726	390726	390726	390726	390726	49473	49473	49473	49473	49473
Interest on loan	208722	208722	193813	178904	163996	149087	134178	119270	104361	89452	74543	59635	44726	29817	14909
Before tax cash flow	-276397	-276397	-261488	-243246	-228337	-205429	-190520	-175611	-160703	-145794	210368	225276	240185	255094	270002
Tax loss carryforward	-276397	-552794	-814282	-1057528	-1285865	-1491294	-1681814	-1857425	-2018128	-2163922	-1953554	-1728278	-1488093	-1233000	-962997
Taxes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Repayment of principal	0	135534	135534	135534	135534	135534	135534	135534	135534	135534	135534	135534	135534	135534	135534
After tax cash flow	125662	6848	39312	72653	106917	142148	178395	215709	254143	293753	334599	376742	420246	465180	511615
IRR (NOI)	5%														
IRR (Net cash flow)	15%														

BEST AVAILABLE DOCUMENT

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ANNEX B

Current and Planned Liquid Waste Works in Tunisia

Gouvernorat	Centre Onas	Pop. 1993	Prise en charge année	Taux de branch. (%)	OUVRAGES ACTUELS — CONDUITES Unitaire ml	eau usée ml	pluvial ml	linéaire total ml	% bon état	regards unité	Avaloirs unité	Bouche d'égout unité	Boite de branch. unité
TUNIS	BAB SOUIKA		1975	95	80361			80361		4220	1387		16066
	BAB BHAR		1975	99	97875			97875		5199		5113	23343
	EL MENZAH-EL KHRADR		1975	96	58922	65058	33030	157010		5526	2272		5907
	JBEL JELOUD		1975	90	72604	140767	43005	256376		10153	2851		37107
	RAS TABIA - EL OMRANE		1975	80	74990	103857	44251	223098		7669	2510	0	26140
	BARDO - HRAIRIA		1975	76	7462	132456	17456	157374		5239	1772	393	13475
	SEDJOUMI		1975	95	2145	102667	13000	117812		5639	805		13732
	GOULETTE - EL KRAM		1975	75		94782	14132	108914		3471	970		7172
	MARSA - SIDI BOU SAID		1975	75	4240	186120	14240	204600		6273	813	813	10230
	Total	1048568			398599	825707	179114	1403420		53389	13380	6319	153172
ARIANA	ARIANA - K. EL ANDALOUS		1975	55		95545	22621	118166		3942	446	50	9091
	EL MANAZEH	0	1975	100		97197	57647	154844		3423	2547		14136
	MANOUBA	0	1975	80		60825	7997	68822		2277	246	294	4484
	ETTADHAMEN - OUED ELLIL	0	1988	36	1000	97756	14274	113030		4257	508	2	10799
	Total	123311			1000	351323	102539	454862		13899	3747	346	38510
BEN AROUS	BEN AROUS		1975	86		160220	38690	198910		5504	1225		9273
	RADES - MEGRINE		1975		28334	88053	14703	131090		3747	477	7037	7037
	MORNAG		1988										
	HAMMAN LIF		1975	65	0	136171	65568	201739		5929	1236		9973
	Total	393508			28334	384444	118961	531739		15180	2938	7037	26283
NABEUL	NABEUL	53305	1978	76	2962	88588	4862	96412	60	3519	120		7293
	DAR CHAABANE	28502	1980	86	2759	34734	0	37493	70	1305	21	31	3656
	BENI KHIAR	14139	1980	58	448	23082	0	23530	60	815	41	12	1534
	MAAMOURA	5137		25	3850	0	0	3850	40	39	0	180	257
	SOMAA	4893		78	8850	0	0	8850	30	89	0	413	763
	KORBA	27952	1992	70	4458	53629	1127	59214	60	1538	4	75	4004
	TAZARKA	6205		70	0	8500	0	8500	40	283	0	0	869
	MENZEL TEMIME	29777		62	820	34500	1980	37300	40	1178	20	38	3692
	KELIBIA	31673	1975	65	0	51660	1100	52760	60	1606	47		3693
	HAMMAMAM LAGHZAZ	5955		70	3700	4185	0	7885	60	177	0	173	834
	HAOUARIA	9452		57	10560	0	0	10560	10	106	0	493	1078
	SOLIMAN	19574	1993	80	11830	0	370	12200	40	122	4	552	3132
	KORBOUS	3553		20	300	1000	0	1300	100	36	0	14	142
	MENZEL BOUZELFA	14308	1993	68	14850	11750	600	27200	50	546	6	693	1946
	BENI KHALLED	8777		60	10000	0	2000	12000	40	120	20	467	1053
	GROMBALIA	15777	1993	90	18260	24065	0	42325	40	1549	90	165	2726
	BOU ARGOUB	6606		17	0	1000	0	1000	0	33	0	0	225
	HAMMAMET	35076	1978	40	4000	62881	4810	71691	70	1930	262		3205
	EL MIDA	3067		25	0	2340	0	2340	100	78	0	0	153
	AZMOUR	4754		20	0	3500	0	3500	60	117	0	0	190
	MENZEL HORR	6622											
	TAKELSA	16067		5		2000		2000	50	67	0	0	161
	ZAOUIET DJEDIDI	5189		23		3000		3000	82	100	0	0	239
	Total	356359			97647	410414	16849	524910		15352	635	3305	40844

BEST AVAILABLE DOCUMENT

Gouvernorat	Centre Onas	OUVRAGES ACTUELS								
		Tissus urbain zones				St. pompage		STEP		
		tourist.	ind.	urbain		Nbr.SP	puis.		DBO	TYPE
				Pop/rur	moy +	unité	KW	unité	Kg/j	TRAIT.
TUNIS	BAB SOUIKA			80	20					
	BAB BHAR			40	60			1	24000	BA
	EL MENZAH-EL KHRADR		20	15	65					
	JBEL JELOUD		70	25	5					
	RAS TABIA - EL OMRANE		0	50	50					
	BARDO - HRAIRIA			40	60					
	SEDJOUMI			90	10					
	GOULETTE - EL KRAM		10	25	65					
	MARSA - SIDI BOU SAID	15	10	15	60			1	5000	LA
	Total					34	896	2	29000	
ARIANA	ARIANA - K. EL ANDALOUS		10	20	70			1	25000	CO
	EL MANAZEH			5	95					
	MANOUBA		5	50	45					
	ETTADHAMEN - OUED ELLIL			90	10					
	Total					8	113	1	25000	
BEN AROUS	BEN AROUS		5	20	75			1	15000	CO
	RADES - MEGRINE		5	25	70			1	265	LA
	MORNAG			80	20					
	HAMMAN LIF		5	30	65					
	Total					26	1781	2	15265	
NABEUL	NABEUL	35	10	25	30	4	238	2	6570	BA/CO
	DAR CHAABANE			50	50	1	125			
	BENI KHIAR			50	50	1	22			
	MAAMOURA			60	40					
	SOMAA			70	30					
	KORBA	1		49	50	3	50			
	TAZARKA			70	30	1	20			
	MENZEL TEMIME			60	40	1	5			
	KELIBIA	5	5	35	55	2	9	1	880	BA
	HAMMAMAM LAGHZAZ			60	40					
	HAOUARIA			80	20					
	SOLIMAN			40	60	1	8	1	1900	CO
	KORBOUS			70	30					
	MENZEL BOUZELFA			60	40	2	15	1	700	CO
	BENI KHALLED			60	40	1		1		
	GROMBALIA		10	30	60			1	1050	CO
	BOU ARGOUB			60	40					
	HAMMAMET	45		15	40	10	603	2	3527	BA
	EL MIDA			90	10					
	AZMOUR			90	10					
	MENZEL HORR			90	10					
	TAKELSA			90	10					
	ZAOUIET DJEDIDI			70	30	1	5			
	Total					28	1100	9	14627	

BEST AVAILABLE DOCUMENT

Gouvernorat	Centre Onas	Pop. 1993	Prise en charge année	Taux de branch. (%)	OUVRAGES ACTUELS — CONDUITES Unitaire ml	eau usée ml	pluvial ml	linéaire total ml	% bon état	regards unité	Avaloirs unité	Bouche d'égout unité	Boite de branch. unité
ZAGHOUAN	ZAGHOUAN	15244	1991	76	10131	45018	115	55264	40	2143	46		3480
	ZRIBA	6631	1992	55	0	22564	115	22679	40	923	7		1257
	FAHS	14814		70		23350	1650	25000	30	795	17	0	2074
	NADHOUR	3326		15		3255		3255	90	109	0	0	100
	BIR M'CHERGA	3566											
	Total	43582			10131	94187	1880	106198		3969	70	0	6911
BIZERTE	BIZERTE	119485	1982		105852	24037	11453	141342	56	5139	68	864	12725
	ML JEMIL	0	1		13130	20345	922	34397	37	1158		153	3073
	ML ABDERRAHMEN	0	1			13545		13545	29	653		25	1623
	EL ALIA	12342		72	9319	9000		18319	70	393	0	435	1777
	RAS JEBEL	18924	1988	64	5228	22015	1078	28321	80	1197		117	2722
	METLINE	6034		70	8850			8850	60	89	0	413	845
	RAF RAF	8383		76	0	10000		10000	70	333	0	0	1274
	MENZEL BOURGUIBA	51368	1984	60	17988	40488	3575	62051	70	2066	319	0	4269
	SEJNANE	3715		81	6500			6500	30	65	0	303	602
	GHAR EL MELH	4486		75	5500			5500	70	55	0	257	673
	AOUSJA	3249		65	5030	8734		13764	60	341	0	235	422
	MATEUR	27543	1992	75		49869		49869	62	1877	74		4370
	TINJA	12987	1	41	3890	3983		7873	80	245	19		856
	Total	268516			181287	202016	17028	400331		13611	480	2802	35231
BEJA	BEJA	58292	1991	85	30000	70000	7700	107700	60	3338	216		7938
	NEFZA	4504		61	4500	1500	1000	7000	60	105	10	210	549
	MEDJEZ EL BAB	17152	1992	42	10000	34000		44000	50	1233	0	467	1441
	TESTOUR	12221		60	10000	3000		13000	20	200	0	467	1467
	TEBOURSOUK	11889		60	17000			17000	40	170	0	793	1427
	AMDOUN	4158		65		4300		4300	60	143	0	0	541
	GOUBELLAT	2624				750		750	100	25	0	0	0
	Total	110840			71500	113550	8700	193750		5215	226	1937	13362
JENDOUBA	JENDOUBA	43707	1991	60	55429	15706		71135	50	2475	1106		6443
	BOU SALEM	20402		45	4800	3760		8560	60	173	0	224	1836
	GHARDIMAOU	17689		65	5040	17470		22510	50	633	0	235	2300
	TABARKA	13784	1992	60	1952	17903	2345	22200	85	630	137	513	1507
	AIN DRAHEM	7606		50	8000			8000	20	80	0	373	761
	Total	103188			75221	54839	2345	132405		3991	1243	1346	12846
LE KEF	LE KEF	46109	1982	80		87968	0	87968	79	3820	59		7126
	SAKIET SIDI YOUSSEF	6002		35		3800		3800	40	127	0	0	420
	TAJEROUINE	18871		70		24000		24000	70	800	0	0	2642
	KALAAT SENANE	5858		36		8000		8000	12	267	0	0	422
	KALAA KHASBA	3805		34		6500		6500	46	217	0	0	259
	JERISSA	17448		6		1920		1920		64	0	0	209
	DAHMANI	16378		70		22800		22800	60	760	0	0	2293
	EL KSOUR	5333		43		9500		9500	20	317	0	0	459
	SERS	4441		70		8100		8100	31	270	0	0	622
	NEBEUR	4148		40		4200		4200	60	140	0	0	332
	MENZEL SALEM	4148		23		4000		4000	80	133	0	0	191
	TOUIREF	2867											
	Total	135408			0	180788	0	180788		6914	59	0	14974

BEST AVAILABLE DOCUMENT

BEST AVAILABLE

Gouvernorat	Centre	OUVRAGES ACTUELS								
		Tissus urbain zones				St. pompage		STEP		
	Onas	tourist.	ind.	urbain		Nbr.SP	puis.		DBO	TYPE
				Pop/rur	moy +	unité	KW	unité	Kg/j	TRAIT.
ZAGHOUAN	ZAGHOUAN	2	20	48	30					
	ZRIBA			80	20					
	FAHS			80	20					
	NADHOUR			90	10					
	BIR M'CHERGA			90	10					
	Total					0	0	0	0	
BIZERTE	BIZERTE	1	29	20	50	5	32			
	ML JEMIL			50	50					
	ML ABDERRAHMEN			50	50					
	EL ALIA			70	30					
	RAS JEBEL			70	30	2	8			
	METLINE			70	30					
	RAF RAF			50	50	1	10			
	MENZEL BOURGUIBA		5	45	50	2	35			
	SEJNANE			60	40					
	GHAR EL MELH			70	30					
	AOUSJA			70	30					
	MATEUR		1	59	40	4	9			
	TINJA			40	60	1	2			
	Total					15	96	0	0	
BEJA	BEJA		20	30	50			1	7800	BA
	NEFZA			70	30					
	MEDJEZ EL BAB			70	30	4		1	1970	BA
	TESTOUR			70	30					
	TEBOURSOUK			80	20					
	AMDOUN			90	10					
	GOUBELLAT			90	10					
	Total					4	0	2	9770	
JENDOUBA	JENDOUBA		5	55	95	5		1	3400	BA
	BOU SALEM			60	40					
	GHARDIMAOU			70	30					
	TABARKA	30		30	40	5		1	1825	LA
	AIN DRAHEM			60	40					
	Total					10	0	2	5225	
LE KEF	LE KEF		5	50	45	2	7			
	SAKIET SIDI YOUSSEF			70	30	1				
	TAJEROUINE			90	10					
	KALAAT SENANE			90	10					
	KALAA KHASBA			90	10					
	JERISSA			90	10					
	DAHMANI			90	10					
	EL KSOUR			90	10					
	SERS			90	10					
	NEBEUR			90	10					
	MENZEL SALEM			90	10					
	TOUIREF			90	10					
	Total					3	7	0	0	

Gouvernorat	Centre Onas	Pop. 1993	Prise en charge année	Taux de branch. (%)	OUVRAGES ACTUELS — CONDUITES: Unitaire ml	eau usée ml	pluvial ml	linéaire total ml	% bon état	regards unité	Avaloirs unité	Bouche d'égout unité	Boite de branch. unité
SILIANA	SILIANA	20230	1992	85	15000	8600		23600	70	437	0	700	3439
	BOUARADA	11834		38		13000		13000	80	433	0	0	899
	GAAFOUR	11038		20	5000			5000	50	50	0	233	442
	LE KRIB	6440		70		9300		9300	50	310	0	0	902
	BARGOU	4650		36		2950		2950	100	98	0	0	335
	MAKTHAR	13628		30		9000	300	9300	30	303	3	0	818
	ROHIA	391		60		6110		6110	15	204	0	0	47
	EL AROUSSA	2508											
	KESRA	2920		30		3500		3500	50	117	0	0	175
	SIDI BOUROUIS	4740											
	Total	78379			20000	52460	300	72760		1952	3	933	7056
KAIROUAN	KAIROUAN	108104	1979	66	0	161571	1382	162953	60	5760	312		11814
	SBIKHA	5201				600		600	100	20	0	0	0
	OUESLATIA	8543		65	400	8230		8630	95	278	0	19	1111
	HAFFOUZ	5726		70		14840		14840	90	495	0	0	802
	EL ALA	2918											
	SIDI AMOR BOU HAJLA	4245				6000		6000	100	200	0	0	0
	SIDI ALI NASRALLAH	5551											
	HAJEB AEL AYOUN	8161		30		7350		7350	83	245	0	0	490
	MENZEL MHIRI	3640											
	Total	152090			400	198591	1382	200373		6998	312	19	14216
KASSERINE	KASSERINE	70915	1984	42		59466		59466	94	1920			5498
	SBEITLA	17098	1988	83		27014		27014	100	850			2312
	SBIBA	4924		6		1000		1000	100	33	0	0	59
	THALA	16317		70		10900	1600	12500	60	379	16	0	2284
	FERIANA	17066											
	TELEPTE	3309											
	MAJEL BEL ABBES	2882											
	JEDLIANE	2754											
	FOUSSANA	3192											
	HAIDRA	2615											
	Total	141072			0	98380	1600	99980		3183	16	0	10154
SIDI BOUZID	SIDI BOUZID	30602	1988	68		53652	3840	57492	80	1842	237		3270
	JELMA	5504											
	REGUEB	4192											
	MAKNASSY	13186		10		5050		5050	100	168	0	0	264
	BIR EL HFAY	4035											
	BEN AOUN	491											
	EL MEZZOUNA	4227											
	OULED HAFFOUZ	2936											
	Total	65173			0	58702	3840	62542		2010	237	0	3534

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		OUVRAGES ACTUELS								
Gouvernorat	Centre	Tissus urbain zones				St. pompage		STEP		
	Onas	tourist.	ind.	urbain		Nbr.SP	puis.		DBO	TYPE
				Pop/rur	moy +	unité	KW	unité	Kg/j	TRAIT.
SILIANA	SILIANA			60	40					
	BOUARADA			80	20					
	GAAFOUR			90	10					
	LE KRIB			90	10					
	BARGOU			90	10					
	MAKTHAR			90	10					
	ROHIA			90	10					
	EL AROUSSA			90	10					
	KESRA			90	10					
	SIDI BOUROUIS			90	10					
	Total					0	0	0	0	
KAIROUAN	KAIROUAN	2	3	40	60	5	21	1	3500	BA
	SBIKHA			90	10					
	OUESLATIA			90	10					
	HAFFOUZ			90	10					
	EL ALA			90	10					
	SIDI AMOR BOU HAJLA			90	10					
	SIDI ALI NASRALLAH			90	10					
	HAJEB AEL AYOUN			90	10					
	MENZEL MHIRI			90	10					
	Total					5	21	1	3500	
KASSERINE	KASSERINE		10	35	55			1	7500	LA
	SBEITLA			60	40					
	SBIBA			90	10					
	THALA			70	30					
	FERIANA			90	10					
	TELEPTE			90	10					
	MAJEL BEL ABBES			90	10					
	JEDLIANE			90	10					
	FOUSSANA			90	10					
	HAIDRA			90	10					
	Total					0	0	1	7500	
SIDI BOUZID	SIDI BOUZID			50	50	2	2	1	900	LF
	JELMA			90	10					
	REGUEB			90	10					
	MAKNASSY			90	10					
	BIR EL HFAY			90	10					
	BEN AOUN			90	10					
	EL MEZZOUNA			90	10					
	OULED HAFFOUZ			90	10					
	Total					2	2	1	900	

BEST AVAILABLE DOCUMENT

Gouvernorat	Centre Onas	Pop. 1993	Prise en charge année	Taux de branch. (%)	OUVRAGES ACTUELS CONDUITES Unitaire ml	eau usée ml	pluvial ml	linéaire total ml	% bon état	regards unité	Avaloirs unité	Bouche d'égout unité	Boite de branch. unité
SOUSSE	SOUSSE - CITE EZZOUHOUR	151061	1975	71	2613	200716	20527	223856	66	8047	115		19299
	HAMMEN SOUSSE	0	1982			60382	664	61046		2057	49		3804
	KALAA KEBIRA	38607	1988	42		46462		46462	35	1404	1		4502
	AKOUDA	14026	1988	69		20799		20799	65	724			1590
	MSAKEN	55486	1991	74	0	95497	2580	98077	28	2610	89		9594
	KALAA SGHIRA	15060	1992	60		17382		17382	80	635	10		1754
	KSIBET THRAYET	5528		18		2600		2600	92	87	0	0	199
	HERGLA	26631		31		4100		4100	100	137	0	0	1651
	SIDI BOU ALI	16454		20		5900		5900	60	197	0	0	658
	ENFIDA	7606		38		11250		11250	60	375	0	0	578
	BOU FICHA	5223		13		1050		1050	72	35	0	0	136
	ZAOUIET SOUSSE	5218		42		5600		5600	80	187	0	0	438
	MESSADINE	4694		36		4500		4500	95	150	0	0	338
	Total	345594			2613	476238	23771	502622		16644	264	0	44541
MONASTIR	MONASTIR	54309	1975	80	9300	83047	13447	105794	70	3739	525		7620
	KHENIS	7658		20		3000		3000	40	100	0	0	306
	BEMBLA ET MENARA	9143		41		7500		7500	100	250	0	0	750
	OUARDANINE	14991	1988	76		23482	1519	25001	87	902	43	5	1898
	SAHLINE-MOOTMAR	10101	1988	42		34805		34805	90	629			891
	JEMMAL	29614	1988	76		52889		52889	60	2725	2		4837
	ZERAMDINE	12928	1988	35		12837		12837	70	389			988
	BENI HASSENE	7203		30		5000		5000	40	167	0	0	432
	KSIBET MEDIOUNI	7692		2		300	1000	1300		20	10	0	31
	BENNENE BOUDHAR	8497		3		500		500	100	17	0	0	51
	TOUZA	5776		5		1350		1350	100	45	0	0	58
	SAYADA	10338		43		11050		11050	100	368	0	0	889
	KSSAR HELLAL	31728	1989	30		26307	2315	28622	70	942	18		1873
	MOKNINE	36933	1984	70	285	51340		51625	34	1852	8		4961
	TEBOULBA	23670		40	1643	18760		20403	100	642	0	77	1894
	BEKALTA	13521		44		9400		9400	100	313	0	0	1190
	LAMTA	4725		50		7070		7070	100	236	0	0	473
	BOUHJAR	3353		40		3985		3985	100	133	0	0	268
	SIDI AMEUR	4215		40		3650		3650	100	122	0	0	337
	ZAOUIET KOUNTECH	4044	1989	58		8130		8130	60	271	0	0	469
	MENZEL FERSI	2405											
	SIDI BENNOUR	3065											
	EL GHENADA	4204											
	CHERAHIL	3044											
	MENZEL ENNOUR	6961		70		8000		8000	100	267	0	0	975
	MENZEL KAMEL	6833		30		4200		4200	100	140	0	0	410
	EL MAZDOUR	2895		80		4200		4200	70	140	0	0	463
	MENZEL HAYET	8504						0					
	AMIRET EL HAJJAJ	5151						0					
	AMIRET EL FOUHOUL	3044						0					
	AMIRET ETTOUAZRA	3566						0					
	Total	350112			11228	380802	18281	410311		14408	606	82	32063

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Gouvernorat	Centre	OUVRAGES ACTUELS								
		Tissus urbain zones				St. pompage		STEP		
	Onas	tourist.	ind.	urbain		Nbr.SP	puis.		DBO	TYPE
				Pop/rur	moy +	unité	KW	unité	Kg/j	TRAIT.
SOUSSE	SOUSSE - CITE EZZOUHOUR	25	5	20	50	17	670	2	15700	
	HAMMEN SOUSSE	40	5	10	45					
	KALAA KEBIRA			50	50	1	13			
	AKOUDA			50	50	1	15			
	MSAKEN			30	70	1	2			
	KALAA SGHIRA			50	50	2	13	1	500	CO
	KSIBET THRAYET			70	30					
	HERGLA			70	30					
	SIDI BOU ALI			70	30					
	ENFIDA			70	30	1	2			
	BOU FICHA			70	30					
	ZAOUIET SOUSSE			70	30					
	MESSADINE			70	30					
	Total					23	715	3	16200	
MONASTIR	MONASTIR	35	15	15	35	4	40	1	2158	FB
	KHENIS			50	50					
	BEMBLA ET MENARA			40	60					
	OUARDANINE			60	40			1	600	CO
	SAHLINE-MOOTMAR			60	40	10	40	2	750	BA/CO
	JEMMAL		2	48	50					
	ZERAMDINE			50	50	1	3			
	BENI HASSENE			70	30					
	KSIBET MEDIOUNI			60	40					
	BENNENE BOUDHAR			60	40					
	TOUZA			70	30					
	SAYADA		2	48	50	1	9	1	600	CO
	KSSAR HELLAL			40	60	1	2			
	MOKNINE		2	38	60	3	50	1	3000	LA
	TEBOULBA			60	40	2	15			
	BEKALTA			60	40	1	5			
	LAMTA			60	40	1	14			
	BOUHJAR			60	40					
	SIDI AMEUR			60	40					
	ZAOUIET KOUNTECH			60	40					
	MENZEL FERSI			80	20					
	SIDI BENNOUR			80	20					
	EL GHENADA			80	20					
	CHERAHIL			90	10					
	MENZEL ENNOUR			90	10					
	MENZEL KAMEL			90	10					
	EL MAZDOUR			90	10					
	MENZEL HAYET			90	10					
	AMIRET EL HAJJAJ			90	10					
	AMIRET EL FOUHOUL			90	10					
	AMIRET ETTOUAZRA			90	10					
	Total					24	178	6	7108	

Gouvernorat	Centre Onas	Pop. 1993	Prise en charge année	Taux de branch. (%)	OUVRAGES ACTUELS — CONDUITES Unitaire ml	eau usée ml	pluvial ml	linéaire total ml	% bon état	regards unité	Avaloirs unité	Bouche d'égout unité	Boite de branch. unité
MAHDIA	MAHDIA	40838	1975	46		63562	1230	64792	80	2493	280		4560
	KSOUR ESSEF	25042		53		24500		24500	90	817	0	0	2654
	CHEBBA	19214						0					
	SIDI ALOUANE	5578						0					
	BOU MERDES	3175		35		6700		6700	90	223	0	0	222
	EL JEM	15880	1992	50		23303		23303	70	759	64		1806
	CHORBANE	5659						0					
	SOUASSI	3391		40		4000		4000		133	0	0	271
	REJICHE	7099						0					
	KARKAR	5237						0					
	OULED CHAMEKH	4598						0					
	HBIRA	3576						0					
	MELLOULECH	5141						0					
	BRADAA	7259						0					
	Total	151686			0	122065	1230	123295		4425	344	0	9514
SFAX	SFAX NORD	383373	1975	45	6872	87005	5305	99182	65	3286	129	97	6526
	SFAX VILLE	0	1975	45		238442		238442		8537	1038	0	20417
	JEBENIANA	7915						0					
	HANCHA	4616						0					
	KERKENA	21500						0					
	BIR ALI BEN KHELIFA	3168						0					
	MAHRES	13876	1933			19767		19767	95	659	0	0	0
	AGUEREB	5737						0					
	MENZEL CHEKER	2789						0					
	SKHIRA	4577						0					
	Total	447550			6872	345214	5305	357391		12482	1167	97	26943
GAFSA	GAFSA	66566	1984	36	4023	57464	1748	63235	50	2176	17	17	5233
	SENED	4893						0					
	REDEYEF	17819		60		17400		17400		580	0	0	2138
	METLAOUI	44150		20		16500		16500	27	550	0	0	1766
	OUM EL ARAIS	19739		12		7075		7075	100	236	0	0	474
	EL GUETAR	12563						0					
	MDHILLA	11806		28		4200		4200	50	140	0	0	661
	EL KSAR	25842		50	20300	1500		21800	50	253	0	947	2584
	Total	203378			24323	104139	1748	130210		3935	17	964	12856
TOZEUR	TOZEUR	27257	1985	75	3276	45260	1180	49716	90	2700	26		5591
	DEGUECHE	7024						0		0	0	0	0
	NEFTA	18671	1988	75		31250		31250	95	1042	0	0	2801
	HAMMET JERID	5850						0		0	0	0	0
	Total	58802			3276	76510	1180	80966		3742	26	0	8392
KEBILI	KEBILI	18624	1992	45		23563		23563	100	730			1439
	DOUZ	19481					300	300		3	3	0	0
	JEMNA	4910						0					
	EL GOLAA	4675						0					
	SOUK EL AHAD	17378						0					
	Total	65069			0	23563	300	23863		733	3	0	1439

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Gouvernorat	Centre Onas	OUVRAGES ACTUELS								
		Tissus urbain zones				St. pompage		STEP		
		tourist.	ind.	urbain		Nbr.SP	puis.		DBO	TYPE
				Pop/rur	moy +	unité	KW	unité	Kg/j	TRAIT.
MAHDIA	MAHDIA	5	15	30	70	6	287	1	4700	LA
	KSOUR ESSEF			50	50	1	8	1	500	CO
	CHEBBA			60	40					
	SIDI ALOUANE			90	10					
	BOU MERDES			90	10					
	EL JEM			50	50	1	5	1	600	LF
	CHORBANE			90	10					
	SOUASSI			90	10					
	REJICHE			60	40					
	KARKAR			60	40					
	OULED CHAMEKH			90	10					
	HBIRA			90	10					
	MELLOULECH			90	10					
	BRADAA			90	10					
	Total					8	300	3	5800	
SFAX	SFAX NORD	1	5	29	65	8	30	1	12300	
	SFAX VILLE	1	4	30	65	11	470			
	JEBENIANA			90	10					
	HANCHA			90	10					
	KERKENA			80	20					
	BIR ALI BEN KHELIFA			70	30					
	MAHRES			90	10	2	11	1	400	CO
	AGUEREB			90	10					
	MENZEL CHEKER			90	10					
	SKHIRA			60	40					
	Total					21	511	2	12700	
GAFSA	GAFSA	1	9	40	50	2	60	1	1250	LF
	SENED			90	10					
	REDEYEF		5	80	15					
	METLAOUI		5	80	15					
	OUM EL ARAIS		5	80	15					
	EL GUETAR			90	10					
	MDHILLA		5	90	5					
	EL KSAR			90	10					
	Total					2	60	1	1250	
TOZEUR	TOZEUR	20	2	48	30	3				
	DEGUECHE			70	30					
	NEFTA	20		50	30	2	30	1	600	CO
	HAMMET JERID			90	10					
	Total					5	30	1	600	
KEBILI	KEBILI	2		58	40	1	5.2			
	DOUZ	2		88	10					
	JEMNA			90	10					
	EL GOLAA			90	10					
	SOUK EL AHAD			90	10					
	Total					1	5	0	0	

Gouvernorat	Centre Onas	Pop. 1993	Prise en charge année	Taux de branch. (%)	OUVRAGES ACTUELS — CONDUITES: Unitaire ml	eau usée ml	pluvial ml	linéaire total ml	% bon état	regards unité	Avaloirs unité	Bouche d'égout unité	Boite de branch. unité
GABES	GABES(1975) - EL HAMMA(1982)	118415	1975			131062	3599	134661	77	4746	232		11275
	EL METOUIA	8936						0					
	OUEDDHREF	10033						0					
	MARETH	6969						0					
	MATMATA	5816						0					
	ZARRAT	3971						0					
	Total	154139			0	131062	3599	134661		4746	232	0	11275
MEDENINE	MEDENINE	38727	1990	30		35792		35792	90	1040			2121
	JERBA (ILE)		1979			73333	2853	76186		1508	45	64	1320
	ZARZIS	64661	1989	6		26340	175	26515	90	573	17	6	667
	BEN GUERDENE	13453					1600	1600		16	16	0	0
	BENI KHEDACHE	2763					350	350		4	4	0	0
	Total	119605			0	135465	4978	140443		3141	82	70	4108
TATAOUINE	TATAOUINE	36526	1989	34		33081		33081	90	920			2630
	GHOMRASSEN	13134						0					
	REMADA	3980						0					
	DHEHIBET	3779						0					
	BIR LAHMAR	2709						0					
	Total	60128			0	33081	0	33081		920	0	0	2630
	total	4976056			932,431	4,853,540	514,930	6,300,901		210837.2867	26085.5	25255.96	530853.88

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Gouvernorat	Centre Onas	OUVRAGES ACTUELS								
		Tissus urbain zones				St. pompage		STEP		
		tourist.	ind.	urbain		Nbr.SP	puis.		DBO	TYPE
				Pop/rur	moy +	unité	KW	unité	Kg/j	TRAIT.
GABES	GABES(1975) - EL HAMMA(1982)	1	5	39	55	9	112.3			
	EL METOUIA			60	40					
	OUEDDHREF			80	20					
	MARETH			50	50		7			
	MATMATA			80	20					
	ZARRAT			90	10					
	Total					9	119	0	0	
MEDENINE	MEDENINE		3	37	60	1	1.8			
	JERBA (ILE)	80	3	5	12	3	48.9	1	2825	LA
	ZARZIS	15	5	30	50	3	6.8	1	1520	CO
	BEN GUERDENE			60	40					
	BENI KHEDACHE			90	10					
	Total					7	58	2	4345	
TATAOUINE	TATAOUINE	1	2	47	50	2	5.8			
	GHOMRASSEN			80	20					
	REMADA			90	10					
	DHEHIBET			90	10					
	BIR LAHMAR			90	10					
	Total					2	6	0	0	
	total					237	5997.8	39	158,790	

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Gouvernorat	Centre	OUVRAGES PROJETES									
		CONDUITES					Tissus urbain zones				Station de pompage
	Onas	Unitaire	eau usée	pluvial	total	Invest.	tourist.	ind.	urbain		nombre
		ml	ml	ml	ml	mD			Pop/rur	moy +	unité
TUNIS	BAB SOUIKA	2289		2115	4404	1,424			80	20	
	BAB BHAR	3137			3137	1,425			40	60	
	EL MENZAH-EL KHRADR	492	540		1032	318		20	15	65	
	JBEL JELOUD				0			70	25	5	
	RAS TABIA - EL OMRANE	3754			3754	2,000			50	50	
	BARDO - HRAIRIA				0				40	60	
	SEDJOUMI		23197	700	23897	7,326			90	10	
	GOULETTE - EL KRAM				0			15	25	60	
	MARSA - SIDI BOU SAID		8500	3225	11725	1,380	20	10	15	55	
	Total	9672	32237	6040	47949	18,395					1
ARIANA	ARIANA - K. EL ANDALOUS		12766	11129	23895	5,752		15	20	65	
	EL MANAZEH				0				5	95	
	MANOUBA				0			5	50	45	
	ETTADHAMEN - OUED ELLIL		19200		19200	2,969			90	10	
	Total	0	31966	11129	43095	8,721					1
BEN AROUS	BEN AROUS		9135	5336	14471	2,074		25	15	60	
	RADES - MEGRINE		3000	2260	5260	3,021		25	20	55	
	MORNAG				0				80	20	
	HAMMAN LIF		4470	1174	5644	744		5	30	65	
	Total	0	16605	8770	25375	5,839					4
NABEUL	NABEUL		66120		66120	2,894	36	9	25	30	4
	DAR CHAABANE		52250		52250	2,430	10	5	40	45	
	BENI KHIAR		34450		34450	1,578	10	5	40	45	1
	MAAMOURA		13600		13600	711	10	5	50	35	1
	SOMAA		12650		12650	678			70	30	2
	KORBA		39300		39300	1,857	1		50	49	2
	TAZARKA		15250		15250	773	5		65	30	
	MENZEL TEMIME		41250		41250	1,967		2	60	38	1
	KELIBIA		51850		51850	2,334	6	6	35	53	1
	HAMMAMAM LAGHZAZ		14100		14100	726			60	40	
	HAOUARIA		23300		23300	1,155			80	20	1
	SOLIMAN		28025		28025	1,277		5	40	55	1
	KORBOUS		5000		5000	256			70	30	1
	MENZEL BOUZELFA		32260		32260	1,541		5	60	35	1
	BENI KHALLED		14450		14450	693		5	60	35	
	GROMBALIA		22950		22950	1,054		15	60	25	1
	BOU ARGOUB		17650		17650	869		5	30	65	1
	HAMMAMET		56620		56620	2,540	50		60	10	
	EL MIDA		8250		8250	395			15	85	
	AZMOUR		8780		8780	421			90	10	
	MENZEL HORR		22500		22500	1,190			90	10	
	TAKELSA		2000		2000	104			90	10	
	ZAOUIET DJEDIDI		10000		10000	448			70	30	
	Total	0	592605	0	592605	27,891					18

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Gouvernorat	Centre Onas	OUVRAGES PROJETES puis. KW	Invest. mD	STEP unité	DBO Kg/j	mD	INVEST. TOTAL mD	Population 1990	Taux accrois.	no	Nbr./ centre	Puiss Sp de Transfert pour projeté	Puiss SP de Transfert pour existant
TUNIS	BAB SOUIKA						1,424 DT			1			0
	BAB BHAR			ext			1,425 DT			2			0
	EL MENZAH-EL KHRADR						318 DT			3			0
	JBEL JELOUD						0 DT			4			0
	RAS TABIA - EL OMRANE						2,000 DT			5			0
	BARDO - HRAIRIA						0 DT			5			0
	SEDJOUMI						7,326 DT			6			0
	GOULETTE - EL KRAM						0 DT			7			0
	MARSA - SIDI BOU SAID			ext			1,380 DT			8			0
	Total	*2212*	*4,054 DT*	1	34756	25,700 DT	*48,149 DT*	*0*	*0*		*13*	*1106*	448
ARIANA	ARIANA - K. EL ANDALOUS			1 + ext	56000	25,700 DT	31,452 DT			9	2	0	0
	EL MANAZEH						0 DT			10		0	0
	MANOUBA						0 DT			11	1	0	0
	ETTADHAMEN - OUED ELLIL						2,969 DT			12	1	0	0
	Total	*2665*	*2,852 DT*	*2 ext*	16454	22,640 DT	*34,213 DT*	*0*	*0*			*1333*	56.5
BEN AROUS	BEN AROUS			ext	10000	22,100 DT	24,174 DT			13	1	0	0
	RADES - MEGRINE						3,021 DT			14	2	0	0
	MORNAG						0 DT			15	1	0	0
	HAMMAN LIF						744 DT			16	1	0	0
	Total	*282*	*1,051 DT*	1 ext	19275	22,100 DT	*28,990 DT*	*0*	*0*			*141*	890.5
NABEUL	NABEUL	90	830 DT	ext	1264	2,190 DT	5,914 DT	48640	3.1	17	1	45	119
	DAR CHAABANE	125	431 DT				2,861 DT	25120	4.3	18	1	0	0
	BENI KHIAR	5	123 DT				1,701 DT	12790	3.4	19	1	0	0
	MAAMOURA	3	100 DT	1	245	703 DT	1,514 DT	4770	2.5	20		1.5	0
	SOMAA	5	123 DT				801 DT	4530	2.6	21		0	0
	KORBA	43	407 DT	1	1560	2,774 DT	5,038 DT	25730	2.8	22	1	21.5	0
	TAZARKA			1	553	1,347 DT	2,120 DT	5580	3.6	23		0	0
	MENZEL TEMIME	2	86 DT	1	1682	2,924 DT	4,977 DT	27570	2.6	24		1	0
	KELIBIA	4	113 DT	ext	1211	2,580 DT	5,027 DT	29240	2.7	25	1	2	4.5
	HAMMAMAM LAGHZAZ						726 DT	5780	1	26		0	0
	HAOUARIA	2	86 DT	1	498	980 DT	2,221 DT	8550	3.4	27		1	0
	SOLIMAN	5	123 DT	1	525	1,010 DT	2,410 DT	18230	2.4	28	1	2.5	4
	KORBOUS	3	101 DT	1	378	964 DT	1,321 DT	3490	0.6	29		1.5	0
	MENZEL BOUZELFA	8	178 DT	1	664	1,158 DT	2,877 DT	13170	2.8	30		4	7.5
	BENI KHALLED						693 DT	8570	0.8	31		0	0
	GROMBALIA	4	113 DT				1,167 DT	14480	2.9	32	1	0	0
	BOU ARGOUB	3	100 DT	1	396	996 DT	1,965 DT	6280	1.7	33	1	1.5	0
	HAMMAMET			ext	4842	5,684 DT	8,224 DT	33150	1.9	34	1	0	301.5
	EL MIDA			1	134	455 DT	850 DT	2890	2	35		0	0
	AZMOUR			1	202	613 DT	1,034 DT	4480	2	36		0	0
	MENZEL HORR						1,190 DT	6240	2	37		0	0
	TAKELSA			1	105	429 DT	533 DT	15140	2	38		0	0
	ZAOUIET DJEDIDI						448 DT	4890	2	39		0	0
	Total	*302*	*2,914 DT*	*12*	*14259*	*24,807 DT*	*55,612 DT*	*329310*	*55*			*151*	550

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Gouvernorat	Centre Onas	OUVRAGES PROJETES									
		CONDUITES					Tissus urbain zones				Station de pompage
		Unitaire	eau usée	pluvial	total	Invest.	tourist.	ind.	urbain		nombre
		ml	ml	ml	ml	mD			Pop/fur	moy +	unité
ZAGHOUAN	ZAGHOUAN		34525		34525	1,544	3	25	45	27	1
	ZRIBA		17865		17865	904			80	20	3
	FAHS		32810		32810	1,608		5	75	20	1
	NADHOUR		11700		11700	576			90	10	
	BIR M'CHERGA		15225		15225	747			90	10	
	Total	0	112125	0	112125	5,379					5
BIZERTE	BIZERTE	4533	57664	12750	74947	6,079	5	30	20	45	10
	ML JEMIL				0			5	50	45	
	ML ABDERRAHMEN				0				50	50	
	EL ALIA		19300		19300	938			70	30	
	RAS JEBEL		24300		24300	1,111		3	70	27	3
	METLINE		12220		12220	740			70	30	2
	RAF RAF		12700		12700	677			50	50	4
	MENZEL BOURGUIBA		58250		58250	3,414		10	40	50	
	SEJNANE		14200		14200	756			60	40	1
	GHAR EL MELH		6800		6800	343			70	30	1
	AOUSJA		7100		7100	391			70	30	
	MATEUR		19850		19850	976		5	55	40	3
	TINJA		23600		23600	1,038			40	60	1
	Total	4533	255984	12750	273267	16,463					25
BEJA	BEJA		63810		63810	2,917		25	30	45	1
	NEFZA		12550		12550	977			70	30	1
	MEDJEZ EL BAB		40000		40000	1,843		5	65	30	
	TESTOUR		22750		22750	1,114			70	30	1
	TEBOURSOUK		25810		25810	1,311		2	80	18	1
	AMDOUN		32200		32200	380			90	10	1
	GOUBELLAT		9000		9000	444			90	10	
	Total	0	206120	0	206120	8,986					5
JENDOUBA	JENDOUBA		72650		72650	3,222		15	30	55	2
	BOU SALEM		56800		56800	2,482		7	56	37	2
	GHARDIMAOU		45605		45605	2,344			70	30	3
	TABARKA		42400		42400	1,923	35	5	25	35	1
	AIN DRAHEM		21345		21345	1,022	15		50	35	
	Total	0	238800	0	238800	10,993					8
LE KEF	LE KEF		57100		57100	2,524		10	50	40	1
	SAKIET SIDI YOUSSEF		15450		15450	701			70	30	1
	TAJEROUINE		33950		33950	1,565			90	10	
	KALAAT SENANE		13450		13450	641			90	10	
	KALAA KHASBA		7400		7400	341			90	10	
	JERISSA		47150		47150	2,100			90	10	1
	DAHMANI		35700		35700	1,873			90	10	
	EL KSOUR		13600		13600	682			90	10	1
	SERS		8800		8800	523			90	10	1
	NEBEUR		9700		9700	497			90	10	2
	MENZEL SALEM		10700		10700	509			90	10	
	TOUIREF		0		0	0			90	10	
	Total	0	253000	0	253000	11,356					7

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Gouvernorat	Centre Onas	OUVRAGES PROJETES puis. KW	Invest. mD	STEP unité	DBO Kg/j	mD	INVEST. TOTAL mD	Population 1990	Taux accrois.	no	Nbr./ centre	Puiss Sp de Transfert pour projeté	Puiss SP de Transfert pour existant
ZAGHOUAN	ZAGHOUAN	3	101 DT	1	1050	1,568 DT	3,213 DT	13320	4.6	39	1	1.5	0
	ZRIBA	8	284 DT	1	447	1,088 DT	2,276 DT	6140	2.6	40	1	4	0
	FAHS	15	188 DT	1	926	1,927 DT	3,723 DT	13170	4	41		7.5	0
	NADHOUR			1	181	566 DT	1,142 DT	3000	3.5	42		0	0
	BIR M'CHERGA			1	356	923 DT	1,670 DT	3360	2	43		0	0
	Total	*26*	*573 DT*	*5*	*2960*	*6,072 DT*	*12,024 DT*	*38990*	*17*			*13*	0
BIZERTE	BIZERTE	*900*	1,420 DT	1	5000	10,000 DT	17,499 DT	110500	2.64	44	1	450	16
	ML JEMIL						0 DT			45	1	0	0
	ML ABDERRAHMEN						0 DT			46	1	0	0
	EL ALIA			1	516	1,284 DT	2,222 DT	11630	2	47		0	0
	RAS JEBEL	6	200 DT	1	839	1,361 DT	2,672 DT	17780	2.1	48	1	3	0
	METLINE	14	274 DT	1	275	765 DT	1,779 DT	5770	1.5	49		7	0
	RAF RAF	18	469 DT	1	384	906 DT	2,052 DT	7970	1.7	50		9	0
	MENZEL BOURGUIBA			1	4619	5,616 DT	9,030 DT	47840	2.4	51	1	0	0
	SEJNANE	3	101 DT	1	207	622 DT	1,479 DT	3390	3.1	52		1.5	0
	GHAR EL MELH	5	123 DT	1	209	627 DT	1,093 DT	4290	1.5	53		2.5	0
	AOUSJA			1	140	471 DT	862 DT	3080	1.8	54		0	0
	MATEUR	6	132 DT	1	1333	1,822 DT	2,930 DT	26340	1.5	55	1	3	0
	TINJA	3	100 DT				1,138 DT	12060	2.5	56	1	0	0
	Total	*955*	*2,819 DT*	*10*	*13522*	*23,474 DT*	*42,756 DT*	*250650*	*23*			*477.5*	0
BEJA	BEJA	2	86 DT				3,003 DT	54130	2.5	57	1	0	0
	NEFZA	5	195 DT	1	270	1,145 DT	2,317 DT	4170	2.6	58		2.5	0
	MEDJEZ EL BAB						1,843 DT	15470	3.5	59	0	0	0
	TESTOUR	2	276 DT	1	565	1,368 DT	2,758 DT	11550	1.9	60		1	0
	TEBOURSOUK	15	188 DT	1	570	1,704 DT	3,203 DT	11170	2.1	61		7.5	0
	AMDOUN	3	101 DT	1	167	532 DT	1,013 DT	3930	1.9	62		1.5	0
	GOUBELLAT			1	148	489 DT	933 DT	2480	1.9	63		0	0
	Total	*27*	*846 DT*	*5*	*1720*	*5,238 DT*	*15,070 DT*	*102900*	*16*			*13.5*	0
JENDOUBA	JENDOUBA	4	175 DT				3,397 DT	39080	3.8	64	1	0	0
	BOU SALEM	70	484 DT	1	1502	2,701 DT	5,667 DT	16890	6.5	65		35	0
	GHARDIMAOU	45	560 DT	1	1013	2,052 DT	4,956 DT	15590	4.3	66		22.5	0
	TABARKA	5	123 DT	1	269	1,094 DT	3,140 DT	12010	4.7	67	1	2.5	0
	AIN DRAHEM			1	952	1,892 DT	2,914 DT	6860	3.5	68		0	0
	Total	*124*	*1,342 DT*	*4*	*3736*	*7,739 DT*	*20,074 DT*	*90430*	*23*			*62*	0
LE KEF	LE KEF	3	100 DT	1	2998	4,389 DT	7,013 DT	41830	3.3	69	1	1.5	0
	SAKIET SIDI YOUSSEF	2	86 DT	1	392	990 DT	1,777 DT	5320	4.1	70		1	0
	TAJEROUINE			1	976	2,000 DT	3,565 DT	16680	4.2	71		0	0
	KALAAT SENANE			1	255	725 DT	1,366 DT	5520	2	72		0	0
	KALAA KHASBA			1	188	581 DT	922 DT	3650	1.4	73		0	0
	JERISSA	4	112 DT	1	730	1,634 DT	3,846 DT	16250	2.4	74		2	0
	DAHMANI			1	848	1,813 DT	3,686 DT	14560	4	75		0	0
	EL KSOUR	2	86 DT	1	283	781 DT	1,549 DT	4880	3	76		1	0
	SERS	2	86 DT	1	278	771 DT	1,380 DT	4100	2.7	77		1	0
	NEBEUR	4	113 DT	1	166	531 DT	1,141 DT	3920	1.9	78		2	0
	MENZEL SALEM			1	162	520 DT	1,029 DT	3920	1.9	79		0	0
	TOUIREF						0 DT	2710	1.9	80		0	0
	Total	*17*	*583 DT*	*11*	*7276*	*14,735 DT*	*27,274 DT*	*123340*	*33*			*8.5*	0

Gouvernorat	Centre	OUVRAGES PROJETES									
		CONDUITES					Tissus urbain zones				Station de pompage
	Onas	Unitaire	eau usée	pluvial	total	Invest.	tourist.	ind.	urbain		nombre
		ml	ml	ml	ml	mD			Pop/rur	moy +	unité
SILIANA	SILIANA		31625		31625	1,385		5	60	35	1
	BOUARADA		19200		19200	867		5	75	20	1
	GAAFOUR		32070		32070	1,525			90	10	1
	LE KRIB		15200		15200	740			90	10	
	BARGOU		16500		16500	750			90	10	
	MAKTHAR		43210		43210	2,042			90	10	3
	ROHIA		8200		8200	377			90	10	
	EL AROUSSA		0		0				90	10	
	KESRA		9700		9700	490			90	10	
	SIDI BOUROUIS		0		0				90	10	
	Total	0	175705	0	175705	8,176					6
KAIROUAN	KAIROUAN		80000		80000	1,073	5	7	35	53	5
	SBIKHA		21600		21600	1,388			90	10	3
	OUESLATIA		14400		14400	917			90	10	
	HAFFOUZ		14000		14000	912			90	10	
	EL ALA		12000		12000	768			90	10	
	SIDI AMOR BOU HAJLA		10200		10200	678			90	10	1
	SIDI ALI NASRALLAH		13000		13000	849			90	10	
	HAJEB AEL AYOUN		19800		19800	1,272			90	10	2
	MENZEL MHIRI		0		0				90	10	
	Total	0	185000	0	185000	7,857					11
KASSERINE	KASSERINE		117860		117860	5,390		10	35	55	
	SBEITLA		18075		18075	818			60	40	1
	SBIBA		17100		17100	795			90	10	2
	THALA		18060		18060	878			70	30	2
	FERIANA		39000		39000	1,794			90	10	
	TELEPTE		0		0				90	10	
	MAJEL BEL ABBES		0		0				90	10	
	JEDLIANE		0		0				90	10	
	FOUSSANA		0		0				90	10	
	HAIDRA		0		0				90	10	
	Total	0	210095	0	210095	9,675					5
SIDI BOUZID	SIDI BOUZID		51050		51050	2,425			50	50	
	JELMA		13100		13100	642			90	10	1
	REGUEB		0		0				90	10	
	MAKNASSY		32400		32400	1,546			90	10	
	BIR EL HFAY		0		0				90	10	
	BEN AOUN		0		0				90	10	
	EL MEZZOUNA		0		0				90	10	
	OULED HAFFOUZ		0		0				90	10	
	Total	0	96550	0	96550	4,613					1

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Gouvernorat	Centre Onas	OUVRAGES PROJETES puis. KW	Invest. mD	STEP unité	DBO Kg/j	mD	INVEST. TOTAL mD	Population 1990	Taux accrois.	no	Nbr./ centre	Puiss Sp de Transfert pour projeté	Puiss SP de Transfert pour existant
SILIANA	SILIANA	2	86 DT	1	1643	2,876 DT	4,347 DT	16700	6.6	81	1	1	0
	BOUARADA	2	86 DT	1	684	1,561 DT	2,514 DT	10490	4.1	82		1	0
	GAAFOUR	12	173 DT	1	577	1,388 DT	3,086 DT	10310	2.3	83		6	0
	LE KRIB			1	328	868 DT	1,608 DT	5660	4.4	84		0	0
	BARGOU			1	251	715 DT	1,465 DT	4110	4.2	85		0	0
	MAKTHAR	36	480 DT	1	779	1,710 DT	4,232 DT	12080	4.1	86		18	0
	ROHIA			1	190	586 DT	963 DT	340	4.8	87		0	0
	EL AROUSSA						0 DT	2370	1.9	88		0	0
	KESRA			1	123	427 DT	917 DT	2760	1.9	89		0	0
	SIDI BOUROUIS						0 DT	4480	1.9	90		0	0
	Total	*52*	*825 DT*	*8*	*4575*	*10,131 DT*	*19,132 DT*	*69300*	*36*			*26*	0
KAIROUAN	KAIROUAN	54	81 DT	1	2667	4,376 DT	5,530 DT	94460	4.6	91	1	27	10.5
	SBIKHA	15	352 DT	1	331	875 DT	2,615 DT	4210	7.3	92		7.5	0
	OUESLATIA			1	378	963 DT	1,880 DT	7910	2.6	93		0	0
	HAFFOUZ			1	345	902 DT	1,814 DT	5090	4	94		0	0
	EL ALA						768 DT	2710	2.5	95		0	0
	SIDI AMOR BOU HAJLA	6	132 DT	1	305	825 DT	1,635 DT	3370	8	96		3	0
	SIDI ALI NASRALLAH			1	242	697 DT	1,546 DT	5170	2.4	97		0	0
	HAJEB AEL AYOUN	42	407 DT	1	434	1,140 DT	2,819 DT	7070	4.9	98		21	0
	MENZEL MHIRI						0 DT	3410	2.2	99		0	0
	Total	*117*	*972 DT*	*7*	*4702*	*9,778 DT*	*18,607 DT*	*133400*	*39*			*58.5*	10.5
KASSERINE	KASSERINE						5,390 DT	60910	5.2	100	1	0	0
	SBEITLA	6	132 DT	1	1067	2,127 DT	3,077 DT	14940	4.6	101	1	3	0
	SBIBA	5	123 DT	1	274	763 DT	1,681 DT	4290	4.7	102		2.5	0
	THALA	7	140 DT	1	777	1,705 DT	2,723 DT	14760	3.4	103		3.5	0
	FERIANA			1	857	1,826 DT	3,620 DT	14700	5.1	104		0	0
	TELEPTE						0 DT	3100	2.2	105		0	0
	MAJEL BEL ABBES						0 DT	2700	2.2	106		0	0
	JEDLIANE						0 DT	2580	2.2	107		0	0
	FOUSSANA						0 DT	2990	2.2	108		0	0
	HAIDRA						0 DT	2450	2.2	109		0	0
	Total	*18*	*395 DT*	*4*	*2975*	*6,421 DT*	*16,491 DT*	*123420*	*34*			*9*	0
SIDI BOUZID	SIDI BOUZID			ext		1,895 DT	4,320 DT	26210	5.3	110	1	0	1
	JELMA	4	137 DT	1	343	898 DT	1,677 DT	4480	7.1	111		2	0
	REGUEB						0 DT	3560	5.6	112		0	0
	MAKNASSY			1	784	1,717 DT	3,263 DT	11040	6.1	113		0	0
	BIR EL HFAY						0 DT	3780	2.2	114		0	0
	BEN AOUN						0 DT	460	2.2	115		0	0
	EL MEZZOUNA						0 DT	3960	2.2	116		0	0
	OULED HAFFOUZ						0 DT	2750	2.2	117		0	0
	Total	*4*	*137 DT*	*2*	*1127*	*4,510 DT*	*9,260 DT*	*56240*	*33*			*2*	1

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Gouvernorat	Centre	OUVRAGES PROJETES									
		CONDUITES					Tissus urbain zones				Station de pompage
	Onas	Unitaire	eau usée	pluvial	total	Invest.	tourist.	ind.	urbain		nombre
		ml	ml	ml	ml	mD			Pop/rur	moy +	unité
SOUSSE	SOUSSE - CITE EZZOUHOUR	19597	91010	44277	154884	6,740	25	10	20	45	3
	HAMMEN SOUSSE				0		40	10	10	40	
	KALAA KEBIRA		45050		45050	2,016			50	50	1
	AKOUDA		18250		18250	1,256			50	50	
	MSAKEN		75000		75000	3,597		5	30	65	1
	KALAA SGHIRA		21900		21900	1,021			50	50	1
	KSIBET THRAYET		14500		14500	712			70	30	2
	HERGLA		18600		18600	996	30		50	20	2
	SIDI BOU ALI		72500		72500	3,312			70	30	
	ENFIDA		18200		18200	868			70	30	
	BOU FICHA		13950		13950	714		5	65	30	
	ZAOUIET SOUSSE		11750		11750	608			70	30	2
	MESSADINE		11000		11000	563			70	30	1
	Total	19597	411710	44277	475584	22,403					13
MONASTIR	MONASTIR		80000		80000	4,016	35	15	15	35	1
	KHENIS		19200		19200	954			50	50	1
	BEMBLA ET MENARA		18000		18000	883			40	60	1
	OUARDANINE		20900		20900	976			60	40	1
	SAHLINE-MOOTMAR		18850		18850	903			60	40	1
	JEMMAL		32750		32750	1,546		5	45	50	
	ZERAMDINE		28850		28850	1,222			50	50	1
	BENI HASSENE		18700		18700	930			70	30	2
	KSIBET MEDIOUNI		19250		19250	914			60	40	2
	BENNENE BOUDHAR		23700		23700	1,141			60	40	1
	TOUZA		18000		18000	854			70	30	
	SAYADA		17600		17600	805		2	50	48	1
	KSSAR HELLAL		73300		73300	3,402			40	60	3
	MOKNINE		32600		32600	1,865		2	40	58	
	TEBOULBA		44400		44400	1,920			60	40	
	BEKALTA		13600		13600	622			60	40	
	LAMTA		10600		10600	480			60	40	
	BOUHJAR		5550		5550	253			60	40	
	SIDI AMEUR		7400		7400	334			60	40	
	ZAOUIET KOUNTECH		5700		5700	262			60	40	
	MENZEL FERSI		0		0				80	20	
	SIDI BENNOUR		0		0				80	20	
	EL GHENADA		0		0				80	20	
	CHERAHIL		0		0				90	10	
	MENZEL ENNOUR		9000		9000	474			90	10	1
	MENZEL KAMEL		17000		17000	936			90	10	1
	EL MAZDOUR		8000		8000	457			90	10	1
	MENZEL HAYET		0		0				90	10	
	AMIRET EL HAJJAJ		0		0				90	10	
	AMIRET EL FOUHOUL		0		0				90	10	
	AMIRET ETTOUAZRA		0		0				90	10	
	Total	0	542950	0	542950	26,149					18

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Gouvernorat	Centre Onas	OUVRAGES PROJETES puis. KW	Invest. mD	STEP unité	DBO Kg/j	mD	INVEST. TOTAL mD	Population 1990	Taux accrois.	no	Nbr./ centre	Puiss Sp de Transfert pour projeté	Puiss SP de Transfert pour existant
SOUSSE	SOUSSE - CITE EZZOUHOUR	*23*	58 DT	1	12000	5,400 DT	12,198 DT	137800	3.11	118	2	11.5	335
	HAMMEN SOUSSE						0 DT			119	1	0	0
	KALAA KEBIRA	2	86 DT				2,102 DT	35850	2.5	120	1	0	0
	AKOUDA			1	2487	3,946 DT	5,202 DT	13140	2.2	121	1	0	0
	MSAKEN	22	218 DT	1	3294	4,632 DT	8,447 DT	50630	3.1	122	1	11	0
	KALAA SGHIRA	2	86 DT	ext	184	516 DT	1,623 DT	14150	2.1	123	1	1	6.5
	KSIBET THRAYET	6	200 DT				912 DT	5350	1.1	124		0	0
	HERGLA	10	160 DT	1	269	752 DT	1,908 DT	24230	3.2	125		5	0
	SIDI BOU ALI			1	1362	2,523 DT	5,835 DT	12430	9.8	126		0	0
	ENFIDA			1	564	1,289 DT	2,157 DT	6940	3.1	127		0	0
	BOU FICHA			1	270	755 DT	1,469 DT	4670	3.8	128		0	0
	ZAOUIET SOUSSE	6	200 DT				808 DT	5110	0.7	129		0	0
	MESSADINE	8	148 DT				711 DT	4410	2.1	130		0	0
	Total	*79*	*1,156 DT*	*7*	*20430*	*19,813 DT*	*43,372 DT*	*314710*	*37*			*39.5*	357.5
MONASTIR	MONASTIR	25	230 DT	1	5346	6,104 DT	10,350 DT	48420	3.9	131	1	12.5	.0
	KHENIS	7	140 DT				1,094 DT	7280	1.7	132		0	0
	BEMBLA ET MENARA	10	160 DT				1,043 DT	8590	2.1	133		0	0
	OUARDANINE	2	86 DT	ext	176	506 DT	1,568 DT	13600	3.3	134	1	1	0
	SAHLINE-MOOTMAR	2	86 DT	1	1894	2,784 DT	3,773 DT	9660	1.5	135	1	1	20
	JEMMAL			1	1991	3,291 DT	4,837 DT	27500	2.5	136	1	0	0
	ZERAMDINE	2	86 DT	1	1033	2,080 DT	3,388 DT	11900	2.8	137	1	1	0
	BENI HASSENE	8	230 DT				1,160 DT	6650	2.7	138		0	0
	KSIBET MEDIOUNI	14	258 DT				1,172 DT	7400	1.3	139		0	0
	BENNENE BOUDHAR	5	123 DT				1,264 DT	8150	1.4	140		0	0
	TOUZA			1	263	741 DT	1,595 DT	5210	3.5	141		0	0
	SAYADA	4	113 DT	1	996	1,494 DT	2,412 DT	9770	1.9	142		2	4.5
	KSSAR HELLAL	42	430 DT				3,832 DT	29120	2.9	143	1	0	0
	MOKNINE			ext	2505	3,046 DT	4,911 DT	35320	1.5	144	1	0	5
	TEBOULBA						1,920 DT	21980	2.5	145		0	0
	BEKALTA						622 DT	12410	2.9	146		0	0
	LAMTA						480 DT	4070	5.1	147		0	0
	BOUHJAR						253 DT	3150	2.1	148		0	0
	SIDI AMEUR						334 DT	3960	2.1	149		0	0
	ZAOUIET KOUNTECH						262 DT	3800	2.1	150	1	0	0
	MENZEL FERSI						0 DT	2260	2.1	151		0	0
	SIDI BENNOUR						0 DT	2880	2.1	152		0	0
	EL GHENADA						0 DT	3950	2.1	153		0	0
	CHERAHIL						0 DT	2860	2.1	154		0	0
	MENZEL ENNOUR	4	115 DT				589 DT	6540	2.1	155		0	0
	MENZEL KAMEL	4	115 DT				1,051 DT	6420	2.1	156		0	0
	EL MAZDOUR	1	66 DT				523 DT	2720	2.1	157		0	0
	MENZEL HAYET						0 DT	7990	2.1	158		0	0
	AMIRET EL HAJJAJ						0 DT	4840	2.1	159		0	0
	AMIRET EL FOUHOUL						0 DT	2860	2.1	160		0	0
	AMIRET ETTOUAZRA						0 DT	3350	2.1	161		0	0
	Total	*130*	*2,238 DT*	*6*	*14204*	*20,046 DT*	*48,433 DT*	*324610*	*73*			*65*	09

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Gouvernorat	Centre	OUVRAGES PROJETES									
		CONDUITES					Tissus urbain zones				Station de pompage
	Onas	Unitaire	eau usée	pluvial	total	Invest.	tourist.	ind.	urbain		nombre
		ml	ml	ml	ml	mD			Pop/rur	moy +	unité
MAHDIA	MAHDIA		66050		66050	3,445	10	15	20	55	1
	KSOUR ESSEF		13000		13000	553			50	50	
	CHEBBA		41500		41500	1,987			60	40	1
	SIDI ALOUANE		0		0				90	10	
	BOU MERDES		6800		6800	326			90	10	
	EL JEM		10600		10600	456			50	50	
	CHORBANE		13500		13500	603			90	10	
	SOUASSI		13600		13600	651			90	10	
	REJICHE		15000		15000	721			60	40	
	KARKAR		0		0				60	40	
	OULED CHAMEKH		0		0				90	10	
	HBIRA		0		0				90	10	
	MELLOULECH		0		0				90	10	
	BRADAA		0		0				90	10	
	Total	0	180050	0	180050	8,742					2
SFAX	SFAX NORD	4993	233870	67593	306456	10,751	1	10	29	60	9
	SFAX VILLE				0		1	9	30	60	
	JEBENIANA		19750		19750	1,057			90	10	1
	HANCHA		14950		14950	790			90	10	
	KERKENA		15800		15800	847			80	20	1
	BIR ALI BEN KHELIFA		0		0				70	30	
	MAHRES		10000		10000	792			90	10	
	AGUEREB		17000		17000	827			90	10	
	MENZEL CHEKER		0		0				90	10	
	SKHIRA		0		0				60	40	
	Total	4993	311370	67593	383956	15,064					11
GAFSA	GAFSA		113700		113700	5,383	3	10	37	50	4
	SENED		17950		17950	927			90	10	
	REDEYEF		47930		47930	2,362		5	80	15	
	METLAOUI		73400		73400	3,604		5	80	15	
	OUM EL ARAIS		36000		36000	1,751		5	80	15	2
	EL GUETAR		33320		33320	1,644			90	10	1
	MDHILLA		24260		24260	1,167		5	90	5	2
	EL KSAR		58200		58200	2,745			90	10	2
	Total	0	404760	0	404760	19,583					11
TOZEUR	TOZEUR		47200		47200	2,181	25	5	45	25	1
	DEGUECHE		21665		21665	1,048			70	30	1
	NEFTA		26600		26600	1,244	25		45	30	1
	HAMMET JERID		15200		15200	809			90	10	
	Total	0	110665	0	110665	5,282					3
KEBILI	KEBILI		44000		44000	2,046	5	5	55	35	
	DOUZ		54700		54700	2,647	5		85	10	
	JEMNA		14600		14600	770			90	10	
	EL GOLAA		19700		19700	996			90	10	1
	SOUK EL AHAD		60600		60600	2,916			90	10	
	Total	0	193600	0	193600	9,375					1

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Gouvernorat	Centre Onas	OUVRAGES PROJETES puis. KW	Invest. mD	STEP unité	DBO Kg/j	mD	INVEST. TOTAL mD	Population 1990	Taux accrois.	no	Nbr./ centre	Puiss Sp de Transfert pour projeté	Puiss SP de Transfert pour existant
MAHDIA	MAHDIA	130	437 DT				3,882 DT	36200	4.1	162	1	0	143.5
	KSOUR ESSEF			ext	697	1,193 DT	1,746 DT	22850	3.1	163		0	4
	CHEBBA	14	190 DT	1	978	2,003 DT	4,180 DT	17330	3.5	164		7	0
	SIDI ALOUANE						0 DT	5090	3.1	165		0	0
	BOU MERDES			1	171	542 DT	868 DT	2880	3.3	166		0	0
	EL JEM			ext	200	521 DT	977 DT	14490	3.1	167	1	0	2.5
	CHORBANE			1	262	738 DT	1,341 DT	5380	1.7	168		0	0
	SOUASSI			1	217	645 DT	1,296 DT	2880	5.6	169		0	0
	REJICHE						721 DT	6670	2.1	170		0	0
	KARKAR						0 DT	4920	2.1	171		0	0
	OULED CHAMEKH						0 DT	4320	2.1	172		0	0
	HBIRA						0 DT	3360	2.1	173		0	0
	MELLOULECH						0 DT	4830	2.1	174		0	0
	BRADAA						0 DT	6820	2.1	175		0	0
	Total	*144*	*627 DT*	*4*	*2525*	*5,642 DT*	*15,011 DT*	*138020*	*40*			*72*	150
SFAX	SFAX NORD	*500*	1,975 DT	1	4000	5,050 DT	17,776 DT	356000	2.5	176	6	250	15
	SFAX VILLE						0 DT			177		0	0
	JEBENIANA	8	145 DT	1	442	1,079 DT	2,281 DT	7160	3.4	178		4	0
	HANCHA			1	297	809 DT	1,599 DT	4010	4.8	179		0	0
	KERKENA	2	100 DT	1	966	1,913 DT	2,860 DT	18840	4.5	180		1	0
	BIR ALI BEN KHELIFA						0 DT	2760	4.7	181		0	0
	MAHRES			ext	743	1,261 DT	2,053 DT	12230	4.3	182		0	5.5
	AGUEREB			1	261	737 DT	1,564 DT	5390	2.1	183		0	0
	MENZEL CHEKER						0 DT	2620	2.1	184		0	0
	SKHIRA						0 DT	4300	2.1	185		0	0
	Total	*510*	*2,220 DT*	*5*	*6709*	*10,849 DT*	*28,133 DT*	*413310*	*31*			*255*	255.5
GAFSA	GAFSA	170	925 DT	ext	2441	3,847 DT	10,155 DT	59520	3.8	186	1	85	30
	SENED			1	207	622 DT	1,549 DT	4530	2.6	187		0	0
	REDEYEF			1	805	1,748 DT	4,110 DT	16450	2.7	188		0	0
	METLAOUI			1	2326	3,799 DT	7,403 DT	38800	4.4	189		0	0
	OUM EL ARAIS	20	311 DT	1	896	1,883 DT	3,945 DT	18330	2.5	190		10	0
	EL GUETAR	3	101 DT	1	549	1,341 DT	3,086 DT	11700	2.4	191		1.5	0
	MDHILLA	18	308 DT	1	510	1,274 DT	2,749 DT	11060	2.2	192		9	0
	EL KSAR	11	255 DT	1	1347	2,503 DT	5,503 DT	22580	4.6	193		5.5	0
	Total	*222*	*1,900 DT*	*7*	*9081*	*17,017 DT*	*38,500 DT*	*182970*	*25*			*111*	30
TOZEUR	TOZEUR	5	123 DT	ext	2070	3,382 DT	5,686 DT	25090	2.8	194	1	2.5	0
	DEGUECHE	5	123 DT	1	341	894 DT	2,065 DT	6580	2.2	195		2.5	0
	NEFTA	2	86 DT	ext	665	1,158 DT	2,488 DT	17440	2.3	196	1	1	15
	HAMMET JERID			1	233	679 DT	1,488 DT	5480	2.2	197		0	0
	Total	*12*	*332 DT*	*2*	*3309*	*6,113 DT*	*11,727 DT*	*54590*	*10*			*6*	15
KEBILI	KEBILI			1	1133	2,218 DT	4,264 DT	16180	4.8	198	1	0	0
	DOUZ			1	1494	2,691 DT	5,338 DT	18090	2.5	199		0	0
	JEMNA			1	201	610 DT	1.380 DT	4600	2.2	200		0	0
	EL GOLAA	4	124 DT				1,120 DT	4380	2.2	201		0	0
	SOUK EL AHAD			1	713	1,606 DT	4,522 DT	16280	2.2	202		0	0
	Total	*4*	*124 DT*	*4*	*3541*	*7,125 DT*	*16,624 DT*	*59530*	*14*			*2*	0

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Gouvernorat	Centre	OUVRAGES PROJETES									
		CONDUITES					Tissus urbain zones				Station de pompage
	Onas	Unitaire	eau usée	pluvial	total	Invest.	tourist.	ind.	urbain		nombre
		ml	ml	ml	ml	mD			Pop/rur	moy +	unité
GABES	GABES(1975) - EL HAMMA(1982)		63885	19935	83820	5,027	1	10	35	54	5
	EL METOUIA		35700		35700	1,721			60	40	
	OUEDDHREF		39550		39550	1,999			80	20	1
	MARETH		23100		23100	1,202			50	50	
	MATMATA		0		0				80	20	
	ZARRAT		18000		18000	882			90	10	1
	Total	0	180235	19935	200170	10,831					7
MEDENINE	MEDENINE		72600		72600	3,955		5	35	60	
	JERBA (ILE)		173500		173500	8,322	80	3	5	12	2
	ZARZIS		152800		152800	6,814	15	10	30	45	3
	BEN GUERDENE		65000		65000	3,064			60	40	
	BENI KHEDACHE		0		0				90	10	
	Total	0	463900	0	463900	22,155					5
TATAOUINE	TATAOUINE		58400		58400	3,079	1	3	45	51	1
	GHOMRASSEN		34760		34760	1,701			80	20	4
	REMADA		0		0				90	10	
	DHEHIBET		0		0				90	10	
	BIR LAHMAR		0		0				90	10	
	Total	0	93160	0	93160	4,780					5
	total	38795	5299192	170494	5,508,481	289,308					173

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Gouvernorat	Centre Onas	OUVRAGES PROJETES puis. KW	Invest. mD	STEP unité	DBO Kg/j	mD	INVEST. TOTAL mD	Population 1990	Taux accrois.	no	Nbr./ centre	Puiss Sp de Transfert pour projeté	Puiss SP de Transfert pour existant
GABES	GABES(1975) - EL HAMMA(1982)	70	330 DT			0 DT	5,357 DT	109000	2.8	203	2	0	0
	EL METOUIA			1	811	1,757 DT	3,478 DT	8060	3.5	204		0	0
	OUEDDHREF	2	103 DT				2,102 DT	9680	1.2	205		0	0
	MARETH			1	595	1,417 DT	2,619 DT	6020	5	206		0	0
	MATMATA						0 DT	5170	4	207		0	0
	ZARRAT	7	168 DT				1,050 DT	3720	2.2	208		0	0
	Total	79	601 DT	2	1406	3,174 DT	14,606 DT	141650	19			39.5	0
MEDENINE	MEDENINE			1	2393	3,860 DT	7,815 DT	33550	4.9	209	1	0	0
	JERBA (ILE)	6	144 DT	2 + ext	885	2,453 DT	10,919 DT	25450	3	210	3	3	24.45
	ZARZIS	47	216 DT	ext	2666	2,779 DT	9,809 DT	58490	3.4	211	1	23.5	3.4
	BEN GUERDENE			1	908	1,901 DT	4,965 DT	11960	4	212		0	0
	BENI KHEDACHE						0 DT	2380	5.1	213		0	0
	Total	53	360 DT	4	6852	10,993 DT	33,508 DT	131830	20			26.5	28.75
TATAOUINE	TATAOUINE	5	148 DT	1	1740	2,995 DT	6,222 DT	33720	2.7	214	1	2.5	0
	GHOMRASSEN	18	551 DT	1	617	1,453 DT	3,705 DT	11950	3.2	215		9	0
	REMADA						0 DT	3590	3.5	216		0	0
	DHEHIBET						0 DT	3540	2.2	217		0	0
	BIR LAHMAR						0 DT	2538	2.2	218		0	0
	Total	23	699 DT	2	2357	4,448 DT	9,927 DT	55338	14			11.5	0
	total	8057	29,620 DT	#VALUE!	197751	288,565 DT	607,493 DT	3134538	589.95		84	4029	2832

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ANNEX C

Experiences of Other Countries with Private Participation in Liquid Waste Services

Private Provision of Liquid Waste Services: A Survey of Selected Countries

1 Introduction

Governments in both industrialized and developing countries are finding it more and more difficult to provide basic services to the satisfaction of their citizens. Where investment costs are high, and public expectations of government performance are great, the gap between supply and demand continues to widen. Such is the case in the liquid waste sector. Investment in wastewater infrastructure is extremely capital intensive and is commonly perceived by both governments and citizens as a public good. According to World Bank data on 29 developing and developed countries, investment in water and wastewater remained constant at approximately 0.4 percent of GDP over the period 1985-1988. At this level of investment, governments will be unable to respond to future demand and are therefore exploring alternative methods for large-scale delivery of liquid waste services.

1.1 Moving Toward the Private Sector

One such method is greater private sector participation in the financing and provision of public services. While both developed and developing countries are choosing to experiment with or employ this method, the reasons for the choice vary. In the industrialized world, the liquid waste sector is characterized by aging facilities, significant central government cutbacks, and rising standards. Municipal governments are therefore looking to the private sector for additional funding sources which can be used to rehabilitate old facilities and bring them up to the new standards.

In developing countries, large increases in urban population, scarce financial resources, and the desire to transform the basic governmental approach are leading toward the exploration of the private sector alternative. Where existing services fall short of user expectations, private sector provision is also seen as a way to improve service quality. Finally, greater participation by private firms is consistent with policy orientations common to many developing countries: development of more discrete accounting functions, increasing cost-recovery by promoting user-pays and polluter-pays policies, introduction of transparent accounting practices in transfers of public monies, and decentralization of investment and operations and maintenance (O&M) of basic infrastructure.

1.2 Cost Comparison

Contracts for the private provision of wastewater services exist in many countries around the world, but at this point there is very little documentation of the results. When cost information is available, extreme caution must exercised in comparing or interpreting the findings. There are several important reasons for this reserved approach. First, accounting systems vary from facility to facility and from country to country. For example, O&M costs for a given sewage treatment plant may or may not include sludge treatment and/or amortization of capital outlays. Second, the size of a sewage treatment plant determines the

degree to which the operator can realize economies of scale. Third, topography, climate, and technology and effluent standards all vary widely from place to place. Finally, indirect administrative costs may or may not be included in the cost analyses. All of these factors make cost comparisons between facilities, regions and countries virtually insignificant.

Measurements of comparative efficiency, however may be more informative. According to the 1992 World Development Report, the number of employees per 1,000 water connections is generally between two and three in Western Europe, and ranges from ten to twenty in most of the Latin American countries.

The following table is a summary of available cost information for a few selected countries.

Table C-1

O&M Costs for Sewage Treatment in Selected Cities

City	Population	With depreciation	With collection	Cost/m3 treated water (US$)
Indianapolis (US)	2,000,000	no	no	.056
Milton Keynes (UK)	300,000	yes	yes	.11
Malmo (Sweden)	300,000	no	no	.094
Beauharnois (Canada)	6,000	no	no	.07
Victoriaville (Canada)	35,000	no	no	.05

Note: Costs include sludge disposal.
Sources: Anglican Water PLC; Proserco, Inc.

1.3 Institutional Arrangements

Despite the difficulty of comparing costs and contracts in different countries, some generalizations can be made about experiences with the private sector to date. With respect to contracting out, the more the contractor is to be held accountable for large-scale maintenance and reparations, the longer the contract period will be and the less contract supervision will be necessary. Shorter contracts, while they tend to promote a competitive environment and help keep bid prices down, generally require more supervision as the operator may be tempted to cut back on costly maintenance activities toward the end of the contract. The additional supervision translates into a greater cost burden to the public entity. Thus, there is often a tradeoff between encouraging a competitive environment on the one hand and minimizing the costs of contract supervision on the other.

With respect to complete privatization, experience has shown that comprehensive regulation and monitoring are necessary to ensure service quality and equitable pricing. The length of contracts of this type also create additional risks for the public entity; during contract periods of 20 years of more, required for amortization of the investment, the governmental entity

may lose its technical capacity to carry out the service itself. This in turn makes the public sector more dependent on the private firm, and weakens the former's position during future negotiations.

2 France

2.1 Background

France was one of the first countries to involve the private sector in water and wastewater management. The 36,000 administrative districts and municipalities of the country have the legal responsibility to manage the 12,000 sanitation facilities, and the authority to choose the appropriate method of operation. Today, 75 percent of the urban population (i.e., more than 40 million inhabitants) is connected to a drinking water system and more than 40 percent benefits from wastewater management services provided by private firms.

Two important characteristics of the French system should be underlined here: first, the French government requires a private operator to present separate and balanced budgets each for potable water management and liquid waste management; and second, all consumers have water meters.

2.2 Moving Toward the Private Sector

There are several criteria which move communities to opt for private sector delivery of liquid waste services:

- Private firms have greater operational flexibility, are more efficient, and therefore more productive.
- Unlike municipal departments, a private firm can set up a contingency fund to cover the costs of large-scale rehabilitation or equipment replacement.
- Private firms are able to recruit and employ more specialized personnel than public agencies, which are often responsible for the provision of many different types of services.
- Private provision is less expensive than public provision in some cases.
- Participation of the private sector in the operation of public services creates a buffer zone between the public sector and the citizenry. In case of problems, the beneficiaries approach the private firm before the public officials.

2.3 Responsibilities of the Private Firm

All tasks related to management, administration, financing, operations, maintenance and billing are assigned to private enterprises. The scope of work varies with the type of contract.

2.4 Institutional Arrangements

Municipalities operate their own facilities either through city departments or financially autonomous agencies. Alternatively, they employ a private firm through a concession, franchising arrangement or service contract.

In a concession, the private firm finances, constructs, and operates the facilities for a period varying between 25 and 30 years. Furthermore, the company generally provides service contact with the public beneficiary, and sees to invoicing and collection of accounts.

In a franchising arrangement (*affermage*), the municipality or administrative district finances and constructs the facilities, then contracts with a firm to operate and maintain the plant. The private operator bills the city for the cost of facility operations, including a profit margin. The city transfers the costs to subscribers, adding in the costs of its own administration (overhead). These contracts usually last no longer than 12 years.

In these two types of contracts, rates are established in the contract between the public and private parties. An indexing formula calculated to include salary increases, and increases in the costs of energy and chemical products generates an annual adjustment in the price of the water or service.

A services contract involves hiring a private firm for some of the tasks associated with the operation of a liquid waste facility. The private company accepts responsibility for personnel costs and, in certain cases, for energy costs and replacement of minor spare parts. The setting of fees and invoicing of customers remains the responsibility of the municipality.

2.5 Cost Comparison

There is very little information available on the service costs of public entities and private firms. Moreover, it is difficult to compare existing data because the service offered and the level of demand differ from one city to another. It is worth noting, however, that private participation does not necessarily bring about a reduction in costs. Many localities have known an increase in costs after transferring responsibility for service delivery to a private firm.

2.6 Constraints

The negotiation process for contracts has for a long time constrained the delegation of sanitation services in France. Until a few years ago, there was great contractual liberty, a condition which led to many contract management problems. The signing of the Anti-Corruption Law in 1993 established a more rigid framework. Municipalities are now required to publish three successive requests for proposals, and to limit the duration of contracts to the period of depreciation in the case of private sector investments. This law also led to the deletion of automatic renewal clauses in contracts, with the objective of encouraging competition.

3 England and Wales

3.1 Background

Private companies have been involved in the provision of water and wastewater services in the United Kingdom for several hundred years. By 1989, 75 percent of these functions was carried out by 10 regional governmental water authorities. The remaining 25 percent of the activity was handled by 29 statutory water companies. The 1989 Water Act privatized the 10 regional authorities, converting them into private water service companies and placing them under a system of regulation based on rate control.

Because water and wastewater utilities are seen to be nearly complete monopolies, the Office of Water Services (OFWAT) was created to regulate the industry, while the National Rivers Authority and the Drinking Water Inspectorate were established to enforce environmental regulation.

3.2 Moving Toward the Private Sector

Four main factors led to the decision to privatize the water and wastewater system in England and Wales. The first was the political climate in England in the 1980s. With the Conservatives in power, there was an ideological inclination to reduce government spending and let the market satisfy needs wherever possible. Second, there was a recognition of the need for an estimated 24 billion pounds investment in water and wastewater infrastructure at a time when government funds were not plentiful. Experts felt that companies would not have been willing to make such large investments if contracts were on a shorter-term basis such as a concession contract. Third, at the time of transition, higher water quality standards were approved, putting into place the requirements set forth in the 1980 European Commission Drinking Water Directive. These standards required substantial investment in more advanced technology. Finally, there was a recognition that there were untenable conflicts of interest in allowing an agency to perform a function and, at the same time, regulate that function itself.

3.3 Responsibilities of the Private Firm

All aspects related to the collection and purification of liquid waste are now being carried out by private companies. Government responsibility is limited to economic and environmental regulation. The change in regulation on dividend control attracted the interest of the French companies Saur, Lyonnaise des Eaux, and Compagnie Générale des Eaux (CGE), who have since actively invested in British water companies. The involvement of large French companies in the provision of water and wastewater activities in England and Wales has enhanced the competitive environment while giving British companies access to technical and financial resources.

In keeping with the intentions of the privatization program, investment in wastewater infrastructure has increased dramatically since 1989. In the 1980s, for example, the capital

expenditure of North Surrey was about 2 million pounds a year compared with a yearly average of 10 million pounds between 1990 and 2000. Experts also report improvements in customer service and water quality since privatization.

3.4 Institutional Arrangements

The legislation allowing the privatization of water and wastewater assets in England and Wales in 1989 stipulated that the private purchasers of the assets would attain a license to provide their services for 25 years. However, the ability of the government to revoke this license is in question because the license holder is the owner and operator of the assets. To revoke the license would mean forcing the current owner to sell the asset to the new licensee. This system is quite different from the different forms of contractual arrangements (concession, franchising, Build-Own-Operate, Build-Operate-Transfer, etc.). Regulation in contractual relationships occurs as a function of specifications in a signed contract for which negotiation and enforcement can occur at the local level. OFWAT, however, is a national body regulating quality, service, and price standards for the entire industry in England and Wales.

3.5 Cost Comparison

OFWAT establishes the prices companies can charge and collect from their customers. Annual price increases are restricted to the retail price index plus an additional factor, K, which is re-evaluated every five years. The goal is to establish rates at which efficient companies have sufficient income to finance their functions but not so much as to be wasteful. The British Parliament decided that limiting prices would be a more effective incentive for efficient operation than regulating the rate of return as is done with public utilities in the United States.

These K factors are reset every five years unless substantial capital investment occurs due to elevated water standards or necessary extensions or rehabilitations. K factors are set for each company by government ministries which examine the relevant economic data. These factors are influenced by two elements related to maintenance: the valuation of the assets and the cost of capital. Efficiency targets are set in relation to both operations and capital expenditure and take into account comparative levels of service. Comparisons between different companies in different locations are made using current cost accounting as a base. This translates the value of all assets employed into a current and common basis.

OFWAT encourages a balance between prices and costs. In establishing a more rational relationship between water and sewer charges, measured and non-measured customers, standing and volumetric charges, it is trying to eliminate cross-subsidizations. As a result of substantial new investments necessary to meet higher standards, debt levels are rising and the increased costs are being passed on to consumers. On the average, sewage prices in the United Kingdom have increased 5 percent per year in real terms since 1989. The number of disconnections for nonpayment is growing and affordability is becoming a problem for some low-income residents who pay 6 percent to 7 percent of their income for water service

instead of the national average of 1 percent to 2 percent. Despite these concerns, the English government has recently ruled that pricing that reflects actual costs is by definition not discriminatory.

Though the calculation of the cost of wastewater purification is a complex matter with many factors greatly affecting the utility of such an exercise, the average cost per m3 of treated effluent in England is $.065 for treatment plants with a capacity of less than one million gallons per day (3,785 m3/day), and $.043 for facilities with a capacity greater than one million gallons per day. These costs represent the expense of operations and maintenance of the wastewater treatment facilities only. The cost of capital, centralized administrative expenses, rehabilitation, and major repairs are not included.

3.6 Constraints

The most fundamental opposition to the privatization model in England and Wales comes from those who believe that wastewater and water are natural monopolies and should remain in the public sector. However, because of OFWAT's insistence that changes in service and price adjustments must be made in conjunction with customers, customer involvement and satisfaction have increased. There is more customer awareness of the need for new investment and greater willingness to share those costs.

4 Canada

4.1 Background

Responsibility for liquid waste collection and treatment in Canada rests at the provincial level and varies greatly from province to province. In Quebec, prior to 1980, liquid waste projects had been undertaken only in the cities of Montreal, Quebec and Ottawa. In that year, a vast liquid waste program was launched in this province of seven million people. To manage the new program, which involved investments of over six billion Canadian dollars, the government of Quebec established a public utility company, the Water and Sanitation Company of Quebec (SQAE[1]). The government subsidized 90 percent of investment costs; municipal governments were responsible for operations and maintenance. The municipalities supervise facility construction, with a support from SQAE in project development. Today, close to 15 years after the start of the program, there are 318 plants in operation in Quebec, handling waste-water product for 65 percent of the population.

In Ontario, the liquid waste program began 10 years earlier. Nearly 50 percent of the plants are operated by a public utility company, the Ontario Co-Water Agency (OCWA). The remaining plants are managed by the municipalities.

[1]La société québecoise d'assainissement des eaux

4.2 Moving Toward the Private Sector

Once construction of the Quebec plants was complete, the municipality had the choice of operating the plant itself, or hiring a specialized firm. Municipal management presents a certain number of problems. On one hand, many municipalities hesitate to hire new employees who, because of union intervention, will gain full employment security, thereby limiting the municipal flexibility. On the other hand, many municipalities have neither the expertise nor the specialized personnel to accomplish such an activity. These conditions contribute to the rising number of treatment plants which are operated by private companies (14 percent of the facilities in the province).

In Ontario, the market for O&M of liquid waste facilities is still closed to private firms. Nevertheless, some enterprises have been hired to manage sludge. Most firms continue to indicate willingness to provide other services for public authorities.

The public utility company OCWA seems to present a conflict of interest in the sense that, at the operating level, it constitutes both the manager and service provider. OCWA manages and distributes among all provincial facilities a liquid waste fund covering 65 percent of the costs associated with the upgrading or replacement of equipment. This conflict could contribute to further delegation of service to the private sector.

4.3 Responsibilities of the Private Firm

In Quebec the wastewater and stormwater systems are managed by the municipalities. Some local governments delegate tasks to private firms such as cleaning manholes, maintaining pumping stations, or inspecting mains. Tasks given to private operators in the treatment plants depend on the type of contract, but may cover the totality of plant activities, i.e. fielding of skilled personnel, supervising and upgrading treatment, laboratory analysis, sludge management, preventative maintenance of equipment, and in some cases repair and replacement of equipment.

4.4 Institutional Arrangements

In all forms of private sector intervention in Canada, the municipality remains owner of the facility. Two types of contracts are currently used in Quebec: franchising and service contracts. In franchising arrangements, the operator takes charge of facility management, operation, and maintenance, and assumes all operations costs. The firm is compensated on the basis of a flat rate established at the beginning of the contract. In the case of a professional services contract, the private operator performs the same work as in a franchising arrangement, but is only responsible for personnel salaries; all other operating costs are approved by the operator, but paid by the municipality. Both types of contracts run for three to five years, and often contain renewal clauses.

4.5 Cost Comparison

Though no precise figures indicate cost advantage when operation of liquid waste facilities is transfered to the private sector, general opinion is that savings due to private participation average five to ten percent. This savings is, however, burdened by the six provincial tax, and seven percent federal tax applied to all service contracts, but which municipalities do not pay when they operate their own plants. The central and provincial governments allow municipalities to recover close to half of these taxes, but there remains a tax burden of about seven percent.

4.6 Constraints

Already familiar with private sector participation in the operation of municipal services, such as collection and recycling of household waste, and management of sludge disposal sites, municipalities and their citizens should find no cause for opposition to further private participation in the liquid waste sector. More important is the question of supervision and reporting mechanisms. In Quebec the government requires a monthly operations report which tracks results of wastewater treatment. The municipality generally delegates contract supervision responsibilities to the Director of Public Works or to a city inspector.

5 United States

5.1 Background

The contracting-out of public services in the United States is becoming increasingly common as the Federal government reduces resources available to municipalities both for the construction of new facilities and for the rehabilitation and extension of existing ones. Among the services for which local governments are seeking alternative methods of provision are wastewater treatment works. It is commonly estimated that in the United States 500-600 wastewater treatment plants with a capacity of 1 million gallons per day or more are currently operated under some form of private contract.

5.2 Moving Toward the Private Sector

The private sector has been involved in municipal wastewater operations in the U.S. since the 1970s, though historically its role has been limited to communities that lack the technical capacity to operate their own facilities. It is only within the last five to seven years that the forms of private sector participation have diversified. Contracting out for O&M is by far the most prevalent form, though deals involving Build-Own-Operate (BOO), Build-Operate-Transfer (BOT) and turnkey arrangements are becoming more common.

There are three fundamental reasons for the general shift toward greater private sector participation in wastewater treatment in the United States. First, federal financing is becoming more and more scarce. The Environmental Protection Agency (EPA) is phasing out its grant program and is now awarding state revolving funds (SRF) for wastewater

treatment. Since the SRF subsidy system for infrastructure development is insufficient, local governments are searching for additional funding. Second, many local governments are close to their legal debt ceilings, and therefore require funding sources that will not push them over the top. Third, water quality standards have become increasingly stringent, requiring the introduction of more advanced technology. These three factors, combined with encouragement from the EPA to develop public-private partnerships, have resulted in increasing private sector involvement in wastewater activities.

5.3 Responsibilities of the Private Firm

Initially, most contracts were service-specific, handling only one aspect of a wastewater treatment plant. Later, companies began to operate and maintain entire wastewater treatment plants and pumping stations. This continues to be the most prevalent scope of work for private firms, although and some companies now manage collection systems, pumping stations and treatment facilities.

Local communities are not as interested in contracting out O&M for sewer networks, since public works departments are already equipped with the necessary personnel and equipment, and since this activity requires neither a high degree of technical expertise nor a large resource base.

5.4 Institutional Arrangements

While contract terms and conditions vary widely, there are elements which occur repeatedly. First, the greater the degree of responsibility and risk the private party is required to assume in the contract (ie, responsibility for the replacement of equipment, major repairs, and change orders during construction), the longer the contract period. One of the key elements in contract negotiations is the degree to which the private party is permitted to pass expenses through to the local government entity. These elements are negotiated project by project and it is difficult to generalize about the terms. However, one nearly universal feature is the continued collection of sewage charges by the local government entity. Fees paid to contractors are often adjusted according to the level of influent and the rate of inflation.

Approximately 50 percent of contracts are negotiated for a period of five years, 30 percent for three years, 20 percent for 10 years. Pumping stations are sometimes contracted out for as little as one year at a time. After contract expiration there is normally a renegotiation for the next period. Ten and twenty year contracts often allow for renegotiation after five year periods. Local governments are given the option to repurchase the facilities at fair market value at the expiration of the contract as well at the time of each renegotiation.

5.5 Cost Comparison

The cost of operations and maintenance and therefore savings to be realized by the local government depend on a number of different factors:

- the previous standard of maintenance of the facility

- the quality of treated water
- the type of sludge treatment, and
- the size of the plant.

Economies generated by contracting out of wastewater facilities vary widely. Common estimates place the savings at between 15 percent and 40 percent, depending on plant size and local circumstances. There are several primary areas of savings. First, in the construction or rehabilitation process, private firms often complete projects in less than half the time required for public agency construction. This can result in the immediate savings of millions of dollars. Second, in the operations in maintenance of wastewater treatment works, savings are realized on a continuous basis. The largest and most common line item for cost savings in plant operations is personnel. Because personnel costs can comprise up to 50 percent of total operations costs, contractors focus on streamlining operations, increasing productivity, and increasing responsibility of workers. Another center of cost reduction for private sector contractors is in the purchase of chemicals. National and international companies have the capacity to purchase chemicals wholesale, negotiating with manufacturers for substantial reductions in prices. Third, the streamlining of operations and introduction of new technology often reduces energy consumption. Finally, a major source of savings can be realized by the kind of maintenance carried out by private operators. Maintenance can be subdivided into two categories: corrective and preventative. Municipalities generally fix things only after they are broken. Corrective maintenance is generally more expensive as problems are only addressed when they become so severe that they endanger the operation of the system. Preventative maintenance anticipates potential breakdowns and seeks to address potential problems before they become manifest. The most common form of preventative maintenance is regular lubrication and greasing of moving parts. It can also include predictive measures such as detailed motor circuit analyses, infra-red scans of circuit controls and other high-technology testing of plant equipment.

An example of cost savings to be realized by operations and maintenance costs before and after contracting out is the Belmont Advanced Wastewater Treatment Plant in Indianapolis, Indiana to JMM Operational Services Inc. As indicated by the chart below, savings over a five year period are on the order of 38 percent.

Table C-2

Savings on O&M: Belmont Advanced Wastewater Treatment Plant (US$ millions)

Operator	Personnel	Utilities	Material & Equipment	Contract Services	Equipment
City	13	5.2	4.2	1.2	.4
Contractor	8.1	3.9	2.7	.4	.2
Savings	4.9	1.3	1.5	.8	.2
Percent Savings	38%	25%	36%	67%	50%

Source: General Waterworks Management and Service Company

5.6 Constraints

The primary constraint on concession agreements in the U.S. is the availability of tax-free municipal bond financing. This financial tool gives municipal governments in the United States an immense advantage over the private sector in financing new construction or rehabilitation of infrastructure.

With respect to service contracts, labor issues have in some cases discouraged municipal governments from looking to the private sector. Where they have explored this possibility, union opposition has in some cases prevented development of the project. Local governments have sought to alleviate this risk by providing for transfers from government employment to private sector employment, imposing city-wide job freezes and then filling the positions with displaced wastewater employees, as well as retraining employees for work in other city departments. The most successful results have been attained when governments work with unions from the moment they begin to investigate the possibility of private sector participation.

6 Mexico

6.1 Background

The liquid waste sector in Mexico is characterized by a high rates of informal connections and low rates of wastewater treatment. Officials estimate that 30 percent of water and sanitation connections in Mexico City are not registered. Data from the 1990 housing census show that only 61 of households are connected to sewer systems. Only 15 percent of collected wastewater is treated. Less than 10 percent of wastewater treatment plants in Mexico are achieving acceptable standards. According to a World Bank study, government subsidies for water and wastewater services in the capital alone amount to 0.6 percent of GDP.

Sewage sector activities in Mexico are the responsibility of the municipality and have traditionally suffered from a lack of technical expertise. Rates have often been influenced by political considerations. There is little coordination between city governments on wastewater policies and practices.

6.2 Moving Toward the Private Sector

The primary goals of engaging private companies in the liquid waste sector are to improve the extent and quality of service and to introduce new technology without increasing the public debt burden. Industry professionals suggest that these gains can occur without substantial increases in user rates by streamlining operations and reducing the number of employees in the wastewater bureaucracy.

6.3 Institutional Arrangements

The Mexican model, developed for drinking water provision in Mexico City, takes the form of a management contract in which the private firm is responsible for operations and maintenance and the government retains ownership of the infrastructure and control over rate setting and collection. Water rights are traded in the open market but the government has created basin authorities to regulate the operators. Contracts have been awarded to four consortia of foreign and domestic firms which operate between 250,000 and 300,000 connections each. The foreign firms present in Mexico include Compagnie Générale des Eaux (France), Lyonnaise des Eaux-Dumex (France), Severn Trent (England), Anglican Water PLC (England) and Northwest Water International Ltd. (England).

As a result of the complexity of the contracts and lack of information on the condition of the collection systems, the contracts will progress in three phases, each phase placing more responsibility on the private company. The first stage consists of installing meters and updating consumer registers. In the second phase, customers will be billed according to their metered consumption. Finally, private companies will carry out rehabilitation and maintenance of the distribution network.

There have also been recent negotiations with companies to establish a turnkey contract for wastewater facilities. The Mexican government is interested in attracting private companies to design, construct, and operate wastewater facilities using private capital exclusively. The long-term goal is to produce a facility which is not only self-supporting, but which can also recover the cost of the capital investment. This strategy for the expansion and improvement of infrastructure with the aid of the private sector complies was originally set forth by various multilateral lending institutions such as the World Bank and the International Monetary Fund. Private sources suggest that with reductions in staffing levels, introduction of new technology and experienced management improved water quality and lower prices are not incompatible.

6.4 Cost Comparison

As no information on private sector service provision has of yet been collected, Cost Comparisons cannot be carried out at this time.

6.5 Constraints

Although private provision of wastewater services in Mexico is still in its infant stages, it is worth noting that no significant labor opposition has appeared thus far. With respect to collection rates, which are historically low and may limit cost recovery by private firms, the contractors are attempting to implement universal metering in order to bill on a measured consumption basis and therefore increase collection revenues.

7 Morocco

7.1 Background

At the beginning of the 1980's, Morocco began to manifest concern for national problems of pollution and protection of the environment. It was not, however, until the end of that decade that the GOM began to generate specific projects to address the problems of wastewater discharge into the sea and rivers.

With the Ministry of Interior in the lead, Morocco developed a Water and Wastewater Master Plan, beginning with Greater Casablanca. This plan undertook the preparation of studies for nine major urban centers: Casablanca, Rabat, Fez, Marrakech, El Jadida, and Kenitra. Other satellite cities were included in the Greater Casablanca area.

In keeping with this effort, other major urban centers with liquid waste collection systems undertook to develop feasibility studies and water and wastewater master plans. The Greater Casablanca Water and Sanitation Project was launched with US$ 50 million financing from the World Bank.

Ten years later, few projects have been completed. This is largely the result of the emphasis on building major infrastructure in Casablanca: an ocean discharge pipeline, 7.3 kilometers long, with no pre-treatment of effluent other than screening and removal of large solids. This work is viewed as a first phase, to be followed in 10 to 15 years, when financing is available, by construction of a treatment plant to serve Casablanca.

Most of the other major urban centers are still in the process of developing their master plans, or seeking necessary funding to begin construction. In the meantime, continued discharge of raw effluent and into the sea and rivers has already caused irreparable damage to the environment. In Fez, heavy-metals from the tanneries contaminate the aquifer, while along the Atlantic coast industrial wastes from the phosphate processing plants have displaced the fish and fouled many miles of beach.

Other problems limit the performance of the liquid waste collection infrastructure. Drains, collectors and other facilities are decayed, and the high number of discharge points will require costly construction of interceptors.

Experimentation to identify appropriate technologies has nevertheless produced several promising results during this period: oxidation ponding for small communities, re-use of treated domestic grey water for irrigation, and fish-farming during appropriate treatment phases, among others.

The primary constraint to progress in the sector is probably a lack of financial resources at the local government level.

7.2 Moving Toward the Private Sector

Faced with funding shortages and lacking the technical expertise required, Morocco has counted on input from the private sector to provide at least a part of the wastewater services its population needs.

Thus the Casablanca wastewater project was built with the financing and technical assistance from a French firm. As to the other projects, they were divided up indiscriminately among numerous engineering firms from different countries, who began to make feasibility studies supported by financial aid from their respective countries of origin. These firms also made pilot studies while awaiting allocation of more substantial funding which might permit the realization of tangible projects.

Currently Morocco is considering the creation of an agency similar to the National Water Bureau (ONEP[2]) for the wastewater sector. In principle, this entity would direct all local government programs; however, because individual citizens are currently unable to pay for this service, the financial viability of such an organization is in question.

7.3 Responsibilities of the Private Sector

Until now the private sector has been responsible primarily for preparation of studies, including the liquid waste master plans; in fact, foreign firms have arrived in country with grants permitting them to undertake studies provided that they receive the implementation contracts. In some instances local governments have financed such studies through loans from the Municipal Development Fund (FEC[3]).

It seems likely that in the future private participation in the liquid waste sector in Morocco will go beyond the level of studies. In particular, BOT (Build-Operate-Transfer)

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[2] *Office nationale de l'eau potable*

[3] *Fonds des Equipements Communs*

arrangements are promising, with the GOM retaining responsibility for relations with the users.

7.4 Institutional Arrangements

Even though Morocco is still in the first stages of developing a true water and sanitation program for the whole of the country, it is already apparent that local governments will be responsible for bringing projects to fruition, under the direction of and with technical support from the Ministry of Interior. Thus, private firms involved in building and operating certain projects should expect to adapt themselves to this structure. Having only one client represents an advantage for the private company.

Morocco seems to be committing itself to a division of responsibilities between the private and public sectors, with the latter maintaining a supervisory role in facility construction and operation.

7.5 Cost Comparisons

Financing the construction and operation of liquid waste installations presents a serious challenge to the semi-autonomous agencies in charge of the potable water distribution systems in urban centers.

ONEP produces 94 percent of drinking water in Morocco. It is nevertheless the municipalities which are responsible for water distribution network O&M. Most cities are scarcely able to recover 75 percent of the costs for water service and are therefore required to subsidize the service.

The fee schedule for drinking water delivery includes an earmarked percentage to cover sanitation services. It seems likely that when sanitation services are further developed this will continue to be the preferable collection method, although other options are being explored in the sewerage master plans.

7.6 Constraints

The Moroccan public sector has been successful in providing drinking water services to the population, and is interested in repeating the experience in the liquid waste sector. Public entities are therefore somewhat reluctant to turn over the responsibility for service provision to private firms unless there is no other way to raise the necessary capital.

8 Cote d'Ivoire

8.1 Background

The water and wastewater sector in Cote d'Ivoire represents one of the most advanced cases of privatization in Africa. SODECI is a joint venture in which the CGE[4], a French company, owns 97 percent of the shares, while the Ivoirian government retains 3 percent. SODECI manages the entire national water distribution network in urban areas and represents the government in relations with users.

SODECI has recently received the mandate to address several problems related to liquid waste management. At this time, the municipalities manage liquid waste systems. Operations and maintenance services are irregular and incomplete, resulting in discharge of raw sewage into the rivers and the Bight of Benin.

8.2 Moving Toward the Private Sector

For future wastewater services, Cote d'Ivoire intends to employ the same strategy it has used in the water sector. Full privatization of wastewater services is therefore likely and will probably involve input from large international firms. The government appears to be satisfied with its relationship with CGE, as exemplified by its recent contract renewal for a thirty year period.

8.3 Responsibilities of the Private Firm

In the water sector, SODECI finances, builds, and manages its water distribution facilities. The agency also collects revenues through a nation-wide system of local collection offices, staffed almost exclusively by women.

To date, no services are provided by private firms in the wastewater sector, although it is likely that the future scope of private sector involvement will be similar to the water sector.

8.4 Cost Comparisons

Since the private sector is not currently involved in service delivery, it is not possible to compare public sector and private sector costs.

8.5 Constraints

There are no major constraints to private sector involvement in the wastewater sector. The government continues to be satisfied with the full privatization arrangement in the water sector, and appears to be will to extend it to wastewater. Unless rates are raised beyond low-

[4]Compagnie générale des eaux

income households' ability to pay, privatization will probably continue to play a role in urban service provision in Cote d'Ivoire.

9 Senegal

9.1 Background

Like many other West African and Sahelian countries, Senegal is looking for both technical and financial resources to address the substantial deficit in water and wastewater services.

Senegal has focused its efforts for the past 20 years on creating an adequate supply of drinking water in urban areas. The national water agency (SONES[5]) has nevertheless only been able to meet part of the demand, largely because of an overall shortage of water in the country.

As a public agency with trained and specialized manpower, SONES has also been given the responsibility for protection and management of groundwater and potable water supplies. Coastal areas, where raw sewage is discharged into the aquifer, pose the greatest difficulty to fulfillment of this mandate.

Only 20 percent of domestic wastewater is treated in Dakar. The only treatment plant is overdesigned and suffers from underfunding and inadequately trained personnel.

9.2 Moving Toward the Private Sector

A regional organization for agencies active in the water sector, UADE[6], has recently presented a series of seminars on the provision of environmental services through the private sector. The seminars have facilitated development of the policies of several countries on the issue of private sector participation. As a seminar participant, Senegal voiced interest in concession arrangements for facility construction and operation, as well as contracting out for O&M. The former formula would allow Senegal to make progress on the wastewater front while it seeks to assemble for reliable revenue generation systems.

9.3 Responsibilities of the Private Firm

Senegal expects to offer the private sector an opportunity to build and operate liquid waste infrastructure in urban areas.

In this scenario, SONES would maintain control over pricing and enforce appropriate standards and performance requirements code. Senegal is therefore exploring various options for the implication of the private sector, but hesitates to go as far as the Ivory Coast where

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[5]La société nationale de l'eau du Sénégal

[6]Union africaine des distributeurs d'eau

potable water supply management is now totally in private sector hands, with wastewater management soon to follow.

9.4 Institutional Arrangements

The institutional arrangements which respond to Senegalese public sector concerns include service contracts, concessions and BOTs. None of these has been used to date.

9.5 Cost Comparison

Since the private sector is not currently involved in service delivery, it is not possible to compare public sector and private sector costs.

9.6 Constraints

The main constraint to private sector involvement in the wastewater sector in Senegal is the poverty of the Senegalese people. The public sector is interested in mobilizing private capital, which by nature seeks a high return on investment. As long as users are unable to pay the full costs of service, and a profit margin as well, the private sector is unlikely to provide new liquid waste facilities.

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ANNEX D

Questionnaire: Private Sector Survey

Etude de marché
Participation du Secteur privé dans le domaine de l'assainissement

Questionnaire
aux Opérateurs Privés potentiels

1. Nom de l'entreprise : _____

_____

2. Date de création : _____

3. Adresse siège social et coordonnées : _____

_____

_____

_____

4. Raison sociale :

( ) S .A.

( ) S. A. R. L.

( ) Personne physique

( ) Autres, prière spécifier :

_____

5. Dirigeants :

Principaux dirigeants	Fonction	Formation	Age	Expérience

6. Capital: _____

7. Répartition du capital: (par nationalité, optionnel)

_____

_____

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8. Capital détenu par : (si vous avez répondu à la question 7, omettez cette question)
   ( ) 100% privé tunisien ( ) 100% étranger
   ( ) majorité tunisienne, minorité étrangère ( ) majorité étrangère, minorité tunisienne

9. Activités principales: (spécifier si vous êtes représentant exclusif de marque)

_____

_____

Autres activités annexes: _____

10. Intérêt dans d'autres sociétés: _____

_____

11. Filiale de: _____

12. Nombre d'employés:
   ..... Cadres dont ..... Ingénieurs
   Ouvriers permanents: ..... Ouvriers temporaires: Minimum ..... Maximum .....

13. Chiffre d'affaire: (dernière année)
   ( ) moins que 1 million DT ( ) entre 5 million DT et 10 million DT
   ( ) entre 1 million DT et 5 million DT ( ) supérieur à 10 million DT

14. Croissance du chiffre d'affaire pendant les 3 dernières année
   ( ) moins de 5% ( ) entre 10 et 20%
   ( ) entre 5 et 10% ( ) supérieur à 20%

15. Liste de votre équipement et matériel roulant: (quantité et valeurs si possible)

Désignation	Nbre d'unités	Valeur estimative

16. Etes vous en contact régulier avec des sociétés étrangères?
    dans votre domaine d'activité ( ) oui ( ) non
    dans d'autres domaines ( ) oui ( ) non

17. Pensez vous que votre entreprise serait éventuellement intéressée par les activités de sous-traitance de l'assainissement:
    réseau ( ) oui ( ) non
    station d'épuration ( ) oui ( ) non

18. Avez-vous eu des relations contractuelles avec l'ONAS dans les activités suivantes:
    - Fournitures ( ) oui ( ) non
    - Travaux ( ) oui ( ) non
    - Etudes ( ) oui ( ) non
    - Autres, spécifiez: _____

19. Etes-vous familier avec le matériel nécessaire pour le service de l'assainissement?
    ( ) oui ( ) non

20. Si vous êtes intéressé par le marché de l'assainissement, votre structure actuelle devra-t-elle subir des changements pour aborder ce secteur ?
    ( ) oui ( ) non
    Si oui, de quelle manière :
    ( ) acquisition de nouveau matériel
    ( ) engagement d'ouvriers spécialisés
    ( ) engagement d'ingénieurs spécialisés
    ( ) création d'une nouvelle société indépendante
    ( ) recyclage des techniciens et ingénieurs existants est suffisant

21. Avez vous visité les 2 dernières années une foire de l'environnement en Tunisie ou à l'étranger ?
    ( ) oui ( ) non
    Si oui, prière spécifier : _____

---

22. Pensez vous que l'obstacle pour un privé pour diversifier dans le domaine de l'assainissement est d'ordre:
    ( ) technique ( ) humain
    ( ) financier ( ) institutionnel (relation avec l'Administration)

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23. En général, vous êtes intéressés d'investir dans des projets dont les critères de rentabilité sont:
    . Taux de rentabilité interne (TRI) de ...
    . Taux de rendement des capitaux propres de ...
    . Marge brute d'exploitation de ...
    . Autres .....

24. Une association avec une entreprise étrangère spécialisée dans le domaine est :
    ( ) inutile ( ) nécessaire ( ) préférable

25. Les formes de contrat que votre entreprise désirerait avoir avec des entités étatiques:
    ( ) Marché de service[1] ( ) Marché de gestion[2]
    ( ) Contruire–opérer–transférer[3] ( ) Autres, prière spécifier :

---

26. Dans le cas de sous–traitance des services d'exploitations des services d'assainissements, quelle formule pour l'équipement serait la plus appropriée:
    ( ) acquisition de nouveaux équipements
    ( ) location du matériel de l'ONAS
    ( ) location avec une option d'achat du matériel de l'ONAS

27. Vous vous intéressez à des contrats de sous–traitance desservants:

. réseaux d'égouts	. station d'épuration
( ) moins de 20 mille habitants	( ) 20 à 50 mille habitants
( ) de 20 à 50 mille habitants	( ) 50 à 100 mille habitants
( ) 50 à 100 mille habitants	( ) plus que 100 mille habitants
( ) plus que 100 mille habitants	

---

[1] sous–traitance de l'exploitation d'un réseau d'égouts ou d'une station d'épuration. La société prend en charge les frais de personnel, le consommable, ainsi que le remplacement des pièces de rechanges de faible importance. Tarification et facturation demeure la responsabilité de l'organisme public

[2] sous–traitance de l'exploitation d'une station d'épuration. La société prend en charge les frais de personnel, le consommable, le remplacement de toutes les pièces de rechanges et le renouvellement des équipements vétustes. Tarification et facturation demeure la responsabilité de l'organisme public

[3] . Construction ou extension d'une station d'épuration ou réseaux d'égouts, et
. l'exploitation et la gestion exclusives pour une durée déterminée, et
. tarification et facturation demeure la responsabilité de l'organisme public, au terme du contrat l'ouvrage est transféré en pleine propriété à l'ONAS.

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28. Les durées de contrat pour de tels services devrait être:
    ( ) moins de 3 ans ( ) entre 5 et 10 ans
    ( ) entre 3 et 5 ans ( ) plus de 10 ans
    ( ) ne sait pas

29. Etes-vous au courant de la tendance de sous-traitance auprès du secteur privé de certaines activités d'assainissement, de services municipaux, ...?
    ( ) non ( ) oui
    Si oui, sources :

30. Avez-vous déjà pris des dispositions ou entamer des démarches pour répondre à la demande potentielle du marché de l'environnement ?
    ( ) contacts avec le Ministère de l'Environnement et/ou l'ONAS
    ( ) études préliminaires de marchés potentiels
    ( ) recherche de financements
    ( ) recherche de partenaires
    ( ) autres dispositions
    ( ) aucune démarche

31. Autres commentaires, suggestions ou remarques : _____

_____

_____

ANNEX E

List of Tunisian Firms Contacted

List of Tunisian Firms Contacted

Company Name	Activity/Capital	Principal Directors	Address	Telephone	Fax
BONNA	Béton Matériaux Préfabriqués 1.600.000D	PDG Radhouane Zouari DC Ben Lassoued Med Moncef	58, ave. Habib Bourguiba 2033 Mégrine	(01) 295-442 (01) 295-353 (01) 295-899 (01) 434-455	433-277
STAS	Assainissement, nettoyage industriel et pétrolier 127.500D	Abdelhamid Zayani	ave. Farhat Hached, Imm. Maless, 3000 Sfax	(04) 225-533 (01) 891-518	
JUGURTHA Manutention	Matériel de protection de l'environnement	DG Mounir Koôli DC Saïda Bazarbacha	78, rue 8600, ZI 2035 La Charguia	(01) 790-901 (01) 794-613	(01) 788-882
INOPLAST	Tubes en PVC, Tuyaux en PE 1.000.000 D	PDG Hachicha Mohsen	68, ave. F. Hached, 1001 Tunis	(01) 341-755	
SEE		Belhassen Hinddaoui	15, rue Med Hlioui, 1004 El Menzah 7	(01) 766-635 (01) 750932	
DALMAS	Matériel de génie civil 170.000D	Moncef Mzabi	2, rue de Thèbes, 2014 Mégrine Riadh	(01) 495-599	
Eurafricaine Bredero	Bâtiment et travaux publics 450.000D	Ben Naceur Abdelaziz	Z.I., 2079 Tunis-Carthage	(01) 234-955	(01) 781-325
SICOMET Ecologie	Matériel de voirie et assainissement 350.000D	Khaled Ben Yahmed	Rte de Mateur, km 7, 2010 La Manouba	(01) 511-267 (01) 510-180	
Ets PARENIN	Machines agricoles et industrielles		91, ave. de Carthage, 1000 Tunis	(01) 519-361 (01) 500-003 (01) 519-137	(01) 504-900
SOGEGAT	Gardiennage et sécurité électronique 1.200.000D	DGA Béchir Lassouad	7, ave. Med Ali Akid, Cité Olympique, BP 48, 1003 Tunis	(01) 783-155	(01) 789-155
MAGRIMEX		Férid Abbas	Z.I. Charguia		
CTR	Gestion industrielle de l'environnement recyclable 50.000D	PDG Fathi M'Barek	28, rue du Liban, 1002 Tunis	(01) 798-671	(01) 798-671
Papeterie du Belvédère	Papiers d'emballage 1.150.000	PDG Ben Ghorbal Naceur DC Ben Ghorbal Néjib	108, ave. Louis Braille, 1002 Tunis	(01) 280-024 (01) 894-614	(01) 785-954
Top Oil Field Services	Assistance technique, conseils et services 10.000D	G Fathi Somrani D Slim Zbidi	17, rue Salem Abou Hajeb, Mutuelleville, 1002 Tunis	(01) 793-818 (01) 793822	(01) 793-814

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Company Name	Activity/Capital	Principal Directors	Address	Telephone	Fax
POULINA	Oeufs, poussins et poulets 1.050.000D	PDG Abdelwaheb Ben Ayed DC Raouf Bouassida	GP 1, km 12, 2034 Ez-Zahra	(01) 482-422	(01) 482-534
Le Moteur Diesel	Camions, tracteurs, mat. agricole 300.000D	Abderrahmen Bouaoudja A. Maniaci	28, rue Kheiriddine Barberousse, 1001 Tunis,	(01) 242-085 (01) 298-820	(01) 354-622
Ets Med Loukil et Cie	Mat. agricole et industriel 1.500.000D	PDG Med Loukil DC Sofienne Enneifer	62, ave. de Carthage, 1000 Tunis	(01) 354-366	(01) 343-401
Tunisie Leasing	Opérations de crédit bail mobilier 10.000.000d	PDG Ahmed Abdelkefi DC Abderrazak Ben Ammar	146, ave. de la Liberté, 1002 Tunis	(01) 788-466	(01) 789-112
Hydromeca	Construction mécanique 700.000D	PDG Béchir Boujdai DC Mohsen Ghédamsi	Rue n°14, La Charguia II, 1080 Tunis CEDEX	(01) 787-422 (01) 788-490	(01) 789-432 (01) 786-252
E.T.H.A.	TP et assainissement 526.000D	PDG Taïeb Ben Ghanem	82, ave. Louis Braille, 1082 Tunis	(01) 281-217	(01) 793-272
SETPAH SAIE	Assainissement, bâtiment 155.000D	PDG Néji Stambouli	39, rue de Jardins, Sidi Rezig, 2033 Mégrine	(01) 299-463	(01) 295-360
SOMATRA-GET	TP, génie civil, travaux maritimes 2.000.000D	PDG Houcine Daboussi DGA Med Kamel Gueddiche	Place Erroussafi, Mutuelleville, BP 69, 1080 Tunis-Cedex	(01) 781-088	(01) 780-717
Spie Batignolles	Montages mécaniques, génie civil 240.890.100FF	Chef d'agence Guioc Yvon	6, rue Masmouda, 1002 Tunis	(01) 284-835	
EGET	TP et hydrauliques 450.000D	Ahmed Fakhfakh	13, ave. Med Hédi Khéfacha, 3000 Sfax	(04) 226-466	(04) 296-357
SEPST	Sablage, métallisation, peinture anticorrosion 200.000D	G Hafedh Chabchoub Co-G Ridha Chabchoub	46, rue Alexandre Dumas, 3000 Sfax	(04) 221-206 (04) 227-355	(04) 229-781
SINAAT	Répandeuses et tankers à bitume, vide fosses 90.000D	PDG Ramchen M. Mustapha DC W.J. Jarrah	16, ave. Taïeb M'hiri, 2014 Mégrine Riadh	(01) 296-381 (01) 297-533	(01) 296-686
SOCEA	Conduites d'eau et assainissement	G Premaillon	86, ave. Mohamed V, 1002 Tunis	(01) 283-266 (01) 283-267	

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Company Name	Activity/Capital	Principal Directors	Address	Telephone	Fax
VIDFOS	Assainissement	G Abdelaziz Fessili	34, rue de Tanger, 2050 Hammam-Lif,	(01) 290-014	
Ent Jerbi			3, rue Yughurta 3060 Mahras	(04) 290-049	
SOTAS			59, ave. Taïeb M'hiri Tunis	(01) 343-227	
SER			21, rue de Kamel	(01) 283-900	
SOTUFEM ATLASCO SEEM		G Laroussi M'zari	km 6.5 Route de Sousse, B.P. 189, Ben Arous 2012, Tunis	(01) 384-100 (01) 380-984 (01) 385-168	(01) 384-105
STIET		D Alibi Abdelkrim	32 bis, rue B. Ghedahem, 1001 Tunis	(01) 348-666	(01) 347-207

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ANNEX F

List of Foreign Firms Contacted

List of Foreign Firms Contacted

Company Name	Address	Fax
Société Québecoise des Eaux	Québec	1 514 873 7879
Scandia Consult	Sweden	46 87 02 1925
Danwaste A/S	Denmark	45 32 66 1881
Waste Management International Services Limited	France	33 1 30 58 72 98
CH2M HILL	U.S.A.	1 503 235 2445
American Anglican Environmental Technologies	U.S.A.	1 609 346 8360
CNC Lavalin	U.S.A.	1 514 876 9273
North Western Water International	U.K.	44 9 25 23 33 60
Kamel Mueller Group	Germany	49 52 84 70 582
OTV	France	33 1 49 04 49 35
Saur	France	33 1 30 60 27 89
Compagnie Générale des Eaux	France	33 1 49 24 69 99
A A B	Germany	49 40 79 24 007
J T Electronics	Germany	49 83 82 79 123
Dégremont	France	33 46 25 65 61

ANNEX G

Questionnaire: Public Sector Survey

Etude des coûts d'exploitation des centres de l'ONAS : Collecte des données

Tab1.Données générales du centre

Population	
Population branchée	
Taux de branchement	
Réseau Eaux usées (ml)	
Réseau Eaux pluviales (ml)	
Boites de branchement	
Nbre Stations de pompage	
Nbre Stations d'épuration	

Tab2. Récapitulatif des charges d'exploitation des stations de pompage du centre (annuel)

Nombre de pompes	
Débit (m3/j)	
Salaires (en DT)	
Energie (en DT)	
Entretien et pièces de rechange (en DT) *	
Dépenses diverses (DT)	
Total des Charges (DT)	

* : y compris coûts de la sous-traitance

Tab3. Charges d'exploitation des stations d'épuration du centre * (annuel)

	STEP 1	STEP2	Ensemble des STEP du centre
Traitement et salaires (DT)			
Entretien (DT)			
Energie électrique (en DT)			
Pièces de rechange(DT)			
Sous-traitance (DT)			
Frais divers (DT)			
Total des Charges (DT)			

* : Si les charges ventilés ne sont pas disponibles au niveau du département, on met le total des charges

Autres données sur les STEP :

	1	2
DBO éliminé (kg /jour)		
Débit moyen (m3/jour)		

Tab4. Charges d'exploitation du centre (annuel) (uniquement pour le réseau)
(non compris les charges des stations d'épuration et de pompage)

Frais de personnel	
Transport et déplacement	
TFSE	
Pièces de rechange et S/T *	
Biens consommés	
Matières consommables	
Frais divers de production	
Total des charges	

* : relatifs au matériel propre du centre et disponibles au niveau de la division maintenance

Ce tableau (Tab4) doit être rempli par le responsable du budget au département avec l'assistance du chef de centre concerné et le chef de la division maintenance

Tab5-1. Liste des engins du district communs à tous les centres et leur utilisation par le centre étudié :

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Type	% d'utilisation

Ce tableau (Tab5-1) peut être rempli avec l'assistance du chef de district

Tab5-2. Coûts des pièces de rechange et de la sous-traitance extérieure des engins communs

Type	Coûts (en DT)

Tab6. Répartition du temps d'équipe de la division maintenance entre les différents centres

Temps total de l'équipe de maintenance (en h) :
* Matériel : .....h
* STEP : .....h
* Stations de pompage : .....h
Coût horaire moyen (DT/h) : .....

	Centre1	Centre2	Centre3	Centre4	Centre5	Centre6	Centre 7
% temps							

Tab7. Données du département

Nombre total d'abonnés :
Réseau eaux usées (ml) :
Réseau eaux pluviales (ml) :
Total réseau :

Frais du personnel affecté au département (en DT / an) :

Division maintenance	
Personnel administratif de la DEX	
Division administrative	
Direction Etudes et travaux *	
Laboratoire régional	

* : pour la Dir. Etudes et travaux donner la part des frais de personnel ayant intervenu au niveau de l'exploitation.

**** Assurances et taxes relatives au centre (en DT/an)***

STEP	
Stations de pompage	
réseaux	
matériel	
Bâtiment	

Tab8. Données du district
Frais de personnel affecté au district (en DT/an .....

Les tableaux 6 et 7 doivent être remplis par le responsable du budget au département avec l'assistance du chef de la division de maintenance et le chef de la division administrative

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ANNEX H

Liquid Waste Subsidies in Tunisia

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Note on Liquid Waste Subsidies

1 Liquid Waste Treatment Subsidies

1.1 Introduction

The extraordinary development of liquid waste services during the last decade can be seen in several indicators:

Table H-1
Development of Liquid Waste Services

	End of 6th Plan (1986)	End of 7th Plan (1991)	2nd Year of 8th Plan (1993)	Forecast, End of 8th Plan
Population connected (thousands of inhabitants)	2,280	2,700	2,870	3,500
Rate of connection in relation to urban population (%)	41	56	57	62
Volume of waste treated (millions of m^3)	61	90	100	115

In addition, investment in the sector (excluding ONAS) was 129 million Tunisian dinars (TD) for the seventh plan, and appear to be 195 million TD (wastewater) during the eighth plan. These few indicators show how intense the investment has been, with the result that liquid waste treatment costs have risen substantially, calling for a higher level of subsidies.

1.2 Operating Resources

The balance between total operating costs (including the financial costs generated by investments on one hand and depreciation on the other) and ONAS's current resources is achieved by means of two categories of subsidies: compensatory revenues and the share of the Local Development Fund (FCCL[1]) allotted to ONAS.

1.2.1 Rate Income

Pricing is established by differentiating among segments (or usage): domestic, industrial and tourism. In addition, it has two components: a fixed component (an set amount per user, per quarter) and a variable component proportional to water consumption.

[1] *Le Fonds Commun des Collectivités Locales.*

- For domestic usage, pricing is graduated for both the fixed and variable components, ranging from 6 millimes/m^3 for the lower segment to 290 millimes/m^3 for the upper segment (>150 m^3).
- For industrial usage, pricing is uniform for the volume of water, but varies from 290 to 450 millimes/m^3 on the basis of the wastewater quality.
- Uniform pricing is applied for tourism usage; the current level is 545 millimes/m^3.

The following two tables illustrate the development of the rates applied and the resulting total income.

Table H-2
Rate Development

Description		12/27/1986		7/26/1988		10/10/1989		10/18/1990		10/16/1991		12/15/1992		4/15/1994		Average Development for the Period (%)	
		Fixed TD/qrt.	Variable thous. m^3	Fixed TD/qrt.	Variable thous. m^3	Fixed TD/qrt.	Variable thous. m^3	Fixed TD/qrt.	Variable thous. m^3	Fixed TD/qrt.	Variable thous. m^3	Fixed TD/qrt.	Variable thous. m^3	Fixed TD/qrt.	Variable thous. m^3	Fixed TD/qrt.	Variable thous. m^3
Domestic Usage	Segment m^3/qrt. 0-20	0.85		1.05	5	1.05	5	1.22	6	1.31	6	1.31	6	1.31	6	6.1	
	21-40	0.85	30	1.05	45	1.05	45	1.22	50	1.31	60	1.31	60	1.31	60	6.1	10
	41-70	1.60	65	1.70	73	1.95	85	2.24	98	2.58	112	2.84	123	3.12	135	9.6	10.5
	71-150	2.80	105	3.05	130	3.50	152	4.03	175	4.05	200	6.35	230	5.90	265	10.2	13.5
	>150	2.90	105	3.05	130	3.50	152	4.03	175	4.65	210	5.35	252	5.90	290	10.2	14.9
Industrial Usage	Low Pollution	2.90	105	3.05	130	3.50	152	4.03	175	4.65	210	5.35	252	5.90	290	10.2	14.9
	Medium Pollution	2.90	140	3.05	170	3.50	200	4.03	230	4.65	265	5.35	321	5.90	385	10.2	14.9
	High Pollution	2.90	170	3.05	200	3.50	235	4.03	270	4.65	310	5.35	375	5.90	460	10.2	14.3
Tourism Usage		2.90	2.00	3.05	240	3.50	280	4.03	322	4.65	370	6.35	451	5.90	545	10.2	14.7

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Table H-3
Development of Rates by Usage (TD millions)

	1986	1989	1990	1991	1992	1993	Average Rate of Development (%)
Domestic Usage	7.200	8.800	9.300	10.800	13.000	15.600	16.7
Industrial (Low Pollution)	0.250	0.290	0.470	0.700	1.100	1.300	39.0
Industrial (Medium Pollution)	0.420	0.555	0.630	0.800	1.100	1.400	27.2
Industrial (High Pollution)	0.830	1.060	1.600	2.200	2.600	3.400	32.6
Total Industrial	1.500	1.900	2.700	3.700	4.800	6.100	32.4
Tourism Usage	1.600	2.100	2.900	3.000	4.400	5.500	28.0
TOTAL	10.300	12.800	15.000	17.000	22.200	27.200	21.4

1.2.2 Operating Subsidies

Historically, the two subsidies cited above were created to balance ONAS's operating budget, due to the insufficient level of income:

- **The share of the FCCL allotted to ONAS.** Since ONAS took over the public function of wastewater treatment, which was previously the responsibility of the local governments, it is natural that ONAS should draw on this fund. At approximately 8 percent of the FCCL, this share has developed along with the fund, the overall size of which has been set annually by the budget since 1987 (its size was formerly calculated on the basis of a certain share of government tax income).
- **Compensatory revenues.** This subsidy balances out the ONAS budget, and is calculated by applying a fixed rate to the volume of water consumed by ONAS' users. This rate has long remained at 40 millimes/m^3.

Table H-4
O&M Subsidies (DT millions)

	1991	1992	1993
Compensatory Revenues	5,520	6,795	7,650
Share of FCCL	5,384	7,680	8,000
Total	10,904	14,475	15,650

1.3 Budget Balance Sheet (Operations)

The following table summarizes ONAS's operating result for the past 3 years. In particular, it shows a rate of cost coverage by revenues of 65 percent with a slight rising tendency of 1.3 percent/year; this can be explained by price increases in excess of subsidy increases.

Table H-5
Operating Account (1991-1993)

	1991	1992	1993
Expenses			
Personnel costs	11,147	13,201	15,696
Raw materials and consumables	4,258	5,132	5,371
TFSE	7,274	5,479	5,564
Taxes and Fees	330	414	553
Financial and operating costs	73	93	364
Misc.	401	563	637
Total expenses	**23,483**	**24,900**	**28,185**
Revenue			
Rates	17,443	22,173	27,208
Construction	3,965	1,978	1,903
Services rendered	700	798	1,012
Misc. assets	2,025	2,279	2,092
Income subsidy	5,520	6,795	7,650
Share of Pool	5,384	7,680	8,000
Net Operating Income	**11,554**	**16,803**	**19,680**
Financing costs	2,968	3,091	3,970
Depreciation	9,600	12,330	14,190
Reserve funds	1,339	1,257	2,597
Financial assets	412	480	613
Net Result	1,941	665	464
Revenue - subsidies / Expenses	64.5%	65.5%	65.8%

1.4 Investment Financing

With one-third the operating budget balance dependent on subsidies, it is clear that the capacity for self-financing is very limited. Thus, investments are essentially financed by the government (around 60 percent), as are outside loans (39 percent for the entire period up to 1990).

2 The Goal of the Subsidies

This complex aspect can perhaps best be approached by asking several questions:

- do the subsidies reach the low-income users in particular?
- does the pricing policy conform to the principle of users paying based on the real cost of their wastewater treatment service?
- does the pricing policy conform to the polluter→payer principle?

It is difficult to answer these questions within the framework of this study. Nevertheless, some light can be shed on the essential elements that can affect privatization policy, or more precisely the policy of subcontracting many activities to the private sector, which is the focus of this study.

2.1 Costs and Subsidies According to Usage

Investigations into costs carried out during this study have shown significant variation among cities in terms of activities, existing urban fabric, etc. Some of these phenomena can be highlighted by examining the following table, taken from the 1994 operating accounts (ONAS forecasts).

Table H-6
Provisional Operating Account (1994)

	Unit	Tunis	Northeast	Northwest
Population				
Municipalities in jurisdiction		20	22	6
Population in jurisdiction	'000s	1,560	570	205
Population connected	'000s	1,440	410	185
Users and volumes of water				
Number of users		227,000	98,000	30,000
Volume of water consumed	m^3 '000s	68.2	29.0	7.1
Volume of water treated	m^3 '000s	52.0	20.0	3.0
Expenses (TD '000s)		**20,107**	**6,921**	**3,646**
Personnel costs		6,650	2,650	1,750
Electricity		1,100	700	400
Services consumed		796	361	249
Goods consumed		1,391	800	617
Financing charges		2,000	650	380
Depreciation and reserve funds		8,170	1,760	250
Revenue (TD '000s)		**22,258**	**9,568**	**2,466**
Rates		13,297	5,641	1,385
Other revenues excl. subsid.		1,550	775	308
Compensatory revenues		3,741	1,595	391
Result (in thousands of TD)		**2,151**	**2,647**	**-1,180**
Ratios				
1. Revenues/costs		66.1%	81.5%	38.0%
2. Assets before subsidies/costs		73.8%	92.7%	46.4%
3. Compensatory revenues/user	(TD/user)	0.016	0.016	0.013
4. Compensatory revenues/m^3 of	(TD/m^3)	0.055	0.055	0.055
water consumed	(TD/m^3)	0.218	0.221	0.238
5. Assets before subsidies/m^3 of	(TD/m^3)	0.195	0.195	0.195
water consumed				
6. Revenues/m^3 of water consumed				

This table lists several sets of data for three different regions: Tunis, the Northeast and the Northwest.

Some characteristics can be discerned:

- First, cost coverage by assets other than revenues appears to be significantly higher in the Northeast, followed by Tunis. This could be the result of several elements working together:
  - The presence of high-revenue-contributing sectors (tourism in the Northeast, industry, and, to a lesser degree, industry in Tunis);
  - A high percentage of upper-segment domestic users (due to income);
  - A higher rate structure in the Northwest.

  This last explanation appears the most likely (this could have to do with the economies of scale that have a greater effect in Tunis and in the Northeast).
- It follows that the necessary subsidy levels will continue to increase from the Northwest to Tunis and the Northeast (the compensatory revenues/total cost ratio in the table is not significant, since, in reality, surplus regions such as Tunis and the Northeast contribute to balancing out regions with shortfalls);
- It can also be seen—and this almost seems to be a paradox—that areas with a lower level of service on average (as in the Northwest) have higher subsidies.

Without drawing definitive conclusions from this brief analysis based on a single (forecasted) year of operation by ONAS (the high operating cost figure for the Northwest requires particular explanation), it is nevertheless clear that wastewater treatment revenues seem to do a better job of covering costs in regions where there is a higher level of service, which could lend credence to the idea that the current pricing does not particularly favor areas with better wastewater treatment, and, in particular, industrial and tourism usage pricing would not fall within the apparent costs borne by ONAS.

2.2 Cost and Subsidies for Domestic Usage

The high degree of correlation assumed to exist between consumption segment and household income is at the root of ONAS' pricing for this usage. In this regard, and on the basis of the schedule in force, a graduated pricing level exerting modest pressure on low-income households can be observed.

3 Foreseeable Development

Generally speaking, the overall development for the period of the eighth plan (outlined by the updated eighth plan document) shows the following large-scale tendencies:

- Revenues: a rate of development of 15 percent per year;
- Compensatory revenues: a rate of development of 10.1 percent per year;
- Pool: a rate of development of 6 percent per year;
- Total cost coverage by revenues rising from 65 percent at the start of the plan to 72 percent at the end of the eighth plan.

With regard to investment, ONAS's own outlay is predicted to be on the order of 11 percent (the government's outlay will exceed 55 percent, compared with 60 percent in the past, and outside financing will drop to 32 percent, compared with 39 percent before).

4 Conclusions and Recommendations

Thus, the pricing/subsidy system operates according to several principles:

- A domestic usage measurement structure that penalizes heavy consumers and favors light consumers, whom are usually believed to be low-income households;
- Uniformity for other usages, with a pricing level well above the domestic usage level;
- Spatial and geographical uniformity, ensuring equal distribution among areas with low wastewater treatment costs and those with higher ones.

The following chief conclusions/recommendations can be offered:

- The pricing principles are aimed at achieving social goals and equal distribution. This system does not appear to produce major dysfunction. Further development in the following areas would nevertheless be useful (through the pricing studies currently planned by ONAS/IBRD or other studies):
  - Awareness of actual costs based on usage, zones, network configuration, etc.
  - Through user surveys, an awareness of the relationship between consumption levels (the pricing basis for domestic users) and income, for the purpose of evaluating the option of modulating pricing according to water consumption segment;
  - Determining allowable pricing limits for the various sectors of the economy (tourism and industry), with the awareness that very high levels can exert unbearable pressure on these sectors' costs.
- The average pricing level does not allow costs and revenues to balance in the short term. Efforts made during the eighth plan will result in some improvement, but they must be followed up on. This is a particularly important aspect to consider in moving forward with the privatization policy. In fact, this policy will have a better chance of success with an operator (ONAS) progressively moving toward autonomously balancing its operating budget, and thus increasingly less dependent on compensatory subsidies.
- The strategy of using private sector services can make it possible to partially reabsorb the deficit, as a result of the overall savings that can be achieved (cf. financial analyses).
- The choice to retain the operator ONAS in its role of managing the public wastewater treatment service took several factors into account:
  - This service will probably continue to require subsidies in the mid-term, rendering complete privatization, as well as concession, ineffective;
  - The pricing policy (with its social and equal distribution goals) does not permit real prices to be strictly applied;
  - It provides a satisfactory level of coverage, on which the private sector will not be able to substantially improve.

ANNEX I

List of Persons Contacted

List of Persons Contacted

Ministry of the Environment and Regional Planning

Mr. Ayed Faiez	Chief of Cabinet
Ms. Benzarti	Cabinet Member

ONAS

Mr. Ganoun	General Manager
Mr. Hajali	Department of Development
Mr. Daoud	Department of Development, Technical Studies Division
Mr. Abid	Department of Development, Planning and Statistics Division
Mr. Aniba	Department of Development
Mr. Hadouala	Finance Division
Mr. Rizghy	Legal Division
Mr. Ben Saad	Technical Studies Division
Mr. Trabelsi	Market Division
Mr. S. Ben Messaoud	Station Chief, Choutrana
Mr. Nejib Ben Mabrouk	Station Chief, Hammamet
Mr. Nacem B. Mabrouk	District Chief (maintenance), Hammamet
Mr. Ben Ottman Kamel	Chief of Operations, Hammamet
Mr. Faycal Bennia	District Chief, Hammamet
Mr. Mr. Ladiri	District Chief, Kairouan

Municipality of Haouaria

Mr. Bousaq	Municipal Vice-President
Mr. Korkad	Technical Services
Mr. Tebib	Technical Services

Municipality of Hergla

Mr. Touati	Secretary General
Mr. Kechiche	Technical Services

Private Firms

Mr. Akremi Ikbal Mohamed	Business Affairs, Jugurtha Manutention
Mr. Khemira Kamel	Engineer, Jugurtha Manutention
Mr. Kooli Mounir	Chief Executive Officer, Jugurtha Manutention
Mr. Fethi Hachicha	Chief Executive Officer, Inoplast
Mr. Mohamed Tahar Essid	Public Relations Director, Green Crescent
Mr. Belhassen Hendaoui	Chief Executive Officer, SEE International
Mr. Béchir Ben Mansour	Engineer, SEE International
Mr. Radhouane Zouari	President, BONNA
Mr. Abdelhamid Zayani	President, STAS
Mr. Taieb Ben Ghanem	President, ETHA
Mr. Jerbi	President, Entreprise Jerbi

ANNEX J

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ANNEX K

Terms of Reference

Terms of Reference

Article I. Objective and background

In August 1993, the Government of Tunisia and USAID signed the capital and grant assistance agreements for the Private Participation in Environmental Services (PPES) program. In addition to budget support for GOT programs in this field, the program provides grant funding for technical assistance which will facilitate increased private sector involvement in the financing and delivery of services related to liquid waste, solid waste and land development. Within the context of that technical assistance, the objective of the present contract is to procure the services of specialists for the preparation of a market study on private sector involvement in the liquid waste sector.

Recent policy trends in the Tunisian public sector reveal a commitment to increase private sector participation in liquid waste services. Until now, the main impediment to this activity has been insufficient knowledge of the market and the opportunities it offers. This study will quantify market potential and identify financially viable operations for both public and private sector actors. The research will also supply the basic information needed for drafting the national privatization strategy; in establishing the overall direction and pace of privatization efforts, this strategy will demonstrate to private sector firms that the market is substantial and permanent.

Article II. Tasks and responsibilities

The contractor will prepare a study to define and quantify the potential markets for private sector intervention in the liquid waste sector. To that end, it is important to determine the size and nature of the market along with its development over time. The study will be conducted nationally and will focus specifically on the following areas of intervention:

1. Sub-contracting sewerage system operations and maintenance;
2. Sub-contracting sewage treatment plant operations and maintenance;
3. Sub-contracting operations and maintenance of non-traditional liquid waste systems;
4. Franchise arrangements for sewerage systems;
5. Franchise arrangements for sewage treatment plants.

The contractor will initially gather information on the experiences of other countries with increasing private sector participation in the liquid waste sector. The experiences of industrialized countries (specifically the United States, France, and Great Britain) and developing countries will be taken into account. The contractor will identify the relevant areas of intervention, financing mechanisms, institutional structures, and primary constraints. The information will influence the design of service models (see below) and will be included in an annex to the market study.

For each area of intervention above, the contractor will supply detailed information on the following:

- Types of activities to be privatized by ONAS in all five sub-sectors listed above. The contractor will specify the degree of sub-contracting (complete, partial, etc.). With respect to treatment plants, this will depend largely on which party covers the costs of the various inputs: energy, chemicals, major and minor repairs, manpower, etc. For system O & M, the contractor will endeavor to develop options for equipment acquisition by future sub-contractors.
- Service delivery models to be defined by type of activity, type of technology, density, and urban form. Each model will be representative of a set of conditions prevalent in Tunisian cities and/or towns.
- Current cost of service. The contractor will make a survey of relevant public entities in Tunisia, analyze the expenses of each, and establish representative current costs for each of the service delivery models.
- Break-even points and conditions for viability for private sector firms. These will be defined for each service model. Cash flow analyses will highlight the profits a private operator can expect to make in each of the sub-sectors mentioned above. The pro formas will also establish the initial and ongoing investment costs for equipment, materials, energy, etc. For each sub-sector, the experts will estimate the minimum length of contract which would attract private sector operators. The possibility of dividing or combining existing administrative jurisdictions will be reviewed.
- Ceilings and financial feasibility conditions for the public sector. The contractor will calculate the estimated rates of cost reduction related to the improved efficiency and performance of private firms. A comparison of costs and current levels of service with future costs and service levels will establish the conditions under which public agencies would be interested in sub-contracting or granting franchises.
- Identification of private firms. The contractors will identify ways to encourage the formation of private firms, whether Tunisian, foreign or joint ventures. The types of existing Tunisian companies capable of start-up activities in the different areas of intervention will be identified. The contractor will suggest measures for increasing their involvement and fostering competition.
- Aggregate size of the national market, defined as the sum of the markets of the sub-sectors. For each sub-sector, the contractor will develop a graph showing the size of the market over a ten year period. The contractor will determine base values and then construct three scenarios, based on different sets of hypotheses, which will inform rates of market growth. The hypotheses will include, but not be limited to, the formation and growth rates of private companies and the rate of project identification and preparation (including requests for proposals) of public entities. Finally, the contractor will represent in graph form the total national market (three scenarios) by combining the values developed for each sub-sector.

Article III: Reports and documents to be submitted

After defining the service modules, the contractor will submit them in report form to the relevant Tunisian entities and USAID. Once the report has been approved, the contractor will prepare a draft study to be submitted to the same parties. Upon approval of the draft, the contractor will prepare a final version to be submitted to the relevant Tunisian entities and USAID.