



Ilha de
Moçambique

World Heritage
Site

A programme for

Sustainable
Human
Development

and

Integral
Conservation

Interregional Project on Historical Cities'
Conservation, Development and
Management Programme (Int/tss2/sta)



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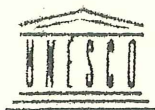
Volume II-B

Water/Sanitation/
Environment

By: P.H. van Beers (NL)
Nelson Matshine (MOZ)
Consultants

STS/UNDP/UNESCO Project
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INTRODUCTION

In the Nampula Province, the district of Ilha de Mozambique covers an area of approximately 245 km² and comprises the "Ilha de Mozambique" with 3 smaller uninhabited islands and the Lumbo locality covering the adjacent coastal strip on the mainland..

The island was the first settlement of the Portuguese colonial Government (1507-1898) but over the centuries the island lost gradually its importance as a Center of administration and commerce. While the Portuguese Administration was moved to capital Maputo (Former Lourenço Marques), other economic centers in the region gradually emerged, such as the Port of Nacala with a railway linking the port of Nacala to the Provincial Capital Nampula and beyond. The stagnating economy due to the civil war caused a further deterioration of the physical and social - economic structure of the island. Presently, the economic and infrastructure base of the island is still in a precarious condition.

With the Independence of Mozambique in 1974, most Portuguese and their descendants left the Ilha. Their belongings and houses were confiscated and many abandoned buildings in the north were occupied by local inhabitants who paid little or no rent to the State owner. Lack of funds of the occupants as well of the Government that had other priorities, started a process of disrepair and degradation of most buildings. This degradation was accelerated when many roofs were blown off when a Cyclone hit the island in 1994.

The Island has about 12.000 inhabitants, which is estimated to be 3 to - 4000 more than the Island's stipulated capacity. This rise in population of the Island is mainly due to an influx of people during the civil war in the eighties of which many remained on the island.

The island is about 3 km long and about 500 m at its widest point. The urban area of the Island gradually changes from the north to the south. In the north the "Stone City" with the fort ("Fortaleza") was the former Center of administration and commercial activities.

The Machete area, or the city of straw ("Macuti City") is located in the south and has been founded later in time. It came about spontaneously at the end of the 19th century and it is exclusively residential with some emerging commercial activities. It represents about 30% of the total area of the island. The Macuti City can be subdivided into a low lying central part ("Lower" Macuti City) with small dwellings of simple construction that occupies several large depressions of excavated land and the "Outer" Macuti City, with mainly stone build buildings.

In 1982, the Ilha de Mozambique was inscribed in the World Heritage List and in 1987 an UNESCO mission formulated a Programme for Sustainable Human Development and Integral Conservation of the island. In July 1998 the presently reporting follow-up mission with a multidisciplinary team of National and International Consultants and representatives of the concerned Ministries took place and visited the island. The main objective of this mission was to evaluate the existing situation and to identify projects and priority areas of intervention in view of a sustainable development of the island, that includes the conservation of the cultural heritage for mankind. The mission was composed of specialists in Project Formulation, Urban Planning, Urban Economy, Tourist Development, Heritage Legislation and Water & Sanitation and Environment.

This report presents the conclusions, recommendations and several proposed "project files" by the Water, Sanitation and Environmental evaluation of this mission.

The evaluation consisted in consulting relevant documentation, interviews with representatives of Governmental and Non-Governmental Organizations on the island as well as on a central level in Maputo, with individuals and on-site observations during a four days stay at the island.

1. STATE OF THE ART

1.1 Water Supply, the modern piped water supply system

The water supply of the Ilha is provided by three different systems:

1. The “modern” system with distribution by pipes
2. The “traditional” system with rainwater stored in generally small private cistern’s or in large cistern’s (e.g. in the Fort, warehouses, hospital, etc.)

The main water supply source for the Ilha de Mozambique (further to be referred to as “Ilha”) is a piped system and dates from 1966 when also the bridge was completed. During the eighties it stopped working and was rehabilitated in a program of technical assistance of the Swiss Development Co-operation in 1994. The operational institutional framework that manages this water supply system consists of several levels of authority, decision making, accounting and execution. Final authority lies on a Provincial level with the xxx. The Empresa de Aqua (EdA) of the Ilha has its own responsibility on the daily operation & maintenance and accounting.

The physical infra-structure of the water supply system consists of three main (system) sections:

1. Ground water exploration
2. Water transport to the Ilha
3. Distribution network within the Ilha

Ground Water exploration

Ground water is pumped in the Entete area about 20 km inland, from two boreholes (nr 3 and nr 6 of a set of six test boreholes), of which one (borehole nr. 6) is at present not in operation.

Ground water quality of these 2 boreholes seems good, although two test boreholes (nr. 1 and nr. 2) showed brackish groundwater. The pH at time of drilling was 6.0. Detailed documentation on the boreholes, equipment and water quality was not available at the EdA. The results of an evaluation of documents, discussions with the employees of the EdA and own field observations can be summarised as follows:

The boreholes have both a total depth of about 31 m. The first 20 m in the more weathered and softer rock the diameter of the borehole is 10“, the following diameter is 5“ into solid rock. It is assumed that most of this deeper part is screened to extract ground water from a sandstone aquifer. Groundsurface elevation is about 1.27 m. above sea level. Static ground water levels are about - 4,4 m. below groundsurface. Specific yield of the aquifer is quite high, with 17 m3/m and 45 m3/m for boreholes nr. 6 and 3, the estimated production capacity of the aquifer zone is 50 m3/h. The boreholes are equipped with Grundfos SP 380 n submersible pumps with a capacity of 45 m3/h. Actual production varies between 300 to 400 M3/day, with an average of 10 hours of pumping per day for the remaining borehole 3.

The total estimated water demand for a population of 13.000 people in the conditions of the Ilha, considering an average consumption of 25 l. pp/day, corresponds with 325 m3/day.

Water transport to the Ilha

The water is pumped from the boreholes to a nearby elevated 100 m3 reservoir in Entete. From this reservoir the water flows under gravity in a 175 mm AC pipe into two 150 m3 reservoirs near the bridge on the Ilha, where two Grundfos C30 pumps alternately push the water up into a 100 m3 water tower in the north of the Ilha near the Fort.

Water is delivered directly from this transport system in Entete to one public standpost near the water tower and in Lumbo to a Cajun factory, households connections and four public standposts, of which two are not operational.

Distribution network within the Ilha

From the water tower three independent 110 mm pipelines supply three separate zones (North, Centre and South). The lines within the zones are interconnected and supply water to seven public standposts, domestic households connections, public services and industrial consumers.

The number of household connections slowly increases, from 305 in 1996 to 440 in July 1998, due to new connections, while about 5 household connection defaulters are cut of every month. The Stone City has most of the household connections (260 or 60 %).

Operation and Maintenance aspects

The system is operated and maintained by the local Water Company, or the "Empresa de Agua" (EdA) of the island. In spite of limited funds and logistics they perform reasonably well, although still an active management and technical support is necessary.

Commercial and consumers aspects

The consumers pay different rates for their water, prices are set by the Government for the EdA to sell water to households connections, commercial services, industrial use and resellers with Public Standposts ("fontenário's").

According to estimations of the EdA present household consumption is 10 to 15 m³/month, for which people pay an average in the order of 25.000 to 35.000 Mt. /month. This indicates water use of 25 to 50 l. pp./d. Water is sold at the fontenário's at an price of 100 Mt. for 20 l., whereas the price of water sold to neighbours and others may go up to 500 Mt. for 20 l. Private selling will account for higher quantities sold to household connections. Industries pay actually more per m³ for their water, but still relatively little and still below production costs for their water.

It is beyond the scope of this sub-report to go into detail on prices of water selling, more information can be found in the report on economic activities of the Ilha.

1.2 The traditional rainwater-cistern system

With an average rainfall of about 750 mm per year, an open surface like a roof of one square meter can collect a amount of ca. 500 to 600 litres of water per year. For an average house with a roof surface of 10 m² this will provide at least 15 l/day. When properly guided to a storage tank ("cistern") and well protected from daylight and dust, although limited, this rainwater - cistern system provides cheap and reliable source of water. Additional treatment is subject to individual appreciation of quality and financial constraints.

Due to a regulation from 1878 most houses and buildings in the Stone City had to be originally provided with these rainwater systems. However, many are not functioning anymore due to the lack of maintenance of roofs and cisterns. Maintenance has ceased due to the availability of cheap and more convenient alternative water source of water under pressure in a piped system, which did not encouraged people to use their limited financial resources to maintain their cistern systems.

An additional important aspect in the water management of the Ilha of these roofs catchments is, or rather was, their water storage capacity in case of heavy showers. The roofs are in fact small basins with a wall around that can hold the water when the intake capacity of the cistern pipe cannot directly cope with the intensity of the rain. With the deterioration of this important retention storage capacity the amounts of surface runoff to the streets is considerably increased, which increases the rain induced problems of erosion and surface drainage.

1.3 Sanitation aspects

Sanitation in this report deals with the (public) toilet facilities ("latrines") and the management of sewage or residual water from households and other buildings. In general at the island sewage disposal of toilets and household water adopts a combination of a septic-tank ("cesspits") of which the liquid effluent (latrine-sewage) is connected to an infiltration pit. This is also the case for most of the public latrines and the toilet blocks in the schools. It is assumed that at present a total of 350 to 400 cesspits exists in the Island of which the majority can be found in the Stone City.

Dry pit latrines are not common on the island and were not encountered .

Sewage management

On several locations near the seaside, both in the Stone City as in the Macuti Area, infiltration of latrine-sewage is directly discharged to the tidal zone for "open" infiltration or infiltration in a covered pit. The last is for instance also the case for the sewage of the hospital, that flows underground from the hospital into the direction of the fishmarket, passes the fishmarket underneath and infiltrates in a pit on the fishmarket's beach. The construction is well done, but the environmental design of this sewage disposal is not adequate. From a viewpoint of avoiding exposure of potential hazardous sewage, it would be better in the present situation to infiltrate this sewage close to the cesspit of the hospital. On this topographical higher terrain, the sewage will be absorbed in the groundwater flow that is directed downward. This is mentioned as an example that specialist advice should be incorporated more often in the design of sewage disposal systems to avoid unnecessary work that can even be counter productive.

Sewage disposal is based on septic tanks combined to infiltration drains. This is particularly the case in the Stone City where, the soil conditions are such that infiltration of effluents from septic tanks is possible. In the Lower Macuti area, sewage disposal based on septic tanks and infiltration drains, is difficult because of the high water table in the area that causes a low absorption capacity of the sub-soil. At present, this problem is somehow hidden by the lack of functional facilities. Improvement of the sanitation conditions in this area asks therefore for proper measures for sewage disposal.

The solution adopted for sewage disposal of some of the existing and functional public latrines is not optimal. Most of the latrines in use at the west side of the island have an open discharge of sewage into the flat tidal zone which leaves the sewage exposed during low tide. The better located latrines at the south-east side of the island with respect to sewage disposal into a deeper part of the sea with stronger currents are not used, here mainly because of the lack of sufficient flush and wash water.

In the colonial days sewage disposal into the tidal zone was not considered as a problem, the impact on the water quality was considered to be low (due to the primarily deposition and biological activities in the cesspit itself) whereas also the relations with health were not fully understood. For those latrines that have an outflow close to strong currents this could be accepted, but the principle of disposal of sewage in the flat tidal zone needs to be reviewed, especially when at present other alternatives are available. One alternative is infiltration of sewage to the groundwater, this will also induce groundwater pollution, however, when the groundwater level is deeper than several meters and the groundwater in that zone is not used for domestic purposes, it would be still a better option to adopt sewage infiltration to the groundwater than sewage disposal to the tidal zone.

This option is available for most parts of the island, however, especially in the "Lower Macuti" area, these conditions do not exist, but also here cesspits are present, while many shallow wells are still in use for domestic water. People use the shallow wells because of its direct access, easy maintenance what makes it a cheap source of water.

The use of groundwater in this area therefore still remains a matter of concern that can only be alleviated with also cheap public water and good services, together with an adequate public sanitation awareness education.

The sewage of public latrines with open outlet to the seaside therefore causes a potential health problem, especially for the latrines located at the west sea-side of the island. Alternative locations, for instance latrines locate in the Center line of the island where infiltration is no problem or connection to a simple sewage gravity drain system with appropriate disposal should be seriously considered.

Present sewage collectors

On the island a reticulated sub-surface drainage system of collectors for drainage of excess rainwater has been build in the colonial time, however, it probably never has been completely operational. There are also no evidences (due to the type, size and distribution of the main collectors) that this system was also intended to deal with (part of) the sewage disposal of households.

Public latrines

In the Stone City the actual number of public latrines is 4 for, of which 2 are more or less functional and the other two are still in rehabilitation. The Macuti area has 5 public latrines, of which 3 are in operation and the other 2 under rehabilitation. The total number of 9 public sanitation facilities for the whole island is far from sufficient. This is especially a problem in the densely built up and over populated Macuti area.

Apart from the limited number, also **the utilization and "acceptance" of the public latrines is an even higher and more urgent matter of concern**. The actual level of utilization of the few functional latrines is very low. For one side this is due to the religious and traditional habits of the poor local population to use the sea-side (beach and rocks) as the most suitable and hygienic defecation place. On the other side it is a well know fact that the service conditions that are offered by the present design of the public latrines are not acceptable at all, they have a general unhealthy appearance with the result that people rather avoid than using the public latrines. **It is not a place that invites to go for your own health, but rather to avoid.**

Based on interviews and review of studies, the main reasons pointed for the non-utilization, bad appearance and avoiding of existing public latrine facilities are:

1. No sufficient water available to flush and clean the toilet;
2. No water available at all to wash themselves after using the toilet;
3. No hygienic appearance, and bad smell;
4. Lack of privacy;
5. In the case of use by children, not suitable for children at all;
6. Distance to far from living place;
7. Limited public hygienic responsibility with respect to the pollution hazards of sea-side defecation;
8. No good facilities for urinating only, so with no flushing water this smell stays behind.

These shortcomings are mainly due to an improper design with a combination of no provisions for management.

Demand for public sanitation services

At present, the vast majority of the population, especially in the Macuti Town, has no or limited access to private sanitation facilities, consequently the demand is high. In this respect it is important to understand that people use "outside facilities" (public latrines as well as the sea-side) for several practical reasons:

1. Own facilities are available, but with little water and / or cesspit storage capacities, so people use outside facilities to minimize the charges on their own toilets;
2. Own facilities are available, but people often have no daily life pattern that keeps them at home, so they prefer to use the nearest outside facility that is available;
3. People have no own facilities at all, so they have to use outside facilities in any conditions.

"Outside facilities"

Outside facilities for defecation include public latrines and other public places like the sea-side. Most visited sea-side places are the beaches adjacent to the Macuti Town and the coral rocks at the southern part of the island. As a result, most of the time the island is surrounded by excrement's and the associated flies and stench.

Ongoing activities

The Municipality (through the Urban Services and Urbanization Department) is putting efforts on the rehabilitation and construction of public latrines supported by a MICOA project with Danish funding. However, the works advances very slowly due to logistic problems and the limited capacity in terms of human resources.

1.4 Drainage

In the rainy season surface drainage becomes a major problem on several locations in the Island. As mentioned earlier, the most of the old system of underground collectors to improve the surface drainage on the island is not functioning anymore. Although some parts of the systems are still operational and could be rehabilitated it is evident that the total collector system on the island need to be redesigned and therefore must be renewed in total.

Stone City

In the Stone City, collecting manholes were constructed along the main asphalt streets. Many collectors and manholes are blocked with garbage and sand as a result of the degradation of the pavements and asphalt of the streets. Consequently, during heavy rains some lower areas of the Stone City are also flooded for prolonged periods while in others the runoff erodes further the pavement and flows directly into the sea.

Macuti Town

The Lower Macuti Town has severe inundation's problems after heavy rains. Surface water up to a depth of 50 cm remains in the depressions for two to four days and the only provision once made for surface drainage was the possibility to connect surface drainage to the underground collector that drains the northern part and that was supposed to be connected to a booster station in the Lower Macuti area to pump the excess water into the sea. These inundation's are due to a combination of factors, namely:

1. The area is formed by several basin like depressions with no surface water outlet;
2. Additional surface runoff from adjacent areas flows towards these depressions, because the protection wall around it has many open places;
3. In the rainy season the ground water table is very close to the surface, the soil has therefore a limited residual storage capacity and can only slowly absorb the surface water after a heavy shower;
4. The infiltration capacity of the soil itself is limited due to the downtrodden earth and pavement of the streets
5. All roofs directly pour the water on the ground because the houses are not equipped with a rainwater-cistern system, that would partly collect the water and prevent it from flowing over the surface.

1.5 Environment

The concept of environmental awareness is not merrily simply to protect nature, it should be directed to manage and correct man's actions, particularly in over-populated areas that creates a pressure on the biodiversity. This should be kept in mind whenever speaking about environmental consequences of actions that intervenes with nature. Any man-induced change in the use of natural resources has its implications in terms of natural absorption capacity, feed back mechanism and mitigating aspects that are unique for the physiography of every region .

Environmental Impact Assessments (EIA's) are therefore fundamental to describe how activities can best be organised, phased, executed and controlled, based on the basic concept of environmental awareness.

The Ilha de Mozambique form part of a small group of (fossilised) coral islands and sand bars on the east coast in the north of Mozambique and is partly covered with dune sands. Beaches are mainly found at the eastern side, while coral outcrops are present in the north and the south and are subject to erosion, especially in the south-east.

The island is about 3 km long with a maximum width of 500 m, with a total area of slightly more than one km² and is connected with a bridge of more than 3 km with the mainland. The topography is slightly undulating with a maximum elevation above mean sea level of 9.07 m. in the north and 1.11 m. in the former quarries in the Macuti Town zone in the south. The maximum differences between high and low tide is 3.5 m.

The island has a sub-equatorial climate with a mean annual temperature that varies between 38°C to 8°C, with an average of 26°C. From June dry easterly winds prevail, the warm and rainy season starts in November with winds from the south, giving an average rainfall of 755 mm/year, with a maximum of 100 to 150 mm/month in January to March.

There are clear indications that the marine environment and the coastal zone habitat are not in an ecological equilibrium due to the increasing commercial activities of men. The shallow bay hosts a rich marine environment with a large variety of fish and sea cucumbers, that are collected for export. Various species of molluscs and crustaceans, including rare species, dolphins and giant tortoises are common. Of particular ecological interest are the coral banks and coral islands with mangroves (like Ilha de Sena), in particular those of the of the Sancul area in the south. The use of mangroves for cooking of sea cucumbers, construction material and medical purposes has yet no important impact, but the extension of salt pans within mangroves zones form a potential danger for the habitat.

Active monitoring of the quality of the fish stock, corals and biodiversity will therefore be needed. Protection of the marine environment of the island and the coastal zone is mentioned as a specific concern in the development of the island in the light of tourist activities, but due to the limited time this subject is not further elaborated in detail in this report at this stage.

The island is highly urbanised, in particular the Macuti Town is completely over-crowded. There seems to be no reliable data or planning of the urban area occupancy, which makes its management extremely difficult. With an estimated total population of probably more than 12.000 this demographic pressure creates a high stress on the urban environment. Due to limitations of time the mission has given priority to the evaluation of the urgent aspects of sewage and urban waste.

Solid Waste

The quality of Municipal Solid Waste Management (MSWM) is always the final responsibility of the local government. It is a complex task that requires organisational capacity and co-operation between the Municipality, and the private sector. Although the relations with public health are obvious, in most cities of development countries the actual situation is normally unsatisfactory. In the case of the Ilha, MSWM has given already some attention in a MICOA project in the framework of institutional and technical support to the Municipality.

As a result of this, at present there is a functioning system of regular collection of solid waste from several primary collection points all over the island. Ideally, after collection this waste should be transported, selected and finally disposed in a carefully sited and well operated and protected sanitary landfill site. However, also on the Ilha logistic and financial constraints hamper a proper execution. Most urgent recent issue is the accessibility of the bridge for transport to the final disposal site on the mainland. Therefore most waste has been dumped this year on the coral outcrops of the southern part of the island, that provides no protection possibilities to the environment.

Of particular concern for public health is the management of the Hospital solid waste, clear information on this could not be obtained during the field visit.

2. ISSUES TO BE ADDRESSED

2.1 Introduction

The mission concluded that with some exceptions, serious interventions in the sectors of Water, Sanitation and Environment will be needed to improve the quality of the services to an acceptable level that will be in accordance with a sustainable development of the island. Whatever the development of the island will be, towards a fast growing and tourist induced booming economic scenario, or towards a more moderate step by step "natural" development scenario, some basic problems need to be solved in the near future. A summary of the issues to be addressed are given in the next paragraphs.

2.2 Water Supply

The main actual issue for the water supply is not to improve the present service level, but to assure its continuation for the future. Therefore intervention is needed on several levels:

1. Technical assistance;
2. Institutional assistance
3. Sustainable financial conditions
4. Direct action and recommendations for management

Technical assistance

Technical assistance is mainly directed to avoid problems in the operation applying good maintenance, i.e. how to do installations and repairs. Therefore this assistance comprises mainly access for the EdA to specific courses or seminars (i.e. every two years) and refreshing courses in technical Operation and Maintenance practice, by an experienced technician that could give training on the spot in a discussion approach. Training on the spot is considered to be of more importance and impact than seminars, due to the personal approach and "Tailored Advice", these trainings have a direct impact on the overall quality of the Operation and Maintenance practice.

Institutional assistance

This comprises all aspects of the management of a water company, starting with the set-up or evaluation of a management plan and how all technical aspects fit into this plan (organisational, technical, which and how materials to be used, maintenance aspects, etc...). The management plan should have as final objective to supply the needs of the clients, with reference to their capacity to pay for the desired service. All with reference to the Governmental direction in delegation of responsibilities.

Some management issues in these respect that need to be addressed are:

- Organisation of water selling in public Sanitation Service Centre's (SSC), in which the contract of the water seller is linked to the operation and maintenance of this SSC.
- Controlling of illegal (private) selling of water. This can never be completely avoided, but it should be controlled in such a way that it does not become a real commercial threat to the official water selling;
- Installing and monitoring of watermeters for all client's connections;
- Serious approach in supplying the actual latrines of sufficient water with sufficient pressure for their operation;
- improvement of water quality management, like regular monitoring and upgrading of water treatment facilities before distribution;
- Promotion and quality control of rehabilitation of private rainwater-cistern systems.

Sustainable financial condition

In view of the recent adopted water policy of the Government, the Water Companies should organise their financial management related to balance of income that can cover all operation cost. With the present income of the selling of water this is not feasible and gradual changes will be necessary in

term of tariff setting together with adaptation of the offered services. Tariffs for small quantities of daily household water supply should preferably remain at the present low level, but pricing of water of good quality water for commercial activities should be looked upon more in terms of real economic costs and not be related to water pricing within a social context. However, this is an issue to be addressed more on a central level and goes beyond the scope of this report to address this issue in more detail.

Direct actions and recommendations for management

Apart from the above mentioned general activities, there are several issues that need direct attention:

- **Drilling of two new boreholes** that are properly designed to an operation with respect to the required amount of groundwater to be pumped each day;
- **Increasing storage facilities** of the present water supply, by rehabilitation of several large cisterns (e.g. in the Fort and at the entrance near the bridge) and preparing an "emergency plan" that could also use some of the other functioning large cisterns (i.e. those of the Hospital and the Warehouses) in case of an emergency.

2.3 Sanitation

In sanitation the main issue to address on the whole island is the functioning of the public latrines. In the Stone City (apart from some houses with "squatters") the problems are less urgent because most of the houses are originally provided with individual toilets systems, even though many are not always in good working order. In the Macuti Town the situation is urgent because of the lack of proper facilities in this over-populated zone.

In addition to that, the combination of the unfavorable topographic conditions and the low subsistence level of the Macuti area, require a careful planning and design of new and improved sanitation facilities. In particular the drainage of excess water from cesspits and public latrines should be studied in detail from place to place, especially at the west coast of the island. It is beyond the scope of this report to indicate in detail new locations for these, because not only a detailed study to the local hydrological situation will be necessary, also the population should be consulted in the total process of the design and location of the new infrastructures.

Public latrines

In view of the above mentioned precarious sanitary conditions of the island the mission found that the main issues in sanitation of public latrines to be addressed to in the Stone City as well as in the Macuti Town are therefore:

- Redesign of adequate public sanitary facilities (that take into serious consideration the negative aspects of the present latrines mentioned in the previous chapter);
- Establish a functioning maintenance system for public latrines;
- Re-examination of all existing latrines and to supply them with sufficient water to flush and wash after defecation;
- Construction of more adequate new public sanitary facilities to reduce the number of people per latrine and to reduce the distance-to-go;
- Promotion and subsidizing of rehabilitation of private toilets and their cesspits to improve also the individual access to sanitation facilities;
- Hygienic awareness education for children, that will bring the message also at home.
- Indicate tolerance zones and not tolerance zones for defecation at the sea-side.
- Locations of new latrines need to be addressed more seriously with respect to sewage drainage.

Sewage disposal

The actual sewage disposal practice in the Macuti area is to a certain extent similar to that encountered in the Stone City, but with overall little functional sanitation facilities that produce sewage also no direct sewage problem seems to exist. However, in all lower areas of the island, whether it is in the Macuti depressions or along the tidal line at the sea-side, a potential problem of sewage disposal is present when sanitation facilities are necessary.

The old solution adopted in the colonial time of a network of communal latrines with direct outlets to the sea was found by the mission not to be a final solution for this problem.

Although the physiographic and scattered location of these latrines may correspond to the currents close to the beach that dissolve the sewage and reduce the health hazards, they are still considered as a potential threat for public health.

For sewage disposal in the Lower Macuti Town a system of communal storage tanks that collects sewage water from cesspits could be a solution. Because of the high water table, the water in these communal storage tanks cannot be infiltrated. Therefore an additional system to empty these storage chambers should be put in place. Depending on the topography this could be gravity drainage to the low tide sea level or mechanically evacuation, direct to the sea or to a higher storage tank that drains under gravity to the sea.

The environmental effects of disposal direct into the sea are considered to be low due to the biological purification activities in the septic tanks in the beginning of the system.

Given the actual and expected future sewage disposal, the issues concerning sewage to be addressed are therefore:

- Careful selection of new or to be rehabilitated cesspits with infiltration drains (with respect to the potential contact of people with polluted groundwater, preferably on higher topographic locations;
- Professional management of construction and maintenance of cesspits and sewage systems;
- Design of one or more (interconnected) sewage disposal drain or drains, for the low lying zones of the island, that could be connected to a proper infiltration location, or to a small water treatment station or could flow out through a long pipe in a suitable place directly into the sea, at a distance of at least 300 m. from the low tide mark.

2.4 Drainage

After prolonged heavy showers high amounts of surface water runoff are present on most locations, whereas also some locations are flooded for several days, especially in the "Lower" Macuti area.

This present inadequate surface drainage has a negative impact on the infra-structure and the stagnant water creates a potential health hazards, especially when it comes into contact with polluted groundwater, which is the case in the Lower Macuti area.. Although this is a problem only in the rainy season, it comes back every year and therefore also needs specific attention.

The surface water problems are caused by a several factors, the issues to be addressed are therefore oriented to:

1. Prevent and minimize the surface runoff and to
2. Eliminate as far as possible the negative effects of the surface runoff and flooding in those area's where flooding cannot be avoided..

In view of the problems mentioned earlier, the issues to be addressed for surface water and drainage are:

- Develop a masterplan to improve and monitor the surface runoff and its impact on the whole island;
- Repair of the wall that surrounds the Macuti depression zones, to stop the extra and unnecessary inflow of extra surface water from higher adjacent areas;
- Design and construct for the Lower Macuti depression zones a conduit with a sluice that drains the surface water from the depression zone to the sea at low tide;
- Promote and subsidize the rehabilitation and construction of new (especially in the Lower Macuti area) of rainwater-cistern systems in order to decrease the quantity of surface runoff;
- Redesign and rebuilt a system of (storm) surface runoff, that is composed partly of surface flow and partly (where necessary to pass elevations) of subsurface drainage;
- Decrease the length of surface runoff as much as possible by diverting surface runoff directly to the sea-side wherever possible;

2.5 Environmnet

The environmental issues to be addresses can be sub-dived into issues:

1. outside the island: the marine habitat and the coastal zone;
2. on the island itself, including management of waste.

Due to the limited time available, the mission had to limit the evaluation on the aspect of the management of solid waste of the island. Other issues, like vegetation on the island and onshore are therefore not considered. Some observations on soil pollution and liquid waste management are discussed under the subject of sewage in the chapter dealing with sanitation.

There is actually no environmental management of waste disposal from the septic tanks. Although hygienically safe in terms of final compost, the idea of individual (on-site) anaerobic digesters proposed in the TOR's was seen by the mission as inadequate for the area. This is because the efficient performance of anaerobic digesters not only depends on the amount of waste produced in toilets but also on the addition of large amounts of other type of waste produced in kitchens and gardens which for the present situation is very little. If improperly managed the compost of digesters is unhandlable, of no value for re-use and may cause severe health problems to the users.

The use of a single digester is therefore suggested for the deposition and treatment of the waste produced in the entire island. Other type of garbage (solid waste) collected in the island can also be used to feed the digester (provided there is a proper mechanism for separation of improper material). The operation of the digester will be left under the responsibility of the Municipality. The location of the digester can be at the mainland (at the site of solid waste dumping).

The most important issues to address for these environment aspects are therefore:

1. Preparation of an "Environmental Masterplan" that include also preparation and evaluation of Environmental Impact Assessments of all proposed economic and infra-structural activities on the island (e.g. salt pans and mangrove vegetation, fisheries, tourist industry, etc...);
2. Management of Urban waste and specific hazardous waste (e.g. Hospital waste, specific waste from economic activities and markets, etc...)
3. Cleaning up of the recently created waste dump at the south part of the island;
4. Design and management of a major waste disposal dump place onshore, for the island as well for the town of Lumbo.

2.6 Development scenario's

At this stage it is worth to point out that the selection of priority interventions for the upgrading of the infrastructure will depends on the final type of development scenario foreseen for the restoration of the patrimony of the Island. Although this issue is beyond the direct scope of the Water & Sanitation team, it has implications on the formulation of proposals for Water, Sanitation and Environment.

The first (low profile) development scenario is a "stop further degradation" scenario. Accordingly, the degree and type of intervention proposed has an emphasis on the adoption of affordable solutions with respect to the social -and economic potential of the Island, with a high involvement of the community for operation and maintenance. The required quality of services will be moderate and should match as much as possible the demands of the local population ("demand driven solutions"), with less emphasis on the demand and standards that tourist require. The interdependence of contribution of external sources of income like tourism for instance, is therefore kept to a minimum.

The second (high profile) development scenario is mainly oriented to the investments in rehabilitation of the infrastructure of the island to provide good conditions for the tourist industry. This implies high running cost for maintaining these quality services, as well as high recurrent costs for maintaining the rehabilitated infrastructure. Although this development scenario does not put aside the other revenues of the local population, it's sustainability will completely depend on the reliability of income generated by tourist.

The project proposals that are discussed in this report are formulated assuming the first "low-profile" development scenario.

2.7 Summary of issues to be addressed

Table 1. Summary of issues to be addressed

	Stone City	Macuti Town
Water Supply	<ul style="list-style-type: none"> • URGENT: Security measures for the water source: Drilling and equipment of two new boreholes in Entete. • Pro-Active institutional and technical support to the EdA • Installing water meters for each client. • Improvement of public water supply with new SSC's (for details see section on sanitation), together with closure of old existing public tap system of fontenario's. • Improve and assure water availability to sanitary installations public service centres as schools, latrines and future SSC's. • Realistic marketing to commercial clients of delivering of water in relation to the production price of the water. • Maintaining a low price for drinking water for the population for household connections and public selling at standposts (or SSC's). 	<ul style="list-style-type: none"> • Rehabilitation of the cisterns near the bridge, to increase the freshwater reserves
Sanitation (sewage)	<ul style="list-style-type: none"> • Rehabilitation of the central cistern in the fort, to increase the reserves of freshwater • Rehabilitation of roof catchments of traditional cistern systems, to increase individual water reserves. 	<ul style="list-style-type: none"> • Design of Sanitation Service Centre (SSC), commercially operated through water selling that supply free service of large toilets / bathrooms and facilities for washing of cloth. • Design of small public SSC, only for toilet / bathroom facilities, operated by a group of families. • Pilot project of construction of 5 large SSC's and about 10 small SSC's • Special attention to sanitation facilities for children and health awareness education in schools • Indicate "Tolerance Zones" where beach defecation is allowed and supervise at the same time "Non-Tolerance Zones" where beach defecation is not allowed.
	<ul style="list-style-type: none"> • Two SSC's: one near the football field and one near the warehouses. 	<ul style="list-style-type: none"> • One SSC's near the market and two on other locations along the beach, to be defined with the population.

Drainage	<ul style="list-style-type: none"> • Pavement of the roads with bricks, that can be made locally and can be installed and maintained by local labour. • Design the new paved streets between the houses "concave" (for easy maintenance) whenever possible, to concentrate surface water flow into one flow path in the middle. • Rehabilitate with the pavement whenever possible also the elevated sidewalks that enable save (free from traffic) and dry walking (in the rain season) along the streets. • Redesign and completely rebuild (not rehabilitate!) in the middle of the new concave streets the existing sub-surface drainage system with numerous intakes with easy to clean deposition chambers. 				
Environment (urban waste)	<table border="1"> <tr> <td data-bbox="384 786 847 1256"> <ul style="list-style-type: none"> • Deviate surface water flow wherever possible directly towards the east and west, using the existing street pattern. • Rehabilitate the roof catchment for water storage and to minimise surface runoff </td><td data-bbox="847 786 1303 1256"> <ul style="list-style-type: none"> • Design and construct several open outlet to the sea with a sluice, to allow excess rainwater to drain into the sea at low tide. • Close the outer walls around the excavated zones to avoid that extra surface runoff flows into these lower zones. </td></tr> <tr> <td data-bbox="384 1256 847 1400"> <ul style="list-style-type: none"> • Develop environmental "Master Plan" for the island, that takes interests of all stakeholders into account. • Elaboration of Environmental Impact Assessments (EIA's) for all future projects, i.e. according to World Bank Orientations. • Evaluation of present urban waste collection program. • Start up of privatisation project in waste collection, in collaboration with cesspit maintenance. • Improve maintenance of the sanitary (dump) landfill site on the mainland (in a step by step approach) • Evaluation of hazardous waste of all commercial activities • Develop a system of collecting on a local level "environmental tax" from tourist that visit the island, (i.e. selling tourist information with an added price that allows for using the public sanitation services). </td><td data-bbox="847 1256 1303 1400"> <ul style="list-style-type: none"> • Special attention for Hospital waste disposal (incinerators) • Cleaning up of the waste dump near the bridge, as a start project in the privatisation of waste management. </td></tr> </table>	<ul style="list-style-type: none"> • Deviate surface water flow wherever possible directly towards the east and west, using the existing street pattern. • Rehabilitate the roof catchment for water storage and to minimise surface runoff 	<ul style="list-style-type: none"> • Design and construct several open outlet to the sea with a sluice, to allow excess rainwater to drain into the sea at low tide. • Close the outer walls around the excavated zones to avoid that extra surface runoff flows into these lower zones. 	<ul style="list-style-type: none"> • Develop environmental "Master Plan" for the island, that takes interests of all stakeholders into account. • Elaboration of Environmental Impact Assessments (EIA's) for all future projects, i.e. according to World Bank Orientations. • Evaluation of present urban waste collection program. • Start up of privatisation project in waste collection, in collaboration with cesspit maintenance. • Improve maintenance of the sanitary (dump) landfill site on the mainland (in a step by step approach) • Evaluation of hazardous waste of all commercial activities • Develop a system of collecting on a local level "environmental tax" from tourist that visit the island, (i.e. selling tourist information with an added price that allows for using the public sanitation services). 	<ul style="list-style-type: none"> • Special attention for Hospital waste disposal (incinerators) • Cleaning up of the waste dump near the bridge, as a start project in the privatisation of waste management.
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3. PROJECT PROPOSALS

It will be evident that in a situation as on the “Ilha de Mozambique” a large number of projects proposals on Water, Sanitation and Environment issues could be indicated. However, the mission estimated that it should limit to the most urgent and relevant issues to be addressed as a primarily result of the present evaluation.

These proposals are formulated and briefly discussed in this chapter. The proposals are further summarised in specific project files that are presented in chapter 5. These project files include for each proposal:

1. State of the art of the subject;
2. Issues to be addressed;
3. Justification;
4. Objectives (development objectives and immediate objectives);
5. Input activities and expected outputs;
6. Legal framework;
7. Phasing of activities;
8. Possible constraints;
9. Work already done;
10. Budget items;
11. Total estimated costs.

For each subject the first three items of state of the art and issues to be addressed with the justifications have been already discussed in the previous chapters. In this chapter therefore the emphasis is on the an further discussion of the other remaining relevant items that may need some more explanation than the brief description on the project files.

Some basic considerations in the formulation of the projects are;

- **A major co-ordination role for the Municipality** of the Ilha de Mozambique in all projects to be executed. The mission is convinced that this should be the overall institutional framework for the projects to assure their impact on the longer term. It will be evident that this co-ordination role needs to be supported with additional (temporary) technical and institutional assistance. This assistance could be for instance with a long term involvement of senior expatriate consultancy on a continuous base for the first 2 years, with a follow-up phase of 4 years with regular monitoring and support missions.
- **Community involvement and commitment;** in particular in terms of contribution in labor that could contribute to an improved economic development and to the feeling of “shared ownership” of the projects results. For this a good project introduction and communication between the Municipality and the population and its leaders will be needed. This could be promoted for instance by a regular flow of information of the “new and projected state of the art” of the ongoing projects through a project information center and a news letter.

With reference to the previous chapter, in which the “issues to be addressed” are outlined, the following project proposals have been identified:

List of proposed (rehabilitation) projects

1. Assure the Water Supply on the island;
2. Integrated Water & Sanitation Services" (IWSS);
3. Private Water and Sanitation facilities;
4. Surface drainage in the Lower Macuti Zone;
5. Surface drainage of the Stone City;
6. Solid waste and cesspit maintenance.

The mission would like to clearly point out that the here proposed proposals are only proposal outlines that can serve as general Terms of Reference and that a *more detailed proposal and subsequent plan of operations should be made* through a consultancy if funding for these proposal outlines are available.

3.1 Assure the Water Supply on the island

The infra-structure and social and economic life of the island and the inhabitants and Caju industry on the mainland depends to a great extent on the daily availability of water of good quality. It is very likely that in the (very?) near future this last borehole will also breakdown, as happened before with the other one. Before it is too late, prevention actions should be taken to create a back-up system to assure the water availability for all activities on the island and monitor its quality.

No action scenario: To drill new boreholes only after collapsing of the remaining one, would leave the island without water for a period of several months, which would have a dramatic and unnecessary effect on its economic development. Moreover, finally the cost for these additional boreholes should be made anyway, sooner or later. Another issue is the quality of the groundwater: brackish water has been encountered in the vicinity of the well field and the movement of this water towards the production boreholes should be monitored in order to make recommendations for save yields.

Finally, the amount of water that can be stored on the piped system is limited and is only sufficient for several days in case of an emergency situation with the water source.

Objectives:

The objective of this project is therefore to assure the continuous supply of good quality water for consumption and industrial purposes, including for tourist industry.

Legal framework:

The local Water Company, within the structure of the Municipality, should have final supervision of the works. This supervision requires specific expertise which is normally not available in a water Company, this could be provided by advice of the DNA in Maputo, but is not sure if this organization could make time and funds available for this. Because of the limited time available the most effective procedure therefore would be that the supervision of works should be tendered to a professional organization with at least 10 years of professional experience of the person in charge of the supervision. The supervision project should have at the same time a training component, as such that the employee's of the Water Company could learn from their experience.

Input activities / Implementing / phasing:

Because the last borehole nr. 3 can break down any moment, the work should start as soon as possible. To begin with preparing tender documents and at the same time already looking for capable companies that could mobilize on a short term (e.g. already working in the area) to start the actual drilling.

The activities can be summarized as:

- Consultancy, supervision and training of personnel of the Water Company;
- Drilling of two boreholes up to 35 m;
- Equipment of the new boreholes with submersible pumps;
- Connection pumps to the existing system;
- Measuring water quality and drawdown every 5 minutes in all existing boreholes during test pumping with 5 m³/hour for 3 hours.
- Rehabilitation and connection to the system of the central cistern in the Fort and the cistern near the water storage tanks at the entrance of the island.
- Preparing a water quality monitoring scheme (with possible actions with an "if-not" schedule) that can be executed by the Water Company on a regular (e.g. monthly) basis.

Outputs:

- Two well equipped boreholes that could assure the continuation of the development of the island;
- A water quality monitoring scheme that gives indications for long term water quality;
- Additional water storage on the island in case of emergency;
- additional “on-site” training of personnel of the Water Company .

Possible Constraints:

Most limiting constraint: Drilling firm not directly available or does not has the necessary equipment and/ or tubing and screens available to start the work. Other constraints are mainly to organize the detailed project design and the overall project logistics on the island.

Estimated budget:

• Design and supervision:	25.000 US\$	
• Training of Water Company:	10.000 US\$	
• Drilling of two boreholes:	50.000 US\$	
• Equipment and connection:	15.000 US\$	
• Rehabilitation of 2 Cistern's:	50.000 US\$	
• Not foreseen:	25.000 US\$	
• <u>Total estimated costs:</u>	175.000 US\$	Total project period: 1 year

Work already done:

A total of 6 reconnaissance boreholes have been made on the Entete location, of which two where connected to the piped water system . No further activities has been done to assure the sustainability of this system. The Water Company has no effective assistance for its Operation and Maintenance activities.

Remarks:

Apart of this infrastructure work, also in the training component a complete “plan of operations” should be made by a consultancy that includes scenario's for all possible threads, including the use of extra water storage on the island in cistern's and the proposed monitoring systems, regular maintenance and financial provisions for immediate actions, etc.

3.2 Integrated Water and Sanitation Services

All existing management models of public Water and Sanitation facilities have shortcomings that makes them not or less effective. Basically most shortcomings can be characterized as “not client oriented”. This is especially true for the public latrines. They are more a place to avoid as much as possible then to use. Therefore simple rehabilitation of old latrines, gives little or no hope that they will be more and the final objective of such a program to improve the overall hygienic situation can and will not be improved in the future.

On the other hand, the selling of good quality drinking water on itself functions quite well, however, there is no additional infra-structure around this “fontenario” at all, they consist of a very simple, but often poor constructed cement structure with a tap, whereas in previous time the place where water was collected often had additional social and practical functions.

All these considerations call for new approaches in pilot projects, that integrates Water and Sanitation (W&S) facilities in a way that they will be used and integrated in the society in an optimal way, to really improve the well-being of the population.

During the evaluation the mission particularly found evidence that apart from the previous described physiographic, social and cultural aspects, **the poor and old fashion design of the public latrines seems to be a major limiting factor for the acceptance and use of the existing facilities by adults, man, woman and last but not least, by children.** Without better alternatives the population (and probably also tourists?) certainly will still find the rocks and the beach a much more suitable and

hygienic place for defecation, despite any health education program and possible pollution hazards. It may also be clear that severe police surveillance to stop people from using the sea-side is definitely not a sustainable solution in the present society, as long as reasonable alternatives are not available. These facts were also felt by the Municipality and persons involved in the ongoing program of the rehabilitation of existing latrines.

Accessibility to functional and more attractive sanitation facilities should be improved. Emphasis should be put to include other services such as laundry and water sales as a way to increase the level of utilization.

A proper location of such latrines should also be looked upon the preference being, public places like the market, entrance of the island, close to mosques etc. New open areas will have to be identified for the location of public latrines particularly in the Macuti area, which means that the program for latrine construction should communicate closely with the program for de-densification of the that area.

The daily management of public latrines should be handled to the responsibility of individuals on a commercial base. Such individuals can be the water vendors at the existing fontenario's who will be awarded the contracts for the management of the public water taps linked to the sanitary facilities. Because of the large amounts of water that will be sold (drinking water + water for laundry), it is believed that the costs for the maintenance of the sanitary facilities could be covered by the revenues gained from water sales. However, good co-ordination and agreements are necessary between the Water Company and the Municipality to make clear who pays for large repairs for infrastructure and the additional facilities.

Objective:

The introduction of sustainable and self-supporting integrated Water & Sanitation facilities that will substantially contribute to an improved hygienic situation and well being of the population, including special facilities for children.

Input Actions / Implementation / Phasing:

The mission proposes to start as soon as possible with a pilot project that aims to develop and implement a new design for commercial operated and maintained public water and sanitation facilities in an integrated approach. Two types of latrine facilities are proposed:

1. Integrated with water selling, bathhouses and washing of cloth ("camping model");
2. New and larger, open latrine, to be described as a "improved bathroom latrine".

Input actions over a period of two years are:

- Design of new (integrated) facilities;
- Identify with population suitable locations for these facilities and "Tolerance Zones" for defecation near the sea-side as an temporary solution until facilities are in full operation;
- Construction works and supervision;
- Introduction of new facilities to the population.

Design criteria for an "Integrated Water & Sanitation Centre" (IWSC)

Based on interviews and review of studies, the main design criteria for a commercial operated "Integrated Water & Sanitation Centre" (IWSC) are the following:

1. Infrastructure design for selling water at least 2 taps, facilities for toilets, showers (access with additional payment) and laundry.
2. The toilets should have a sufficient large space of at least 2 x 2 m. each with wall of 2 m. high and be equipped with a tap that supplies a small but sufficient quantity of water to clean the toilet and to wash after using the toilet.
3. To have an own large storage tank (connected to a rainwater - cistern system for extra water and demonstration purposes) for periods with no pressure on the public system;
4. Sufficient ventilation of the toilet rooms by creating a large (1 m.) space between the walls and the roof;

5. To have at least 5 “simple-flush” toilet facilities for man and woman and at least two for children, also only for men, an urinoir wall with water flush should be present;
6. Location not too far from center of the population;
7. Sewage disposal in function of distance to the groundwater, otherwise linked to a small diameter drainage pipe that is connected to a treatment station or to a disposal site into the sea at a suitable distance from the low water line, preferably on the lower southern part of the island.
8. The price of the sold water should match the cost of the operation and maintenance of the IWSC.

Design criteria for the “improved bathroom latrine” (IBL)

These criteria are basically the same as for the larger IWSC, but here no laundry and shower facilities are available and only 2 “simple-flush” toilets for men and women and 1 for children are foreseen, with also a urinoir wall with flush water.

Management and cleaning of this IBL will be generally under the responsibility of the person that also commercially operates one of the nearest IWSC’s. Also in particular cases the management can be delegated to a group of families or other strong organizational institutes in the zone of this IBL.

Outputs:

- 2 functioning Water & Sanitation Centers;
- 5 functioning Improved Bathroom latrines;
- Improved overall hygienic awareness.

Legal framework:

Public health facilities are the responsibility of the Urban Services of the Municipality. The project should therefore be co-ordinated and supervised by the Municipality, in close collaboration with the Water Company for the part of the integrated services of drinking water supply.

Additional technical support could be expected of MICOA and DNA; on a central governmental level the experiences of this pilot project could be used to set up similar project in other locations.

Possible Constraints:

A new design should be made. This requires a good literature study and a close monitoring and collaboration with the clients of the facilities during construction to avoid “practical evident” mistakes. Also the communication and regular reporting of progress and constraints between all stakeholders of the Project (Municipality, Water Company, MICOA and DNA) is of primary importance for such a pilot project.

Another constraint could be to accept some extra cost of water that will be used for cleaning the facilities and latrines, these cost should be calculated and if possible put as an “overhead” cost on the price of the water sold at the Center.

Budget:

• Project design:	25.000 US\$	
• Construction of 2 IWSC:	250.000 US\$	
• Construction of 5 IBL:	125.000 US\$	
• Consultancy and Supervision	50.000 US\$	
• Expatriate assistance, Training	150.000 US\$	
• Not foreseen & Operation cost:	50.000 US\$	
• Total estimated costs:	500.000 US \$	Total Project period: 2 years

Work already done:

There is an ongoing MICOA project on the island with financial assistance of the Danish Development Co-operation, that aims to improve public sanitary facilities. Starting activities of the proposed project could be integrated in this ongoing project. This could imply a re-orientation of that project, to include new design-concepts of the public latrines (sanitary facilities instead of public latrines). Some of the already existing facilities should be partly reconstructed according to the new design.

3.3 Private Water and Sanitation facilities

Although operation and maintenance of private (cistern based) water and sanitation (toilets) systems is the concern of the owner of the building, this project in the particular case of Ilha de Mozambique is justified by the argument that the owners generally have no funds for this rehabilitation, whereas the rehabilitation of these private systems is a prerequisite to restore the previous "natural" equilibrium of individual and public water and sanitation facilities on the island.

It is therefore proposed that a credit facility will be organized that will be awarded to individuals who stresses the willingness to improve their living conditions.

Funding of a project to reassure this equilibrium must therefore be seen as an extension of funding for provision of public water and sanitary facilities: public water and sanitation facilities alone cannot satisfy on itself all the needs of the inhabitants.

Objectives:

Sustainable development potential through a combination of private and public Water and Sanitation services that can satisfy all needs of the population.

Inputs activities / Implementation /Phasing:

For this project a specific "tailor made" Credit / Subsidy system under the responsibility of the Municipality needs to be designed and implemented. This will need professional consultancy services and training of the personnel of the Municipality.

For instance, a 50% credit with 50% loan could be adopted, with specific stimuli and incentives to return the loan in cash or with other contributions like labor in construction work at other projects on the island. The overall project budget therefore should be considered as a subsidiary contribution, that will probably not completely come back to the Municipality.

The rehabilitation of the private rainwater - cistern's could be done (or subcontracted to a local firm) by the house owner or by the persons that officially rent the house who are motivated to improve their own facilities in case of the house owner cannot participate in the project for whatever reason.

The project should start with project design and institutional support to the Municipality, followed by a selection of house owners and/or individuals that could realize project examples to stimulate the further development of the activities. Gradually the number of rehabilitated households systems could then be increased by a "natural" demand driven approach.

Main input activities for a period of 3 years are:

- Detailed Project design of Credit system managed by the Municipality;
- Co-ordination of project execution and assistance to the Municipality.

Outputs:

- Increased number of private sanitary and rainwater - cistern facilities; 120 in Stone City and 720 in Macuti Town;
- Less pressure on the public Water & Sanitation facilities, in a more equilibrated ratio of private/public facilities;
- Optimizing of (rain)water resources and reducing surface runoff.

Legal framework:

Credits should be given through the Municipality, in which a special W&S rehabilitation credit (and/or subsidiary) management section with access to funds should be implemented, with an external auditing to justify the expenses and activities. Capacity building of this department is a must and the ongoing MICOA program could initiate the implementation of this proposed project.

Possible Constraints:

People could apply for credits, but will have no jobs that could bring up the financial means to pay the loan part back within the given period. Alternative solutions for these kind of problems should be considered. Another internal constraints in the project management is the relatively high sum of

required total subsidy, it would be necessary to establish a Step-by-Step approach to make funds available to the project, together with a regular auditing of project activities in terms of input, procedures and output.

Budget:

- Credit rehabilitation fund: 1.260.000 US\$
- Consultancy assistance: 50.000 US\$
- Municipality co-ordination: 40.000 US\$
- Unforeseen: 50.000 US\$
- **Total estimated costs:** 1.400.000 US\$ **Total project period: 3 years**

Work already done:

Practically none on a co-ordinated basis. Several individuals that have some private funds available already started rehabilitation of their toilet systems, but rehabilitation of the sewage part (cesspit and effluents) and the cistern system is generally not taken care of.

3.4 Surface drainage in the Lower Macuti zone

Although drainage problems only exist in the rainy season, prolonged pounding of surface water in this densely build up zones is a risk for public health. Moreover, the associated erosion contributes to the deterioration of the infra-structure. An integrated program of surface drainage with subsurface outflow to the sea will therefore contribute to preservation of public health and infra-structure, which will favor further economic activities.

The installation of a pumping station to evacuate the excess surface water from these depressions (previous Portuguese project design) is not considered a favorable solution by the mission. Although technically feasible, the mission considers in view of prevailing and future conditions of operation and maintenance cost and logistics within the Community that this is not a long term sustainable solution and should therefore be disregarded.

For the Lower Macuti zone a main (open flow) channel running through the lower part of the town (identified as the flooding area) will be constructed with secondary (open) lines that drain the outer parts of the depression. Box-culverts under the roads will connect adjacent depression zones.

Objectives:

Improvement of overall health, accessibility and preservation of infra-structure, through an improved drainage of Lower Macuti Zone.

Inputs activities / Implementation / Phasing:

The mission recommends a project in which the discharge of runoff water into the sea will be done through a simple gravity system made of open channels in the depression zone, collecting the surface water to a subsurface channel with a level controlled sluice gate to the sea. The choice for this simple gravity solution implies that discharges of runoff can only take place during low tide. Depending on the rain intensity and duration, partial flooding of the area could therefore not completely be avoided. It is important to realize that this does not call for a solution with a pumping station; the capacity of the pump cannot keep up with the amount of water to be evacuated within 6 hours, so the choice for the gravity solution does not really change this situation. Moreover, with gravity drainage the capacity can be higher than with a pumping station, which means that under normal conditions the flooding will be limited to a period of less than 6 hours, being the time span between high and low tide.

However, it is important to realize and to take into account for future planning of the area, that temporary and partial flooding will always be a possibility and therefore a limitation in the development of these depression zones.

Because the main flooding area has already been identified, the new drainage system will follow in principle the same path that was defined for the old system. The new drainage system will consist of

main central open channel flow running through the central part of the Bairros Letine, Esteu and Macarripe having (open) secondary lines in the central part of the Bairros Marrangunhe, Areal and Unidade Santo António. The crossing of the elevated roads around the depression will be done through adequate box-culverts. Because the main drainage line will follow the streets, it is proposed that removable concrete slabs be used to cover the channel for easy and fast maintenance (mainly regular removal of sand). The slabs should have open connecting joints for an improved entrance of the surface water into the channel.

The construction of the main channel and of the secondary lines could imply that some houses of the Macuti area will have to be removed. It is therefore recommended that for the detailed design a co-ordination with the plans for de-densification of the area will be established with the Municipality services. The proposed activities will therefore need a co-ordinated detailed project design, tendering of works the project could then start within one year.

In order to stop the inflow of runoff water from the adjacent higher areas, the small dam that surrounds the depressions need to be rehabilitated.

For all phases of the project it is foreseen that assistance is given to the Municipality to co-ordinate this project.

The main inputs activities are therefore:

- tendering for detailed project design and supervision
- tendering of work;
- execution of works with assistance and "On-the-job" training of the Urban Services of the municipality in all activities.

Total time for realization: 2 years

Outputs:

- Open channel surface drainage system, with secondary lines in the depression zones, total estimated 2 km length;
- Closing of outer wall around the depression zones;
- Subsurface drainage (outlet) channels of the depression zones, with a sluice gate to the sea. (low-tide sealevel discharge).

Legal framework:

Works will be under final supervision of the Urban Services of the Municipality.

Possible Constraints:

Works needs to be executed and completed within the dry period that last about seven month, field-activities should be starting in May to be completed before the rains of November.

Because the Macuti area is unpaved, a risk will always exists that sand and garbage could blocks the system, particularly the secondary lines. Therefore, the project needs to be well explained and understood by the population through local organizations that need to be involved in the organization and maintenance (cleaning, reporting failures) of the system.

Budget:

- | | | |
|---------------------------------|---------------------|---------------------------------------|
| • Detailed project design: | 25.000 US\$ | |
| • Infrastructure work: | 200.000 US\$ | |
| • Consultancy and training: | 75.000 US\$ | |
| • Unforeseen | 50.000 US\$ | |
| • <u>Total estimated costs:</u> | 350.000 US\$ | Total Project period : 2 years |

Work already done:

Practically none, previous Portuguese drainage system is completely blocked with sand and debris and cannot be rehabilitated, therefore a total new system must be re-designed.

3.5 Surface drainage in the Stone City

Although drainage problems only exist in the rainy season, prolonged pounding of surface water in build up zones is a risk for public health. Moreover, the associated erosion of large quantities of surface water flow in the streets contributes to the deterioration of the infra-structure. An integrated street pavement and drainage program will therefore contribute to preservation of public health and infra-structure. Moreover, the accessibility and general appearance of the Stone City will improve, which will favor further economic activities, especially tourist development of this zone.

Objectives:

Improvement of surface drainage, overall accessibility and preservation of infra-structure.

Inputs activities / Implementation /Phasing:

The mission concluded that in the actual situation, the existing surface drainage system with the sub-surface conduits is not recoverable. Although parts are still intact and could be rehabilitated, in view of an overall approach that requires a new drainage system design, the rehabilitation of still operational parts would more complicate the works (and also associated maintenance in the future) than make it more easier. Also for cost aspects it is not believed that partly rehabilitation would be more economic.

It is therefore proposed to design a completely new system for surface drainage in the Stone City that replaces the old system. Wherever possible the design and lines of the old system will be followed.

The new system will be primarily composed of open and semi-open channels that concentrates the surface flow wherever possible perpendicular to the axis of the island directly to the tidal zone. Sub-surface connections and collectors will be needed for the drainage of lower areas of the Stone city (e.g. the market place), to connect these zones to lower topography, allowing a further gravity drainage to the sea.. For easy maintenance the drainage system should remain open wherever possible, to clean the system of sand and street debris that comes with the surface flow.

Pavement of the main streets with an open drainage system

To avoid overland flow with high amounts of sand from street erosion, the main streets should be paved and other measures like rehabilitation of the former roof rainwater catchments with cisterns should be implemented. This issue of rehabilitation of the rainwater - cistern system is dealt with in a separate project proposal concerning the rehabilitation of private water and sanitation facilities. In the here discussed street drainage project, it is proposed that the main streets should be paved to avoid sand from street erosion, which is in fact rehabilitation of the former situation.

In the past, most streets of the Stone City were paved with (a thin layer of) asphalt. Although relatively cheap in investment (roughly 7-10 US\$/m²), asphalt pavements is sensitive to degradation in tropical conditions and requires specific maintenance materials and procedures with associated relatively high costs (approx. 40 US\$/m/year). Rehabilitation of the street pavement with asphalt is therefore considered not a favorable sustainable solution in view of actual and future technical and financial potential of the Municipality of the Ilha de Mozambique.

The mission proposes therefore an alternative pavement procedure with cement bricks. The bricks can be produced locally, as is already the case in a pilot project street pavement with cement bricks in Nampula. In the Nampula pilot project it is estimated that the investments costs are about 20 US\$/m² with a relative easy and cheaper maintenance in the order of 5 US\$/m/year. An important argument for the brick option is that opening of the streets for the maintenance or other purposes is relatively easy and can be done with local labor. In addition to the advantages of lower maintenance costs, the alternative of cement-bricks option also fits better with the former architecture of the Stone City. A disadvantage of the brick option is the relatively high initial cost of approximately 20 US\$/m² which implies that for the same amount of funding less streets could be paved. However, in spite of the higher initial costs, the mission strongly recommends the brick option in view of the future maintenance facilities and proposes therefore a project that starts with pavement of the main streets,

while the secondary streets are left unpaved for the moment and could be paved in a second phase with a second phase (additional) funding.

For these secondary streets “bare zones” special attention should be given to other projects that aims to minimize the surface runoff, like the previous mentioned rainwater - cistern promotion project. In addition to this, in the drainage design of the paved streets special attention should also be given to the location of sand collectors/separators at the connection of paved and unpaved streets, to avoid excess deposition of sand from the bare zone into the drainage system.

Input actions are therefore:

- Detailed project design for tendering of works to implement a drainage system, with special attention to the following items:
- Sub-division of the Stone City in streets to be paved and secondary streets with additional measures to minimize surface runoff;
- Pavement of streets with locally made cement bricks;
- Identification of surface drainage and sub-surface drainage conduits that are integrated in the new paved streets and that directly drain towards the sea, perpendicular to the axis of the island;
- Training components (institutional and technical) for all project phases for the Urban Services of the Municipality of the island.

Total project realization time: 2 years, after (subcontracted) detailed project design and tendering in a six month period, the project should start as soon as possible, to be completed within one and a half year.

Outputs:

- Pavement of about 10 km of (main) streets in the Stone City with locally made cement bricks, integrated with a surface drainage system;
- Open channel and sub-surface drainage systems for main streets and depression zones;
- Training of Urban Services of the Municipality and local labor opportunities for construction and maintenance.

Legal framework:

Works will be under supervision of the Urban Services of the Municipality in the framework of a institutional and technical training program for this Department.

Possible Constraints:

Execution of drainage works, together with the pavement of streets with locally made bricks and drains needs a good project co-ordination of organizing production and transport of materials and supervision of work in several teams. The Municipality therefore will need additional institutional and technical support. Another concern is the rainy period, preferably the works should therefore be phased in parts that could be completed in the dry season.

Budget:

- | | | |
|---------------------------------|----------------|-------------------------------|
| • Detailed project design: | 25.000 US\$ | |
| • Streets pavement: | 1.000.000 US\$ | |
| • Drainage system | 175.000 US\$ | |
| • Consultancy and supervision: | 100.000 US\$ | |
| • Unforeseen | 100.000 US\$ | |
| • <u>Total estimated costs:</u> | 1.400.000 US\$ | Total project period: 2 years |

Work already done:

Practically none, previous Portuguese tar roads and drainage system are not functionally anymore and cannot be rehabilitated, therefore a total new infra-structure and drainage system needs to be re-designed.

3.6 Solid waste and cesspit management

One of the “performance” indicator of the state of development of the island is the degree to what a municipality is able to organize (and/or delegate) collect, transport and dispose of solid household and latrine waste (ludos). It is believed that the “appreciation and well being” of the island’s inhabitants and tourist / visitors will be highly improved if the issue of waste management and health related subjects are seriously taken care of. Moreover, it will be evident that any “bad reputation” in this respect will have a negative effect on the overall development of the island.

Objectives:

Sustainable environmental management of solid waste and sewage disposal, that creates local employment and contributes to a better overall hygienic situation and environmental awareness on the island.

Inputs activities / Implementation /Phasing:

The overall philosophy of the proposed project is to commercialize the collection of solid waste and sewage from (private) cesspits under the responsibility of the Municipality. The proposed organizational structure for this is to identify an existing private company or to identify persons that could start such a company, that could perform these task on a commercial base with a (renewable) contract with the Municipality. Institutional and technical assistance to the Municipality will be necessary for the project design and to assist in the first years of practical operation. This (new) company will be given a subsidy to invest in material and an initial project to start up its activities.

For the part of the collection of solid waste, several operational management systems should be evaluated, including the actual waste collection on the island. Special emphasis should be given to the location and improved management of final disposal of solid waste on the mainland. It is proposed that the new company could start with the cleaning up of the existing “spontaneous” waste dump at the southern part of the island, as a “starting-up” project to gain momentum in its activities. This waste should than be transported to the improved final waste dump at the mainland.

For the part of sewage management and especially the emptying and maintenance of cesspits, it is proposed that the Municipality in the framework of this project should introduce and promote a Manual Pit Emptying Technology (MAPET Concept), with the associated transport equipment and commercialization of services through (preferably) the same company.

The MAPET Concept has been developed and successfully implemented by WASTE Consultants in collaboration with the Sewerage and Sanitation Department of Dar es Salaam in Tanzania, to improve environmental sanitation in over-populated areas in low-income countries. The equipment consist of a piston handpump on a pushcart, a 200 liter vacuum tank with a 3/4 inch hose-pipe to drain the sludge from the pit. It’s technology is based on:

- Independence of fossil fuel; hand-operated;
- Small equipment on a pushcart, that can also operate in narrow path of unplanned areas;
- Equipment that can be locally manufactured and maintained at low cost.

It is assumed that the activities of this private company should gradually develop and increase, including other commercial activities related to the subject of waste and sewage. Activities could also include the construction and maintenance of private and public cesspits on the island, whereas the company will gain and build up specific experience in these activities which will improve the quality of services and infra-structure . In due time and when commercial activities will permit, the introduction of a mechanical operated motor-pump for the sludge evacuation of cesspits can be considered for this company. However, in view of the present situation that foresees mainly emptying of small private cesspits, the acquisition of such a larger and more expensive to operate and maintain equipment (like a “honey-sucker”) is not recommended at this moment.

The project period will be three years, including a project design and starting up period of six month..

Outputs:

- Environmental sound collection and management of waste and sewage on a commercial base;
- Institutional development for the municipality;
- Introduction of sustainable (adequate) technology;
- Cleaning up of temporarily waste-dump at the southern part of the island;
- Start of a commercial “waste and sewage enterprise”
- Professional rehabilitation and construction of cesspits.

Legal framework:

All activities will be under supervision of the Urban Services of the Municipality. The Municipality can have additional support from MICOA to evaluate the project, also in view of adapting the project design for similar situations in Mozambique.

Possible Constraints:

No Human Resources available to set-up a commercially operated enterprise; this will slow down the project, as additional time will be needed to find and to train potential employees.

Budget:

• Project design	15.000 US\$	
• subsidy to clean-up waste dump:	35.000 US\$	
• material investments:	50.000 US\$	
• Consultancy assistance 2 years:	100.000 US\$	
• Not foreseen:	50.000 US\$	
• <u>Total estimated costs:</u>	250.000 US\$	Total project period: 3 years

Work already done:

At present there is solid waste collection on the island by the Municipality, with assistance of MICOA. This is an ongoing project that needs evaluation and additional technical and institutional assistance. The first stages of the here proposed project could be included in this MICOA project. The proposed project could then continue and integrate the present ongoing activities.

4. CONCLUSIONS AND RECOMMENDATIONS

The present services of water supply, sanitation, sewerage, surface drainage and solid waste disposal of the Island was evaluated by the Water & Sanitation team. In this chapter the main conclusions and recommendations are summarized for each subject. Several of the recommendations are further elaborated in proposed project files and described in chapter 5.

4.1 Water Supply

1. The actual Water Supply is adequate, however, the water source not reliable, as it is dependent on one borehole only, that is not properly designed.
 - It is recommended to assure the availability of the water by drilling two new boreholes and to connect these to the existing system (see project file/proposal nr. 1)
2. The island has limited water reserves in case of problems with the water supply from the boreholes.
 - It is recommended to increase the water storage capacity on the island by rehabilitation of several large cisterns and to connect these to the piped water system (see project file/ proposal nr. 1).
3. The Water Company has little institutional or technical active support to assist in its operational duties.
 - It is recommended that the Empresa de Agua will have more access to training, especially to "training-on-the-job" that could be given through the proposed projects. (see project file/proposal nr.1)
4. The water from the boreholes is groundwater that has generally a good quality, this water is pumped directly into the system without any treatment.
 - It is recommended to install a monitor system for the water quality, including provisions for water treatment in case of an emergency.
5. In general the population has a capacity and willingness to pay for the water services at the actual price. However, the revenues of the selling of all water does not cover the production cost of the water. This creates short term and long term financial problems for maintenance and for the sustainability of the services.
 - It is recommended to keep the prices of water to the public at the present low level, and to sell water for commercial purposes at a real production price.
6. Besides to standard household connections, water is also sold from public standposts. Illegal re-selling with a profit of water from household connections to neighbours and to others occurs. It is not clear to what extend this is, or will be a problem for the Water Company in terms of its economic sustainability.
 - It is recommended to do further research to the effects of re-selling of water on the island on the water price and if necessary, establish a control system than limits the illegal re-selling of water.
7. Public water not easy available for tourists, drinking water is sold in small bottles, only in some shops. Poor people also collect water (of poor quality) from non protected public cisterns (e.g. in the Fort).
 - It is recommended to start with a pilot project that will make drinking water more accessible to tourist and the poor people, for instance with the introduction of Integrated Water and Sanitation Centres (see Project file/proposal nr. 2)

4.3 Sanitation

1. Sewage of residual water of households and toilets causes problems in the lower Macuti zone due to the shallow groundwater levels and inundation hazards in the rain season, many inhabitants of houses in the Stone City deteriorated sewage systems.

- It is recommended to start with a project that subsidizes the rehabilitation of private sanitation facilities (see project file/proposal 3).
- It is recommended to start a detailed study to the possibilities of a system of communal storage tanks that collects and discharges sewage water from cesspits in the Lower Macuti Zone

2. "Traditional" public latrine design is not adequate; not conform local cultural habits, has not sufficient (flush and wash) water available, generally a bad smell and has the appearance of an unhealthy place, rather to avoid to keep in good health than to use for your own benefit. Also the design is not adequate for use by children as well and have no additional facilities for urinating only. Present latrine / sanitation programs focuses mainly on physical rehabilitation, but also feel the need for new solutions, but there are yet no clear ideas how to approach the problem that people do not use public toilets.

- It is recommended to completely re-design the public latrine concept with the following design criteria: more open, aerated, larger, with more water available, also for washing the body and that have also additional accommodation for children and urinating. (see project file/ proposal 2)

3. Suitable public location for defecation and urinating do not exist for the many who have no suitable private facilities, sea-side (on the beach and between the rock outcrops) defecation has therefore always been the most suitable hygienic personal option, in spite of undesirable visual and overall less hygienic conditions that this creates.

- It is recommended to start pilot projects with the above mentioned new public latrine design on carefully selected sites. (see project file/proposal 2)

4. Excess sewage water of cesspits infiltrates into the ground, therefore groundwater will be polluted near these cesspits. This creates no health problems in the central parts of the island where the groundwater flow is downward directed and the groundwater level is several meters deep, as long as this groundwater is not used from wells for domestic purposes. Sewage disposed at the seaside on the tidal flats at the west side of the island are creating health hazards because they fall dry during low tide and leaving the sewage behind.

- It is recommended to infiltrate the sewage of cesspits and latrines wherever possible in the center line of the island, where the distance to the groundwater is the most, and to avoid infiltration of sewage near the tidal (beach) zone.
- It is recommended that sewage disposal in the sea should preferably be done at the south-eastern part of the island, where the sea is deeper close to the island.

6. Besides the low number of good functioning public latrines, also the private sanitary facilities are not sufficient and often not in good working order. It cannot be a sustainable solution that the inhabitants of houses with toilets in disrepair should always be depended on public facilities.

- It recommended to start, together with the rehabilitation and construction of new improved latrines, a project that gives credits and loans to individuals that would like to improve their private facilities (see project file/proposal 3.)

7. The public latrines have no daily management nor supervision that maintains them in a good working order. Daily management present and is functioning relatively well with the water selling points (fontenario's).

- It is recommended to integrate the daily management of the water selling in the operation and maintenance of the new public latrine design, whereas also other activities as laundry and showers could be integrated under this supervision. (see project file/proposal 2.)

8. In view of the traditional habits that have also a very clear hygienic aspect in the past, it is not believed that force and police actions only should and could be used to keep people from defecating near the sea-side (beaches and rocks).

- It is recommended that, together with the public introduction and promotion of the new improved and integrated sanitation facilities, several "temporary tolerance zones" could be indicated where sea-side defecation is not prohibited, awaiting the availability of the new improved facilities. (see project file/proposal 2).

9. Sewage disposal of households in the Stone City is traditionally with septic tanks + infiltration drains. This situation is generally acceptable when groundwater is not used (wells) for domestic purposes.

- It is recommended that existing septic tanks should also be renewed with the rehabilitation of the buildings. If this is not possible the sewage should be collected into communal septic tanks (serving a number of households).

10. Maintenance and emptying of private cesspits is the concern of the owner of the house, however, often this maintenance is not done due to lack of knowledge and material.

- It is recommended to promote the start of a private company that could include, amongst other activities, the maintenance and construction of private cesspits on the island. (see project file/proposal 6).

11. Maintenance of public septic tanks (e.g. of public latrines) and cleaning of public places is and will be the final responsibility of the Urban Services and Urbanization Department. However, this requires operational management and material with extra cost involved for extra material that is not constantly needed.

- It is recommended that the Municipality sub-contracts (and supervises) the maintenance of the public septic tanks to the above mentioned private company (see project file/proposal 6).

4.4 Drainage

1. Under normal "natural" conditions the Ilha should not encounter drainage problems. In general there is a good infiltration into the beach and dune sands to the underlying permeable coral rock. However, in the rain period during heavy showers the Lower Macuti and on several places in the Stone City pounding of water occurs during several days. Drainage systems from the colonial time were never concluded completely and are presently on most parts blocked by sand and garbage. It is estimated that this system cannot be rehabilitated. Deterioration of pavement of streets, open spaces and houses also contributed for the deposition and accumulation of sand into the pipes.

- It is recommended to design a new integrated an simple system based on (open) surface drainage for the Stone City and the Macuti Town, and to start with the pavement of the main streets (see project files/ proposals 4 and 5).

2. Additional surface water enters the streets from the former (roof) rainwater catchments that do not discharge anymore into cisterns. In the Lower Macuti depression zone additional surface water from adjacent areas flow in which aggravates the inundation problems.

- It is recommended to limit the surface water flow wherever possible, for instance by restoring the rainwater - cistern systems and closing of walls of depression zones in the Macuti zone (see project files/proposals 4 and 5).

4.5 Environment

1. There are indications that the biodiversity of the marine habitat around the island is slowly decreasing due to over-exploitation. Also the existence of mangrove forests in the coastal zone is threatened by extension of salt-pans.

- It is recommended that the biodiversity of the island and the coastal zone will be considered in the economic development of the island as one system that needs to be managed in the framework of an overall environmental masterplan for the coastal area around the Ilha de Mozambique.
2. Urban waste collection and disposal is presently done by the Municipality but not yet adequate in terms of management of the collection system and disposal locations. There are also no special precautions for hazardous (i.e. hospital) waste.
- It is recommended to promote the commercialisation of the urban waste collection and create or identify a private company that could integrates their activities. (see project file/proposal 6.)
3. There is actually no environmental management of solid waste from septic tanks. Although hygienically safe in terms of final compost, the idea of individual (on-site) anaerobic digesters proposed in the TOR's was seen by the mission as inadequate for the area.
- It is recommended to further study the environmental sound waste disposal site at the mainland and the possibilities of introducing a (single) digester for the deposition and treatment of all waste produced in the entire island.

5. PROJECT FILES

5.1 Assure water supply of good quality

priority: high

<p><u>State of the Art:</u> Present water supply service level is satisfactory, but the water source is in danger, because it is supplied by only one out of two (the other one is broken down) boreholes. Ground Water quality at the well field is not monitored, while brackish water is probably approaching.</p>	<p><u>Issues to be addressed:</u></p> <ul style="list-style-type: none"> • Sustainability of water supply in quantity and quality; • Training of Water Company personnel. 												
<p><u>Justification:</u> The infra-structure and social and economic life of the island and the inhabitants and Caju industry on the mainland depends to a great extent on the daily availability of water of good quality. It is very likely that in the (very?) near future this last borehole will also breakdown, as happened before with the other one. Before it is too late, prevention actions should be taken to create a back-up system to assure the water availability for all activities on the island and monitor its quality. No action scenario: To drill new boreholes only after collapsing of the remaining one, would leave the island without water for a period of several month, which would have a dramatic and unnecessary effect on its economic development. Moreover, finally the cost for these additional boreholes should be made anyway, sooner or later.</p>													
<p><u>Development Objectives:</u> To assure the availability of good quality water for consumption and industrial purposes.</p>	<p><u>Immediate Objectives:</u> To take away the thread of not having a water supply at all at the island for a prolonged period.</p>												
<p><u>Input activities:</u></p> <ul style="list-style-type: none"> • Consultancy, supervision and training of personnel of the Water Company; • Re-drilling of two boreholes up to 35 m; • equipment with submersible pumps; • connection to the existing system. <p>Location: Entete</p>	<p><u>Outputs:</u></p> <ul style="list-style-type: none"> • Two well equipped boreholes that could assure the continuation of the development of the island; • additional "on-site" training of personnel of the Water Company 												
<p><u>Legal framework:</u> Supervision of the works should be delegated by the Water Company to a capable organization.</p>	<p><u>Implementing / phasing:</u> As soon as possible, work should preferably be done by a drilling firm already present in the area to avoid extra loss of time for travels, all within one year.</p>												
<p><u>Possible Constraints:</u> Drilling firm not directly available or does not has the necessary equipment and/ or tubing and screens available to start the work.</p>													
<p><u>Estimated budget:</u></p> <table> <tr> <td>Design and supervision:</td> <td>25.000 US\$</td> </tr> <tr> <td>Training of Water Company:</td> <td>10.000 US\$</td> </tr> <tr> <td>Drilling of two boreholes:</td> <td>50.000 US\$</td> </tr> <tr> <td>Equipment and connection:</td> <td>15.000 US\$</td> </tr> <tr> <td>Rehabilitation of 2 Cistern's:</td> <td>50.000 US\$</td> </tr> <tr> <td>Not foreseen:</td> <td>25.000 US\$</td> </tr> </table>	Design and supervision:	25.000 US\$	Training of Water Company:	10.000 US\$	Drilling of two boreholes:	50.000 US\$	Equipment and connection:	15.000 US\$	Rehabilitation of 2 Cistern's:	50.000 US\$	Not foreseen:	25.000 US\$	<p><u>Work already done:</u> A total of 6 reconnaissance boreholes have been made on the Entete location, of which two where connected to the piped water system. After drilling no rehabilitation actions have been reported.</p>
Design and supervision:	25.000 US\$												
Training of Water Company:	10.000 US\$												
Drilling of two boreholes:	50.000 US\$												
Equipment and connection:	15.000 US\$												
Rehabilitation of 2 Cistern's:	50.000 US\$												
Not foreseen:	25.000 US\$												
<p><u>Total estimated costs:</u> 175.000 US\$ Realization period: 1 year</p>													

Remarks: Apart of this infrastructure work, also a complete "plan of operations" should be made by a consultancy that includes scenario's for all possible threads, including extra water storage on the island in cistern's and the proposed monitoring systems, regular maintenance and financial provisions for immediate actions, etc.

2. Integrated Water & Sanitation Services

priority: high

<p><u>State of the Art:</u></p> <ul style="list-style-type: none"> Public sanitation facilities (latrines) are being rehabilitated but there are little indications that they will be used by the population. Water is sold at public taps, but it's potential use is low profile, as there are no other facilities for further use. (e.g. total commercialization of a modern petrol station) 	<p><u>Issues to be addressed:</u></p> <ul style="list-style-type: none"> New design with combination of water, sanitation, shower and laundry facilities; Use of improved public bathhouse - latrines by population, including children; Defecation on sea-side (beaches and rocks) Improved sanitation awareness 												
<p><u>Justification:</u></p> <p>All existing management models of public Water and Sanitation facilities seems not to be effective, water selling points have no additional use and, even for the rehabilitation of old latrines, there is little or no hope that the objective of overall hygienic situation can and will improve in the future. This calls for new approaches in pilot projects, that integrates Water and Sanitation (W&S) facilities.</p>													
<p><u>Development Objectives:</u></p> <p>Sustainable and self-supporting W&S facilities to contribute to an improved hygienic situation and well being of the population.</p>	<p><u>Immediate Objectives:</u></p> <ul style="list-style-type: none"> Start of pilot projects of public integrated water and sanitation services (IWSS) and Improved Bathroom latrines (IBL) Toilet facilities also suitable for children; 												
<p><u>Input Actions:</u></p> <ul style="list-style-type: none"> Design of new IWSS and IBL infra-structure; Identify with population suitable locations for these facilities and "Tolerance Zones" for defecation near the sea-side as an temporary solution until facilities are in full operation; Construction works and supervision. 	<p><u>Outputs:</u></p> <ul style="list-style-type: none"> 2 functioning Water & Sanitation Centers; 5 functioning Improved Bathroom latrines; Improved overall hygienic awareness. 												
<p><u>Legal framework:</u></p> <p>Work to be executed under supervision of Urban Services of the Municipality, in collaboration with the Water Company. Additional technical support of MICOA and DNA.</p>	<p><u>Implementing / phasing:</u></p> <ul style="list-style-type: none"> Total project time: 2 years; After identification of priority locations direct start of construction works and connection of water supply. Fast implementation is important to improve the creditability of the project. 												
<p><u>Possible Constraints:</u></p> <p>A new design should be made. This requires a good literature study and a close monitoring and collaboration with the clients of the facilities during construction to avoid "practical evident" mistakes.</p>													
<p><u>Estimated Budget:</u></p> <table> <tr> <td>Project design</td><td>25.000 US\$</td></tr> <tr> <td>Construction of 2 IWSC</td><td>250.000 US\$</td></tr> <tr> <td>Construction of 5 IBL</td><td>125.000 US\$</td></tr> <tr> <td>Consultancy and Supervision</td><td>50.000 US\$</td></tr> <tr> <td>Expatriate assistance, Training</td><td>150.000 US\$</td></tr> <tr> <td>Not foreseen & Operation cost</td><td>50.000 US\$</td></tr> </table>	Project design	25.000 US\$	Construction of 2 IWSC	250.000 US\$	Construction of 5 IBL	125.000 US\$	Consultancy and Supervision	50.000 US\$	Expatriate assistance, Training	150.000 US\$	Not foreseen & Operation cost	50.000 US\$	<p><u>Work already done:</u></p> <p>There is an ongoing MICOA project on the island that aims to improve public sanitary facilities. The start of the proposed project could be integrated in this ongoing project.</p>
Project design	25.000 US\$												
Construction of 2 IWSC	250.000 US\$												
Construction of 5 IBL	125.000 US\$												
Consultancy and Supervision	50.000 US\$												
Expatriate assistance, Training	150.000 US\$												
Not foreseen & Operation cost	50.000 US\$												
<p><u>Total estimated costs:</u> 500.000 US \$ Realization period: 2 years</p>													

3. Private Water & Sanitation facilities

priority: medium

<p><u>State of the Art:</u> Many individual sanitation facilities (toilets) and rainwater - cistern systems had no maintenance for more than 20 years and are not functioning.</p>	<p><u>Issues to be addressed:</u></p> <ul style="list-style-type: none"> • Rehabilitation of individual rainwater - cisterns systems; • Rehabilitation of private (flush) toilets, cesspits and sewage disposal. 								
<p><u>Justification:</u> Although operation and maintenance of private water and sanitation systems is the concern of the owner of the building, this project in the particular case of Ilha de Mozambique is justified by the argument that the owners generally have no funds for this rehabilitation and that the rehabilitation of these private systems is a prerequisite addition to equivalent public services, to restore the previous "natural" equilibrium of the combination of these individual and public facilities on the island, in view of a sustainable long term development. Funding of these individual systems must therefore be seen as an extension of funding for provision of public water and sanitary facilities, that cannot satisfy on itself all the needs of the inhabitants.</p>									
<p><u>Development Objectives:</u> Sustainable development through a combination of sufficient satisfactory private and public Water and Sanitation services.</p>	<p><u>Immediate Objectives:</u></p> <ul style="list-style-type: none"> • Creation of more independence of individuals from the public Water & Sanitation systems; • Optimizing of (rain)water resources and reducing surface runoff. 								
<p><u>Inputs activities:</u> Detailed Project design of Credit system for rehabilitation of individual W&S systems for an estimated individual credit of 1.500 US\$</p>	<p><u>Outputs:</u> Increased number of private sanitary and rainwater - cistern facilities; 120 in Stone City and 720 in Macuti Town.</p>								
<p><u>Legal framework:</u> Credits should be given through the Municipality, in which a special W&S rehabilitation credit (and/or subsidiary) management section with access to funds should be implemented, with an external auditing to justify the expenses and activities.</p>	<p><u>Implementing / phasing:</u> Total realization period: 3 years Starting with institutional support to the Municipality and careful selection of individuals that could realize project examples to stimulate the further development of the activities.</p>								
<p><u>Possible Constraints:</u> People could apply for credits, but will have no jobs that could bring up the financial means to pay the loan part back within the given period. A 50 /50 % (or other ratio) of credits and contribution could be adopted, with specific stimuli and incentives to return the loan in cash or with other contributions, for instance with labor in construction work at other projects on the island. The credit budget therefore should be considered as a subsidiary contribution, that will not come back in total to the Municipality.</p>									
<p><u>Estimated Budget:</u></p> <table> <tr> <td>Credit rehabilitation fund:</td> <td>1.260.000 US\$</td> </tr> <tr> <td>Consultancy assistance:</td> <td>50.000 US\$</td> </tr> <tr> <td>Municipality co-ordination:</td> <td>40.000 US\$</td> </tr> <tr> <td>Unforeseen:</td> <td>50.000 US\$</td> </tr> </table>	Credit rehabilitation fund:	1.260.000 US\$	Consultancy assistance:	50.000 US\$	Municipality co-ordination:	40.000 US\$	Unforeseen:	50.000 US\$	<p><u>Work already done:</u> Practically none on a co-ordinated basis. Individuals that have some finances available restore toilets and bathrooms, but generally not cesspits and the cistern system.</p>
Credit rehabilitation fund:	1.260.000 US\$								
Consultancy assistance:	50.000 US\$								
Municipality co-ordination:	40.000 US\$								
Unforeseen:	50.000 US\$								
<p><u>Total estimated costs:</u> 1.400.000 US\$ Realization period: 3 years</p>									

4. Surface drainage in Lower Macuti Zone

Priority: high

<p><u>State of the Art:</u> In rainy season high amounts of overland flow with soil erosion towards the Lower Macuti Zone, with subsequent pounding of water. No drainage facilities in operation.</p>	<p><u>Issues to be addressed:</u></p> <ul style="list-style-type: none"> • Improved surface drainage; • New gravity drainage towards the low tide mark of the sea; • Closure of the Lower Macuti Zone from inflow of additional surface water. 								
<p><u>Justification:</u> Although drainage problems only exist in the rainy season, prolonged pounding of surface water in this densely build up zones is a risk for public health. Moreover, the associated erosion contributes to the deterioration of the infra-structure. An integrated program of surface drainage with subsurface outflow to the sea will therefore contribute to preservation of public health and infra-structure, which will favor further economic activities.</p>									
<p><u>Development Objectives:</u> Improvement of overall health, accessibility and preservation of infra-structure.</p>	<p><u>Immediate Objectives:</u></p> <ul style="list-style-type: none"> • Drainage of Lower Macuti Zone; • Creating local job opportunities 								
<p><u>Inputs activities:</u></p> <ul style="list-style-type: none"> • Consultancy for detailed project design and supervision of works by a contractor; • Assistance and "On-the-job" training of the Urban Services of the municipality in all activities. 	<p><u>Outputs:</u></p> <ul style="list-style-type: none"> • 2 km open channel surface drainage system, with secondary lines; • Closing of outer wall around depression; • Subsurface drainage channels with a sluice gate, that conduits surface water from the Lower Macuti Zone to the low-tide sealevel. 								
<p><u>Legal framework:</u> Works will be under final supervision of the Urban Services of the Municipality.</p>	<p><u>Implementing / phasing:</u> Total time for realization: 2 years After (subcontracted) detailed project design and tendering project can start within one year.</p>								
<p><u>Possible Constraints:</u> Works needs to be executed and completed within the seven month dry period, starting in May and to be completed before the rains of November.</p>									
<p><u>Estimated Budget:</u></p> <table> <tr> <td>Detailed project design:</td> <td>25.000 US\$</td> </tr> <tr> <td>Infrastructure work:</td> <td>200.000 US\$</td> </tr> <tr> <td>Consultancy and training:</td> <td>75.000 US\$</td> </tr> <tr> <td>Unforeseen</td> <td>50.000 US\$</td> </tr> </table>	Detailed project design:	25.000 US\$	Infrastructure work:	200.000 US\$	Consultancy and training:	75.000 US\$	Unforeseen	50.000 US\$	<p><u>Work already done:</u> Practically none, previous Portuguese drainage system is completely blocked with sand and debris and cannot be rehabilitated, therefore a total new system must be re-designed.</p>
Detailed project design:	25.000 US\$								
Infrastructure work:	200.000 US\$								
Consultancy and training:	75.000 US\$								
Unforeseen	50.000 US\$								
<p><u>Total estimated costs:</u> 350.000 US\$ Realization period: 2 years</p>									

5. Surface drainage Stone City

priority: medium

<p><u>State of the Art:</u> In rainy season high amounts of overland flow with soil erosion and subsequent pounding of water in depressions. No drainage facilities in operation.</p>	<p><u>Issues to be addressed:</u></p> <ul style="list-style-type: none"> • Pavement of main streets in Stone City; • Subsurface drainage channels for main streets and depression zones. 										
<p><u>Justification:</u> Although drainage problems only exist in the rainy season, prolonged pounding of surface water in build up zones is a risk for public health. Moreover, the associated erosion of streets contributes to the deterioration of the infra-structure. An integrated street pavement and drainage program will therefore contribute to preservation of public health and infra-structure. Moreover, the accessibility and general appearance of the Stone City will improve, which will favor further economic activities.</p>											
<p><u>Development Objectives:</u> Improvement of surface drainage, overall accessibility and protection of infra-structure.</p>	<p><u>Immediate Objectives:</u></p> <ul style="list-style-type: none"> • Pavement of 5 km of main streets • Creating local job opportunities 										
<p><u>Inputs activities:</u> Detailed project design, that aims at pavement and surface drainage of 5 - 10 km roads and 1 km subsurface drainage in the Stone City.</p>	<p><u>Outputs:</u></p> <ul style="list-style-type: none"> • Pavement of main streets in the Stone City with locally made cement bricks; • Open channel and sub-surface drainage systems for main streets and depression zones. 										
<p><u>Legal framework:</u> Works will be under supervision of the Urban Services of the Municipality.</p>	<p><u>Implementing / phasing:</u> Total project realization time: 3 years After (subcontracted) detailed project design and tendering, the project can start within one year.</p>										
<p><u>Possible Constraints:</u> Execution of drainage works, together with the pavement of streets with locally made bricks and drains needs a good project co-ordination of organizing production and transport of materials and supervision of work in several teams. The Municipality therefore may need additional (institutional) support in logistics and personnel.</p>											
<p><u>Estimated Budget:</u></p> <table> <tr> <td>Detailed project design:</td> <td>25.000 US\$</td> </tr> <tr> <td>Streets pavement:</td> <td>1.000.000 US\$</td> </tr> <tr> <td>Drainage system</td> <td>175.000 US\$</td> </tr> <tr> <td>Consultancy and supervision:</td> <td>100.000 US\$</td> </tr> <tr> <td>Unforeseen</td> <td>100.000 US\$</td> </tr> </table>	Detailed project design:	25.000 US\$	Streets pavement:	1.000.000 US\$	Drainage system	175.000 US\$	Consultancy and supervision:	100.000 US\$	Unforeseen	100.000 US\$	<p><u>Work already done:</u> Practically none, previous Portuguese tar roads and drainage system are not functionally anymore and cannot be rehabilitated, therefore a total new infra-structure and drainage system needs to be re-designed.</p>
Detailed project design:	25.000 US\$										
Streets pavement:	1.000.000 US\$										
Drainage system	175.000 US\$										
Consultancy and supervision:	100.000 US\$										
Unforeseen	100.000 US\$										
<p><u>Total estimated costs:</u> 1.400.000 US\$ Realization period: 3 years</p>											

6. Solid Waste and Cesspit management

priority: medium

<p><u>State of the Art:</u></p> <ul style="list-style-type: none"> On the island no masterplan or special precautions exist for waste and (latrine) sewage management. Solid waste is collected at several locations on the island, further transport and disposal is not adequately managed; 	<p><u>Issues to be addressed:</u></p> <ul style="list-style-type: none"> Public sanitation facilities; Solid Waste transport and disposal sites Local labor opportunities; Institutional support to the Municipality; Environmental protection of waste disposal; Hygienic awareness 										
<p><u>Justification:</u></p> <p>One of the “performance” indicator of the state of development of the island is the degree to what a municipality is able to organize (and/or delegate) collect, transport and dispose of solid household and latrine waste (ludos). It is believed that the “appreciation and well being” of the island’s inhabitants and tourist / visitors will be highly improved if the issue of waste management and health related subjects are seriously taken care of. Moreover, it will be evident that any “bad reputation” in this respect will have a negative effect on the overall development of the island.</p>											
<p><u>Development Objectives:</u></p> <ul style="list-style-type: none"> Proper hygienic situations on the island, as well as in public places as in private houses; A sustainable management of sewage on the island, that creates local employment and contributes to a better overall hygienic situation and environmental awareness. 	<p><u>Immediate Objectives:</u></p> <ul style="list-style-type: none"> Improved waste collection at “eco-points”; Cleaning up of temporarily waste-dump at the southern part of the island; Start of a commercial “sewage enterprise” Rehabilitation and construction of new small and large cesspits. 										
<p><u>Inputs activities:</u></p> <ul style="list-style-type: none"> Institutional assistance to the Municipality; Introduction, acquisition and in-company training of a small hand-operated cesspit pump (MAPET Concept), associated transport equipment and commercialization of services through expatriate Consultancy. 	<p><u>Outputs:</u></p> <ul style="list-style-type: none"> Proper solid waste and sewage management on a commercial base; Rehabilitated and new cesspits that are properly maintained. 										
<p><u>Legal framework:</u></p> <p>Commercial activities are subcontracted under supervision of the Urban Services of the Municipality to a private (new) enterprise.</p>	<p><u>Implementing / phasing:</u></p> <p>Total of two years, with initial set-up phase and follow-up phase of 1 year each.</p> <ul style="list-style-type: none"> Start of waste collecting and cleaning up of present temporarily waste-dump. Gradually increase of commercial activities. 										
<p><u>Possible Constraints:</u></p> <p>No Human Resources available to set-up a commercially operated enterprise; this will slow down the project, as additional time will be needed to find and to train potential employees.</p>											
<p><u>Estimated Budget:</u></p> <table> <tr> <td>Project design</td><td>15.000 US\$</td></tr> <tr> <td>Subsidy to clean-up waste dump</td><td>35.000 US\$</td></tr> <tr> <td>Material investments:</td><td>50.000 US\$</td></tr> <tr> <td>Consultancy assistance 2 years:</td><td>100.000 US\$</td></tr> <tr> <td>Not foreseen:</td><td>50.000 US\$</td></tr> </table>	Project design	15.000 US\$	Subsidy to clean-up waste dump	35.000 US\$	Material investments:	50.000 US\$	Consultancy assistance 2 years:	100.000 US\$	Not foreseen:	50.000 US\$	<p><u>Work already done:</u></p> <p>Waste collection by the Municipality, with assistance of MICOA. Ongoing project that needs additional technical and institutional assistance.</p>
Project design	15.000 US\$										
Subsidy to clean-up waste dump	35.000 US\$										
Material investments:	50.000 US\$										
Consultancy assistance 2 years:	100.000 US\$										
Not foreseen:	50.000 US\$										
<p><u>Total estimated costs:</u> 250.000 US\$ Realization period: 2 years</p>											

6. POSSIBLE SOURCES FOR FUNDING

6.1 DONORS

During the mission a number of Donor activities and possible future funding for projects in the Nampula Province were mentioned. An overview of these funding possibilities that came to our attention is listed below. It should be stressed however, that this information is preliminary and not complete and that further detail should be obtained with the organisations mentioned.

Dutch Embassy

- Funding the "SURN Project" that focus on institutional support in the water sector in the Nampula Province. This project has small funds available for projects that focus on sustainability aspects.
- SNV (former Dutch Volunteers Organisation) in Maputo, has several development programs for Governmental and Non Governmental (NGO's) organisations, technical and institutional support.

Danish Embassy

- Funding a MICOA project in supporting the Municipality in rehabilitation of sanitation and environmental aspects of the Ilha.
- General funds available for Environment and Disaster relief.

CDS Nampula

- Probably next year funds available for Environment and Rehabilitation projects, no detailed information available yet, but indications of maximum of 70.000 US\$ per project per year.

World bank

- Funds of Global Environmental Assist Program, for several Districts in the Province of Nampula, with overall objective to preserve biodiversity in developing socio-economic activities in the coastal zone.

ANNEXES

Terms of Reference

Within the objectives set forth in the STS Document for the Ilha de Mozambique and under the co-ordination and supervision of the UNESCO Office in Maputo, the International Water and Sanitation engineer, in collaboration with the National Water and Sanitation Engineer and the quantity surveyor, will review inter alia the available information on water in the Island and will survey the current situation of sewerage and drainage, both in Macuti City and the Stone City.

In particular, attention will be paid to:

1. Review actual and projected water demand, quantity and quality of available water supply, physical and operational conditions of the existing system and actual level of service;
2. Review the quality of sources of water, its distribution and use of cesspits, systems, soakpits, etc. that may contribute to the groundwater pollution;
3. Review the design, capacity, effectiveness, operation and condition of the existing surface and, if any, subsurface drainage system;
4. Propose community toilet blocks, both in Macuti City and the Stone City, connected to digesters and water supply;
5. Propose an upgrading of the sewerage in the Stone City;
6. Advise on the feasibility and need for a honey-sucker tanker in the island;
7. Propose an program for storm water channels in Macuti City;
8. Assess the methods of waste water evacuation, condition and operation of existing sewerage system and project the required additional system capacity;
9. Calculate the cost involved for a sound and sustainable water/sanitation program in the Island, taking into account environmental concerns, particularly for the cleaning up of beaches;

Working program

Date	Program of activities
19/07/98	<ul style="list-style-type: none"> • Arrival of International team-members in Maputo • Informal meeting team members
20/07/98	<ul style="list-style-type: none"> • Meeting with the Technical Cabinet of Restoration of the island at UNESCO • Meeting with the Director of the National Commission of UNESCO - at the CNUM • Working session with mission team at UNESCO
21/07/98	<ul style="list-style-type: none"> • Meeting at the Ministry of Industry, Commerce and Tourism • Meeting at the Ministry of Public Works and Housing • Meeting with Direcção Nacional Das Edificações • Meeting at the Ministry of Environment & Unidade de Gestão Costeira • Meeting with the resident Officer of UNDP - UNDP • Plenary working session at UNESCO
22/07/98	<ul style="list-style-type: none"> • Departure to Ilha de Mozambique via Nampula
23/07/98	<ul style="list-style-type: none"> • Plenary working session at the Centro de Recursos of OIKOS • Meeting with the Mayor at the Conselho Municipal • Working session at the Water Company • Working session (briefing) at OIKOS
24/07/98	<ul style="list-style-type: none"> • Site survey in the Macuti City (water, sanitation and environmental issues) • Site visit to the boreholes of the water supply system of the Ilha • Plenary working session at OIKOS
25/07/98	<ul style="list-style-type: none"> • Meeting with the water company of Ilha de Moçambique • Site visit Stone City, including the Rehabilitation works of the Hospital • Site visit to Fortaleza and its water reservoirs (cistern's)
26/07/98	<ul style="list-style-type: none"> • Site visits to Macuti Town and the Stone City • Plenary working session
27/07/98	<ul style="list-style-type: none"> • Meeting with the Head of the Urban Services and Urbanization Department of the Ilha de Mozambique • Departure to Nampula • Meeting with the Dutch SURN project (Support Unit Region North) • Meeting with the MICOA-CDS program (Centro de Desenvolvimento Sustentavel in Nampula)
28/07/98	<ul style="list-style-type: none"> • Departure to Maputo
29/07/98	<ul style="list-style-type: none"> • Plenary working session • Meeting with the resident representative UNESCO and the Cabinet Técnico at UNESCO Office
30/07/98	<ul style="list-style-type: none"> • Meeting with the Co-ordinator in Maputo of the MICOA project on the Ilha de Mozambique • Meeting with the acting director of the Low- Cost Sanitation Programme • Plenary working session
31/07/98	<ul style="list-style-type: none"> • Debriefing at UNDP dispensary • Plenary working session
01/08/98	<ul style="list-style-type: none"> • Final Meeting of the Mission

List of resource persons during the mission

Mr. Germain Bakker	SURN Project, Water Engineer - Nampula
Mr. Balança	Head Urban Services & Urbanization Department - Ilha de Mozambique
Mr. Kim Himmergen	MICOA- advisor, CDS - Nampula
Mr. Yorick Houdayer	Free Lance Architect - Ilha de Mozambique
Mr. John Hutton	Consultant, Impacto - Maputo
Mrs. Viebe Johnsen	Advisor Coastal Management Unit, MICOA - Maputo
Mr. Adamo José	Water Company - Ilha de Mozambique
Mr. Carlos Noa Laisse	Acting Director Low Cost Sanitation Programme - Maputo
Mr. Ron van Leeuwen	SURN Project, Economist - Nampula
Mr. Alfredo Massinga	Coordinator Coastal Management Unit, MICOA - Maputo
Mr. Kees Metselaar	Royal Dutch Embassy - Maputo
Mr. Paulino Mualene	Local Consultant, MICOA - Ilha de Mozambique
Mr. Costa Pereira	Water Company - Ilha de Mozambique
Mr. Salimo	Water Company - Ilha de Mozambique
Mr. Rod de Vletter	World Bank - Maputo

References

During the mission and reporting a large number of documents and articles on Ilha de Mozambique were consulted, a small list of the most relevant consulted documents is given below:

- "Ilha de Mozambique, a World Heritage Site"; A Programme for Sustainable Human Development and Integral Conservation, Basic document, report by S. Mutal, 1997.
- "Ilha de Mozambique, a World Heritage Site"; A Programme for Sustainable Human Development and Integral Conservation, report CCII by S. Mutal, 1998.
- "Ilha de Mozambique"; University of Aarhus, Department for Architecture, Denmark, 1985
- "Water Supply in the peri-Urban Areas of Mozambique, an evaluation in 7 towns"; SAWA-Mozambique, 1997.
- "Conceptual Framework for Municipal Solid Waste Management in Low-Income Countries"; UMP/SDC Working Paper, Serie 9, by P. Schubler, 1996.
- "MAPET, a neighbourhood-based pit emptying service with locally manufactured handpump equipment in Dar es Salaam, Tanzania"; WASTE Consultants Holland, 1992.
- "Project de Gestao da Zone Costeira de Mozambique, Project Document"; DANIDA 1996.
- "Community Managed Small Towns Water Supplies in Ghana, Changes and Challenges in the Transition Phase"; Community Water and Sanitation Conference, May 5-8, 1998, Washington, DC, by S. Sulley Gariba, G.A.S. Development Associates Ltd., Accra. 1998.
- "Focus, Consultative Group to Assist the poorest in Micro-finance program"; CGAP, Worldbank, Washington DC 20433, 1997.
- "Programa de recuperacao da Ilha de Mozambique, estrategias para um Desenvolvimento Sustentavel"; Gabinete tecnico do Ministerio da Cultura e Juventude Republica de Mozambique, IUCN/EU, 1994.

