

SUMMARY OF THE ADVICE

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1. INTRODUCTION

The government of the Republic of Yemen and the authorities of the Shabwah Governorate plan to upgrade and develop the water supply and sanitation facilities for the population centres of Ataq, Nisab and Beihan and the rural area of Wadi Jirdan in Shabwah Governorate. The government of the Kingdom of the Netherlands intends to assist the government of the Republic of Yemen in implementing this initiative. The Netherlands Government, in consultation with the government of the Republic of Yemen, has decided to carry out an environmental impact assessment (EIA) in support of the feasibility study for the proposed initiative.

In a letter dated 19 July 1993 (see appendix 1), the Netherlands Minister for Development Cooperation has invited the Commission for EIA in the Netherlands to prepare an advice on the contents of the environmental impact statement (EIS) which will be drawn up for the proposed initiative. The request is made in the framework of an agreement dated 23 March 1993 between the Netherlands Minister for Development Cooperation and the Netherlands Commission for EIA. The intention of the advice is to specify the contents of the EIS and to delineate the environmental aspects which must be investigated and described in the EIS. According to the letter of 19 July 1993, the EIA-activities will be integrated with the feasibility studies for the pertinent project areas in Ataq, Nisab, Beihan and Wadi Jirdan.

The advice is prepared by a working group of independent experts of both Yemeni and Dutch nationality of the Commission for EIA. The composition of this working group is presented in Appendix 2 to this advice together with some general information on the proposed initiative.

The advice is prepared and submitted to the Netherlands Minister for Development Cooperation by the working group on behalf of the Commission for EIA in the Netherlands.

During the preparation of the advice, the working group of the Commission visited the study areas of the proposed initiative as well as several Government agencies in Sana'a, Aden and Ataq from 19-29 September 1993. Also during this period visits were made to the "Support to Rural Water Supply Department Project", the "Municipal Services Project" both in the Dhamar region and to the "Rada Water Supply and Sanitation Project" and the "Aden Green Belt Project". The programme of the field visit is presented in Appendix 3 to this advice. Herewith the Commission wishes to express her gratitude for the excellent support and courtesy extended to the Commission by the government of the Republic of Yemen, the Governor of Shabwah and by the Royal Netherlands Embassy in Sana'a during this visit.

1 The figures for water demand in 2010 for the individual population centres are predicted as follows : Ataq - 1,6; Nisab -0,7; Beihan-0,8; Wadi Jirdan-0,9 million cubic meters/year.

2. STATEMENT OF THE PROBLEM AND OBJECTIVES

The EIS must present a description of the background of the proposed initiative leading to a clear statement of the problem as envisaged in Shabwah Governorate in relation to the future water supply, sanitation facilities and waste water disposal for the population centres of Ataq, Nisab, Beihan and Wadi Jirdan.

In turn, the statement of the problem must form the basis for clearly formulated (and if possible quantitative) objectives which must be observed for the various components of the initiative for a certain planning period during the subsequent stages of implementation (preparation, construction, operation, extension and follow up, including monitoring).

In Shabwah Governorate, it is envisaged that the present water supply and sanitation facilities for Ataq, Nisab, Beihan and Wadi Jirdan (amongst other population centres) are in need for upgrading, improvement and enlargement. It is postulated that (drinking) water demand will increase considerably in the near future in these population centres due to an increase in population and due to an increase in the water consumption per head of the population. According to a preliminary calculation as carried out by TNO Institute of Applied Geoscience in the Netherlands the drinking water demand in the year 2010 will have increased to a total of 11,100 cubic meters/day or approximately 4 million cubic meters/year¹. This is an estimated four to five fold increase over current consumption levels.

In the EIS the predicted water demand for the individual population centres must be substantiated, taking into account facts and best available assumptions concerning population growth and development of the per capita consumption as a result of changes in health awareness. This will lead to a prognosis of the development of the water demand in each of the population centres over the planning period till the year that will be observed as the planning horizon (2010?). This prognosis must be compared with the present consumption level. It forms the basis of the first objective of the proposed initiative:

"to supply safe drinking water without serious interruption over the planning period as well as adequate sanitation facilities to the population centres of Ataq, Nisab, Beihan and Wadi Jirdan".

This objective must be seen in relation to the matter of operation and maintenance of the system once it has been implemented. According to a study being carried out by a task force of Yemeni water experts, since 1992 with the assistance of FAO on the development of National Water Resources Policies² inefficient operation and maintenance in many water supply projects in Yemen is a serious problem setting in motion a cycle of degradation/rehabilitation and in some instances irreversible damage to aquifers and the environment.

Therefore, the statement of the problem must look at the proposed initiative from the point of view of the "principle of sustainable development". The only reliable source of fresh drinking water which is available in the study areas surrounding Ataq, Nisab, Beihan and Wadi Jirdan is groundwater. The aquifers concerned may either contain renewable or non-renewable water resources. Renewable water resources occur in those aquifers which are recharged naturally by rainfall or through infiltration by run-off, flood-water, irrigation water or (treated) waste water. Non-renewable water resources have accumulated in the distant geological past and their mining will eventually result in total depletion without a chance of proper replenishment. Improper management of the available water resources

2 In this advice this study which is still in progress will be referred to as the "Task Force (TF) on National Water Resources Policies (NWRP)".

3 These reports are entitled:

- Geohydrological Investigations Shabwah, factfinding on the areas of Wadi Beihan, Wadi Hamman (Nisab), Wadi Jirdan and Ataq by Sigrun Spaans, Salem Hassan Bashueib, draft June 1993.
- Geophysical Survey Ataq-Wadi Jirdan, Shabwah Province by Abdul Rahman Al Jendari, Abdul Hefaz, Yahia Al Kibsi, Mohamed Assabahi and Jozsef Csonka, draft July 1993.

may result in pollution of aquifers. The statement of the problem must recognize the finity and vulnerability of the water resources in the study areas.

The second objective therefore, runs as follows:

"to meet the predicted water demands in the long run through a balanced and sound exploitation of the available water resources for all sectors of development both in terms of quantity as well as quality".

This objective aims at emphasizing water management rather than simply trying to achieve water production to meet domestic water demands. Therefore, it also includes matters related to water use efficiency, water conservation practices and enhancement of groundwater recharge, including the possible re-use of (treated) waste water.

In the third place, the statement of the problem must look at the aspect of participation of the users in the management of water supply systems and sanitation facilities at the various sites. At present, a considerable number of local initiatives takes place, that receive little support from the concerned service delivery system. These initiatives that are directly related to the experienced needs, often imply substantial involvement of the people, both in labour and in finance. It appears logical that the project tries to build on these efforts, encourages them so that they become incorporated in time in the project design. This approach will encourage commitment and social sustainability in the operation and maintenance once the projects have been completed.

The third objective hence can be formulated as follows:

"to ensure social sustainability through the commitment and participation of the beneficiaries (especially the women) of the water supply and sanitation facilities in all phases of the project-cycle".

Fourthly, the improvement and expansion of the water supply and sanitation in the Shabwah Governorate is only possible in a sustainable way when the functioning of all persons rendering services at the various levels is strengthened. This entails both the reinforcement of their technical and social and managerial skills. In order to increase their capacity to handle the social aspects of the interventions such as the incorporation of the needs of the population, the development of their social skills and management is particularly important. Furthermore, the management capability of these persons and the capacity of the local government structures in which they will operate should be strengthened. This last aspect notably entails the reinforcement of the coordination between the large number of technical staff performing water-related services at the Governorate level.

Hence, the fourth objective is described as follows:

"to ensure the institutional sustainability through the strengthening of the technical and social skills of all persons rendering water-related services, including their coordination capacity".

These four objectives must be fulfilled if the proposed projects on water supply, sanitation and disposal of waste water in Ataq, Nisab, Beihan and Wadi Jirdan is to be implemented successfully. However, apart from fulfilling the objectives, there is a need to place the proposed projects in a broader planning and management context in the region. The ongoing study of the forementioned "Task Force on National Water Resources Policies" has highlighted the problem of many individual water development projects being undertaken in Yemen to respond to perceived needs and opportunities for single or limited sectoral uses (e.g. agriculture, municipal water supply, industry, oil and natural gas exploration/exploitation). Integration or even coordination between such projects was often insufficient or absent. It is important that the proposed projects do not trigger the development of such a situation in the study areas. Therefore, an effort should be made right from the start to integrate the feasibility study / EIS for the proposed project into a broader vision about water production and water resources management as a whole in the region. At the moment, there are no national policies on water resources and apparently no such policies exist as yet at the regional level in the study area. However, a draft Water Law has been submitted to Parliament. The feasibility study / EIS should pay close attention to this development as well as to any development in the field of environmental protection. In this advice, the following relevant aspects can be mentioned:

- According to the study of the "TF on NWRP" municipal water supply accounts for less than 10 percent of water use in Yemen, whereas water use for agriculture is predominant. The implementation of a water supply system for domestic use will certainly raise interest amongst potential users of the same sources for the agricultural sector and possibly for other developments as well (oil/natural gas exploration and exploitation, industry and mining). The feasibility study / EIS should therefore recognize the problem of allocation of the limited resources in the study areas between the various competing demands. This is particularly significant with a view to production limits imposed by the principle of sustainability (or simply the finity) of available fresh groundwater resources.
The availability of water for domestic use is therefore also dependent on any development in agriculture, industry and mining taking place or planned in the study area's watersheds and aquifers (e.g. changes in agricultural land use, changes in agricultural practices, introduction of crops, improvement of production efficiencies, application of agricultural chemicals and disposal of wastes polluting aquifers, enhancement of infiltration by rainwater and run-off, etc.)
- The preparation of National Water Resources Policies envisages in the near future the adoption of laws, rules and regulations governing the allocation of resources, recognition of water use rights, incentives for increasing water production efficiencies, pollution control of surface and groundwater bodies, water re-use and conservation practices, use of alternative sanitation systems, etc. The EIS / feasibility study must indicate how these laws, rules and regulations once adopted, will affect the objectives of the proposed projects.

3. CURRENT SITUATION AND STUDY AREAS

The project is proposed for execution in four different areas: the towns of Ataq, Nisab and Beihan with surrounding villages and the area of Wadi Jirdan including many small villages scattered over the entire length of the Wadi over a distance of approximately 70 kms. In the EIS, the study areas for these four projects must be clearly specified.

The delimitation of the study areas is determined by the watersheds and aquifers from which the drinking water is and will be obtained, the population centres which are supplied with drinking water and sanitation facilities, the areas where (treated) waste water and sludge are possibly applied for agricultural or industrial uses and the sites where residual material and waste water are disposed of. The geohydrological conditions, as well as the current water supply and sewage disposal systems vary considerably over the four areas. The EIS must describe the current situation in terms of

- the water sources (both ground water and surface water),
- the used water quantities and qualities, the recharge capacities of the aquifers involved,
- the water supply and distribution systems,
- the sanitation and waste water disposal facilities,
- the extent to which pollutants may adversely affect the drinking water resources (e.g. oil, fuel and chemical spills from pump stations, organic pollutants from malfunctioning waste water disposal systems and agricultural chemical residues which find their way through infiltration into aquifers),
- the existing social structures, the local needs and initiatives of the population, and
- the institutions or agencies involved in the water sector in the study areas. In the preparation of this description, use must be made as much as possible of existing studies and reports.

In the identification memorandums dated February 1993 on the proposed projects some information on the current water supply situation is given. However, this information is insufficient to serve as a basis for the formulation of the preferred intervention in the four areas. Since the identification mission in February 1993 two reports on the geohydrology prepared by TNO Institute of Applied Geoscience in the Netherlands became available.⁴ During the visits of the Commission to the four

⁴ See the Report on the Identification Mission to Shabwah Governorate and the Identification Memorandums in the four areas dated February 1993.

study areas from 23-25 September 1993 it appeared that additional information on potential aquifers, well fields and (exploratory) boreholes is available. This information is scattered over a large number of reports including information dating back from the time of the former People's Democratic Republic of Yemen before unification with the Yemen Arab Republic. Particularly, recent geological studies carried out by oil companies in the Wadi Jirdan area may contain valuable information for the preparation of the EIS / feasibility study. During the field visit of the Commission it appeared that TNO had just started with the drilling of an exploratory borehole at Wadi Shawlah between Ataq and Wadi Jirdan in the cretaceous Tawilah sandstone aquifer which may provide water to Ataq and possibly also to Wadi Jirdan. The results of this drilling will become available in October or November 1993. If successful, an additional survey will support an adequate siting of production wells. However, if not successful, further exploratory survey and follow-up is needed.

During the field visit to Wadi Jirdan on 24 September 1993 the Commission observed a number of cisterns which are filled during the rainy season by rainwater, run-off and floodwater collected by means of some dams. The best of these cisterns is located at the upstream end of a side valley where a water basin is created underneath an intermittent waterfall (Umm al- Khair). In addition water is brought by truck from Ataq and sold for 13 Y Real per 10 litre.

All relevant information on existing and past (ground)water resources exploration and exploitation must be carefully analyzed. The performance of present resources and systems must be scrutinized in order to define areas of insufficient data.

Data should be collected from existing wells (in use) and boreholes (not in use) including lithological description and geophysical logs (if any), pumping tests and water quality analysis. These data combined with data on topography, surface hydrology and rainfall will give a picture of the hydrological boundaries, presence and extent of aquiferous and non-aquiferous layers, geohydrological properties of the various strata, groundwater flow directions and potential for further development.

If existing data is found inadequate, selected field investigations on pumped quantities, water levels, water quality, well yields and drawdown are necessary.

Concerning the existing sanitation and waste water disposal facilities the Identification Memorandums only provide limited data.

The following information on water supply, sanitation and waste water disposal facilities is needed in order to assess the current situation which must be used as the point of departure for the formulation of the preferred intervention in each of the four project areas (see chapter 4). This information could possibly be collected through the methodology of a "Rapid Rural Appraisal" which will make use of the interdisciplinarity of the issues to be tackled:

- Household surveys to assess the use (quantity, quality, taste) of domestic water by the various members of the household and their sanitary/customary practices, the use and number of latrines, septic tanks and the occurrence of existing sewage systems and observed problems. Care should be taken that different social strata, particularly women are approached to find out the tasks in storing and use of water, sanitary arrangements and problems in assuring sanitary privacy.
- Insight in the women's needs with regard to water supply, sanitation and watering of livestock.
- Insight in existing or potential organizational structures which can play a role as water associations.
- Insight in the willingness of the population to participate in cash, kind or labour to the implementation of the activity and to the setting up of an O&M-system in relation to desired alternative levels of sophistication in supply, sanitation and disposal facilities.
- Insight in possible conflicts of access to water of different socio-economic strata of the population, conflicts between local groups about rights concerning the transferring of water from

5 In this respect the Commission recommends to request the expert who will carry out a baseline study for the health project in Shabwah Governorate (Mr Roy Stoves) to include some questions on the need for water and sanitation in his questionnaire.

one area to another area and conflicts about public use of water from private sources as well as conflicts about water allocation among competing water sectors.

- Insight in the existing waste disposal system in the four areas.⁶

The identification memorandums do not provide information on the existing institutions and agencies involved in the water sector, nor do they indicate their possible role to support the project.

During the field visit the Commission was informed that the following institutions and agencies are active in the water sector in Shabwah Governorate:

- Ministry of Planning and Development, responsible for coordination and planning of all activities.
- National Water and Sanitation Authority (NWASA, see page A35 of "Water supply, waste water and sanitation", Final report Vol. VI, June 1992; Technical secretariat of the High Water Council, UNDP/DES/DES Project YEM/88/001), responsible for urban water supply and sewage systems under the Ministry of Electricity and Water. This authority is in charge of the implementation of water programmes and water supply to the users, including O&M services. It is therefore also responsible for the collection of the user fees (cost-recovery systems and tariffs, see Vol IV page A30, same reference).
- General Authority for Rural Water and Rural Electricity Supply, also under the Ministry of Electricity and Water, responsible for rural water supply (page A34, same reference). This Authority has a training centre in Sana'a for the instruction of the village operators.
- Public Water Corporation (PWC), embodies in fact in the southern Governorates both National Water and Sanitation Authority and General Authority for Rural Water and Rural Electricity Supply. It is not clear what will happen to PWC in the future. At the moment the sewage systems in the southern Governorates seem to pertain to the municipalities (Ministry of Local Government).
- Ministry of Agriculture and Water Resources (MAWR), formally in charge of water-related policies and water resources. More than 90 percent of the water in the country is used for agricultural purposes.
- Local Cooperative Councils for Development (LCCD) appear to be more active in the northern Governorates than in the southern Governorates.
- Ministry of Housing and Urban Planning, provides to NWASA pertinent information concerning land use plans. This Ministry contains a Department of Environmental Health. This department considers the establishment of a training centre for solid waste disposal and other related issues.
- Ministry of Health has no direct responsibility for the maintenance of water quality.

It appears also important to describe the functioning of these existing institutions in their daily operations; their strong and weak points, their responsibilities and capacity for implementation. Insight in the issue of privatisation of the solid waste collection systems might provide important additional information to plan for the future (see plans in Dhamar in this respect).

The EIS must describe the tasks and responsibilities of all agencies in the water sector in the four project areas as well as any existing or planned coordination activities between the agencies. This must take place with a view to the formulation of the preferred intervention in the project areas (see chapter 4).

4. FORMULATION OF THE INTERVENTIONS AND DESCRIPTION OF THEIR ENVIRONMENTAL IMPACTS

6 In this respect the Commission observed severe malfunctioning of the sewage systems in Ataq and Nisab leading to serious health hazards (cholera). In Beihan, the Commission noted that compared to the situation earlier 1993, the sewage disposal situation in the town had greatly improved thanks to a private initiative by a local people's organization called "Gamiat al Khairiah (Beihan Betterment Society)".

4.1 Approach towards the formulation of interventions

The following move in the preparation of the EIS must concentrate on the formulation of the preferred interventions in the four project areas. The objectives (as defined in chapter 2) must be attainable by the preferred interventions, whereas the current situation (as indicated in chapter 3) acts as the point of departure.

The following methodological approach is proposed to arrive at the preferred interventions.

As a first step, it must be recognized that the development potentials for future water supply/sanitation/waste water disposal systems for the four project areas are governed by the (geo)hydrological situation in the study areas. The (geo)hydrological situation restricts the number of acceptable solutions to the use of groundwater from certain aquifers only. Surface water represents an unreliable source of water both in terms of quantity as well as quality.

In the second step, the use of the potential aquifers must be looked at from the point of view of the principle of sustainability. This principle is of paramount importance in a climatological setting where the average rainfall amounts to only 100 mm per year and where potential evaporation exceeds this amount many times. Sustainability forms the key to the management of water resources of acceptable quality which looks beyond short term solutions and which can guarantee the safe supply of water to many generations in the future. Sustainable use of the aquifers must take into account their recharge capacity and their protection from pollution as well as the social and institutional aspects of their exploitation.

This implies that a safe and reliable system of water supply/sanitation/waste water disposal can only be set up and operated in perpetuity if due attention is given to the three aspects: physical, social and institutional sustainability in the proposal projects.

Lastly, in the third step the most suitable combination of physical, social and institutional elements must be determined to formulate the preferred intervention for each project area. Local conditions will dictate which elements will need emphasis in this combination. For example, if water resources are limited both in quantity as well as in quality and water demands are high, development of the institutional aspect is most important in order to achieve a fair and strict distribution of the limited water resources over all water users and the various water uses.

In the course of this selection the impacts resulting from each reasonably achievable intervention must be predicted and considered. Both the negative as well as positive impacts must receive attention. Impacts can either be reversible or irreversible. The emphasis must be on the irreversible impacts. The magnitude of the impacts and the degree in which they will manifest themselves depend on the degree of sustainability that can be attained by the projects' interventions. Any significant changes in the existing state of biodiversity in the study areas which can be ascribed to the proposed project must be reported. In the EIS / feasibility study the applied prediction methods and assumptions must be indicated as well as their limitations and inaccuracies.

In the following paragraphs the three aspects of sustainable development for the four project areas are looked into in more detail.

4.2 Physical, social and institutional sustainability

4.2.1 Physical sustainability

Pressures on the exploitation of water resources in the study areas are increasing, owing to population growth, increasing demand for agricultural use and other uses, rising standards of living and growing awareness of health and sanitation.

Surface water and groundwater are usually interdependent and interrelated: aquifers are recharged by streambed infiltration, infiltration of run-off or boundary inflows and infiltration by disposed waste water. Pollution of surface water will eventually result in the pollution of groundwater through the same process of infiltration and seepage.

Factors such as climate, soil structure, streamflows and surface water use affect the groundwater balance. In addition, geological information and hydraulic properties of aquifers are indispensable for understanding the groundwater regime and for planning groundwater exploitation.

Continuous exploitation of groundwater can result in periodic or permanent lowering of the groundwater table, thus limiting both the quality of water available for other uses. Extensive exploitation or over-pumping can result in pollution of fresh groundwater by increased concentration of pollutants in the aquifer, due to leaching of pesticides, fertilizers and salts from agricultural lands or from geological strata containing rock salts. It can also lead to changes in the delicate interface, both horizontally and vertically, between salt and fresh groundwater, inducing salinity intrusion.

Detailed field investigations in the Nisab area including Wadi Hammam and in the Beihan area and a comparison of newly obtained data with those existing data from previous studies could reveal whether (one of) these phenomena or mixing of groundwater with saline groundwater occur and whether further deterioration may be expected in the future.

The risk of contamination of surface and groundwater is also great in areas which are subjected to flooding.

Hence, the location of potential sources of pollution e.g. sewerage outfalls, solid waste disposal sites and septic tanks should preferably avoid such areas.

Disposal of untreated domestic waste water, dumping of solid waste and spills of fuel and lubricants in the Wadi beds, as observed around Nisab and Ataq may result in runoff and groundwater polluted with harmful substances that can have a serious impact on water quality and health.

Irrigation consumes in general over 90 percent of all fresh water available, thus conserving water by increasing irrigation efficiency has great potential. Land and water resources must also be considered together because of their mutual causal relationship. A change in management of either land or water resources will have a direct bearing on these resources in total. Agricultural use, in particular spate irrigation in upstream areas may alter patterns of surface run-off and infiltration, resulting in diminished groundwater recharge and lowered water table.

Water use decisions in one part of a watershed are likely to pose opportunities and constraints for users in another part. These circumstances argue for integrated planning on a watershed basis to ensure that the basin's water is not overcommitted, that the projects meet their intended objectives and that demands are kept in balance with the capacity of the water resources.

This means that the only sound approach to the exploitation of the available water resources must be found in the achievement of a state of physical sustainability in which water demand and supply are balanced through:

- arational distribution of water productions either for domestic or for agricultural use

- optimal reduction in water losses from distribution systems⁷,
- the introduction of a progressive tariff system for water consumption to encourage water conservation and
- enhancement of surface water infiltration, including the infiltration of (treated) waste water following its re-use for agricultural purposes.

4.2.2 Social sustainability

The aspect of social sustainability is conditioned by the following prerequisites which are taken from the DGIS sector paper on women, water and sanitation:

- an integrated approach in which the improvement in the water supply system must be linked with improvements in sanitation, sewage disposal, solid waste disposal and hygiene education;
- a commitment of the users which can be achieved through their involvement (particularly the women) in the whole project cycle, i.e. preparation, implementation and follow-up, including evaluation. This commitment will also imply financial support for investment and recurrent expenditure (water consumption fees, contributions to water user associations) by users.

If these prerequisites are not met and if they are not elaborated on the basis of the information as indicated in chapter 3 of this advice, the following adverse environmental impacts and consequences will occur:

1. increased accessibility to safe water with a positive effect on the health of the population while at the same time stimulating increased consumption with unknown effects on the availability of water in the long run;
2. increased problems in the field of O&M, leading to diminishing quantity of safe water and to the continuing incapacity of the existing services to take appropriate remedial action;
3. increased problems with the existing drainage and sewage system, leading to increased exposure of health risks (water borne diseases, such as cholera);
4. problems with regard to the social sustainability because participation (in cash, kind or labour) and information-dialogue-decision making with the users about the forthcoming intervention will be almost entirely absent;
5. as women are the most involved target group in this project, it will not be clear in what way their needs will be taken into account, thus further diminishing social sustainability;
6. as no health education is systematically provided to the users, the potential consciousness-raising about water-related issues and its scarcity will be absent.

In order to avoid these problems and to preclude unwanted impacts the preferred interventions must include the following measures:

1. The preparation of integrated water and sanitation programmes which take into account the specific local situation of each of the four project areas. In the towns of Ataq, Nisab en Beihan the upgrading of the sanitation system should be phased in such a way that eventually all individual systems can be incorporated in a central collection/treatment facility when need for such a facility arises. The experiences gained in the Rada Water Supply and Sanitation Project can serve as reference in this respect. In Wadi Jirdan the construction of septic tanks can be improved and extended.
2. Information campaigns to all women and men concerning all aspects of project design and implementation as well as all mutual obligations. Care should be taken that local initiatives that have been started in all four project areas are stimulated and built upon.

⁷ The study of the "TF on NWRP" indicates that the percentage of water "unaccounted for" in municipal systems in Yemen amounts to more than 50 percent of supply! According to the study insufficient funds for operation and maintenance are mainly responsible for malfunctioning of water and waste disposal facilities in the country.

3. Establishment of a contract between representatives of the communities (e.g. betterment societies or responsible representatives of urban quarters), PWC/NWASA being the local water authority, the governorate and the projects.

This contract must contain the following elements:

- labour input and financial contribution
 - responsibility for O&M (including the salary of the local operators, the cost for fuel, spare parts etc)
 - conditional linkage of household sewage connection to water-supply
 - relation to water use for agricultural purposes etc.
- Care should be taken to guarantee relatively small social entities to assure effective participation (not more than 2000 persons per unit).

4. Study of the possibility to decentralise financial water management together with the existing or potential water associations and NWASA/PWC at local level.
5. Health education to broad groups of women and men to transfer basic information concerning water and sanitation (by means of a mobile team or through fixed services?).

The expected impact of these social measures will result in:

- increased accessibility to safe water with a positive effect on the health of the population
- few problems in the field of O&M
- health risks will diminish and water borne diseases are likely to be better controlled than in the existing situation
- more knowledge on the part of the users (particularly women) and consciousness about the consequences of water use for the environment.

4.2.3

Institutional sustainability

At the moment there are many uncertainties about the exact tasks and responsibilities of all agencies involved in the water sector (see Chapter 3 of this advice). The general rule appears to be that policies are formulated centrally, while their implementation is carried out at the local level. There should be an effective body for the coordination and monitoring of project implementation.

Furthermore, it is not clearly defined which agency must take the lead for the important role of extension and health education to the users, thus giving rise to a variety of ad-hoc, project-related and non-sustainable solutions. No links with existing Health Centres appear to exist for the supervision of the training of village women in health education. As yet no budget is available to carry out these educational tasks. This could become an important contribution from the Yemeni side in the proposed project.

These shortcomings are likely to lead to limited institutional involvement and imprecise definition of responsibilities of the concerned parties. This in turn will have negative consequences not only for the setting up of the water supply and sewage systems but also for its Operation and Maintenance, including the motivation and commitment of the personnel. As currently there hardly seems to exist a budget for the setting up and maintenance of the sanitary facilities at governorate and district levels, the future of these initiatives depends even more on the interest of the people to participate in these schemes.

Another result could be a malfunctioning water fee-collection system.

Finally it is not likely that a core of well trained and dedicated national staff is developed who can guide and plan the service delivery system in Shabwah Governorate in such a way that both technical and social requirements are met.

From the foregoing it appears that human resource development is needed in order to improve the institutional capacity in the four project areas.

- For example the Commission observed that initiatives from the population (maintenance of water supply to prevent leakages, construction of septic tanks, elaboration of drainage systems in the

- urban centres) currently can not be well technically supported by the service-related personnel. It is clear that technical know-how and skills are urgently needed to respond to local initiatives.
- Furthermore, knowledge and skills are needed among the personnel of the concerned ministries to better find out the needs of the population (especially women) and their capacity to contribute to local solutions. Care should be taken that these local initiatives should be supported and stimulated so that services become complementary to what the population can provide.
 - Finally, the responsible staff for service delivery needs additional knowledge and skills in planning and management of their services.

In general the need for additional training and skills development in this area is equally important to the more technical support that is mentioned before. For example the technical staff should participate in the household surveys about the needs of the population.

Therefore, the following institutional elements for the preferred interventions are suggested:

1. to assure regular and continuous coordination between all water-related institutions in Shabwah in order to plan and monitor project implementation;
2. to develop a human resource development plan, that describes the training needs both in the technical and social field for various levels of service personnel.

The expected impact of these institutional measures will result in:

- an improved technical capacity of the service delivery system to implement the projects according to the expressed needs of the population
- a functional human resource development plan to upgrade the existing personnel both in technical and social skills.

4.3 Preferred intervention per project area

The nature and features of the preferred intervention in each project area will be determined by the most suitable combination of physical, social and institutional project components.

The proposed development in each project area will have to make as much use as possible of existing physical, social and institutional structures which through adaptations, extensions and improvements will be able to meet increased demands and requirements over the projects' lifetime. Only when existing structures definitely appear to be inadequate, new structures and facilities will have to be developed. This can be illustrated by the following examples.

1. Ataq is supplied with water from a well field 25 kms west of Ataq in Wadi Hammam. The water quality is reported to be poor in that it is too saline to serve as good quality drinking water. Water is only delivered to the old section of the town. The new quarters do not have piped water supply. At present, a well is drilled at Wadi Shewlah about 45 kms northeast of Ataq with the aim to explore water production for Ataq. In the EIS / feasibility study the existing situation must be investigated for its potential for rehabilitation, improvement, and extension, and compared to the situation which will arise if water is supplied to Ataq either from the potential well field at Wadi Shawlah or from any other well field.
2. At present, Ataq and Nisab experience considerable problems with the disposal of waste water: sewage pipes have insufficient capacity and are blocked and manholes and soakaway pits are overflowing. Improvement and extension of the present sewage systems without waste water treatment can easily be materialized; the situation in Beihan demonstrates that considerable improvement can be realized fairly rapidly with modest means. However, the EIS / feasibility study must also be able to predict the moment when a more advanced waste water collection disposal and treatment system, such as the system which is being constructed in Rada, is needed in Ataq and possibly also in Nisab and Beihan. Therefore, improvements of the existing systems must be in line with the possible future installation of a more advanced system of treatment and

disposal. All waste water disposal systems must also look into their potentials for re-use of (treated) waste water in agriculture and the use of sludge as fertilizer. The positive experiences with the "Aden Green Belt project" prove that re-use of waste water in tree production is possible and attractive from the point of view of environmental protection.

3. In Wadi Jirdan there seem to be several alternative development options to supply water from either
 - the potential well field at Wadi Shawlah or from
 - the well field at Ayadh or from
 - any potential well fields possibly identified by the oil company active in the area.

The EIS / feasibility study must also look into the possibility of improvement of the present system of cisterns as a supplementary or back-up system for domestic use and for livestock-watering.

The cost of intervention plays a role as an environmentally discriminating factor in the selection of the preferred intervention per project area if such cost has a significant relation to either environmental benefit or hazard reduction.

8 A report in the framework of the FAO assistance to the Republic of Yemen to the Green Belt Project around Aden (TCP/YEM/0156) from June 1992 writes in this respect:
"Socio-cultural and religious aspects are very important in determining the degree of acceptance of efficient re-use within the Yemeni context. Although no survey of this kind has been carried out, the attitudes which prevail in several regions in the country seem to indicate that no serious objections to effluent re-use are foreseeable. In fact, the demand appears to be very high, and wherever possible farmers are tapping effluent discharge to irrigate their fields".

5. MITIGATING MEASURES

In the EIS additional measures which may further reduce the environmental impacts resulting from the implementation of the proposed projects must be indicated. Here, the following mitigating measures can be suggested already for consideration:

- the delimitation of protection zones around the well sites in which no activities are allowed which may adversely affect or contaminate the water production facilities
- the construction of concrete catchment structures underneath pumps and fuel tanks in order to intercept fuel, oil and chemicals leaks and spills as well as the safe disposal of these fluids
- the application of monitoring measures to restrict water losses from the distribution systems
- the (gradual) replacement of Asbestos Cement (AC) pipes in the existing water supply systems for obvious health reasons and the safe disposal of AC.

6. COMPARISON OF THE ENVIRONMENTAL IMPACTS FROM THE PROPOSED INTERVENTIONS WITH THE CURRENT SITUATION

In the EIS the impacts which will occur from the proposed interventions in the four project areas must be compared with the impacts from the existing situation as well as with the situation that would develop if the interventions would not take place; in other words, if no improvements of the water supply, sanitation and waste water disposal systems would be implemented. The autonomous development of the existing situation must take into account any developments such as those in the field of oil exploration which in turn may set in motion a number of related developments affecting the economy, the population and hence, the environment of the study areas.

In the description, national and international standards on drinking water quantity per capita and quality, on sanitation, waste water disposal and possible re-use of (treated) waste water must be observed as benchmarks for the comparison.

7. REMAINING GAPS IN KNOWLEDGE AND POST-PROJECT EVALUATION

The EIS must include a list of the gaps in knowledge which remain. Any uncertainties in forecasting the environmental impacts must also be included. The significance of these gaps in knowledge and uncertainties for the implementation of the proposed projects must also be specified.

In view of the remaining uncertainties, it is recommended that the EIS will include a monitoring programme. The monitoring including field observations, selected tests and water sample analyses of the supplied drinking water and the quality of the effluent is needed in order to carry out a quality control of the entire production cycle and to assess the actual impacts which result from the implementation and operation.

The monitoring programme should be established immediately and must start before the actual implementation of the projects to provide a baseline for comparison.

Laboratory facilities are needed to enable analysis of the water and residual sludge samples. The laboratory of the Aden Green Belt project which is now defunct could be rehabilitated to also provide these services for the water sector in Shabwah Governorate.

8. SUMMARY OF THE EIS

The summary must present the most important elements of each of the chapters of the EIS, preferable in the form of maps, figures, tables and diagrams.