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RADA WATER SUPPLY AND SANITATION PROJECT

***INSTITUTIONAL STRENGTHENING NWSA RADA BRANCH
(First Draft, February 1997)***

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1 INTRODUCTION

1.1 Institutional Strengthening of NWSA Rada Branch under NWSA Umbrella

The Rada Water Supply and Sanitation Project (RWSSP) started in 1988, within the framework of the Netherlands - Yemeni bilateral development cooperation. The project aims at improving the public health situation in the Rada urban area by providing adequate water supply, sewerage, drainage and solid waste disposal systems. The project is to serve an estimated population of 50,000.

The design and tendering activities of the proposed improved facilities took mainly place in the period up to the end of 1991, whereafter the construction of the various project works started. These construction activities were recently (1996) completed. The project will end in March 1997.

To operate and maintain the newly implemented water supply and sewerage facilities, implemented by RWSSP, the National Water and Sanitation Authority (NWSA) established in 1994 the NWSA Rada Branch. This Branch was assumed to be set up and to operate within the existing NWSA organization. During the start up phase and until the water supply and sewerage systems became operational (mid 1995), the organisational structure and staffing of the Branch were still more or less geared to construction activities.

As the organisational set-up of NWSA branches as well as NWSA's financial and administrative systems were more or less defined, institutional development was at that time focused on :

- the determination of staffing requirements based on an assessment of the tasks of the Branch;
- the procurement of the physical resources to enable the Branch to carry out its tasks;
- the development of O&M procedures for the newly introduced water supply and waste water facilities;
- human resources development, mainly through on the job training during the construction and start up phase, and training in the region and overseas.

1.2 Institutional Strengthening in a Decentralised Set up

Already soon after the start of the Branch operations, the RWSSP Project Management realized that a more independent financial and administrative status of the Branch would be necessary to create the conditions for sustainability of the water supply and waste water facilities. A set up for the Branch was proposed which would :

- enable the Branch to manage and control its revenues, needed to cover its operation and maintenance expenditures;
- give the Branch more autonomy in tariff setting and in staff recruitment, staff release and staff remuneration.

A major breakthrough was reached in June 1996, when the Minister of Electricity and Water, in close consultation with NWSA HQ, GTZ/NWSA, Royal Netherlands Embassy and the Consultancy Team of the Project, basically agreed on a more independent status of the Branch as a pilot case for decentralisation (see annex I).

Additional Technical Assistance (TA) by RWSSP was provided from May '96 onwards to support the implementation of the proposals for the establishment of a more independent Branch as well as to strengthen the Branch in order to be able to meet its new responsibilities

and tasks. The Terms of Reference for this additional assignment are attached to annex II.

To enable the Branch to carry out its tasks on a more commercial basis, it was realized that the existing NWSA administrative and financial systems needed to be changed and improved. Focus in the TA was therefore on the building of autonomy and the development of new/improved working procedures, especially of those related to the newly introduced computerized Financial Management and Management Information System, which in the new set up is assumed to be operated by the Branch itself.

The table below summarises the changes in approach in building the required institutional capacity at the Branch:

Main elements initial approach (before February 1996)	Main elements current approach
<p>Procurement of physical resources to enable the Branch to carry out its tasks</p> <p>Human Resources Development through training</p>	<p>Building of autonomy</p> <p>Human Resources Development with emphasis on staff motivation (incentive scheme) and building training capacity</p> <p>Development/Improvement of administrative and financial systems to enable the Branch to carry out its tasks on a more commercial basis</p>

1.3 Progress and Constraints in TA

During the TA assignment, a model for the decentralised Branch, including an organisational framework and improved administrative systems/procedures, could be developed. Furthermore some progress could be achieved in the implementation of the decentralisation proposals for the establishment of a more independent Branch.

However, due to time limitations the newly developed administrative and financial systems could not be implemented and on the job training in new procedures could only to a very limited extent be initiated. The delay in the implementation schedule of the Consultants' activities was caused by the following :

i) promotion of connections

During the additional assignment the Consultant had to spend more time than anticipated on the promotion of the construction of sewer and water connections in order to guarantee a more sound income basis of the Branch. This task was assumed to be done by the Branch itself (see section 5.4 and 14.3).

ii) *Branch Management situation*

The Branch Management situation during the course of the assignment was highly unsatisfactorily, as a result of which the framework for a successful and timely implementation of the proposals was missing; at the start of the TA, the then General Manager and Technical Manager of the Branch were still in function, although replacement of this staff had already been agreed upon in February 1996. After they left the Branch, for some time the Branch had to operate without management at all. The

subsequently appointed manager faced major problems in being accepted by the local authorities and could therefore hardly operate effectively. For these reasons, mid-October a new (Acting) Branch Manager was appointed. Since August 1996 the Branch is operating without a Technical Manager and a Financial Manager.

iii) development of Billing Software

In 1995, it was in cooperation with GTZ/NWSA agreed to introduce for the NWSA Rada Branch the more or less standard NWSA software for accounting and billing, which software was already developed in the mid eighties. This software was at that time in the process of conversion from the VS to the UNIX operating system¹⁾. Various promises were made during the past years by NWSA HQ and the software supplier on the availability of this converted software, but mid 1996 it became clear that this software was not yet operational and had not been tested properly. Moreover, it was foreseen that the software would not become available on the short term. Finally it was realised that the software would not be more than converted outdated software which does not comply with requirements of up to date financial information systems. This situation made the Consultant look for alternatives. The Consultant found a comprehensive integrated accounting package developed for the Yemeni market and ultimately decided in close cooperation with GTZ/NWSA, the Royal Netherlands Embassy and NWSA HQ to buy this package and to develop tailor-made software for the billing system, considering use of these packages in other NWSA branches. The Consultants had to organize and supervise the development of this billing software, which was not anticipated²⁾.

iv) lack of institutionalized training capacity

During the construction and start up phase of the water supply and waste water facilities, key staff of the Branch was comprehensively trained in the technical operations by the Consultant's technical experts. Due to resign and release of a number of these staff members, in combination with a lack of an internal mechanism to transfer knowledge to new staff, a substantial number of the existing staff is still insufficiently prepared to properly operate and maintain the facilities. During the additional assignment some assistance has been given to correct this situation, but this was by far insufficient due to time limitations.

v) delay in the delivery of operation and maintenance equipment and materials, as a result of which also limited time was available to train staff in the O&M operations.

vi) delay in the formalizing of elaborated proposals by NWSA HQ (see section 3.1.4)

vii) the Steering Committee for the NWSA Rada branch, which should assist the Branch in the process of decentralisation (see annex III), was only installed in July 1996 and started its activities in August 1996. However, the Committee never could function effectively, probably because of a lack of consensus within NWSA on the extent to which the decentralisation should take place and the role of the Steering Committee in this process.

¹⁾ This conversion is necessary as Wang hardware, which uses the VS operating system, is since 2-3 years not produced and locally supported any more. Sun hardware which uses the UNIX operating system and which is locally supported has been selected for the billing and accounting system.

²⁾ The newly developed software can be operated under the UNIX system.

1.4 Purpose of Document

In strengthening the NWSA Rada Branch, a wealth of information became available on the implementation of the decentralization policies. The experience gained in the efforts to set up and strengthen a more independent NWSA Rada Branch has been brought together in this document. This document serves four purposes :

- it gives a clear insight in the activities which were carried out during the additional assignment on institutional development;
- it gives a model (organisational framework and improved procedures/administrative and financial systems) for the establishment of a decentralized branch;
- it gives an insight on further activities required for building capacity at decentralized branches and for strengthening the NWSA Rada Branch in particular;
- it is an effort to make the experience available to other agencies involved in water supply and sewerage development projects of similar nature as RWSSP.

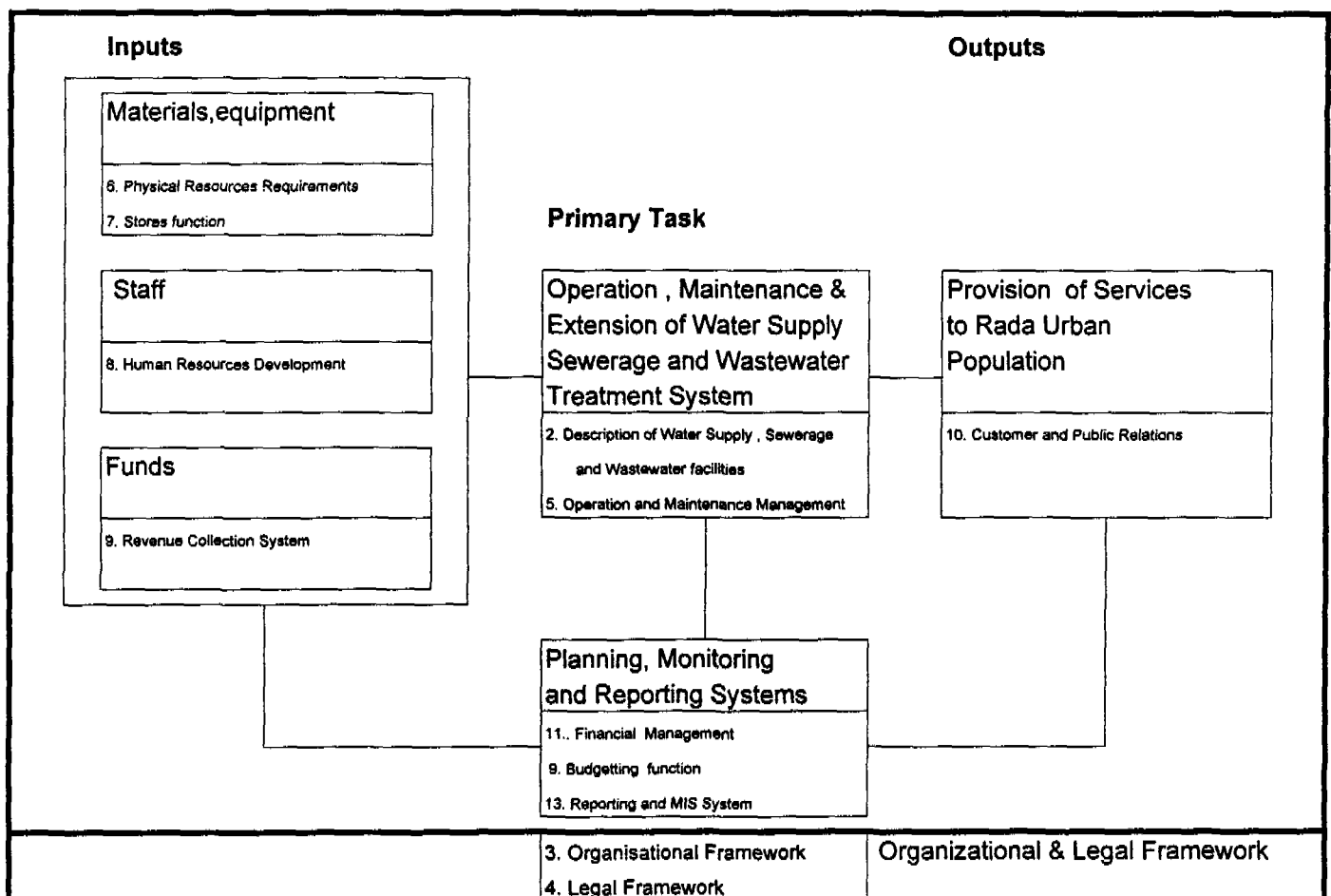
For those who want to become quickly aware of the progress achieved in strengthening the Branch and the constraints experienced, reference is made to the sections 'Progress' of the various chapters.

1.5 Report Structure and Contents

Conceptual Model of NWSA Organization/Report Structure

The report structure, which is discussed below, closely follow the conceptual model of an organization as shown in figure 1.1

Figure 1.1 : Conceptual model of NWSA Rada Branch



The main responsibilities of the Branch are to :

- provide adequate water supply to the Rada urban area;
- facilitate the urban population in this area to discharge their waste water to the sewerage system;
- treat the collected waste water.

The primary task of NWSA to meet its responsibilities is to properly operate and maintain the water supply, sewerage and waste water facilities. To enable the Branch to properly carry out this primary task, it needs to be supplied with three kinds of resources : human resources, physical resources (materials, tools and equipment) and finance. The NWSA Rada branch must be able to attract all three of them and to put them into productive use. Relevant in this context is the organisation structure which provides the basic framework in which people work to reach the objectives of the institution. Appropriate planning and control systems are required to run the organization effectively and efficiently. Plans give the organization its objectives and outline the strategies to achieve them. The control process on the other hand measures the progress towards those goals and enables the management to detect deviations from the plan in time to take corrective action.

Contents of the Chapters

Chapter 2 gives some basic features of the water supply, sewerage and waste water treatment systems which have been implemented. From this description one can form an idea of the work load involved in the administration of the systems.

Chapter 3 outlines the roles of the Branch, Local Government, NWSA Headquarters and the Supervisory Board in the decentralised set up and presents the organization chart and staffing requirements of the Branch.

Chapter 4 delineates the required (adjustments in the) legal framework to enable the Branch to effectively carry out its basic tasks.

Chapter 5 gives an overview of the operation and maintenance activities to be carried out. Details of these activities can be found in the Operation and Maintenance Manuals of the Rada Water Supply and Sanitation Project. In the description it is clearly indicated which tasks can be carried out by the Branch itself and for which tasks the Branch needs technical assistance, either from the NWSA HQ, other NWSA branches or the private sector.

Chapter 6 gives details of the materials, tools and equipment handed over to the Branch; a separate report gives the details of these materials, tools and equipment.

Chapter 7 discusses the stores function, which function is necessary to meet the operational requirements of the branch. This chapter discusses guidelines for procurement, stores coding, the various documents proposed for stores administration and stores accounting, as well as procedures for physical verification of stocks.

Human Resources Development is at the heart of the strengthening of the NWSA Rada Branch. Chapter 8 introduces the job descriptions, which are attached to annex V. These job descriptions describe the tasks which each employee is expected to perform and are the necessary reference material to select and recruit staff, assess the training needs and evaluate staff performance. Training needs of present staff, appropriate training courses and training methods are indicated as well.

The costs incurred by the NWSA Rada Branch for supplying water and waste water services, should be recovered by payment of bills presented to the customers. Revenue collection is essentially the second major task of the Branch. In Rada the billing is based on the actual

water consumption, requiring that the water meters have to be read regularly. In Chapter 9 procedures are provided for the various steps in the revenue collection process : the setting of water tariffs; the meter reading; the preparation of the bills based on the water tariffs and meter reading, and the actual revenue collection. Special attention is given to the set up of an appropriate customer data base, which is a crucial condition for effective billing and revenue collection.

Although the operation and maintenance of the technical facilities is the major task of the Branch, fulfilling this task does not guarantee continuity. For that, the Branch needs customers who use the system in a proper way, are satisfied with the services rendered and are willing to pay for these services. Chapter 10 deals with the customer and public relations and describes the activities in this field from the pre-construction phase up to the operational phase. Important action fields are discussed and cover information campaigns prior and during construction, the application procedure for connections, campaigns on tariff and use of the facilities, as well as addressing non-paying and tampering customers and complaint handing.

Each day, the Branch effects a number of transactions , such as the billing of customers, the payment of salaries, the payment for materials etc.. All the financial incidences related to these transactions are recorded and processed in and communicated by the accounting system. The proposed flow of input data as well as the flow of financial information to management in the form of financial management information sheets are discussed in Chapter 11.

Chapter 12 discusses the budget function, which function is considered as one of the keys to successful commercial operations. This function establishes :

- the (yearly) budgets: resources allocated to the various branch activities;
- the analysis of the differences between the actual expenses and budgeted amounts. This regular analysis will provide management with the basis for an effective management control system and enable management to carry out its activities as efficiently as possible and thereby increasing the possibilities of sustaining the system;

The chapter suggests the various budget formats to be used in preparing the budget and also the expected reporting on budgetary control to management.

To support the management function, especially planning and control, systems for supplying information to managers are of special importance. Chapter 13 outlines the reporting system, which consists of three levels :

- reporting from the Branch Management to the Supervisory Board;
- reporting from the Head of the Sections to the Branch Management;
- reporting from the operational level to the Head of the Sections.

The different reporting forms are attached to annex XI and are shortly described.

As a supplement, the report evaluates the (financial) sustainability of the water supply and waste water facilities. In the analysis the required tariffs are given for recovery of O&M costs, O&M costs plus short term investments and all costs. This analysis is done for different scenarios of water consumption and number of customers.

In addition to the description of the resources, framework and systems required by/proposed for the Rada Branch, at the end of each chapter a description is given of the progress and the constraints experienced in developing these systems. In these sections also the proposed follow up for a successful implementation of these systems is indicated.

2 DESCRIPTION OF WATER SUPPLY AND WASTE WATER FACILITIES

2.1 Water Supply

Up to 1995 (i.e before the construction of the improved water supply system), the population of Rada got its water from small, mostly privately owned, water supply systems. These systems, which provided water for only a few hours a day, consisted of disorderly networks of small galvanised pipes running all over the streets.

The systems were considered to be unsuitable for continued use and as these systems did not lend themselves for integration into a new, larger system, it was decided to construct a new centralized water supply scheme for the Rada Urban Area, which should totally replace these old systems.

The new Rada water supply system is designed to serve an estimated population of 50,000 people (i.e the projected population in 1995). In the second phase, for which a detailed design has been prepared, but of which the implementation is not part of the present project, the system is proposed to be extended to serve 75,000 people (the projected 2010 population).

The design of the new water supply system is based on the National Water and Sanitation Authority (NWSA) criteria, which allow a per capita water consumption of 50 l/c/day in 1995, against 70 l/c/d in the year 2010. It has been envisaged that by 1995, 95% of the population in the served areas will be connected to the system, to grow to 100% by the year 2010. Taking into account non-residential demands, peak demands and water losses (24 % of the average daily demand), the water supply has been designed for a production capacity of 3,750 m³/day in the year 1995 and 8,300 m³/day in the year 2010, as detailed in table 2.1.

Table 2.1 : Population, Demand and Production Capacity of Water Supply System

		Phase 1	Phase 2
a	Design Horizon	1995	2010
b	Population *	50,000	75,000
c	Residential demand (l/cap.day)	50	70
d	Population served (%)	95	100
e **	Net residential demand (m ³ /day)	2,375	5,250
f	Non-residential demand in m ³ /day (10 % of res.demand)	238	525
g (e+f)	Net Demand - Sub-total	2,613	5,775
h (1.2 x g)	Maximum day demand (= 1.2 * average daily demand)	3,135	6,930
i	Unaccounted for water (=20 % of maximum day demand)	627	1,386
j (h+i)	Maximum day demand/production capacity	3,762	8,316

Note : * 1988 population : 35,000; ** = b*c*d/10,000

Figure 2.1 shows the lay-out of the water supply system. The new system has been designed to provide a 24 hours supply of drinking water of a good quality. It is based on abstraction of ground water from a well field north of the town. The project has paid special attention to sustained water abstraction from a well field. For this purpose in-depth hydrogeological investigations were carried out and due attention was given to site selection. Accurate drilling

in faults traced by electro-magnetic methods resulted in the construction of high yielding boreholes.

Six wells have been drilled, each equipped with a submersible pump, producing ca. 36 m³/hr (at a pumping head of 110 m). The results of pumping tests and model calculations show that the yield of the six boreholes of the Rada water supply can be sustained beyond the year 2010.

From the well field water is transported to an elevated ground reservoir of 750 m³ which is located about 1 km North-East of the present outskirts of Rada town. Before entering the reservoir the water receives a safety chlorination. Gaseous chlorine, in future to be imported from Saudi Arabia, is used as oxidizing agent.

The power supply situation in Rada showed a shortage of electric power, resulting in a frequent lack of power, phase failure and insufficient voltage. To guarantee an uninterrupted water supply system, a power plant consisting of 4 diesel generators has been constructed. The plant has presently (1995) 100 % spare capacity, which will gradually diminish to 0 % when the second phase of the construction (2010) will be implemented. After connection in the future of the well pumps to the national electricity grid, the gen sets can easily be used as emergency stand-by units. Recently Rada has been connected to the national grid through a power connection from Dhamar. This has slightly improved the power supply situation in the town, but a further improvement of the network inside Rada is necessary to satisfactorily power the well pumps from the national grid.

The generator house and chlorination house have been constructed on a compound together with a store, an operation building, and the NWSA Rada Branch office building. The NWSA Rada Branch compound is located at approx. 1 km from the reservoir.

From the reservoir the water gravitates to the distribution system, which consists of HDPE pipelines. Figure 2.2 shows the distribution area, of which details are given in table 2.2. The distribution system has been sub-divided into several supply districts, taken into account the administrative distribution of the urban area. The districts are connected to the primary network at two or more locations. The connections comprise a (district) water meter, a valve and a non-return valve. In this way water can only enter a district and not leave it. This set-up has been chosen to easily accommodate volumetric checks of water flows and to enable the implementation of an adequate water loss prevention/reduction programme.

The entire water supply distribution network is based on private connections provided with house water meters (installed in the street); there are no public taps. The present phase of the project covers (by design) the construction of 5,000 house-connections³⁾. In-house plumbing is the responsibility of the households. For fire fighting and flushing of the sewerage system, 18 fire hydrants have been incorporated in the distribution system.

³⁾ Refer section 2.3 for actual numbers.

Figure 2.1 : Lay-Out of Water Supply System

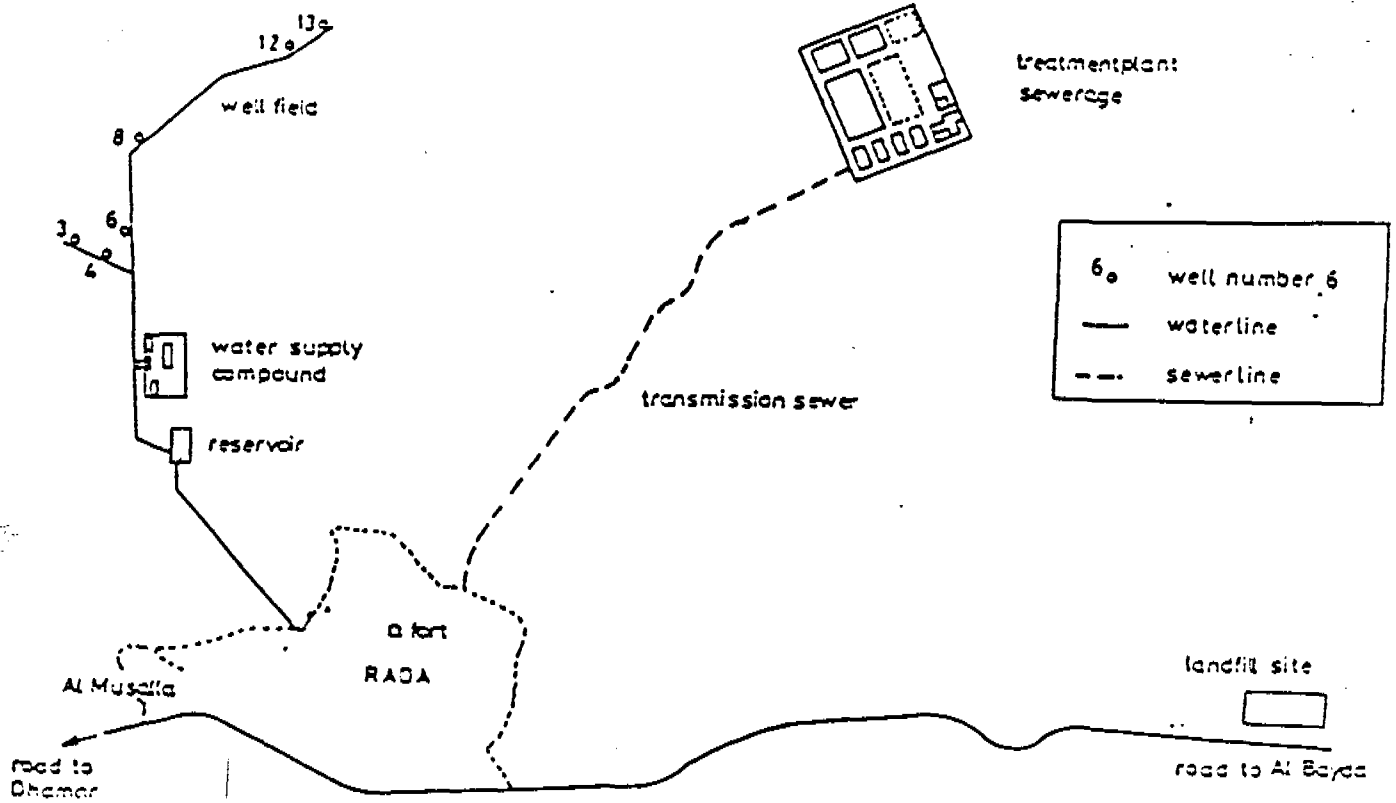


Figure 2.2 : Distribution Area

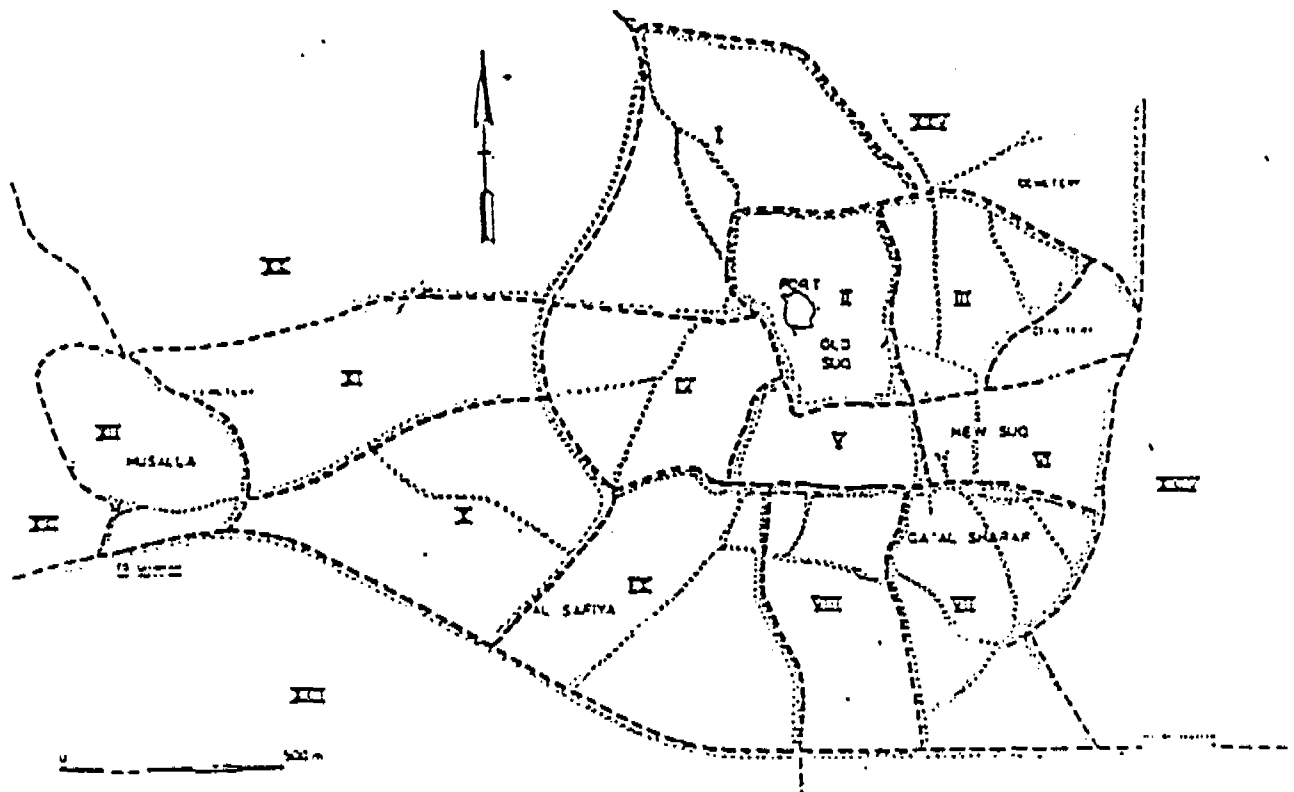


Table 2.2 : Details Water Supply Distribution Network

	Phase 1	Phase 2
Transmission water supply main	5.5 km	-
Primary line	5.4 km	9.2 km
Secondary line	52.3 km	12.8 km
Tertiary line	48.4 km	30.9 km
Total	111.6 km	52.9 km
No. of water connections	5,000	2,500

2.2 Sewerage and Waste Water Treatment

No adequate waste water disposal system existed in Rada before. About half of the households disposed of their waste water via septic tanks and soakaway pits. In large parts of the city, the ground is not permeable and in these areas, waste water was often seen running freely into the streets.

Because of the adverse soil conditions and the housing density, on-site sanitation could only provide incidental solutions and therefore a central waste water collection and treatment system was chosen.

Considering the climatic conditions prevailing in Yemen, separate systems for the collection of waste water and rainwater were opted for. The high rainfall intensities (45 mm/hour) and the long dry season made this mandatory; a combined system would require pipes with very large diameters and would be economically unattractive. Furthermore, an unacceptable high level of maintenance of a combined system would result from the very low flow velocities.

In the design of the sewerage system it has been assumed that 80 % of the water consumed will reach the sewer system and that 90 % of the population will ultimately be connected to the sewerage system. Only in the outskirts and for stand alone houses the use of septic tanks/soakaways has been assumed.

A system consisting of three main sewers which all run in an approximately West-East direction has been constructed. Secondary and tertiary sewers are connected to these main sewer lines. East of the town, the three main sewers come together and are connected to the waste water treatment plant by a gravity collector sewer.

The constructed sewer system has a length of 135 km, consists of PVC pipes with diameter ranging from 110-400 mm and is provided with manholes at every 50 to 80 m. Details of the sewerage network are given in table 2.3.

Table 2.3 : Sewerage (design)

	Phase 1	Phase 2
Transmission sewer main	5.5 km	-
Primary line	9 km	0.6 km
Secondary line	53.3 km	25.6 km
Tertiary line	67.5 km	29.3 km
Total	134.8 km	55.5 km
No. of sewer connections	4,500	2,250

The present phase of the project covers (by design) the construction of about 4,500 sewer inspection chambers. The households have to discharge their waste water to the sewer inspection chambers before they get approval for a water connection. The inspection chambers have been constructed in the street in order to avoid lots of property problems, which arose when the chambers were constructed on owner's plots.

For waste water treatment a pond system was chosen (treatment capacity 42,750 population equivalents, average flow : 1880 m³), especially because of its simplicity in operation. The constructed system covers inlet works, containing screens and a flow measuring device, 4 anaerobic ponds (each of 2300 m², depth : 3 m), 3 facultative ponds (54,1000, 25,350 and 12,600 m², each with a depth of 1.5 m) in which secondary treatment takes place and 2 infiltration beds (each 3630 m²) to discharge the water. The bottom of the ponds are sealed with 1.5 mm HDPE in order to prevent seepage into the ground.

In the year 2010, the sewerage and waste water treatment plant are proposed to be extended concurrently with the extension of the water supply system.

2.3 Progress - Status of Extension Works under Phase I Implementation

At present nearly all the construction works for the water supply, sewerage and waste water treatment systems have been finalised. The defects liability period of Contract No. 2 - Civil Works, Contract No. 3 - Mechanical/ Electrical Works and Contract No. 4 - Surface Rain Water Drainage Works expired on 31 January 1997; still outstanding matters will be finalized during the period 17 February 1997/ 1 March 1997.

Phase I has been designed for 5,000 water connections and 4,500 sewer connections. Due to budgetary constraints only 3,793 connections could be made, out of which 175 end capped. Most (3,200 = 90 %) of the potential customers have in the meantime been connected to the water supply system. The sewer connection rate is lower (ca. 2300 = 64 %) by December 1996), because NWSA staff did not stick to the agreed upon procedure that water meters should only be installed when people have been properly connected to the sewerage system.

The remaining project budget could allow for the supply of the necessary construction materials for another 350 water connections (Districts 20 (water supply) and 24 (water supply and sewerage)), totalling the potential number of water connections to approx. 3,550. The works should be executed by local contractors and/or NWSA itself. However, the assistance of NWSA HQ in processing the Master List concerned and in arranging customs clearance for the import of the materials was delayed; therefore, the materials could not be delivered by the contractor.

As a result of this situation, the Branch's income base is still weaker than originally projected. Chapter 14 presents more details on the effect of the number of connections on the income projections and the Branch's ability to cover O&M costs and depreciation/replacement costs of short term investments.

3 INSTITUTIONAL AND ORGANISATIONAL FRAMEWORK

3.1 Decentralised Set Up of Branch

3.1.1 Need for Autonomy

To operate and maintain the new water supply and sewerage facilities, implemented by RWSSP, the National Water and Sanitation Authority (NWSA) established in 1994 a NWSA Rada Branch. This Branch was assumed to be set up and operate within the existing NWSA organization. During the start up phase and until the water supply and sewerage systems became operational (mid 1995), the organisational structure and staffing of the Branch were still more or less geared to construction activities.

Already at the start of the Branch operations, the RWSSP Management anticipated the following constraints, which would frustrate the sustainability of the system:

- the tariffs to be charged to customers, which were nationally regulated, were not tuned to the revenue requirements of the Branch and would at present level be insufficient to meet the O&M costs on the long term; arrangements already made in the past with NWSA HQ for specific tariff setting were considered to be no longer valid because of major increases of prices since that time;
- the revenues of the Branch, which were completely controlled by NWSA HQ, could flow to other, weaker NWSA branches, which were in a more dire need for financial support/ rehabilitation;
- the staff remuneration, set by NWSA HQ, was assumed to be too low to motivate the staff to satisfactorily carry out its duties;
- the NWSA financial and administrative systems and procedures were deemed to be inadequate to run the Branch on a more commercial basis;
- the existing NWSA framework was not considered to be supportive to a fast, effective and efficient decision making process, required to reach and sustain an high quality of Branch services to customers.

In this context, the RWSSP Management realized that a more independent financial and administrative status of the Branch would be necessary in order to create a successful Branch and set the conditions for sustainability of the water supply and waste water facilities. The RWSSP proposed a set-up for the NWSA Rada Branch which would:

- give the Branch more autonomy in tariff setting, staff recruitment, staff release and staff remuneration;
- enable the Branch to control and manage its own revenues needed to cover its operation and maintenance costs.

3.1.2 Ratification and signing of the Proposal for the Administration of NWSA Rada Branch as a Pilot Case for Decentralisation

In February 1996 various discussions took place with the Ministry of Electricity and Water, NWSA HQ, GTZ/NWSA, Royal Netherlands Embassy and the RWSSP Consultancy Team, which lead to basic agreement on proposals for a more independent status of the NWSA Rada branch.

A major breakthrough was reached in June 1996, when the Minister of Electricity and Water agreed on this more independent status of the branch as a pilot case for decentralisation in the Water Sector in Yemen and the proposal for the administration of the NWSA Rada Branch regarding the proposed decentralisation was officially ratified and signed by the Minister of Electricity and Water (see appendix I).

This approval should be considered as a first step towards decentralization and needs to be elaborated and supported by rules and guidelines, which clearly define the authorities and obligations of the Branch.

3.1.3 Dependencies - Supporting Tasks of Supervisory Board, Local Government and NWSA HQ

In July 1996 a Steering Committee was established with the specific task to assist and support the Branch in implementing the decentralisation proposals (see Decree No (101) of 22 July 1996 of the Minister of Electricity and Water attached to annex III). This Committee has, however, a temporarily character.

According to the recently adopted water policies, the establishment of a Supervisory Board, to which the NWSA Rada Branch should report, is seen as part of the decentralisation process. These policies furthermore suggest the participation of local authorities and local leaders in the Board.

In order to prevent that the Branch will be controlled by one actor, it is proposed that both representatives of the Local Government and NWSA HQ will participate in the Board. The set up should be such that for some critical decisions (like O&M budgets, appointment of management staff) consensus should be reached between the two parties.

The Board should be consulted and approve decisions regarding a.o:

- yearly work plan and O & M and replacement budgets;
- tariff adjustment/increase;
- staffing plan;
- remuneration structure and awarding of incentives;
- plans for extension of the systems;
- contracting out of (large) works;
- training plan;
- (major) expenditures related to unforeseen and emergency situations.

Both Local Government and NWSA HQ are expected to play a major role in supporting the relatively small Rada Branch to sustain its activities. The envisaged role of NWSA HQ would cover :

- hiring of Management Staff of the Branch;
- provision of specialized manpower for maintenance and trouble shooting of the equipment (e.g. electrician, mechanic).
- supervision of new construction works;
- arrangement of funds for new works;
- ensuring that the policies of the Branch are formulated within the framework of the National policies.

The Local Government is expected to play an important role in :

- the protection of the resources and assets of the Branch;
- the maintenance of customer relations;
- settling difficulties in administration (e.g. penalising tampering customers, support in disconnection of bad debtors, penalising misuse of sewerage system, etc.)

In addition the NWRA is expected to play a major role in the protection of the water resources of the Branch (see section 14.1), especially when the water sources in the area will become more scarce. To enable the NWRA to play that role, effective and appropriate legislation on water resources abstraction and allocation should be developed. Furthermore

the legislation should effectively be enforced.

3.1.4 Progress in Implementation of Decentralization Proposals

Although supported by the recently adopted Water Policies and the Minister's approval, the implementation of the decentralization proposals has been delayed. The Steering Committee to the Project did not get the necessary support to implement the proposals. This has probably been caused by a lack of consensus among NWSA on the extent to which this decentralisation should take place and the role the Steering Committee should play in this process. Furthermore, NWSA might have been reluctant to set precedents in issues like autonomy in salary structure, tariff setting etc.

At this stage a number of the proposals still needs to be effectively implemented. The present situation with respect to the autonomy in critical decision areas is as follows :

- autonomy in tariff setting :

Although the Branch got the approval of the Minister to introduce a single increase in water tariffs by 1 July 1996, it still has no autonomy to decide on future tariffs increases, which may be necessary if costs will increase.

- autonomy in administrative matters :

As a first step to grant the Branch more autonomy in administrative matters, it has been agreed that the Branch Manager would report to the Steering Committee, so that interference from NWSA HQ could be decreased. However, as the Committee has not been effective, NWSA HQ is still in a position to control the Branch. In fact, to a certain degree it plays the role which in future should be played by the Supervisory Board.

- autonomy in staff remuneration

The Branch got the approval of the Minister to introduce an incentive scheme. However, this was an one-off decision and the Branch still has no autonomy to decide on future increases of the incentives and to link these incentives to the inflation and/or the development of salaries and incentives in the private sector.

- autonomy in hiring and firing :

The hiring and firing applies to the staff temporarily employed by the Branch. As most of the existing staff is still employed (and continues to be employed) by NWSA Headquarters, firing of staff is not legitimate; in fact, firing them, means sending them back to NWSA Headquarters. But this situation will at least enable the Branch Manger to efficiently carry out services and release redundant staff.

- a Supervisory Board which will take over the role of the Steering Committee has not yet been established.

On the other hand, the Branch has opened its own bank accounts and can fully control its revenues, from which it should pay its O & M expenditures. In this field the autonomy of the Branch should even be restricted by the Board.

In addition to the elaboration and implementation of above, the following issues still need to be addressed:

- the arrangements for (financial) contributions by the Branch to NWSA HQ and Local Government;
- the arrangements for settlements of possible arrears in the payment of water bills of governmental institutions. Note that the Water Policies currently adopted propose that the payments of these debtors should be arranged by NWSA HQ and deducted from the contribution of the Branch to NWSA HQ.

3.2 Branch Organisation

3.2.1 Structure

When the Branch was established in 1994 under the NWSA umbrella, it was assumed that the Branch should be to a large extent self-sufficient in operation and maintenance.

However, this idea was abandoned when the Branch was assumed to operate on a more commercial basis. The initial staffing requirements for the Branch have been reviewed for the new set up. Some functions have been combined in order to get sufficient workload per function, other functions have been deleted as the expected workload does not justify to engage separate staff for these functions. In order to enable the Branch to carry out its tasks efficiently and realizing that the Branch should not recruit highly specialised staff for infrequent tasks, it is furthermore proposed that the Branch should contract out these specific tasks to the private sector, NWSA HQ or other NWSA Branches (see section 5.3).

Figure 3.1 shows the proposed organisation chart for the NWSA Rada Branch. The chart gives the functions and sections and how they are related. The solid lines indicate the chain of command and the official channels of communication.

The chart shows that the Branch organization is structured by function; all those engaged in related activities are grouped together.

The Water Production Section is responsible for the operation and maintenance of the water production facilities (deep wells, gensets, reservoir). The section falls directly under the responsibility of the Technical Manager. The work of the Distribution Section covers all water mains and consumer piping. The Waste Water Section is charged with the operation and maintenance of the sewerage facilities and the waste water treatment plant. The Finance Section is responsible for customer accounting, meter reading, billing and bill collection. Finally the Administration Section is responsible for maintaining personnel records, supervision of stores and general administration not directly associated with finance.

The customer/public relations officers are proposed to report directly to the Branch Manager in order to maintain their independent position in complaint handling. The work of the Branch is furthermore supported by a rather large Security Section, which is in charge of safeguarding the Branch's infrastructure: wells, compound, reservoir and waste water treatment plant.

The meter readers are grouped in the Finance Section as they are mainly involved in data collection for billing and bill distribution.

An useful indicator for quickly assessing a water enterprise's efficiency is the number of staff per 1000 connections. The National Water Policy proposes that this ratio should be below 5.

The actual number of staff is 51 (including 14 staff of the Security Section) on a total of approx. 3,200 existing and approx. 3,600 potential connections when the first extension works will be completed. According the guidelines the staff number should therefore be below 15-

20. The difference with the above mentioned ratio can be largely explained by:

- the high number of staff required for security, which is typically for the Rada situation; leaving out of consideration the staff of the Security Section, the number of staff would have been 38;
- the ratio does not take manpower requirements of the Waste Water Section into account.

Leaving aside these factors, the staff ratio still remains on the higher side, mainly due to the relatively limited number of connections. Obviously, an increase in efficiency should be achieved by an increase in the number of connections, as increase of the connections of 3,700 to 5,000 has hardly any impact on the staffing requirements (see also section 14.3.1).

The integration of the activities of the departments in order to realize the organization's goals efficiently should in addition to the formal managerial hierarchy/organization structure be achieved by :

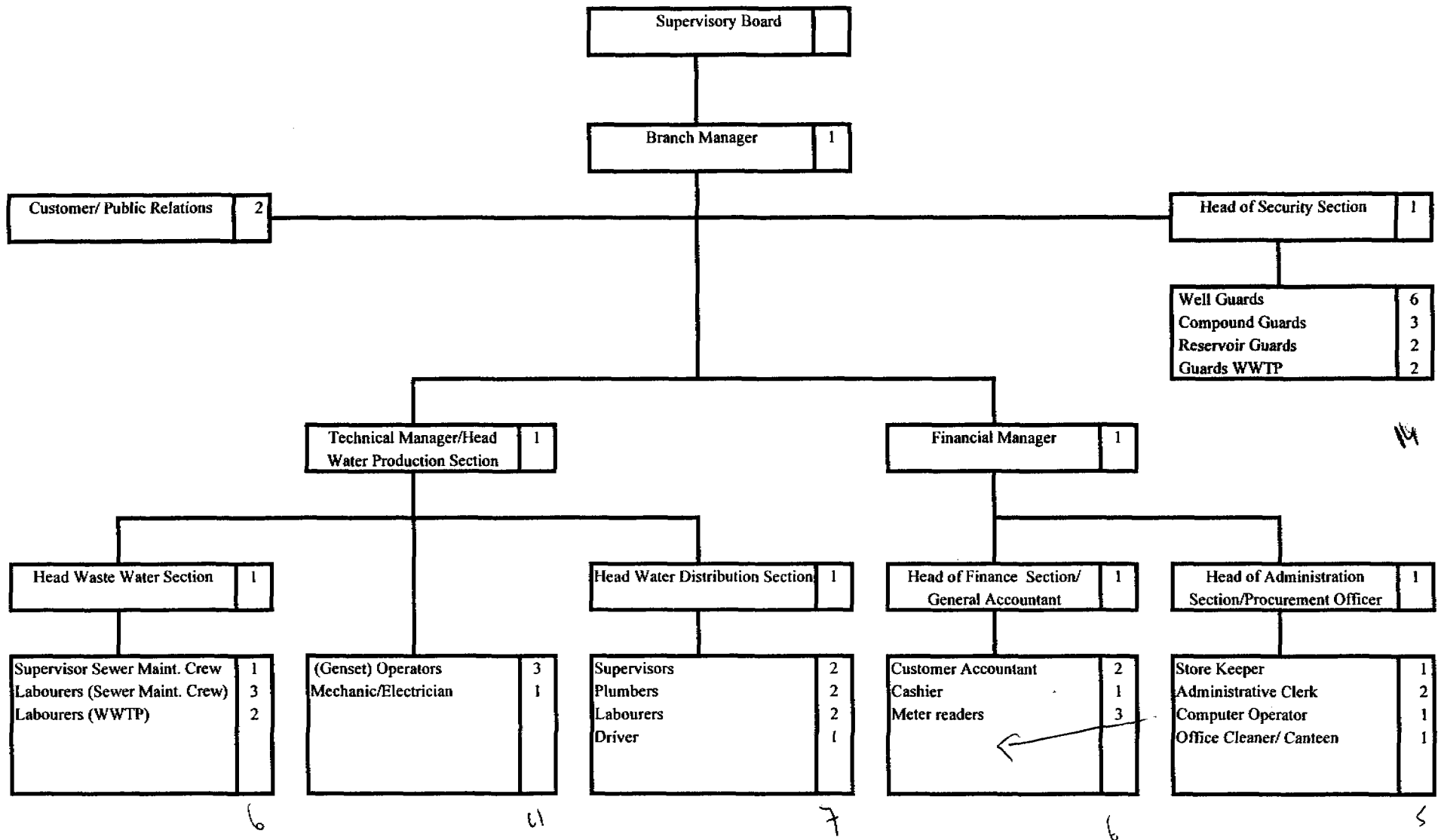
- rules and procedures to handle routine events;
- branch and departmental work plans, which facilitate that the efforts of the various departments are aimed towards the achievement of the organizational goals;
- the management information system;
- weekly meetings of management with the Heads of the Sections.

3.2.2 Progress - Existing Deficiencies

At the start of the assignment the Branch was still in a transition from a project organization to a service organization. By that time the Branch still employed a large number of staff for construction activities. During long discussions with NWSA HQ and Branch management agreement could be reached on the staffing plan and measures were taken to dismiss redundant staff, mostly by referring staff back to NWSA HQ.

In the meantime the Branch has been nearly fully staffed. However, proper functioning of the Branch is seriously hampered by the absence of a Financial and Technical Manager. Furthermore, the Branch is not fully convinced of the need of customer/ public relations officers, which is apparent from the fact that the (female, ex RWSSP E & Section) customer/public relation officers are being employed as daily paid labour.

Figure 3.1 - Organization Chart NWSA Rada Branch



4 LEGAL FRAMEWORK

4.1 Introduction

To enable the NWSA Rada Branch to effectively carry out its tasks, it should be supported by rules which clearly define its authority and responsibility. Moreover, legislation is required to regulate the responsibilities and obligations of the community regarding water supply and sewerage services.

4.2 Progress

During the additional assignment on institutional development, a study on the existing and required legislation could not be carried out, since the decentralisation proposals have not yet been fully crystallized (see section 3.1.4). Therefore such a study should be carried out as soon as the proposals for decentralisation have been fully operationalized.

A study on the legal framework should focus on the existing and required legislation on :

- organisation, status, responsibilities and obligations of the Supervisory Board,
- the waste water discharge, in particular laws which enforce the connection to the sewer system and specify what should be discharged to the sewer and what should not;
- the authority of the Branch to collect fees;
- the arrangements for contributions by the Branch to NWSA HQ and Local Government;
- the arrangements for the collection of water bills and outstandings of schools, military institutions, hospitals and other statal and para-statal organisations;
- the arrangements for possible surcharges in the water bill for solid waste collection and maintenance of the surface rain water drainage system⁴⁾;
- the authority of the Branch to select financial and administrative procedures and systems which deviate from the procedures and systems to be applied by statal and para-statal organisations,
- the property rights of assets.

Also, relations of the Branch with Local Government should be defined, taking into account recent legislation on Local Government.

At this moment the ratified and signed proposal for the administration of NWSA Rada Branch as a pilot case for decentralisation of June 1996 is the only basis for the establishment of the decentralised Branch.

In developing a legal framework for the Branch, close cooperation should be sought with the Technical Secretariat for Water Supply and Sanitation Sector Reform.

⁴⁾ In order to sustain the solid waste collection system and surface rain water drainage systems, it has been proposed to include surcharges for these services in the water bill.

5 OPERATION AND MAINTENANCE MANAGEMENT

5.1 Importance of O&M and O & M Manual

Operation and maintenance are two different things. Operation has to do with the activities which are required to let the system function (examples: switching the pumps on and off, regular checking). Maintenance has to do with the activities to conserve the system and to prevent it from breakdowns (example : refilling of oil of the pumps).

Due to a lack of awareness of the benefits of good O&M in combination with a lack of funds, preventive maintenance is often not carried out, as a result of which mechanical/electrical equipment frequently breaks down.

The importance of good preventive maintenance cannot be stressed enough. Good preventive maintenance will result in lower maintenance costs in the following ways :

- preventive maintenance costs are substantial lower than repair costs⁵⁾;
- it will increase the productivity/reliability of the system (the costs per m³ water produced will thus go down);
- it will extend the lifetime of the system components.

In the case of the sewerage system, good preventive maintenance is required to prevent that the waste water overflows into the street or into someone's home, thereby nullifying the benefits of the system.

The Consultants have prepared a comprehensive Operation and Maintenance Manual for the Rada water supply and sewerage systems in order to facilitate the introduction of the O&M procedures for these newly introduced systems. A modular approach was adopted in the preparation of this manual.

The manual provides :

- a description of the system parts;
- the relationship between the system parts;
- technical specifications of the equipment;
- operation instructions;
- checks to reasonably ensure a proper functioning of the system and which may serve as early warnings for any problems;
- maintenance instructions to prevent that problems will arise;
- fault charts which may serve to identify the most likely sources of error;
- references to the equipment manuals;
- reporting instructions.

It is of utmost importance that the procedures in the Manual are strictly followed. This refers to the different steps in undertaking the activities, the materials prescribed⁶⁾ as well as the frequency of the activities.

The proper recording of the timetable of the maintenance activities executed and the

⁵⁾ For example, if the control panels are not kept in a clean condition, expensive items such as change over units can burn out. This can be prevented by keeping the O&M room in a clean condition and by always closing the panels, which require just little efforts/costs.

⁶⁾ Example : The operators used pure water instead of a mix of water and glycol as coolant of the diesel engines. This recently resulted in overheating and subsequently in a leakage of the radiator, which in turn accelerated the problem.

deficiencies found during checks/maintenance are of particular importance. Deficiencies should be immediately reported to the Management.

The recording of data related to O&M will also assist experts in finding the causes of the problems and will assist in adjusting schedules and procedures if/when necessary in order to overcome the concerning problems in the future.

The table *Task Allocation*, attached to annex V, shows the various O&M activities. Details of these activities can be found in the O&M manual. In the next section, an overview is given of some crucial activities.

5.2 Overview of Tasks

Production related

The daily tasks of the operators include the operation of the deep well pumps from the control panel. The number of pumps to be operated depends on the water level of the reservoir, which level should be continuously monitored. The pumps and gensets should be operated in such a way that an equal distribution of running hours over these apparatus is achieved.

The daily water production is one of the most important indicators to evaluate the proper functioning of the water supply system. A decreasing trend in the production can be a sign of decreasing well yields, lowering of water levels, decreasing pump performance or water losses in the transmission lines. It can also indicate a decreasing demand for water, for example because tariffs have been increased. Breakdowns will cause irregular decrease in the water production.

The production is derived from the daily readings of the bulk water meter at the reservoir. It is important that the meters are read at a fixed time early in the morning (around 8 a.m) in order to get reliable production figures by day.

The readings of the ground water level of the deep wells is proposed to be carried out quarterly to early detect an over-abstraction in the well field.

In addition also pumping discharge tests should be carried out. If decreased discharges are found, the causes should be established (e.g decreased ground water level, clogging of screens etc.) and corrective actions should be taken in order to recover the production level.

Quality Control

Full chemical and bacteriological analysis of the water produced should be carried out regularly in order to detect an early change in water quality. If that is the case, the cause should be detected. These can include : pollution of sources, deteriorating condition of screens, natural processes related to lower ground water level, etc..

The chlorine dosing of the chlorination plant should be adjusted on the basis of the measurement of the residual level in the reservoir. This level is therefore proposed to be checked weekly. Monthly these residual chlorine levels are proposed to be read at the beginning and periphery of the distribution system. If the levels at the periphery are too low, the dosing should be adjusted, provided that the levels at the reservoir will not become too high. If the latter is the case, the solution should be found in leakage control.

UFW

The fight against unaccounted for water (UFW) is often seen as one of the major actions to achieve financial sustainability of water supply operations. In Rada, it also has another dimension, that is to prevent losses of a scarce commodity.

To calculate the UFW, the district water meters should at least be read two times a month :

- concurrently with the readings of the customer meters in order to calculate the unaccounted for water within the districts;
- at the beginning of the month in order to calculate the unaccounted for water in the main distribution lines⁷⁾

These comparison of the district meters, the customer meter readings and bulk water meter readings will give a first indication where the UFW can be found. The exact location is expected to be found through searching for illegal connections and opening and closing valves/lines in the districts.

Customer management

In order to achieve correct billing of customers, the staff of the Water Distribution Section, should keep up to date records on water meter replacements, disconnections and reconnections as well as new connections. These data should be reported to and be processed by the customer accountants.

Sewerage and waste water treatment plant

The major maintenance activities of the sewerage system are basically meant to properly discharge the waste water (i.e. without overflowing) to the WWTP. The manholes are therefore proposed to be inspected every quarter in order detect an early accumulation of solids in the system. The frequency may be higher in the rainy season, when manholes are normally opened to discharge the waste water. In addition all sewer lines are at least to be cleaned every two years.

In order to counteract the entry of solid waste in the sewerage system, the correct positioning of the covers of the inspection chambers should be checked every month. The condition of the covers of the manhole and inspection chambers should be checked for the same reason.

If blockages will occur, they should be removed through rodding and hydraulic cleaning. A proper recording of these blockages, will enable the management to adjust the preventive maintenance schedules or to educate the customers on the use of the system (see also section 10.2.2), if/when required.

An inventory of people without sewerage connection in sewered areas should be carried out every 2-3 months as long as a 100 % system coverage has not been achieved. This inventory should form the basis for follow up actions.

⁷⁾ The total unaccounted for water (UFW_{tot}) is calculated as follows :

$$\frac{1}{\text{UFW}_{\text{tot}}} = \frac{1}{\text{UFW}_1} + \frac{1}{\text{UFW}_2}$$

in which : UFW₁ = unaccounted for water in main distribution lines; UFW₂ = unaccounted for water within districts

The basic activities in the O&M of the treatment plant are the measurement of the influent flow, the checking for blockages between the pond connections, the removal of floating materials in the anaerobic ponds and obviously the monitoring of the treatment efficiency.

5.3 Contracting out and Tendering of Activities

In order to enable the Branch to carry out its tasks as efficiently as possible and realizing that the Branch cannot easily and should not recruit highly specialised staff, it is proposed that specialized irregular/incidental tasks will be contracted out to the private sector, NWSA HQ, or other NWSA Branches. Note that in the past, the Branches relied on NWSA HQ or donor funded projects for the execution of these tasks, which provided their services (nearly) for free.

On basis of the inventory of the O&M tasks (as well as the financial/administrative tasks), an assessment was made of the tasks which are proposed to be contracted out. The results are shown in table 5.1. The table also indicates the reason for contracting out as well as the agency to which the activity could be contracted out.

Table 5.1 : Activities to be contracted out

Category	Activity	Reason for contracting out	Contracting out to
General	Construction and supervision of construction of extensions of the water supply and sewerage system	Expertise	NWSA HQ
	Assessment of the status of the equipment	Expertise	NWSA HQ
	Specialized repairs	Expertise	NWSA HQ or private sector
Wells	Two yearly checking of the deep well pumps	Expertise	NWSA HQ (private sector)
	Well cleaning, regeneration and development	Expertise	Private sector
Distribution	Repair of transmission line	Expertise/Needs specialized equipment	Private sector
	Water meter testing and repair	Efficiency	Other NWSA branches
Quality control	Full water analysis (half yearly)	Expertise	NWSA HQ
Administration	Selection of computer hardware/software, maintenance and repair of hardware and software, modification/development	Expertise	NWSA HQ and private sector
	Repair and maintenance of vehicles	Efficiency; focus on main tasks	Private sector

As can be seen most of these activities are proposed to be contracted out because they require special expertise.

The water meter testing/repair and the repair/maintenance of vehicles are proposed to be contracted out for efficiency reasons. Another reason for contracting out the repair/maintenance of vehicles is to enable the staff of the Branch to concentrate on its main activities (i.e water production, supply and waste water discharge). The full chemical water analysis is proposed to be contracted out to facilitate the correct interpretation of the results.

The assessment of the status of the equipment is proposed to be carried out every two years and should give inputs for the preparation of the annual (replacement) budgets.

The contracting works often involve repair of vital mechanical electrical equipment and therefore proper arrangements for the execution of these tasks should be guaranteed to sustain the system.

The Branch has no experience with tendering of activities on a (semi-) commercial basis. Tailor made tender procedures for the Branch should be elaborated on the basis of the existing NWSA tender procedures. Obviously, the Board needs to approve the contracting out of works which exceed a certain set amount.

5.4 O&M Performance and System Functioning

Water supply

So far the new water supply system has been operating without major problems. The reliability of the system and the water quality have been satisfactorily. Furthermore, the comparison of the total consumption of the individual customers and the water production (with the assistance of the computerized billing program) last January revealed that there is no unaccounted for water. The demand for the water services has also been very high. In the meantime more than 90 % of the households in the distribution area have been connected to the water supply system. This has given the Branch a reasonable basis to sustain the water supply and sewerage systems (see section 14.3.2).

To ensure that the system will continue to function without major problems on the long term, it is of utmost importance that preventive maintenance is carried out in accordance with the O&M manual. So far this has not been done (mainly due to a lack of awareness of the benefits of it, and due to a certain reluctance to provide funds for it) which resulted in two problems that could have been prevented easily:

- overheating of one of the diesel engines;
- faulty residual chlorine analyzer, hampering the control of the residual chlorine level in the reservoir.

In the meantime these problems have been solved with assistance of GTZ/NWSA water supply technicians.

The Project handed over to the Branch a lot of relatively expensive laboratory equipment and materials. The Project made available and supervised the services of an experienced laboratory technician in order to equip the Branch's laboratory and to train staff in the various tests and analyses to be executed.

Waste water disposal

The start up of the waste water disposal activities has been less promising. The measurement of the waste water flow last September revealed that only 45-50 % (650 m³/day) of the water produced (1400-1500 m³/day) was discharged to the sewer system. This necessitated the Consultants to execute a complete inventory of the customers without sewerage connections,

which confirmed that only 55-60 % of the customers with a water connection in sewered areas, had a sewer connection. The inventory made clear that the Branch had not stuck to the application procedure, which prescribes that customers first should connect to the sewer system before they can apply for a water connection. In the inventory it was also observed that many sewer connections were poorly constructed, probably because of a lack of support of the Branch to the concerned households (see also section 10.1.2).

In order to fully achieve the benefits of the sewerage system, the Consultants had to pay special attention to the promotion of the sewer connections. It is a pity that the Branch more or less ignored this issue; it is clear that for a lot of customers only limited pressure is needed to make them start connecting to the sewerage system.

The measurement of the waste water flow last January showed an increase of the waste water flow up to 1000 m³/day. However, still approx. 600 - 700 (out of the 3,200) households need to be connected to the sewerage system (situation: mid February 1997). A small household survey which was carried out last September furthermore revealed that a small majority of the households still does not discharge their waste water from the kitchen to the system in order to prevent blockages of the floor drains, which are typically located in the combined bathroom/toilet.

Up to now, several blockages in the sewer system have emerged, mainly due to entrance of solid waste and sand at places where :

- the covers of the manholes and inspection chambers were moved by traffic;
- manhole covers were opened during rainy conditions.

At some places it was found that people even throw part of their solid waste in the sewer system. Obviously, these problems can only be solved by a further education of the community on the use of the system, and by inviting the community to report displaced covers of manholes and inspection chambers.

The functioning of the treatment plant has been hampered occasionally by the discharge of oil to it. The discharge of oil, which has a potential toxicity to the bacteria which treat the waste water, should be prevented by a further community education on the use of the system, the introduction of by-laws for discharge of waste water as well as the installation of filters at restaurants to separate the cooking oil from the water. Designs for such filters are available at NWSA HQ.

Last July-September, the development of a reddish-pink colour was observed in the anaerobic and facultative ponds⁸⁾. This phenomenon is typical for arid and semi-arid countries, where the water consumption is low (and hence highly concentrated sewage), and the temperatures are high (from May-September). It is caused by purple non-sulphur bacteria, which disfavour the algal growth in the anaerobic ponds and hence the treatment of the water in the waste water ponds. Despite this phenomenon, the waste water treatment efficiency was still satisfactorily. The effluent of the first facultative lagoon contained less than 250 mg BOD/litre, while the influent contained over 1000 mg/litre.

⁸⁾ For more details refer : S. Veenstra & G. Alaerts - Purple non-sulphur bacteria and their influence on waste stabilization pond performance in the Yemen republic, Water Science Technology, Volume 31, pp. 141-149, 1995

6 PHYSICAL RESOURCES REQUIREMENTS

6.1 Equipment, Tools and Materials procured through the Project

To enable the Branch to carry out its tasks, a wide variety of materials, tools and equipment has been procured through RWSSP, either directly through technical assistance funds or through the contractors involved in the construction of the various works. Also a NWSA Rada Branch office building, operations building and a stores building have been constructed as a part of the project.

At present the available materials, tools and equipment at the Rada Branch include materials, tools and equipment related to:

- i) operation, maintenance and monitoring of the systems:
 - mechanical and electrical service equipment and other tools and equipment to maintain the well pumps, generator sets, control panels, pipelines and pipeline appendages, etc.;
 - a sewer maintenance vehicle, equipped with a combined suction and flushing unit, for cleaning the sewer lines from sand, mud;
 - rods for removal of blockages in sewer and house connections;
 - safety equipment for the sewer maintenance crew;
 - a well equipped laboratory with measuring equipment and chemicals to analyze the most relevant water quality, quantity and waste water parameters;
 - fire fighting equipment.
- ii) administration :
 - office furniture and equipment (desks, chairs, filing cabinets, photocopier, etc.);
 - communication facilities (fax, telephone lines) to enable the Branch to quickly respond to emergencies;
 - 14 vehicles (of which at present one handed over to NWSA HQ, one confiscated by NWSA HQ, one hijacked, and five cars out of order);
 - a bus for transport of staff from/to Rada town and NWSA Rada Branch office premises (on order);
 - a computer network system with 2 work stations, loaded with comprehensive Billing, Accounting and Stores Management software and provided with a heavy duty printer, various other (line-) printers and 2 separate personal computers;
 - drawing equipment.
- iii) stores :
 - storage equipment (storage trays have been ordered, and stage racks and shelves have been constructed/installed) to enable the Branch to properly and efficiently store spare parts, materials and tools;
 - spares for the mechanical/electrical installation/equipment;
 - spares for the water supply and sewerage system.

6.2 Condition, Constraints and Needs

In order to assess whether the Branch is sufficiently equipped for its intended tasks in the new set up, an inventory of materials, tools, and spare parts handed over to the Branch has recently been made by the Project (see separate report Equipment, Materials, Tools and Stocks handed over to NWSA Rada Branch (January 1997)). Note that in the new set up, a number of activities are proposed to be contracted out in the future for efficiency reasons :

maintenance and repair of vehicles, water meter testing and repair, etc.. Keeping (large) stocks of equipment, tools and spare parts for the activities to be contracted out, should be avoided.

Based on the inventory made one can conclude that the Branch is in general well equipped to carry out its tasks. Main problems are at present :

- the type of the vehicles handed over to the Branch does partly not match the requirements of the NWSA Rada Branch. Most of the vehicles handed over are passenger cars, whereas the Branch requires at least partly vehicles of the pick-up type. It should be noted that for the last purchase of vehicles in 1995 the Project strongly suggested to purchase pick-up type vehicles; however, the management of the NWSA Rada Branch ignored this advice;
- a number of cars should be considered written off/ total loss and efforts to repair these vehicles should be discouraged. It does not make sense to try to repair at high costs heavily used vehicles, already manufactured in 1986/1987. Also, repair of more recently produced vehicles which were involved in serious accidents and of which the costs of repair are estimated at at least YER 500,000 to 600,000 is not advised; the Project advises to sell these vehicles by auction in Rada and use the funds generated to purchase (secondhand) pick-up vehicle(s);
- the condition of a number of cars leaves to desire, also because of a lack of preventive maintenance and a lack of spare parts; in this context the Project proposes to purchase a stock of spare parts for the various types of vehicles in use with the Branch to enable the Branch on short term to carry out its operations. On the long term obviously a sound income basis should enable the Branch to properly run, maintain and repair its vehicles;
- storage of materials, tools and equipment is still very poor, as a result of which it is not always clear, which items are actually available and what is missing; in general the accessibility of store items is still inadequate. This situation needs to be improved by the proper grouping, storing and coding of the store items in combination with the implementation of the computerized stores management system. The Project provided the NWSA Rada Branch with lists of materials and spares provided either directly by technical assistance funds or through the various contractors involved in the construction works, with the request to compare these lists with a complete physical verification of stocks in store in order to have a proper starting point for stores management and accounting. Up to now, no proper action has been taken. This physical verification and checking with the lists of materials and spare parts received would form the basis for any further requests to order needed materials and spares from remaining Project budgets;
- some of the equipment and materials handed over to the Branch, should be considered obsolete and/or redundant (out of order photocopiers, drawing boards, spare parts for sewage pumping station (not executed), outdated computer equipment, etc..). The project strongly suggest to dispose of this equipment and materials, either by transfer to NWSA HQ, other NWSA Branches or by sale by auction.

Furthermore, in the present set-up the Branch still incurs the risk that NWSA HQ as well as Local Authorities (which are in shortage of the necessary physical resources to carry out their functions) claim assets of the Branch. In order to cope with this problem, the property of assets implemented and provided by the Project needs further elaboration, also from a legal point of view.

Finally, the Branch will need in the short term various pre-printed forms for stores administration and accounting, procurement and financial accounting to support the adjustments proposed in financial and administrative systems and procedures.

7 PROCUREMENT AND STORES

7.1 Stores Function

The primary objective of the stores function is to provide services to the operating functions of the Branch. Services to be rendered by the stores function can be analyzed as follows:

- to make available a balanced flow of tools, equipment and any other commodities to meet the operational requirements,
- to provide spare parts, materials, tools and general stores as required,
- to receive incoming goods,
- to account for all receipts, issues and goods in stock.

Store services should be provided economically: at any given moment large sums of money are tied up in stocks and it is very necessary to organize the stores function so that the investments in stocks is kept to the minimum. At the other hand, the more stock is held, the easier it is to have stocks available on hand. Therefore it is necessary to find and operate a satisfactory compromise between minimizing stocks and requirements of stock on hand.

Besides the physical protection to be afforded to all stores, efficient management of stocks therefore also involves procuring stores at the most reasonable prices, holding them in just the right quantity, ensuring a constant flow of them so that at no stage operational activities are being disturbed due to lack of materials and spares, reducing the possibilities of misappropriation, theft and deterioration, and accurately calculating their costs so that these can be charged to the appropriate cost centres.

The Branch has received rather large quantities of stocks of materials, spare parts and tools through the contracts of Civil Works and Mechanical/ Electrical Works. For those stores that are not and will not be available in the local market, the Branch will continue to keep sufficient stocks. For stores readily available in the local market, direct procurement should be the rule, such as to limit the costs of using working capital, storage costs and to avoid the creation of obsolete stocks.

Stocks still to be provided by the Project should be considered to be a contribution to the working capital of the Branch.

7.2 Procurement

The stores function and the purchasing function are largely inter-dependent. The purchasing function will be in charge of:

- collecting quotations for goods to be procured,
- commercial negotiations,
- reaching agreement on prices and other conditions,
- order placing,
- preparation of supply contracts,
- checking progress of orders,
- clearance of invoicing for prices and other purchase conditions,
- transfer of goods received to stores.

It is clear that the number of purchases to be executed is still rather limited, so that no separate purchasing function will be necessary. It is therefore suggested to combine the staffing of this function with other functions within the administration section.

The request to purchase certain items should be initiated by the stores section for routine

stocks usually kept in store, or by the requisitioning section of the Branch for specific items not usually kept in store. However, requests to purchase goods issued by sections, should be presented to the storekeeper in order to seek confirmation that the goods requested are not in store. The person responsible for purchasing will contact the appropriate suppliers and obtain at least three quotations. A Purchase Order should be issued to the supplier chosen to deliver the goods, specifying the details of the goods, the quantity required, date and place of delivery, price per unit, discounts, credit period, etc. The Purchase Order will need the approval of the Branch manager. Copy of the Purchase Order will be submitted to the stores section and the accounts section. The proposed format of the Purchase Order is given in annex IV to this report.

7.3 Identification of Stores

Normally an article can be identified by simple description, but for stores purposes this is not a satisfactory solution. It is necessary to develop some logical base of identification which is more precise and less cumbersome. This can be done by using letters or figures or a combination of both in the form of a stores code. This code is then employed to identify all store items exactly. The advantages of a proper coding system are:

- avoids repeated use of long descriptive titles,
- accurately identifies all items,
- prevents duplication of items,
- assists in standardization and the reduction of varieties,
- provides proper data for purchasing,
- allows quick and simple sorting and recording of store documents,
- is needed for processing of data by the computerized stores management and accounting system,

For the time being, we suggest that the stores vocabulary will be based on the coding used by the suppliers of spare parts and materials. Other NWSA branches should be consulted in order to obtain information on coding systems used in order to assist in developing a coding system for the NWSA Rada Branch.

7.4 Stores Documents

7.4.1 Goods Received Notes

For each delivery to stores, a Goods Received Note should be prepared, giving details of the goods received (see annex IV). This document is made in duplicate; the original will be forwarded to the accounts section. To avoid the possibility of double or incorrect payment to suppliers or payment without delivery of the goods invoiced, invoices should be cleared only from original goods received notes. The original of the goods received note will be attached to the supplier's invoice concerned. The goods received notes should be numbered serially in order to be able to trace them in case of queries concerning the goods received.

7.4.2 Goods Issued

Stores in stock represent money and should not be misappropriated, wasted or improperly used. For this reason, issues cannot be made without some authority for the transaction.

The normal method is to use an issue note for each issue of goods from store, duly signed and approved by an authorized person. It is suggested that - at least for the time being - heads of sections should approve requests for issues from stores and that issues need the approval of the Branch manager. Issues should mention the cost centre to be charged for the value of the

goods issued.

Spare parts should only be issued on condition that the spare part to be replaced will be simultaneously be handed over to the stores section.

7.5 Stores Control and Records

Normally stores records are kept at two levels. The stores section will keep records for the physical quantities only for each item in its custody, while the accounts section will keep records for both quantities and values.

The computerized stores management system will provide both the stores section as well as the accounts section with various reports on goods in store, goods received, and goods issued.

It is suggested to introduce bin cards, which will be kept with the physical stocks itself by attaching the card to the bin or racks containing the stock. These cards can be rather simple, giving a description of the item, the identification number, the unit of issue, the quantities received and issued, and the balance remaining (see annex IV).

7.6 Stores Accounting

Adequate stores accounts are necessary for the following reasons:

- to indicate the value of stores in stock,
- to provide a basis for charging out of costs of stores issued,
- to provide the means of operating stock control by value.

The computerized stores management system will provide the necessary information needed for proper stores accounting.

7.7 Stock taking

Stock taking is the process of verifying the quantity balances of items held in stock.

The reasons for physical stocktaking are:

- to verify the accuracy of stock records,
- to support the value of stocks shown in financial statements by physical verification,
- to disclose the possibility of fraud, theft or loss,
- to reveal weaknesses in the system of custody and control of stock.

By the periodic method of stocktaking, the whole of stocks is covered at the same time at the end of a given period, mostly the end of the financial year. This stocktaking will need a good deal of preparation at a time that the financial section will already be busy closing the accounts and preparing financial reports. A system of continuous stocktaking, whereby stock is taken continuously through the year in accordance with a predetermined programme so that each item is physically verified at least once in the course of the year, or more frequently if required, is suggested. The format proposed to be used during physical verification of stocks is given in annex IV to this report.

7.8 Progress

- at the beginning of December 1996 the equipment of the stores building with racks and shelves has been completed; finally, stores can be grouped and stored properly,
- it is reported that a physical stocktaking took place as per the end of December 1996; the value of this stocktaking is limited as no comparison took place of this physical stocktaking with goods received and goods issued;

- the Project provided the Branch in December 1996 with lists of spare parts and materials handed over to the Branch, with the request to check these lists with physical verification of stocks, in order to establish a starting point for stores administration and stores accounting;
- issues of stores are being recorded; however, this does not lead to proper stores accounting. Stores accounting is still lacking completely;
- the accounting software, installed in November 1996, includes a module for stores management and accounting. A short training of relevant staff in the use of this module took place (however, the storekeeper was absent during this training !). It is proposed to start using this module as from 1 January 1997;
- in view of the relations with customer administration and accounting, the issues and receipts (for repair, checking, etc.) by stores of water meters will have to follow specific administrative and stores procedures;
- pricing of stores will be a major problem as for most of the stores supplied through the contractors of the Civil Works and Mechanical/ Electrical Works unit prices of the stores delivered are not known. If no prices are available, stores accounting should be based on estimated cost prices per unit.

8 HUMAN RESOURCES DEVELOPMENT

8.1 Introduction

Human Resources Development (HRD) is at the heart of the institutional strengthening of the Branch. The HRD process can be seen as a continuing procedure to keep the Branch supplied with the right people in the right position at the right time. In this section attention is given to some critical HRD issues :

- job descriptions, which serve as the necessary reference material for staff recruitment and staff appraisal;
- staff recruitment and release procedures (hiring and firing), which are on the one hand meant to attract the right people and on the other hand to release excess staff in order to enable the branch to efficiently carry out its tasks;
- training to improve the skills necessary for proper execution of the job assigned;
- staff remuneration to obtain and retain adequate number of suitably qualified people, and to encourage good performance.

8.2 Job Descriptions

Job descriptions specify the tasks which each staff type has to perform and represent the necessary reference material for staff recruitment and staff training. The descriptions also serve as a basis for grading and remuneration of the various functions.

Job descriptions have been prepared for most of the staff which is proposed to be employed by the Branch. Some of the job descriptions of the administration and finance staff have not yet been included, as these descriptions will depend on assignments of tasks after the implementation of the computerized billing, accounting and stores management system; it is expected that this implementation will lead to a major redivision of (new) tasks within these sections. The job descriptions are attached to annex V of this report.

8.3 Recruitment and Selection

The Branch has in the meantime recruited most of the staff as indicated in the organization chart (section 3.2). According to the proposed set up, only the Branch, Technical and Financial Manager are to be recruited and employed by NWSA. Yet, most of the Branch staff still holds a contract with the NWSA.

The Consultants sought for assistance with NWSA HQ to arrange for employment contracts in the new set up and outlined a letter to inform the staff about their new contract. But NWSA HQ did not give follow up on this issue. As a result, it is not always clear to the Branch staff in which set up they operate and what kind of contract they (will) hold (see annex V). This obviously affects their motivation. Proposals were made for the remuneration of overtime and out of station allowances. These proposals are still under discussion.

8.4 Training

8.4.1 Training Approach : Institutionalization of Training

To support the achievement of the required skills and knowledge, training of the key staff of the Branch in the region and overseas formed an important part of the training programme during the course of the Project. In addition, key staff of the Branch was comprehensively

trained on the job in the technical operations by the Consultant's technical experts, during the construction and start-up phase of the water supply and waste water facilities.

The efforts in strengthening the NWSA Branch through human resources development, however, did not lead to the desired results. Due to the resignation and release of a number of staff members, and the absence of a qualified Technical and Financial manager, in combination with a lack of an internal mechanism to transfer knowledge to new staff or to staff in new positions, a substantial number of the existing staff is still insufficiently prepared to properly operate and maintain the water supply and waste water facilities. In order to avoid that training becomes in future a one-off exercise, training capacity should be built.

To ensure continuity in training delivery, it is crucial that the training courses for staff of the NWSA Rada Branch should be incorporated into existing institutions. Furthermore, the institutional set up which best ensures sustainability and continuity of training should be determined. The role of actors (including the NWSA Rada Branch itself) in the water and sanitation sector in training needs assessment, training development and training delivery (on-job and off-job) should be specified and procedures detailed. Special attention should be given to the potential role of the private sector.

8.4.2 Training Needs

By working with the Branch staff, the Consultants could determine the general training needs of the staff. The training needs have been assessed through comparison of the required capability and the actual capability of the various staff types.

Especially, the capabilities in the fields of data analysis and reporting, accounting and financial management, computer applications and general management sciences are presently limited and training is considered to be the solution to close the gap between actual and required capabilities.

A strengthening of the capacity in data collection, data analysis and reporting and computer applications (to enable the fast processing of data) has a high impact in the strengthening of the Branch as it is needed in nearly all fields and yet these subjects have been insufficiently covered in the curricula. The same applies to the knowledge in management sciences, which is deemed as very essential as most of the fundamental problems facing the Branch are managerial in nature.

A course of Financial Management for Non-Financial Managers is deemed necessary for the Branch Manager, Technical and Financial Manager and heads of Sections to gear branch activities towards the strengthening of the Branch's income basis and to carry out the O&M activities as efficiently as possible.

Finally, a course for training in training is considered to be crucial for the development of the in-house training capacity in the Branch, as a substantial part of the staff training should be provided on the job by the managers/head of the sections. Experience showed that the systematic internal transfer of knowledge by the managers to their sub-ordinates has been lacking.

Table 8.1 summarizes the need for general courses for the Branch staff. All of these courses could be incorporated into existing institutions. For the course Financial management for Non-Financial Managers contacts have been made with KPMG Cairo. It is suggested to organize this course not only for management of the NWSA Rada Branch, but also for management staff of other Dutch financed projects in Yemen.

Table 8.1 : Summary of proposed courses

Course	Target Group	Duration
Data collection and analysis	All staff involved in collection, recording, processing and analysing of data	1 week
Computer applications	Staff of Finance and Administration Section, Head of sections and Management	2 weeks
Reporting	Head of Sections and Management	3 * 2 days
Financial management for non-financial managers	Head of Sections and management	1 week
Management sciences	Head of Sections and management	2 weeks
Training in training/training needs assessment	Head of Sections and management	2 weeks

8.5 Salary System

The staff motivation is assumed to have a major impact on the performance of the Branch. The incentive scheme as proposed and approved by the Minister of Electricity and Water in June 1996 has in the meantime been adopted. The increase in incentive up to the maximum agreed upon was proposed to be granted gradually. Criteria for evaluating performance are still lacking and the decision making process regarding the incentives awarded is unclear.

The performance indicators can be defined, once the critical success factors have been established. These include for example for the Distribution Section : unaccounted for water; timely and correct reporting of water meter replacements, disconnections/reconnections, etc..

In order to promote the cooperation among staff within the sections, it is proposed that the performance indicators will be largely related to the performance of the group, rather than to individual performance.

The impression exists that remuneration, even after being increased with the specific NWSA Rada Branch incentives, does not match salaries, allowances and incentives paid by the private sector. Also, it should be realised that this special incentive is a fixed amount, which is not adjusted in relation to inflation/ general increase of salaries in Yemen.

8.6 Progress

The progress in the field of human resources development has been modest due to the following reasons:

- the Consultants expected a major role to be played in this field by the Steering Committee (the Director of Administration NWSA is a member of the Committee);
- the Consultants have given special attention to the development of improved financial and administrative systems and procedures for the Branch;
- technical training in sewer operation and maintenance could only to a limited extent be provided due to late delivery of sewer equipment.

Moreover, the Consultants feel that first the conditions for institutionalization of training should be created to cope with the staff transfers, before the training can be effective. The

Consultants have identified and outlined general training courses for the Branch staff. Specific training courses for each of the function areas should be elaborated and should be based on the proposed job descriptions. These courses should form the basis for the formulation of a training plan (for both existing and new staff). In addition to the preparation of a training programme, a Trainer's Guide should be developed for training delivery.

The Branch has in the meantime recruited most of the staff as indicated in the organization chart (section 8.3). The (secondary) employment conditions for the Branch staff still have to be reviewed. The proposed and approved staff incentive scheme has in the meantime largely been implemented. A system for performance assessment still needs to be elaborated.

A review of present staffing, including salaries, allowances and the special NWSA Rada branch incentive payments is included in annex V.

9 REVENUE COLLECTION SYSTEM

9.1 Introduction

The revenue collection is essentially the secondary task of the Branch. Without a sound income basis, the Branch is not in a position to sustain the water supply and wastewater facilities.

From the start of the Branch operations, the billing has been done by the NWSA HQ, while customer details were manually kept at the Branch. The system is characterized by slow billing procedures, lack of awareness of Rada staff of the importance to collect and provide reliable and up to date input data, late feedback of billing errors and consequently a low billing efficiency⁹⁾. This in combination with the low tariffs and low collection efficiency has resulted in a situation where the outstanding income by the beginning of this year has reached a period of over 3-4 months.

Obviously, the establishment of a sound revenue collection system was considered to have the first priority in the Technical Assistance activities in order to get the Branch out of the financial mess, in which it was. With a manually maintained customer database and billing system at NWSA HQ this was deemed to be an impossible task. Central elements in the consultants approach were thus computerization of data and billing at Branch level.

Mid 1996 it was agreed to develop new software for the billing system in Rada, considering use of these packages in other NWSA branches (see for details section 1.3 - iii). This package has recently been introduced in the Branch and will from now onward be used for the billing.

In the collection of the customer details for the new system from NWSA, it appeared that the customer data were to such extent unreliable, that a decision had to be taken to execute a complete physical verification of these data. Ultimately, it appeared that more than 30 % of the NWSA records were not correct.

In this chapter essential details are provided for the various steps in the billing and revenue collection process : the set up of a reliable customer database; the setting of water tariffs; the meter reading; the preparation of the bills based on the water tariffs and meter reading; and the actual revenue collection.

More information on these procedures can be found in the *User Manual on the Billing Program, February 1997*.

9.2 Establishment of reliable Customer Dbase

Importance and records

The proper management of the customer records is essentially the first step in the establishment of an effective billing system. An inappropriate identification and classification of the customers may lead to situations where the billing is not done correctly and where some people even may receive the services of the Branch without paying money. This situation obviously jeopardise the continuity of the Branch operations, because the measurements by two standards will frustrate customers who do pay and may affect their willingness to pay.

⁹⁾ Approximately 200-300 customers were not billed !

obviously jeopardises the continuity of the Branch operations, because the measurements by two standards will frustrate customers who do pay and may affect their willingness to pay.

The details identifying and classifying the customer for bill calculation should be kept by the Branch and stored in the computer. These include :

- customer identification (name, address, district, contract number, meter number, connection date);
- customer classification (tariff group, availability of sewer)

In Rada, the name of the neighbour is often used to specify the address.

The contract number is the basic record identifying the customer, while the water meter number is often used by the water meter readers for identifying the customer during the monthly readings.

The correct entering of the district number is of major importance to get reliable management information (such as unaccounted for water) on district basis. In this context it is highly recommended that the staff of the distribution section use maps of the network while specifying the district.

Errors found

During their assignment the Consultants had to spend much more time than was foreseen to supervise the establishment of a customer database. In general, this activity was hampered by :

- poor data collection, data recording, data checking and data filing capacity of the Branch; it appeared that many changes were not recorded and that data recording was not coordinated;
- no controlled and authorized input in the database;
- the fact that names in Rada are alike;
- the fact that addresses in Rada are unknown.

More specifically the following problems were encountered :

- incomplete records (e.g. missing water meter number and district);
- inaccurate records (e.g. wrong indication of district);
- illegal connections (with and without water meter);
- new customers were not entered timely;
- double contracts;
- double water meter numbers, because water meter replacements were not recorded or because another water meter was installed at a customer's place than agreed upon;
- some customers were found to have 2 water meters and only one contract; when they moved to another house, they got a new water meter number and kept the same contract. The old record was still kept in the file;
- missing contract numbers (some contracts were cancelled, but this was not centrally recorded);

Procedures for new system

In order to cope with above problems, the Consultants incorporated in the new system automatic checks to control the major data input flows. The new, computerized billing system does not accept the entry of the same contract number or water meter number and hence may alert the user on inaccuracies in the database. Furthermore, the program has the possibility to

sort the customers by contract number, water meter number and connection date, in order to facilitate the checking of customer records.

Although these automatic checks are meant to control the correct input of data, mistakes can still be arise because of :

- new customers are not entered in the database and can hence not be billed;
- water meter replacements are not reported in time, which may result in the calculation of too high consumption;
- disconnections are not reported in time, which may cause the debiting of the minimum charge to the concerned customer in the next period;
- reconnections are not reported in time and hence these customers are wrongly billed.

The computer operator may be alerted on water meter replacements, because the new readings may not be accepted (because they are less than previous month readings) or because a warning is given if the reading is much higher than the previous reading. The other events may however not be detected by the billing program. In order to have this information timely available and processed in the program, it is of utmost importance that the forms covering above data are filled in properly and timely and processed in the billing programm before the water meter readings are processed.

Table 9.1 gives an overview of the forms which should be filled in and authorized to keep the customer database up to date and to support the billing process. The forms are attached to annex VI of this report. The implementation of this data collection and recording routine is considered to be crucial for the successful execution of the billing process.¹⁰⁾

Table 9.1 : Data Collection Schedule for updating customer database

Section	Form	Frequency	Responsibility	Form no.
Water distribution	Disconnections and reconnections	Weekly	Head of Water Distribution Section	DIS-02
	Customer meter replacements	Weekly		DIS-04
Finance	New customers (or changes in customer details)	Weekly	Customer Accountants	FIN-00

9.3 Tariff Setting

Considerations

Tariff determination is the last step in the improvement of the income base and should be done after establishment of a reliable customer database, and improving billing and collection efficiency to levels above 90 %.

It is now obvious that so far the setting of water prices was not the result of technical-economical calculations, but rather the result of political considerations. The end result was often a price which was too low to allow proper operation and maintenance of the water facilities.

¹⁰⁾ In addition to these activities, the Branch should also keep an up to date file of cancelled contracts.

It is now well proven, contrary to earlier convictions, that low tariffs have generally a socially negative effect.

When water is sold below its real price, it should be indicated which costs should be covered (O&M costs only ?; O&M costs, replacement costs and new investments ?; etc.).

The proposed principles for water charges are:

- the water service must be considered as a commercial service and no longer as a social service. This means that the water revenues should at a minimum meet the O&M costs and surplus for short-mid term replacements to enable the O&M organization to carry out its tasks on the short-medium term;
- the water service must be mainly financed by the customers living within the zone serviced by the system and not through an increase in the tax burden;
- the tariffs should prevent excessive profit beyond the need of the water company; the consumer must be guaranteed a regular good quality supply at the least possible cost.
- the consumers should be able to pay the water charges.

The tariff structure should be developed on basis of the following criteria:

- the structure should be as simple as possible;
- the structure should have an element of cross-subsidy between commercial and domestic users and among domestic users in order to make safe water affordable for the urban poor;
- the structure should promote the efficient use of water, via higher charges per quantity used over a certain level of consumption

Administration

A tariff increase as from 1 July 1996 had been approved by the Minister of Electricity and Water in the framework of the approval of a more decentralised NWSA Rada branch. However, this increase was never implemented. In consultation with representatives of the Radai population and after approval by NWSA HQ, an adjusted tariff increase was implemented as from 1 October 1996. Under pressure of complaints by customers, a new round of meetings with representatives of the Radai population took place in January 1997, whereby again another tariff structure was proposed. This last proposal was not accepted by NWSA HQ, so that at least for the time being the agreed upon tariff structure as per 1 October 1996 will continue to be applied.

It is clear that In the future organisational set up the tariff increase is proposed to be approved by the Supervisory Board.

In Rada, increased revenues may not be forthcoming when the community and public authorities are not involved in the establishment of new tariffs. In this negotiation process a compromise should be made on what is wanted ideally and what is feasible in practice. Essential is that the different user groups are represented in this process. Furthermore, the considerations for tariff increase should be clear to the parties involved. This requires amongst other that :

- the Board and community representatives have an insight in the O&M costs and short term replacement investment costs;
- management of the fund for reservations for short/medium replacement is transparent and the members are fully aware of the need to make these reservations;
- the principles are strictly followed (e.g. although ability to pay for water by the poor is pursued by the politicians and the Branch, the minimum tariff for domestic has at

present been set at 400 YR/month, see section 10.2.7).

9.4 Meter Reading

Procedures to get reliable water meter readings

A reliable system of water meter reading is essential for a correct billing. In December '96 and January '97 special attention was given to get reliable water meter readings in order to facilitate the smooth conversion to and implementation of the new billing system. Despite that, still 2-3 % mistakes were made, either in recording of the readings or in entering the readings in the billing program. In this context, it should be remarked that mistakes are easily made in reading (English) numerals on the meters and in recording the correct numbers. (staff is used to read from right to left and numerals are often interchanged, e.g. 69 instead of 96)

In order to cope with this unavoidable problem, it is proposed to record the readings which appear to be unreliable on a special form and have them checked once more. First it should be checked whether a punching error is made by comparing the input reports with the records on the data entry forms of the recent or previous period. If no mistake is made in entering data, the meters should be checked again (in batches) if/when necessary.

The unreliable readings can be detected as follows :

- during data entry : the program does not accept readings less than the readings of the previous period and gives a warning if the reading exceeds a certain tolerance level, which can be set per tariff group; these readings should be recorded on the special form during data entry
- from the input report on water meter readings (sequenced by route number), which compares the consumption of every customer in the present period with the maximum, minimum and average consumption in the past year.

If the check reveals that a mistake has been made in the previous month, then both the bill and the reading of the previous period should be corrected in the program.

Route number and administration

The reader route number is one of the customer details to be entered in the newly developed billing program. It is the number on the route the meter reader will take.

As a part of the start up of the new system, the reader route number has been determined for all the customers during last December readings. The record is used to sequence the customers on the blank reading forms, which are pre-printed by the program. It is also used to sort the bills according to the route, in order to facilitate efficient bill distribution.

With the new reading forms, the meter readers took only 40-50 % of the time, which they normally needed to read the customer meters¹¹⁾.

The customer meters are proposed to be read at the end of every month. Two meter readers can read the 14 districts (3200 customers) within one week time. The same readers can also in the first weeks of the month distribute the bills in order to get sufficient work load. Other tasks of the meter readers include :

¹¹⁾ Reading rate : 50-60 customers per hour.

- checking of readings if/when required;
- specifying route numbers of new customers;
- notifying the Water Distribution Section on water meters not working properly, signaling illegal connections, leakages, etc.

9.5 Billing

Billing procedure

The newly developed billing procedure is computerized and summarized in the section below.

The billing of the Branch's customers basically covers the processing of payments and water meter readings. The periodical billing is proposed to be done on a monthly basis.

To guarantee a reliable billing, the inflow of readings and payments should be :

- checked by the customer accountant, before he submits them to his superiors for validation;
- checked and validated by the individuals authorized to approve the input flow; in addition it is important that these individuals sign each of these input documents and that these documents are properly filed.

The program is designed in such a way that only the individuals authorized to approve the various steps in the billing process have access to the validation procedure.

Once data have been validated, they cannot be edited anymore. In this context it is therefore of major importance that the input data are properly checked and changes in customer details timely reported.

In order to create a constant work flow of entering water meter readings, calculation of bills and bill printing, the program has been designed in such a way that billing can be done on a district basis.

The readings can only be validated if the readings of the previous period have been validated.

Bills can only be calculated, if all daily payments for all the days in the period for the concerning district as well as the readings have been validated. Bills are also not allowed to be calculated if bills from previous period have not been validated.

Although the validation of the water meter readings and payments are meant to control the input flows, errors can still be entered. In order to correct this situation, the program has also an option to correct and calculate the bills more than once.

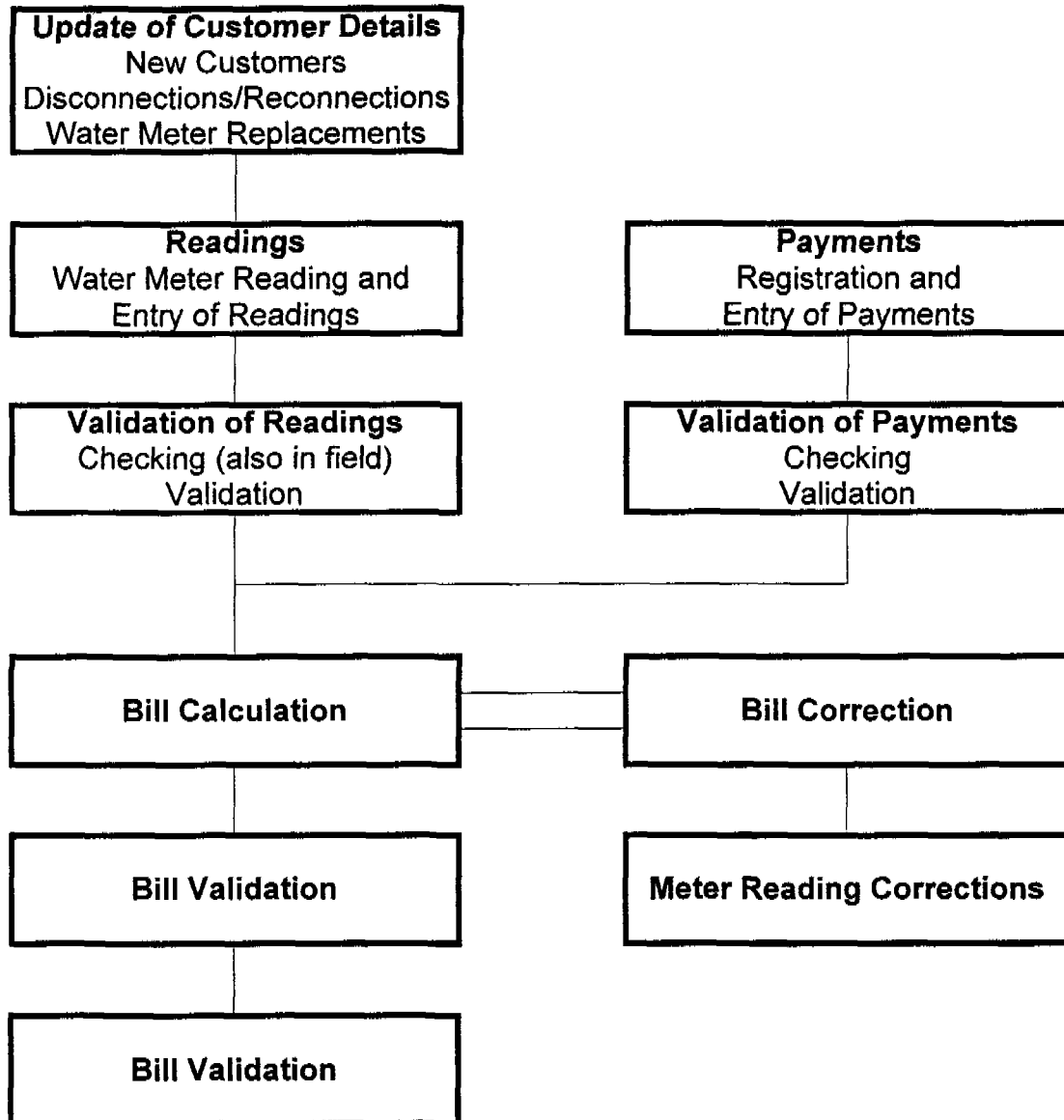
A bill correction is assumed to be entered by an individual authorized to approve the bill calculation. The corrections straightly go to the accounts (validation is not incorporated in this procedure).

The bill corrections should be manually carried out. In the program only the correction amount, correction date as well as the reference document should be entered.

The bill validation date is the date which appears on the bills. At this date the billed amounts for the consumption for this period go to the accounts.

The bills can only be printed if they have been validated in order to prevent that wrong bills can be printed and distributed. The bill printing can be sequenced by reader route no,

Summary of Main Activities to get reliable bill production



facilitating the bill distribution, or by contract number.

Features of billing program

The main features of the program are :

- linked to the Yemen Soft locally developed commercial accounting package;
- locally supported; hence a fast provision of services when needed;
- bilingual; menus as well as reports are possible in Arabic and English;
- runs under Windows 95 or Windows NT;
- ability to add records while printing;
- immediate saving of data in most of the menus, preventing that data are lost when electricity goes off;
- possibility to export the reports to the most popular spreadsheet programmes (such as Excel, Lotus, etc.) for further processing if desired;
- ability to estimate readings in three possible ways in case actual readings are not available (e.g. house closed) or unreliable (e.g. due to a faulty water meter).
- possibility to calculate bills based on separate water and sewer charges as well as on separate surcharges for solid waste and drainage;
- availability of module on water production and supply, facilitating the control of unaccounted for water;
- availability of module for controlling the outstanding connection fees;
- availability of module on opening balance, enabling a smooth change to the system;
- ability to printout input reports, bills and management information reports both on the screen and printer;
- ability to generate up to date reports on (aged) customer accounts, facilitating the timely revenue collection.

Moreover, the program has the following additional features :

- password facility to protect the databases from unauthorised use;
- automatic checking of the major data input flows

Administration

With the new system the bill production is assumed to go much faster and more organized (as bills can be prepared in district batches). Moreover, it is expected that the number of billing errors will be reduced, due to the developed data collection procedures and automatic checks incorporated in the program.

The time requirements are summarized in the table below :

Activity	Time per day (hours)	Time per district (hours)	Time (days) per month (for all districts)
Readings of customer meters (2 readers)		4-6	6-7
Entry of payments	1		2-3
Entry of readings		2-3	4
Bill printing		1-2	2-3

The proposed planning for the billing cycles is as follows :

- updating the customer data base (few days before readings)
- printing of blank reading forms (day before reading);
- reading the customer meters (last week of the month);
- (optional) checking selected meters (first week of month, one day);
- bill calculation and printing (First week of the month);
- bill printing (second week of the month);
- bill distribution (second week of the month).

9.6 Revenue Collection

So far the performance of the Branch in revenue collection has been poor. At present the outstanding are more than 3 months income. This situation has been caused by deficiencies in the billing system (slow procedures, incomplete customer database, many billing errors) as well as in a complete lack of follow up of outstandings. The latter has also been caused by absence of reliable and up to date data on outstandings.

With the new billing system, up to date lists of customers with outstanding can be printed. This should together with a more active policy of the branch in addressing non-paying customers and in disconnecting non-payers result in a decrease of the outstanding.

For reasons of efficiency and accountability, it is furthermore proposed that customers should pay at the revenue collection office rather than through bill collectors. In case customers cannot come to the revenue collection office, special payment arrangements can be made. The correct posting of the daily payments is of major importance for the correct billing. Validation procedures have been built in the program in order to reasonably ensure that the correct amount and contract number are entered. This procedures already proved to be effective in preventing wrong data entry in the computer.

9.7 Progress

In developing the revenue collection system substantial progress has been achieved :

- a modern billing software package has been developed, which has a great potential for use in other branches;
- procedures have been developed to make the customer meter readings, billing and bill distribution faster/more efficient and more reliable; (these include the automatic checks incorporated in the program and procedures to address unreliable readings);
- tools has been developed to enable the branch to keep up to date information on outstanding;
- user manuals on the billing program have been/will be prepared to facilitate the implementation of the new billing program;
- a reliable customer database has been set up;
- procedures for updating of the customer details have been developed;
- staff training in the new procedures has been initiated.

Last December NWSA staff was instructed to fill in the data collection forms for updating the customer data. At that time the staff was not fully aware of the importance of filling in these forms. However, the major problems (including non acceptance of readings and warning for exceeding the tolerance level) in entering the January data could all be brought back to :

- inadequate reporting of water meter replacements, new customers and disconnections/reconnections;
- errors in data entry of readings and reading of meters.

In the meantime the staff has become more aware of the need to fill in this forms, but still more discipline is required in this field. In this context it is proposed that the incentives of the distribution staff will for a part be related to the correct and timely provision of these data. The correctness may be checked by problems found during the meter readings.

Furthermore, a more strict policy of the branch in addressing non-paying customers is required to collect the necessary income.

The analysis of Unaccounted for Water (by means of the new billing program) revealed that the specification of the district of groups of customers still needs improvement in order to effectively control the unaccounted for water in the future¹²⁾.

Finally, the participation of local authorities and local leaders in the tariff setting needs to be elaborated (see for more details, section 10.2.7).

¹²⁾ The analysis (comparison of the water production with the total of the consumption of the customers) revealed that there is no unaccounted for water. The negative figures of UFW (ranging from -10 to -50) in a number of districts in combination with the high calculated UFW in a few other districts (ranging from 10 to 40) could only be explained by an incorrect specification of the district of groups of customers.

10 CUSTOMER AND PUBLIC RELATIONS

Adequate water supply and wastewater discharge are basic needs for all human beings. The Branch has the challenge to provide these services to the Rada urban area. Although the operation and maintenance of the technical facilities is the primary task of the Branch, it does not guarantee a continuity. For that the Branch needs customers who use the system in a proper way, are satisfied with the NWSA services and are willing to pay for it.

The Branch customer relations activities basically falls in 2 groups :

- the development phase in extension districts, during which the potential customers have to be convinced to take a water and sewerage connection, in order to fully achieve the benefits of the improved facilities as well as to create a solid income basis for the Branch;
- the operational phase, during which a good relationship with the customers has to be maintained in order that the customers pay their monthly bill in time and properly use the facilities.

The strategy and approach in each phase are different. In the construction phase the branch has mainly to deal with potential customers and in the operational phase with existing customers.

10.1 Development Phase

10.1.1 Method and Approach developed by RWSSP's Extension and Training Section

In the development phase, the Branch has to attract customers. In the process of becoming a customer any potential customer is passing three distinct psychological phases. Firstly he has to become aware of the services of the Branch. Secondly he has to understand why the improved water supply and wastewater facilities are important and what the benefits are. Thirdly he needs to be convinced and motivated to become a customer.

This concept has been fully taken into account in the development of the promotion campaigns by the Extension and Training (E&T) Section of the RWSSP. The approach and materials developed by the E&T Section have drawn the special attention of other development projects in Yemen and are nowadays being used in other places in the country.

The approach is also proposed to be used in extension works in future districts to be connected to the water supply and sewerage systems.

The approach used is based on the following principles :

- high coverage : essential information has to reach all households;
- phased information delivery in accordance with the progress of the construction activities.

The following five leaflets (attached to annex VII) were produced by the Section :

- pre-construction :
 - . general information on the new water supply and sewerage systems;
- start of the construction :
 - . the construction activities done by the contractor in the streets;
- end of construction phase :
 - . how to make a proper house-connection to the public sewerage system (including the required in-house plumbing);

- how to make a proper house connection to the public water supply scheme (including the required in-house plumbing);
- when people can apply for connections :
 - how to apply for house-connections.

The leaflets on the house-connection were intentionally scheduled before the leaflets on the application of the house-connection in order to enable the customer to get a clear insight in the costs involved in making a house-connection.

Mass media were used to arise awareness to the wide public. In the project the leaflets were distributed house-to-house. To facilitate the accessibility of the information to illiterate women, girls of intermediate and secondary schools were requested to read the leaflets to these women.

In order to increase understanding and motivation, meetings with small groups of customers were undertaken. The following methods were used by the project and are also proposed for future extension works :

- district meetings organised with men and women to discuss the provided information in detail.
- meetings with intermediates (lecturers at schools and the women centre, local leaders) who can disseminate the information;
- the information centre (nowadays the revenue collection office), where details were provided to individual people.

Figure 10.1 shows a typical implementation schedule of the various extension activities for Rada Districts (population 2,000 - 4,000)

Figure 10.1 : Scheduling of Extension Activities during Development Phase

CR activities	Month					
	1	2	3	4	5	6
Pre-construction information (leaflets 1 & 2)						
Mass media	XX					
Group meetings	XXX					
In-house plumbing (leaflets 3 & 4)						
Mass media					X	
Group meetings					X	
Application house-connection (leaflet 5)						
Mass media						X
Group meetings						X

10.1.2 Lessons Learnt

The major E&T activities more or less ended in December 1995, when there were only 600-700 connections. During the additional assignment on the institutional strengthening, the

following constraints were found in the construction of the house connections :

- the application procedure was initially very slow, as the people involved in the installation of the water meters had a lack of incentives to install the meters; the Project had to create the necessary conditions to motivate them to install water meters;
- many of the sewerage connections were found to be poorly constructed, caused by a lack of support from NWSA's technical staff to the households as well as inadequate coordination between the technical staff and the extension workers;
- the staff of the Branch, did not stick to the procedure that the households first should connect to the sewerage system before they could get a water connection. As a result many people were found not to have a (an adequate) sewerage connection¹³⁾.

These constraints should in future be prevented by :

- staff motivation through provision of incentives (note that this is one of the basic elements of the autonomy);
- strictly following the agreed upon procedures;
- supporting the households in the construction of their connections;
- adequate monitoring of the delivery process by the Customers/Public Relations officer(s).

10.2 Operational Phase

In the operational phase the Branch should provide a reliable water supply of sufficient quantity and satisfactorily quality and adequate wastewater services to the people in the Rada urban area. The Branch can only adequately carry out its tasks if the customers will pay the monthly bill in time and properly use the system. These requirements can only be fulfilled if both parties show a joint responsibility and willingness to cooperate, for which good customer relations are a necessity. Customer relations activities aim to support the relation between the Branch and its customers by :

- timely informing customers on changes in the services, like interruptions, tariff changes (10.2.1);
- providing information on the proper use of the water supply and sewerage facilities (10.2.2);
- encouraging customers to ventilate their complaints and suggestions and to report leakages and blockages (10.2.3);
- monitoring the satisfaction of the customers (10.2.3)
- addressing ex-customers to learn about their reasons not to use the services any longer (10.2.6);
- sifting the incoming information and taking steps as and when required to adjust services and procedures (10.2.3);
- reminding customers on their responsibilities (paying, not tampering the facilities, not using them illegal) in order to ensure the continuity of the Branch (10.2.4-5);

In the following sections more details on these activities are provided.

10.2.1 Information Campaigns on Service

Customers need to be timely informed on interruptions in supply, about tariff changes or new regulations. In general timely information will make acceptance easier.

¹³⁾ In October 1996 more than 90 % of the households had a water connection, while by that time only an estimated 60 % had a sewerage connection. Out of this 60 % many households did not discharge all their wastewater to the sewerage. This situation has improved considerably since then.

How to inform the customers depends on the matter and on the time available.

An increase in tariff should always be announced with an official letter signed by the Branch Manager. Such letters should at least include information on the need for the new tariff, when they will be implemented, the new tariff structure, an illustration of the new tariff and where the people can get additional information on the tariff increase. Annex VIII contains an example of a leaflet for a tariff increase. The leaflet was last August used to announce the tariff increase (which was finally not implemented !).

Before these letters will be distributed on a large scale, it is proposed that the tariff increase is introduced to the prominent figures in Rada in order to get the necessary support for the increase, on the condition that these people do represent the different customer/tariff groups. Furthermore, it is proposed that the distribution of these letters is supported by district meetings in which the increase can be further clarified.

A temporary interruption of the water supply (e.g. because of construction works) can be announced by means of the water bill. If the time-frame does not allow to use this medium, then the interruptions can be announced through letters. The letter should explain when the interruption takes place, how long, why and what the user can do himself/herself to decrease the inconvenience (i.e storing water).

New regulations that will largely affect the customer should be explained in a similar way as tariff changes, while a non-personal medium can be chosen if the new regulations are expected to have a minor impact.

10.2.2 Information Campaigns on Use of Facilities

People have to learn how to use the water supply and especially the sewerage facilities.

Clean drinking water is a high value and scarce resource. Wastage of water puts a constraint on scarce resources and directly implicates a loss of money that could have been spent on something else.

All customers should be connected to the sewerage system and discharge all their wastewater to the system in order to gain and maintain the full benefits of the sewer system.

If the systems are not properly used, blockages in the sewerage system may occur frequently, resulting in an outflow of wastewater from manholes and house connections

In order to prevent blockages/overflows, households should be fully aware that :

- they should not use the sewer system for disposal of garbage (also not through the manholes);
- they should put small plastic screens on the various wastewater discharge points inside the house (except toilet);
- they should not open manholes (also not during rainy periods)
- should not discharge rainwater from their plot to the sewer.

Moreover, it should be clear to the households that they are not allowed to discharge oil, acids or other chemicals to the sewer system. These materials will attack the sewer pipes and impede a proper functioning of the wastewater treatment plant.

Annex VIII also contains a leaflet, which can be used to properly inform the customers on the use of the sewerage system.

10.2.3 Complaint Handling

Need

The best judge of the services provided by the Branch are the customers. Complaints of customers may be an indication of poor performance and should be perceived by the Branch as a stimulus to improve its services. Complaints can be the result of a (temporary) lack of the service offered by the Branch or the result of too high customer expectations. Complaints should be dealt with as soon as possible in order not to frustrate the customers. Satisfied customers are likely to be more motivated to pay and less inclined to tamper with the facilities.

Procedures

With little effort customers can be invited to forward complaints and suggestions for improvement of the services. It can be a sign or poster in the revenue collection office, which can be seen by the customers when they pay their monthly water bill.

The redressing of the complaints is a concern of all sections. Inviting and taking in of complaints is to be done by the Customer/Public Relations (CR) Section, which sifts them and channels them to the responsible sections. The CR section is responsible for internal coordination and for monitoring the follow-up of complaints. A good record keeping of the process of the redressing of the complaints is necessary. A standard form for registering the complaints will have to be developed.

Customers may complain because their expectations are too high. In this case the CR officers should try to convince the customer that his/her wishes are unrealistic.

Emergency complaints are normally reported by phoning the emergency number (which is indicated on the water bill) and are received by the supervisors of the Water Distribution Section. These supervisors should inform the CR officers of the complaints received. In case the complaints concerns leakages, these supervisors should obviously immediately take action and try to repair the leakages.

Not all customers will forward their complaints or suggestions. A way to discover all kind of irritations that might become complaints or, even worse change customers into non-customers, is the customer survey. It is proposed that such a survey is carried out once every one or two years under a sample of the customers. This will provide useful information how the service of the Branch develops and can be improved. Annex VIII contains an example of such a survey.

10.2.4 Addressing Non-Paying and Tampering Customers

Need

The Branch's services can only continue on the basis of a joint responsibility of the Branch and its customers. Non-paying and tampering customers jeopardise the continuity of the Branch and the supply to other customers. If the service is good, the Branch can demand from its customers to pay the monthly water bill and not to tamper with the facilities. Non-paying or tampering customers cannot be tolerated by the Branch and should be penalised for late payment and ultimately disconnected. On the other hand non-paying and tampering could indicate disappointment with Branch's services.

Non-paying customers and tampering should be warned as soon as possible.

Non-Paying Customers

Every month the Custom Accountants should prepare a list of customers with an outstanding balance and the ageing of their accounts. This reviews will be produced by the billing system. The customers with an outstanding balance of more than a certain period should be given a reminder for payment through the water bill. If the outstanding balance is more than a to be specified number of months a penalty for late payment should be given and a warning for disconnection, if they don't pay within a certain number of days. At this stage the customer should also be visited by an CR officer. A visit has the advantage that the customer can respond immediately and express his/her complaints. The CR officer can channel this feedback to the sections involved and help to solve possible problems. Although complaints sometimes are justified, in principle this does not dismiss the customer from his/her responsibility to pay the bill. The CR officer is therefore responsible for reminding these non-payers on their responsibilities and the sanctions to be implemented if they insist on refusing to pay. The sanctions to be taken should be clearly stated and carried out strictly according to the rules. For the customer involved this is a very unpopular action. On the other hand by taking the rules strict against non-payers, the Branch shows it is serious in its policy and it will stimulate discipline among the other customers who have to pay their bills. After payments have been received the connection can be restored after charging a reconnection fee.

Disconnection and eventually re-connection will be executed by the Distribution Section and the collection of penalty fees is the responsibility of the Customer Accounts.

In case of needy customers, the CR officer may make payment arrangements to settle the outstanding balance over a longer period. The Billing Program allows for an interruption of sending reminders and charging penalty fees to these customers.

In case the non-paying customer concerns a government institution or prominent figures, the visit is proposed to be made by the Branch Manager himself.

Tampering customers

Tampering customers may be identified by staff of the Water Distribution Section and the water meter readers during the execution of their works. If found, they should be directly reported to the CR officer, who should contact these customers.

These customers should be given a warning that they will be immediately disconnected if they continue to tamper with the system and do not keep the connection in a good order.

Lists of tampering customers should be filed by the CR officer. The report on visits made to these customers should be filed as well.

10.2.5 Addressing People with Illegal Connections

Need

People with illegal connections receive the services of the Branch without paying money. These people jeopardise the continuity of the Branch because it does not receive any payment for the water supplied. Illegal users are also frustrating for customers who do pay. If illegal use of water has no consequences the discipline among paying customers to fulfil the monthly obligations will decrease.

Detection of Illegal Connections

The detection of the illegal connections forms an integral part of the water losses reduction programme. Water losses might be from administrative origin (illegal connections and under-metering) or technical origin (i.e. physical losses).

The first steps in the detection of the water losses are :

- the comparison of the bulk water meter readings with the district water meter readings, which indicate the losses in the main distribution lines;
- the comparison of the district water meter readings with the customer water meters which reveal the losses in each of the districts.

Both reports can be generated by the computerized billing and MIS system.

If the supply to a district is substantially higher than the metered consumption, the area needs further attention of the Distribution Section.

Physical leaks can be found through step-testing and/or sounding (see O&M manual, module 3.830). Illegal connections may be found through a field survey in the area concerned. In order to encourage the reporting of illegal connections, the staff of the Distribution Section and the water meter readers should be rewarded for the illegal connections found.

As illegal connections may be constructed with knowledge of the staff of the Branch, it is also proposed that the staff of the Customer Relation Section annually will undertake a survey on illegal connections.

Visit of Illegal User

If an illegal connection has been located, the staff of the CR section should visit this household and explain that the Branch does not accept any illegal users. The CR officer can offer a legal connection first. If the household involved is not willing to become a paying customer it should be disconnected immediately by staff of the Distribution Section.

The visit to the illegal users should be well prepared and supported by the Branch Manager. The CR officer should point out the intolerable attitude of the user and its effect on other customers and the system sustainability.

In case the illegal connection concerns a government institution or prominent figures, the visit and the arrangements should be made by the Branch Manager himself.

10.2.6 Addressing Ex-Customers

At present most of the people in the Rada urban area enjoy the Branch's services. However, in future situations may arise that customers will cut off. An inventory of reasons why customers will be disconnected may give an indication of the performance of the Branch. These reasons may include :

- inability to pay for water consumption;
- too low reliability, quantity of water;
- poor water quality.

The Branch can try to improve on these aspect, avoiding a further loss of customers. Inability to pay obviously concerns the low income groups and may only be tackled by a review of the tariff structure, if the budget will allow.

However, putting efforts into re-convincing these ex-customers to reconnect may only make

sense if the conditions will be different from those prevailing when these customers were cut off.

Ex-customers should be kept in a separate file by the CR officer. It can be used for further analysis. This file should contain at least information on period of connection and reasons for disconnection. If disconnection will be made because the customer did not pay, the reason should be stated why the customer did not pay.

10.2.7 Progress

So far, the CR activities have mainly been focused on the development phase. Since the expatriate E&T specialist left (December 1995), there has unfortunately been no continuity in the CR activities. In the beginning of the year, the Branch made various promises to employ the female extension workers. However, by mid June, the Project had to employ them again. At this stage it is unclear whether the Branch is willing to offer them a permanent job.

At present the CR Section is only staffed with females. It is felt that there is a need to also include a male member, to properly address non-paying customers, as payment is often a men's issue.

The addressing of people with illegal connections took mainly place on the initiative of the local RWSSP consultants.

In August a tariff increase campaign was held on the initiative of the Project. Although the tariff proposed by the project/branch was approved by a Minister's Decree, experience showed that the involvement of local leaders is crucial in tariff setting. Although the local leaders were consulted in the tariff proposals, the tariff approved by the Minister was finally not favoured by them and ultimately in November '96 a new tariff structure was prepared and implemented as per 1 October 1996 in close cooperation with the local leaders. However, whether these leaders are representative for the different customer/tariff groups is questionable, considering the complaints of many people on the new tariffs. In this respect the Consultants feel that the tariff as proposed by the Minister's Decree was more appropriate (see table). This tariff would enable that basic water requirements could be met at affordable price for the lowest income groups.

Table 10.1 : Actual Tariff and Tariff according to the decision of the Minister

Domestic Consumption Block (m3)	Tariff according to decision Minister 01.07.97 (not implemented)	Tariff as per 01.10.96 (actual)
Fixed charge/month	-	100
Minimum charge/month	-	400
0-5 m3	35 YR/m3	30 YR/m3
6-10 m3	75 YR/m3	30 YR/m3
11-15 m3	130 YR/m3	80 YR/m3
> 15 m3	130 YR/m3	180 YR/m3

The present situation shows that there is a need for introduction of the customer/public relation activities in the Branch as :

- there are regular problems with the sewerage system (blockages/overflow), due to disposal of coarse material and oils to it and due to the opening of manholes during rainy periods;
- a large number of the customers have an outstanding balance of more than 3 months. This requires a more strict policy in addressing these non-payers;
- there is still a misconception among the Rada people on the need to pay (higher prices) for water;
- already 2 district meters have been vandalised and 30 water meters have been replaced;
- the repair of leakages and the removal of blockages often takes a long time, due to lack of coordination mechanism to follow up and monitor these complaints.

The performance of the Branch in customer relations has been unsatisfactorily; the Branch is still too much a bureaucratic government organization and too less a service organization, which is consumer and commercial orientated. The importance of the customer relation function is not seen by the Management, which can also explain that the Branch does not see the need to permanently employ the Customer Relation Officers. This situation hampers the effective implementation of the customer relations procedures. Therefore, key staff of the Branch first need to be sensitized towards the need of customer relation activities.

The need of local participation in the management of the Branch (especially in water pricing) has been expressed several times by local leaders. This idea is fully supported by the Consultant. Through the experience gained in the implementation of the RWSSP, the Consultants feel that in Rada the cooperation of the community, and hence their involvement in the Board, is crucial for the sustainability of the water supply and sewerage facilities.

According to the recently adopted water policies, the establishment of a Supervisory Board, to which the NWSA Branch should report, is seen as part of the decentralisation process. These policies furthermore suggest the participation of local authorities and local leaders in the Board. This issue clearly needs to be elaborated.

FINANCIAL ACCOUNTING

1.42 Introduction

The fundamental role of management is to make decisions, the continuous function of choosing between several courses of action. The role of accounting is to provide management at various levels with financial data which will form the basis of managerial decisions. Accounting is therefore an information service, not only providing data to assist in decision making, but also evaluating decisions already implemented.

The ultimate effectiveness of financial data for decision making will finally depend on its being used, which, in turn, depends on the form and timing of providing financial data. The structure of an accounting system will be decided by both the data input and the data output. Data output will again depend on the needs of management. Also, the choice of the accounting system to be used will be influenced by the professional abilities and capabilities of accounting staff of the Branch.

1.43 Accounting system

Financial accounting analyses revenue and expenditures according to the type of transactions. Cost accounting is that part of accounting that provides data on actual costs of operations, processes or products and analyses the variances and profitability of these operations, processes or products.

It is suggested that the accounting system of the NWSA Rada Branch will at least for the time being be limited to financial accounting only, whereby revenue and expenditures will be recorded, classified and analyzed according to the types of revenue and expenditures, but already classified according to the organizational structure of the Branch.

Cost Centres

A cost centre is anything in relation to which costs may be ascertained. Cost accounting for the NWSA Rada branch will be limited to the recording, classifying and reporting of financial data according to the organizational cost centres, being the various (sub-)sections of the organizational structure.

Following cost centres are proposed:

- Management,
- Administration,
- Finance,
- Water supply,
- Sewerage.

1.45 Books of Original Entry

Following books will be used to record financial transactions and will form the input sources of financial accounting:

- Petty cash/ Cash in hand book,
- Cash at Bank book - , acc. no.
- Cash at Bank book - , acc. no.
- Billing/ Accounts receivable,
- Payroll,
- Stores accounting,
- Journal proper.

1.46 Chart of Accounts

A chart of accounts will facilitate the recording, classifying and reporting of financial data. a system of *classification and codification* will allocate an unique decimal code number to each account of the chart of accounts; this will facilitate sorting and tabulation in conjunction with computerized data processing.

The rather complicated and extensive chart of account now being in use within the NWSA organisation will be replaced by a rather simple chart, without losing possibilities for consolidation of the accounts within the NWSA organisation. The proposed chart of accounts is given in annex to this report.

1.47 Computerized Data Processing

In view of the rather large number of data and financial transactions related to the customers accounting, billing and payments received, the application of computers to assist in financial accounting is almost unavoidable. Therefore, a ready made integrated accounting package, specially developed for the Yemeni market and taking into account specific Yemeni requirements, has been procured in October 1996. This package includes payroll and stores administration and accounting.

1.48 Petty Cash/ Cash in Hand book

The petty cash/ cash in hand book should record all cash transactions, both cash receipts as cash expenditures. It is proposed that the petty cash will operate according to the imprest system. Imprest will be allocated to the petty cash; as soon as the cashier runs out of money, the petty cash book will be balanced off and checked, after which the balance should be restored to the original imprest amount.

For reasons of internal control, payments received from customers, either directly by the cashier or through collectors, and recorded in separate daily statements of cash collection, will also be entered in this petty cashbook. Also the deposits of cash receipts to the appropriate bank account will be recorded as an expenditure, so that the petty cash book will at any time give the exact position of cash money available.

The petty cash book will be maintained on a daily basis; the cash book will be balanced off, checked and signed daily. The cashier will prepare the cash book, present the balanced off book to the financial manager, who will check the book and its supporting documents and forward the book for approval by the manager. After that, the cash book and the supporting documents will be filed by the general accounts section for further processing.

The proposed format of the daily cash statement is given in annex to this report.

1.49 Statement of Cash Collection

Amounts received from customers will be recorded on a daily basis in daily statements of cash collection. The present format in use to record these receipts will need minor adjustments in order to provide sufficient and relevant data for further processing in the computerized billing system.

These statements should be kept by the cashier receiving payments by customers, as well as by collectors. Collectors should be instructed to deposit money collected daily with the cashier. In no circumstances, collectors should be allowed to keep money in their possession overnight, nor should they be authorised to use funds collected for expenditures; funds collected should be deposited in tact with the cashier. For processing purposes each daily

statement of cash receipts should be attributed a unique sequence number.

1.50 Cash at Bank Book

The cash at bank book will be used to record all transactions made in the bank account concerned; separate books will be kept for each bank account. The cash at bank book will be kept up to date on a daily basis by the general accounts section. The books will be balanced off, checked and signed at the end of each month, after which the books will be presented to the manager for approval.

The balance of the bank account according to the cash at bank book will be checked monthly with the statement received from the bank concerned. As soon as the bank statement has been received, a bank reconciliation will be carried out, in which the balance of the bank account according to the cash at bank book will be checked with the balance according to the bank statement. The results of this reconciliation will be recorded in a bank reconciliation statement. This statement, including proposed actions to clear the differences found, will be signed by the financial manager and forwarded to the manager for approval.

The proposed format of the cash at bank book and bank reconciliation statement are given in annex to this report.

1.51 Billing/ Accounts Receivable

Reference is made to Chapter 9 of this report.

1.52 Payroll and Payroll Accounting

The accounting software includes a module for payroll administration and accounting.

1.53 Stores Administration and Stores Accounting

The accounting software included a module for stores administration and accounting.

1.54 Journal Proper

The journal proper should be used to record adjusting and closing entries. The proposed format of this journal is given in annex to this report.

1.55 Financial Management Information

Accounting is not an end in itself; its true role is to assist management in providing relevant data for decisions. Accounting should therefore lead to a timely and consistent flow on financial information to management at various levels. The proposed flow of financial management information for NWSA Rada branch includes:

- daily report on cash transactions,
- weekly report cash position,
- monthly budget control sheet,
- monthly review of movements of essential stocks,
- balance sheet,
- cash flow forecast,
- monthly review of staffing,
- various reports regarding production, billing, accounts receivable to be produced using the reporting module of the billing software.

The proposed formats of these financial management information sheets are given in annex to this report.

1.56 Progress

- until October 1996, all revenue collected was deposited in a bank account managed by NWSA HQ; the Branch only received funds to cover salaries and wages. Financial accounting was till that date limited to customer accounting. As the Branch did not have resources to pay for operational expenses, the Project provided the necessary funds,
- only in October 1996 the Branch received permission to manage funds collected. Therefore, the Branch opened a specific bank account, to be controlled and managed by the Branch. Revenue collected will be used to cover operational costs,
- at that time the Project realised that billing of customers and control on outstanding amounts was far below standards: customer details and thus billing of customers was unreliable, insight in outstanding amounts was completely lacking, and even the most basic accounting and financial procedures were not being followed (collectors who kept funds collected for weeks, using money collected to advance expenditures, no proper recording of transactions in bank accounts, etc.) Therefore, the Project decided to make available to the Branch the services of an internal auditor/ accountant. His first task is to provide insight on funds collected and the use of funds since the start of the branch. At the same time his task will be to assist in introducing (adjusted) financial and administrative procedures,
- in October 1996 the integrated accounting software was installed; staff of the financial section received a -short - training in the use of this software. The Project suggests that this software will be implemented as soon as possible, so that all financial data as from 1 January 1997 will be recorded in this system,
- the Project will assist the Branch in providing the data necessary to prepare the opening balance of the Branch: costs of infrastructure handed over, stores handed over by the contractors and the Project, equipment, tools and materials.

12 BUDGETING

12.1 Purposes

Establishing an effective budgeting process is the key to a successful business environment. Without a proper budgeting system, management has only vague ideas where the business unit is headed financially. Effective budgeting will supply such information as cash needs, expected expenditures for operation and maintenance, timing of capital expenditures, etc. At the end of a budget period, budgets will help management to assess areas of strength and weaknesses by comparing actual results and budgeted amounts.

A budget is a financial and/or quantitative statement, prepared and approved prior to a defined period of time, of the policy to be pursued during that period for the purpose of attaining a given objective. A budget calls for planning and forecasting, coordination and control.

The primary objective of a budget is to forecast future financial and non financial transactions and events; a second objective is to present information that will be as accurate and meaningful to management as possible.

12.2

12.3 Budgetary control

Planning and control of operations and related resources and their costs are the keys to proper management. Budgetary control is the establishment of budgets relating the responsibilities of management to the requirements of policies set, and the continuous comparison of actual and budgeted results either to secure the objectives of the policy set or to provide a basis for its revision. The objectives of budgetary control are:

- to assist in establishing procedures for preparation of planned revenue and costs,
- to assist in coordinating and communicating those plans to the various levels of management,
- to formulate a basis for effective revenue and cost control.

Setting budgets provide targets for managers against which actual performance can be measured, thus providing a management control system. The effectiveness of budgetary control depends on the setting or preparation phase and, therefore, on planning and coordination. Also, an effective accounting system for recording actual results and comparing them with the set budgets will be necessary.

A budget refers to a defined period of time. In the case of the NWSA Rada branch the period of time will coincide with the usual financial year. A master budget should represent the consolidated financial budget for the Branch. Period budgets should supply the projected costs and revenue for each department or section of the Branch that produces costs and revenues. Budget preparation will therefore more or less follow the organizational structure of the branch.

Preparing the sales budget is the starting point of the budgeting process and also the most critical component. The sales budget is a detailed plan identifying the sales of water/ supply of sewer services over the financial year, both quantitatively as well as expressed in money, including forecasting of changes in pricing, and targets for collection efficiency. It is clear that the sales budget provides the basis for the costs portion of the master budget.

It should be realised that the major portion of the costs are or more less fixed costs, which do

which remain more or less constant within a defined range of activity or time period. This stresses even more the importance of the sales budget.

For each section or department of the Branch a budget should be prepared, specifying expected labour costs, costs of repair and maintenance of the water and sewerage system, vehicles and equipment, as well as general and administrative expenses. A set of formats proposed to be used in budget preparation and budget control is given in annex ...

Specific budgets to be prepared are:

- capital expenditures budget, detailing plans outlining the timing and mounts involved of anticipated capital expenditures (investments: extensions of the water supply and sewerage system, but also the purchase of assets),
- cash flow forecast, giving a projection of the cash receipts and payments for the budget period.

Cash flow forecasting is one of the most important aspects of the budgeting process. Without sufficient cash, the Branch can not function. Cash flow forecasting is not a one time exercise during budget preparation, but should in principle being done at the end of each month, giving the cash flow projection for the next quarter, so that periods of expected cash shortages are highlighted in time.

2.04 Progress

Budgeting is a rather new process for the Branch. Up to October 1996, the Branch did not manage its own revenue and expenditures: revenue collected was deposited in a bank account managed by NWSA HQ; only salaries and wages were paid by NWSA HQ. Most running costs had to be paid by the Project. Staff lacks experience in running the Branch financially independent. Heads of sections/ departments are absolutely not interested in the financial consequences of their operations. Developing budget procedures and assisting in budget preparation should assist in making management at all levels aware of the fact that the Branch has to stand on its own feet and cover its own costs.

Various efforts have been made to start a proper budgeting process. The absence of an experienced financial manager. A budget for the financial year 1997 should still be prepared. It should be noted that the integrated accounting software, to be implemented as from 1 January 1997 provides for budget control reporting.

13 REPORTING AND MANAGEMENT INFORMATION SYSTEM

To support the management functions systems for supplying information to managers are of special importance. Only with accurate and timely information managers can monitor progress towards their goals and turn plans into reality. If managers cannot stay "on track", anticipating potential corrections, developing the skills to recognize when corrections are necessary, and then making appropriate corrections or adjustments as they progress, their work may become both fruitless and costly.

The management information system developed by the Consultants distinguishes three levels in the Branch, which follow the line of authority in the organization:

- reporting from the Branch Manager to the Supervisory Board;
- reporting from the Heads of the Sections and Financial and Technical Manager to the Branch Manager;
- reporting from operational level to the Heads of the Sections.

The purpose of reporting is to inform the management on the technical as well as financial performance of the Branch. The reports contain standards for reference, so that it easily can be determined whether there are deficiencies and whether corrective actions should be taken.

Annex XI contains the Technical Reporting Forms. The forms to be filled in at operational level for the other functional areas (stores, billing, accounting, budgeting) are attached in annexes IV, VI, IX & X.

13.1 Performance Report from Branch Management to Supervisory Board

The monthly report from the Branch Management to the Supervisory Board should be sufficient to allow the Board to control the technical as well as financial performance of the Branch.

The table below gives an outline of the performance report to the Board.

Table 13.1 : Outline of Performance Report to the Board

Field	Type of Record	Value
Water supply	Coverage of Water Supply	
	Water Production (m ³ /month; m ³ /day)	
	Water Consumption (l/cap.day)	
	Unaccounted for Water (%)	
	Unscheduled interruption in supply (hours/days)	
	Water Quality (E-coli in drinking water)	
	Number of leakages reported	
Wastewater	Coverage of sewerage (%)	
	Number of sewage overflows	
	Wastewater flow (m ³ /month; m ³ /day)	

Field	Type of Record	Value
	Wastewater Treatment Efficiency (%)	
Efficiency	Number of staff per 1000 water connections	
Revenue Collection	Billing Collection Efficiency	
	Operating Ratio	
	Cost Revenue Ratio	
Budget and actual expenses	Budget and Actual Expenses (salaries; office running; cars; fuel; chemicals; maintenance equipment; replacement; contracting)	
Financial Position	Profit and Loss Account	
	Amount in Provision Post for replacement of assets	
	Amount in Provision Post for emergency repairs	
	Cash-flow forecast on short-medium term	

The daily water production is one of the most important indicators to evaluate the proper *functioning of the water supply system*. A decreasing trend in the production can be a sign of decreasing well yields, lowering of water levels, decreasing pump performance or water losses in the transmission line. It can also indicate a decreasing demand for example because tariffs have gone up. Breakdowns will cause irregular decrease in the water production.

The primary function of the Branch is to provide water and sewerage services to the Rada urban area; obviously the number of water and sewer connections is an important indicator to which extent the Branch meets its functions. Moreover, a high coverage of connections is required to guarantee a sound income basis and to enable the Branch to sustain the systems.

The fight against unaccounted for water (UFW) is often seen as one of the major actions to achieve financial sustainability of water supply operations. In Rada, it also has another dimension, that is to prevent losses of the scarce water.

The national policy is to provide the people throughout Yemen with a certain quantity of clean, reliable water. The design of the RADA water supply is based on the National Water and Sanitation Authority (NWSA) criteria, which allow a per capita water consumption of 50 l/c/day in 1995. The consumption level measured is thus an important indicator to which extent the Branch meets the national policy guidelines.

The water quality is indicated by the number of E-coli. Pollution by E-coli indicates the extent to which the water is bacteriologically polluted.

The functioning of the wastewater facilities is basically indicated by the number of sewage overflows reported and the wastewater treatment efficiency.

Both the number of staff per 1000 connections and the labour costs (% of the operating costs) are indicators of the efficiency of the human resources. The National Water Policy proposes that the number of staff per 1000 connections should be below 5.

The collection efficiency (= total collection/total billing) should at least be 90 per cent.

The operating ratio (= O&M costs/billing) and the cost/revenue ratio give the ability of the

branch to cover its O&M costs. Obviously these figures (expressed in %) should be smaller than 100.

The expenses in the different fields indicate whether the Branch is still operating within the approved budgets. See also section 12.

The amounts in the provision posts for emergency repairs and replacement investment indicate the capacity of the Branch to finance emergency repairs and replacement investments.

13.2 Reporting within the Branch

The reports from the Heads of the Sections and the Financial Manager and Technical Manager to the Branch Manager should enable the latter one to forward accurate and complete reports to the Board. They should also contain as much information as the Branch Manager needs to fulfil his supervisory duties, as described in his job description.

The same requirements as indicated above apply for the reports at the lower levels within the organization.

The sectional reports within the Branch cover in addition to the performance indicators also the availability of the resources and the training needs of staff to carry out the work.

In fig. 13.1 the proposed reporting system/information flow is summarized.

13.3 Progress

As a part of the present assignment, the Consultants have developed the basis for a comprehensive management information system. The following has been achieved :

- the forms for reporting at operational level have been developed for all functional areas. These forms are attached to the report and form the basis of the MIS;
- the linkages of the reporting between the reporting at lower levels and the higher levels have been defined for the billing and technical functional areas;
- the financial information flows have been computerized through the implementation of the computerized stores, accounting and billing program.

The Consultants consider computerization of information flows essential to facilitate the adequate storing, timely processing and presentation of the information at the various levels of the organization.

In order to complete a computerized MIS system covering all functional areas, the following activities still need to be done :

- software development for the Technical information system to facilitate the timely and adequate identification of technical problems related to the operation and maintenance of the water supply system and properly assess the technical performance of the various components of the water supply and wastewater systems;
- definition and implementation of linkages between the reporting at lower levels and the reporting at higher levels for the stores and accounting functions.

The first experience in collecting and recording data for the computerized billing system clearly indicated the training need of NWSA staff in :

- data collection;
- data checking;
- data recording/filing in the forms (in case the information is not generated);
- filing of input data;

- (for management staff) interpretation of data received and formulating corrective actions if/when needed.

Clearly this need refers to all functional areas.

14 SUSTAINABILITY

14.1 Introduction

The sustainability of the introduced facilities requires that :

- the Branch has sufficient capacity to operate, maintain and manage the water supply and wastewater facilities (institutional sustainability);
- the Branch has sufficient funds to cover at least the costs for operation and maintenance as well as for replacement of assets with limited lifetime; in the new set-up, the Branch is assumed to collect all these funds from its customers (financial sustainability);
- the customers will not tamper the facilities and are willing and able to pay for at least the O&M costs and replacement costs for short term assets (social sustainability);
- the water sources will be conserved (environmental sustainability).

The institutional capacity is being built through :

- building autonomy of the Branch;
- improving the administrative and financial systems and procedures of the Branch;
- human resources development of Branch staff, in particular through motivation and building of in-house training capacity.

The activities which are being undertaken to build this capacity are discussed in detail in this report.

The project has paid special attention to a sustained water supply from a well field. For this purpose profound hydrogeological investigations were carried out and due attention was given to site selection. Accurate drilling in faults traced by electro-magnetic methods resulted in the construction of high yielding boreholes. Model calculations show that the water sources will produce sufficient water up to 2020, provided that the water abstractions in the well field can be controlled. Informal arrangements have been made with the people living in/around the well field to prevent over-abstraction. But it is questionable how long these arrangements will last, if water for agricultural use in the area will become more scarce. All the more, if one takes into account that effective and appropriate legislation on water resources abstraction and allocation is still lacking and that NWRA needs to be strengthened to effectively enforce the legislation (see also chapter 3).

In this chapter focus is on the revenue requirements (costs), the financial sustainability and customers ability to pay for the water and waste water services. The required tariffs are given to enable the Branch to sustain the system for different water consumption patterns. The tariffs are related to the number of customers as well. In the analysis the revenue collection efficiency is assumed to be 100 %.

14.2 Methodology Cost Calculation

The operation and maintenance costs are broken down in the following categories : staffing costs; energy costs; chemical costs; maintenance costs. The latter costs are incurred to conserve the system (e.g by painting, oiling etc..) and prevent it from breakdown as well as to repair it when it breaks down.

The costs are given at the price level of October 1996. The exchange rate is assumed to be 1 DGL = 75 YR.

Staffing

The staffing costs are calculated on basis of the staffing requirements indicated in section 8. Details of the staffing costs (covering salaries, allowances/incentives) for the different employees can be found in annex V. As can be seen the total staffing costs are estimated at 7 Million YR/year.

Energy

The energy costs are incurred for operating the diesel engines/gen sets.

The power requirements of each of the deepwell pumps, which produce on average 43 m³/hr, are 22 kW. The estimated power consumption of the compound (for lightning, chlorination) is 20 kW. The net daily power consumption in kWh is thus :

$$480 + (\text{daily production} / 43) * 22.$$

The manufacturer's specifications indicates that the fuel consumption can be estimated at 0.30 litre per kWh output. The unit price of diesel is assumed to be Yr 7 /litre.

Chemicals

In the calculation of the chemical (chlorination) costs, the dosing of gaseous chlorine to the groundwater is assumed to be 2 mg chlorine per litre water produced (this will produce a water with a residual chlorine level of 0.1-0.2 mg/litre at the storage tank). The unit costs of one chlorine cylinder of 50 kg Chlorine is assumed to be 250 DGL, excluding transport and import costs. 7.5 % of the chlorine is assumed to be lost taken into account losses during connecting of the cylinders as well as chlorine remnants in used cylinders.

Running costs car park

For the execution of its activities, the Branch needs 10 cars and one sewer maintenance vehicle (see chapter 6). The running costs (fuel costs and maintenance costs) is assumed to be 18,750 Yr per car per month.

Maintenance Costs

Maintenance costs include the costs of maintenance, repair and major overhauls of all equipment and civil works. It is difficult to estimate precisely such maintenance costs and the normal way of allowing for these costs is as a percentage of the capital costs/procurement costs. The costs of the diesel engines have however been calculated in detail, based on manufacturers experience/prescriptions see below.

The table below shows the percentages used for the calculation of the maintenance costs.

Table 14.1 : O&M costs and lifetime of water supply components

Component	Investment Costs		annual O&M costs (% of investment)	Lifetime (years)
	DGL	YR (millions)		
Wells	485,000	36.4	0.5	30
Deepwell pumps	420,000	31.5	2.0	10
Chlorination	140,000	10.5	1.25	10
Control centre	35,000	2.6	1.25	10
Genset (excl. engines) *	780,000	58.3	1.25	10
Medium Volt. Installation, Low Voltage distribution and Lightning protection	730,000	54.8	1.25	20
Civil works (mainly water and sewer pipeline) **	32,860,000	2465.0	0.25	40
Car park (10 cars)	425,000	31.9		7
Computer system	30,000	2.3	5.0	4

Note : * the costs of gensets including engines is 990,000 DFL

** the figure for O&M costs only applies to the short-mid term; on the long term a figure of 0.5 % is more appropriate

The rates are based on proper maintenance of the water supply and wastewater facilities. It is assumed that the maintenance costs are constant during the lifetime of these facilities. In practice, however, O&M costs will be incurred irregularly and will be lower when facilities are new and higher at the end of the lifetime of the facilities.

Maintenance costs of Diesel Engines

According to the manual of the manufacturer, the lube oil (16.4 litre) should be changed every 125 hours. Taken into account the fill up during operation, the estimated lube oil consumption for this period will be about 20 litre. The unit costs of lube oil are assumed to be 150 YR/l.

The manufacturer manual proposes maintenance turns after every 250, 1,500 and 6,000 running. The table below summarizes the estimated replacement costs per replacement turn for each engine.

Table 14.2 : Replacement costs of Diesel Engines

Frequency	Replacement costs in DGL (per engine)
250 hours	100
1500 hours	500
6000 hours	3000

The frequency that these turns will take place can be derived from the daily running hours of

the engines (see below for formula).

According to the recommendation of the manufacturer each engine should be overhauled after 10,000 operation hours. The replacement costs are estimated at DGL 14,000 per engine. The costs of a specialist of Cummist, who will overhaul the 4 engines at the same time, will be DGL 8,000. The costs for overhaul will be averaged over the year taken into account the overhaul frequency.

The overhaul frequency is obviously related to the water production and can be derived from the daily running hours :

$$\begin{aligned} \text{daily running hours} &= \frac{\text{daily power consumption in KWh}}{\text{power production per engine in KW * no. of engines * the average load of the gensets (\%)/100}} \\ &= \frac{\text{daily power consumption in kWh}}{90 * 4 * 0.7} \end{aligned}$$

Administration costs

The administration include office supplies, utilities for the offices, rents, insurance, travel and communication expenses and reproduction costs. These costs are estimated at 2 million YR a year.

Overhead costs

The overhead costs represent the central services delivered to the Branch by the NWSA HQ and the Local Government. The services from NWSA HQ cover specialized manpower for maintenance and trouble shooting of the equipment (e.g. electrician, mechanic). The Local Government is expected to play an important role in the protection of the Branch's resources and assets, the maintenance of customer relations and when difficulties in administration will happen (e.g. penalising tampering customers, support in disconnection of bad debtors)

In the Minister's Decree it has been agreed that the Branch should pay to NWSA Head Office 10 % of the revenue from the monthly billing as a contribution for Head Office technical services and overhead costs. The payment should be made regardless of the revenue actually collected. The contribution to Local Government is proposed to be 5 %.

Depreciation Costs

The depreciation costs are based on a linear write-off of the assets. Short term assets are assumed to have a lifetime up to 10 year. This thus means that the Branch should be able to cover the depreciation costs of the deepwell pumps, gensets, chlorination plant, car park and computer equipment.

14.3 Results Cost and Revenue Analysis

14.3.1 Costs

Table 14.3 shows the O&M costs, O&M costs and depreciation costs of short term assets and

the total costs for different levels of the water production :

- 1,400 m³/day - the December 1996 production;
- 3,140 m³/day - the phase I design demand;
- 4,000 m³/day

The maximum production capacity is assumed to be 4,000 m³/day. This amount will be produced if 4 out of the 5 pumps will be operated continuously.

Cost category	Cost Item	Production (m ³ /day)		
		1400	3150	4000
Operation related	Salaries	7.0	7.0	7.0
	Office running	2.1	2.1	2.1
	Car park	2.2	2.2	2.2
	Chlorination	0.3	0.8	1.1
	Diesel (fuel)	0.6	1.5	1.9
	Subtotal	12.2	13.6	14.3
Maintenance	Diesel	1.1	2.7	3.4
	Water supply and sewer lines	6.1	13.7	17.4
	Other civil	2.7	2.7	2.7
Subtotal (O&M)		22.1	32.7	37.8
Depreciation (short term)		17.0	17.0	17.0
O&M + short term depreciation		39.1	49.7	54.8
Depreciation (long term) **		83	160	197
Total costs : long term depreciation + O&M		105	193	234

Note : ** increase of depreciation due to extension of sewer and water lines

The table shows that the staffing related costs (salaries, office running and car park) cover the larger part (> 90 %) of the operating costs. It is also seen that the fuel and chemical costs represent only a small proportion of the operation related costs. This is obviously due to the low fuel prices.

The maintenance costs cover also a substantial part of the O&M costs, in spite of the low assumed maintenance costs of the pipeline (0.25 % of investment costs).

From the figures, it can be seen that in absolute terms the effect of the water production on the O&M costs is moderate and consequently the costs decrease strongly with increased production capacity. This situation can be explained by the relatively low contribution of the production variable costs to the total O&M costs. Note also that the major O&M cost components (staffing costs, substantial part of the and maintenance costs) hardly don't bear a relation with the water production. The staffing related costs only slightly depend on the size of the network and the number of connections¹⁴⁾. The calculation of the maintenance costs of

¹⁴⁾ The staffing requirements as indicated in chapter 3 are based on 3,000-4,000 connections.

the water and sewer lines is indirectly based on the existing pattern (average consumption : 12 m3 per connection per month). To utilize the design capacity, the number of connections should be increased to 7,200; assuming that 90 % of the people are already served with a connection, the size of the water supply and sewer networks should be increased accordingly. Hence the maintenance costs will also increase.

In this context efforts to reduce physical water losses can only be justified to prevent wastage of scarce water resources rather than to reduce the O&M costs. In future, however, control of the physical water losses is also important to postpone investment for augmentation of the production capacity.

The table also shows that the O&M costs and the short term depreciation costs are of the same order. The long term depreciation costs are however around 4 times higher than the O&M costs.

14.3.2 Revenues versus Costs

Table 13.4 shows the potential revenues based on the following assumptions :

- the actual block tariff (for category I : minimum charge : 400 YR/month. connection; 80 YR/m3 for use in the consumption block 11-15 m3; 180 YR/m3 for use above 15 m3/month), which was implemented in October 96;
- actual water consumption pattern (average : 12 m3 per connection per month);
- all customers fall under the category 'domestic users'. The distribution of the users is as follows : 70 % consumes 7 m3/month; 10 % consumes 15 m3/month; 20 % consumes 30 m3/month)
- 100 % billing and collection efficiency.

The table also shows the O&M costs as well as the total of the O&M costs and short term depreciation costs.

Connections	Corresponding production capacity (m3/day)	Revenues (million YR/year)	Revenues minus contributions to NWSA HQ and Local Gov't (mil YR/year)	O&M costs (mil. YR/year)	O&M and short term depreciation costs (mil. YR/year)
3200	1400	40.7	34.6	22.1	39.1
4000	1750	50.9	43.3	24.2	41.2
5000	2200	63.6	54.1	26.9	43.9

From the table, it can be seen that the new tariffs are just enough, to cover the O&M and short term replacement investment costs. However, this will not be the case if the contributions to NWSA HQ and Local Government will be taken into account.

Most of the people (> 90 %) living in the existing distribution area are connected to the water supply system and a strengthening of the income basis can only be achieved if the network is extended. It is seen that for an extension of the system the income basis is more solid.

If the extension works in districts 20 and 24 will be implemented, the total number of connections will reach to 3700 After the works in districts no further extension of the networks are foreseen on the short term.

The Branch is however unable to cover the long term replacement investment costs.

Assuming an average household income of 10,000 YR/month, the monthly bill will correspond with 4.5 % of the household income (excluding the customers with a consumption of 30 m³/moth).

The questions of what level of cost recovery is 'affordable' is hotly debated. A problem in assessing the ability to pay is to determine the criterium to be used. In the selection of the criterium, consideration should be given to the household income and the costs of other essential items. Usually, it is supposed that people can afford the facility if the costs to be met do not exceed a certain percentage of the income. Literature about the percentage to be used is scarce. As a test guide households are usually expected to be able to spend 3-5 % of their income on water. For countries like Yemen, where water is scarce a higher figure can be justified. Taken this into account, one may conclude that the households in Rada are able to pay the water bills based on the present tariffs. Even bills based on a tariff increase of 20-30 % can be considered as affordable. The willingness to pay obviously depend on the services (see chapter 10).

Although, the tariff has been increased, it is not considered too high. If the people would buy water from private tankers, they could for the same amount as their new bill only get 8-10 l/cap.day, which is considered in the various planning books as the absolute minimum. From the Branch they get sewerage services as well.

The analysis reveals that the income basis of the branch is still vulnerable to cover both the O&M and replacement costs. In this context it is critical that the branch tries to reduce the O&M costs to the highest extent possible. In this context, it is critical that the Branch :

- carries out its services as efficient as possible and will in particular limit the number of staff to the absolute minimum necessary (see chapter 3); in this context higher salaries of key staff is only proposed, provided that the total budget for salaries will not increase.
- strictly carries out the preventive maintenance procedures in order to both conserve the system and limit the O&M costs (see chapter 5);
- improves its billing and bill collection operations (chapter 9);
- maintain good community relations in order that the customers are willing to pay (chapter 10);

In addition, the possibilities of the Branch to increase the conditions for sustainability will increase if the works in the extension districts will be carried out.

The powering of the deepwells and operation building from the National grid will not substantially reduce the costs as the fuel prices are low compared to the electricity charges (7 YR/KWh).

14.4 Progress in achieving Financial Sustainability

So far the Branch has not been able to cover its O&M costs and short term replacement costs. This has been mainly due to :

- a very poor billing and bill collection system; in this context reference is made to chapter 9
- very low tariffs (note that this is not valid anymore);
- up to May 1996, a relatively low number (ca. 1800) of water connections (however during the additional assignment extra attention was given to the promotion of water and sewer connections and the number has increased to approx. 90 % of the possible connections).

Obviously, the improvement of the Billing System has the highest priority. The newly introduced Computerized System will enable the Branch to improve its operations in this field. But the implementation of this system alone is not enough. Moreover discipline is required to keep the customer database reliable.

Finally, the Branch should more actively address non-paying customers (see section 10.2.4) and people with illegal connections (see section 10.2.5).