CHAPTER 3 IMPLEMENTATION PLAN

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3-1 IMPLEMENTATION PLAN

3-1-1 Implementation Concept

This Project is aimed at constructing water supply facilities relevant to the characteristics of each of the four project sites in two southern and eastern governorates in Yemen under Japan's grant aid system. In an effort to formulate the implementation plan of the Project, the proper organization and work schedule shall be worked out, taking into due consideration the scale of works as well as the work period determined under the scheme of Japan's Grand Aid. Although the local market for the construction of water facilities remains yet to reach a significant level, the involvement of local contractors and labor force is highly encouraged to support smooth progress of works under harsh natural and social environments.

The executing agency is the GAREW belonging to the Ministry of Electricity and Water, which has been an executing agency in the previous rural water supply projects with Japanese assistance. The chairman of the GAREW, as general manager, is to supervise overall administrative matters of the Project. The Bilateral Department under the general manager engages in practical jobs for the implementation of the Project, appointing full-time counterparts of two or three selected from this office, as well as cooperative engineering staff to be assigned in specialty divisions for supporting the progress of the Project. On the other hand, Aden and Hardramout Branches of the GAREW is to be directly involved in the field activities, since the Project sites are located in southern and eastern governorates 600-1,000km away from the capital city of Sana'a where the GAREW's headquarters is situated.

Under this supervising and supporting setup of the executing agency, a Japanese consulting firm is employed mainly for making the detailed design of the Project, assisting in the execution of the tender, and supervising the construction work.

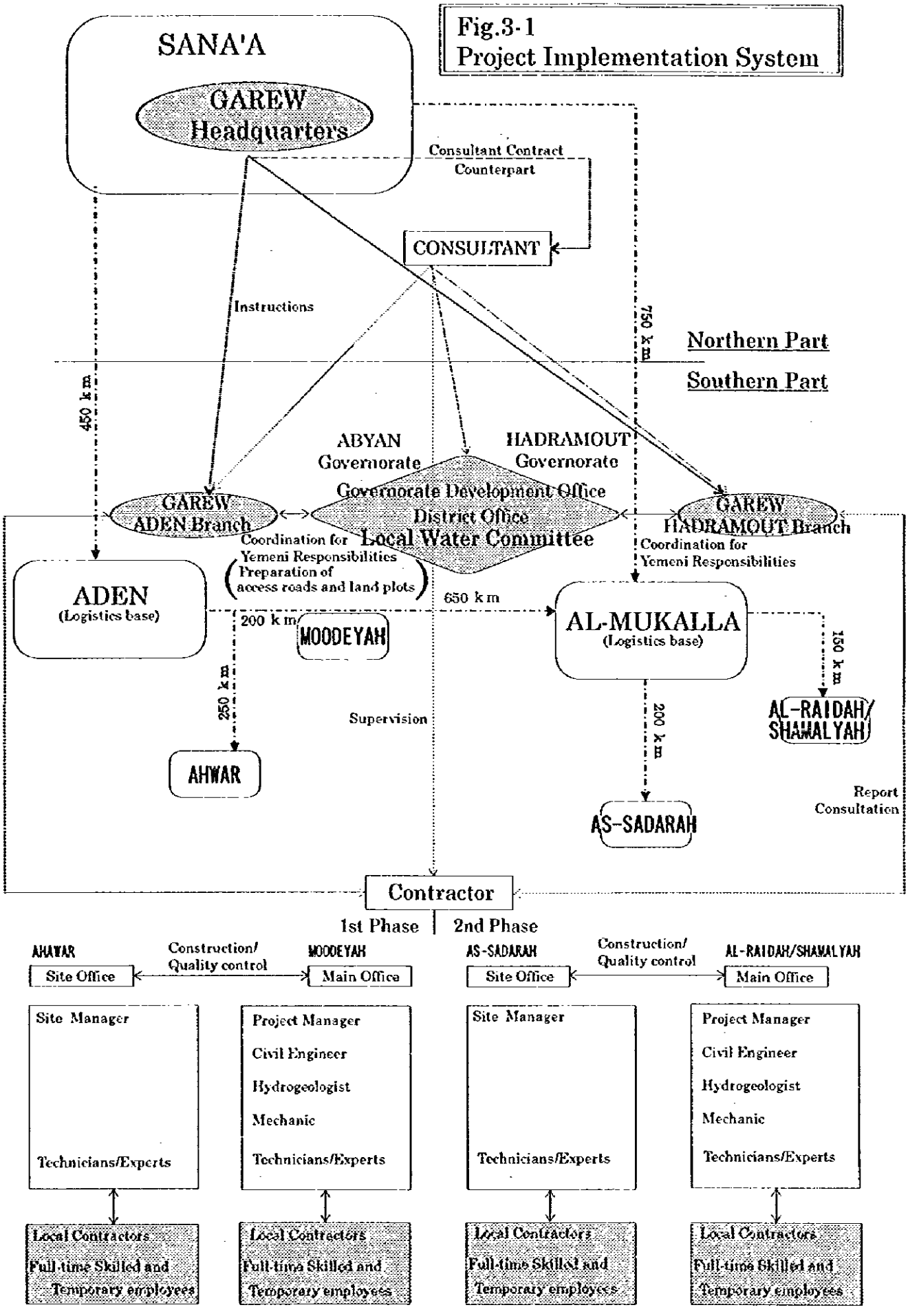
The construction work is carried out by a Japanese company, which has been awarded a contract through the tender. The contractor is held responsible for constructing the water supply facilities in strict compliance with the requirements of the specifications and drawings under the administration of the GAREW and the supervision by the consultant. The main office of the contractor will be installed in the site to which easy access in a relatively shorter distance can be made from the governorate capital where the GAREW's branch is located (Moodeyah for the 1st phase and Al-Raidah/Shamalya for the 2nd phase), with its staff headed by a project manager engaging in controlling the quality and progress of work under the contract. On the other hand, a site managers is assigned to head the construction teams in the other sites where the work progresses simultaneously. They are responsible for smooth progress of work in the respective sites in coordination with the project manager at the head office.

The construction of water supply facilities under this Project involves the rehabilitation work of existing wells, civil work, plumbing and mechanical work. In view of a technical level in this country, it is considered to be critically important that the contractor should establish an organization of its engineering staff in various fields of specialties to control the quality and progress of the work so that it could accomplish the work satisfactorily within the designated period under Japan's grant aid system. For a part of the construction works, for example, stone tanks which are widely used in the Southern part of Yemen, active participation of local specialists is required, but the quality and schedule control of local specialists will also come under the control of the Japanese engineers.

The water committees of the local governments are in charge of performing coordination between the contractor and the communities at the sites in order to ensure smooth execution of the Project. These offices operate with the district director as general manager. This organization will be in charge of operation and maintenance of facilities after the facilities and equipment are transferred from the GAREW upon their completion. As the agencies possessing direct interest in the execution, the committees will carry out, under the direction of the GAREW, the preparation of access, repair roads and secure land necessary for the work, developing a network of cooperation for the implementation of the Project with the communities.

Figure 3-1 shows a diagram of the implementation system.

Fig.3-1
Project Implementation System



3-1-2 Implementation Conditions

In order to achieve required quality within a work period set under Japan's grant aid scheme, the Japanese contractor is required to execute its own supervision of construction and quality management. Skilled and un-skilled workers may locally be employed, and for a part of works a local sub-contractor will be hired. Yet a team of Japanese experts is needed to be established for the works, depending on the types of construction works and their implementation schedule.

The procurement of locally available equipment and material as well as hiring of local contractors are highly encouraged under the Project. For the construction of reinforced concrete water tank, which has been one of standardized facilities of the Southern part, the employment of experienced local contractor is appropriate, since it requires specialized technique. It is not difficult to employ local contractors of small- and medium-scale companies in the southern governorates. However, the Japanese contractor under the Project shall do management in implementation, construction, and quality control.

3-1-3 Scope of Work

The responsibilities of both the Yemeni and Japanese sides for the implementation of the Project are as follows:

(1) Responsibilities of the Yemeni Side

a. To acquire, clear and level the land necessary for the construction of water supply facilities, such as water sources, machine rooms, water tanks, pipes, water service facilities, temporary offices, accommodations for construction workers, and store yards at the project sites.
b. To provide and maintain access to each water supply facility construction site as well as to repair and expand the roads necessary for construction in the project sites.
c. To install distribution pipelines in the project sites using the plumbing materials to be procured under the Project and to install supply pipelines from due installed

distribution pipelines to the households in the project areas where individual connection is planned.

d. To achieve sustainable operation and maintenance after completion of construction work with establishment and capacity building of water committees.

e. To construct other facilities outside the scope of this Project included in this basic design plan.

(2) Responsibilities of the Japanese Side

a. To construct the following water supply facilities in the four sites where this basic design plan will be implemented.

* Water sources/Water intake facilities (including rehabilitation of existing boreholes and borehole pump stations)
* Transmission facilities (including booster pump stations)
* Distribution facilities (including water tanks), and
* Service facilities such as public water stands

The project sites are as follows:

* Ahwar (Abyan governorate)
* Moodeyah (Abyan governorate)
* Al-Raidah/Shamalya (Hadramout governorate)
* As-Sadarah (Hadramout governorate)

b. To bear the cost of all equipment and materials, temporary facilities, construction equipment and vehicles necessary for accomplishing the work other than those to be borne by the Yemeni side.

c. To supply plumbing materials to above mentioned four project sites to extend distribution pipes after completion of the pipeline construction by the Japanese side, as planned in this basic design.

d. To provide consulting and supervision services for construction and implementation of

the Project.

3-1-4 Consultant Supervision

The detailed design and construction supervision will be conducted by the Japanese consultant, on the basis of Japan's grant aid system. The details are as follows.

(1) Pre-construction Stage

a. Detailed design
b. Preparation of tender documents
c. Administration of tender process
d. Evaluation of tender results
e. Assistance and coordination in the conclusion of the construction contract

(2) Construction Stage

a. Construction supervision
b. Inspection and technology transfer
c. Preparation of reports

The detailed design is carried out by the consultant to establish the detailed plan for the facilities and equipment, based upon the field survey in the sites involved in the Project. During the field survey, special attention is paid to clarify the situation of land to be used for the construction work, particularly concerning the courses of pipelines, with the cooperation and coordination of the GAREW and the water committees so that no questions would be raised among villagers during the actual work. The results of the detailed design are reflected in the subsequent preparation of tender documents, and the schedule of the tender is decided with the consent of concerned offices and agencies of the government of Japan. The consultant administers and controls the process of tendering for and on behalf of the executing agency, evaluates its results and assists the GAREW in concluding the contract with an eligible Japanese firm.

As a first step during the construction stage, the consultant's staff carries out the transfer of the project sites to the construction firm, and as the work proceeds, they engage in supervising it with the cooperation and coordination of the concerned offices and agencies as well as the GAREW on the Yemeni side.

When the construction of the facilities is completed, they conduct the inspection and direct technological transfer on the operation and maintenance. Upon completion and delivery of facilities, the final completion report is prepared by the consultant.

3-1-5 Procurement Plan

(1) Local Procurement

All the locally available construction material that meets the requirements of the Project shall be procured and utilized. Construction materials such as aggregates, cements, concrete blocks can be easily procured locally all over the country. Two cement plants constructed with Japan's assistance are actively engaged in production activities. As a result of the survey of the local market, the following materials are recommended to be procured in this country for the execution of the Project.

1) Cement

The supply of cement is stable with plants operating in Basil city of Hodeidah governorate, completed with assistance by the former Soviet Union (annual production 250,000 tons); in Amran, completed by a Japanese company (annual production 500,000 tons); and in Mafraq, completed in 1993 by a Japanese loan project.

2) Concrete Blocks

Small house industries are located throughout Yemen, and concrete blocks can easily be obtained.

3) Aggregate and Water

Aggregate in general is of degraded quality, with coarse aggregate made of crushed basaltic rock and fines one containing much silt. However, a steady supply, relatively good in quality, is found in the suburbs of the country's major cities, and procurement in these areas raises no difficulty. The water used for the work can be obtained in and around the sites.

4) Fuel

Although prices have been raised, the supply of home-produced petroleum and diesel oil has been stable, and is expected to hardly raise problems for the operation of construction vehicles and equipment.

5) Borehole Pumps

The great majority of deep well pumps in this country are of diesel engine driven vertical shaft pumps, imported mainly from European countries such as Italy, Denmark, and Cyprus. Since the procurement of their spare parts are much easier and local conditions for maintenance are better than with submersible motor pumps, this type of pumps are planned to be purchased locally for use in the facilities where high-lifting capacities are not required. Diesel engines are normally supplied together with the pumps selected by the pump manufacturers..

(2) Procurement in Japan

Most of equipment and materials for the construction of water supply facilities are imported ones in Yemen, and their procurement has long been in difficult conditions due to severe import restrictions by the government, deriving from shortages of foreign reserves. To make the matter worse, progressive inflation since the outbreak of the Gulf war has sent market prices of all imported products skyrocketing. Under the present circumstances, therefore, main equipment and materials are planned to be procured in Japan, since they are stable both in quality and prices. These products are listed as follows:

a. Pumps: Submersible motor pumps for deep wells needing high-lifting capacity and

multi-stage volute pumps for booster pumps

b. Power drive units: Diesel engine driven generator

c. Water tank materials: Steel panel tank and steel tower for elevated tanks

d. Plumbing materials: Steel and ductile iron pipes, fittings and valves

(3) Construction Equipment and Vehicles

The project sites are dispersed countrywide, with the construction work planned to proceed simultaneously in two separate sites. On one hand, the headquarters for construction work is planned to be stationed at the site of easy approach in a shorter distance from the governorate capital in which the GAREW's branch is located (at Moodeyah in phase 1, and at Al-Raidah/Shamalya in phase 2). On the other hand, a field office for construction work will be stationed at the other site (at Ahwar in phase 1 and at As-Sadarah in phase 2). For the headquarters' management and control of the quality and progress of work, cargo trucks for transportation of equipment/materials and 4-wheel drive vehicles, etc. are required as well as for the execution of work developed in vast areas of the sites. In addition, one unit of crane truck is necessary for handling heavy equipment/materials. The trucks and small four-wheel drive cars suitable for severe road conditions are mostly of Japanese make, and maintenance service and procurement of spare parts of Japanese vehicles can conveniently be provided all over the country. Bringing vehicles from Japan is both easy and economical. Local acquisition of such construction equipment/vehicles is not easy either through procurement or through lease. In this view, they are proposed to be procured in Japan.

There are no rentals and leases for construction machinery. Hourly rentals are rarely assured even in major cities, and maintenance is not good. As the construction machinery will be fully operated over a long period of time in this Project, procuring them in Japan is considered best.

(4) Temporary Facilities

A similar difficult situation is prevalent both in the northern and southern parts of the country in acquiring temporary facilities for offices and lodgings quarters, etc. These facilities are planned to be procured in Japan as well.

3-1-6 Implementation Schedule

The implementation schedule for this grant aid project is as follows.

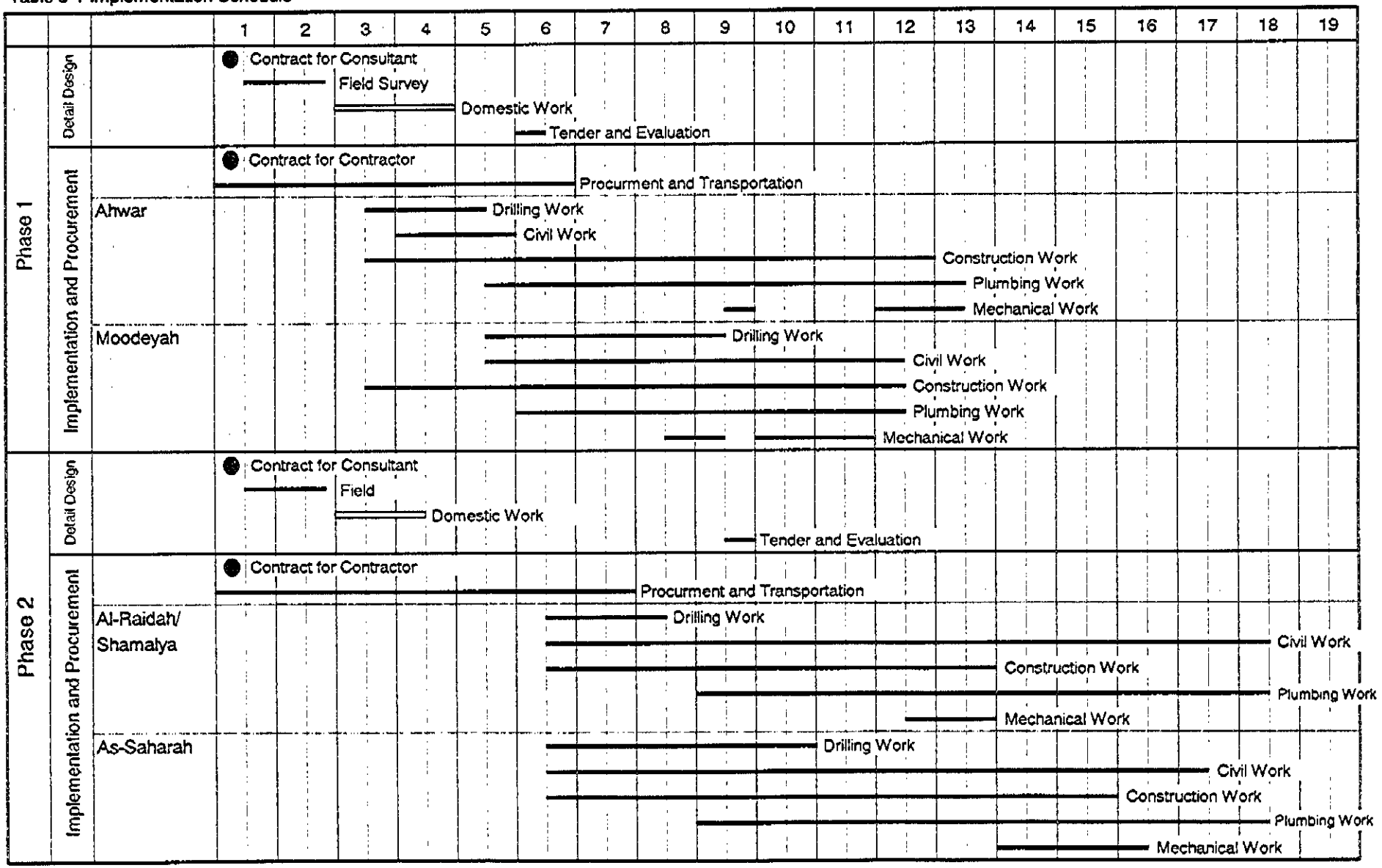
a. Exchange of Notes between the Governments of the Republic of Yemen and Japan
b. Consulting contract
c. Detailed design and preparation of tender documents
d. Tendering and conclusion of the construction contract
e. Procurement of equipment and materials
f. Shipping of procured equipment and materials, and their customs clearance
g. Field construction work
h. Delivery of completed facilities

The construction at each project site consists of various works and will be completed in approximately 10.5 to 12 months after the conclusion of the construction contract. The appropriate plan is to divide the overall construction term into two phases, taking into account such factors as the priority of the sites, locations of the sites, the scale of the works and the construction costs. The optimum implementation schedule is proposed as follows.

1. Phase I Ahwar and Moodeyah (both sites in Abyan governorte)
2. PhaseII Al-Raidah/Shamalya, and As-Sadarah (both sites in Hadramout governorate)

Table 3-1 shows the whole construction schedule divided into 2 phases.

Table 3-1 Implementation Schedule



3-1-7 Obligations of the Government of Yemen

(1) Undertakings by the Yemeni side

The Government of Yemen is required to execute following arrangements necessary for the smooth implementation of the Project in case the Government of Japan has decided to implement the Project under Japan's Grant Aid Scheme.

a. To provide relevant data, information and documents necessary for the execution of the Project.
b. To provide, secure, clear and level land and access at each construction site prior to the commencement of the construction of water facilities.
c. To ensure speedy unloading, tax exemption, customs clearance at the port of disembarkation and prompt inland transportation, of products purchased for the Project in accordance with the Exchange of Notes to be concluded between the Government of the Republic of Yemen and the Government of Japan.
d. To make necessary arrangement for the entry and stay in the Republic of Yemen, of Japanese nationals whose services may be required in connection with the supply of products and services under the verified contracts for the Project.
e. To exempt Japanese nationals involved in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Yemen with respect to the supply of equipment/machines and services under the verified contracts for the Project in accordance with the Exchange of Notes to be concluded between the Government of the Republic of Yemen and the Government of Japan.
f. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement for the Project.
g. To bear all expenses other than those to be borne by the Japanese Grant Aid necessary for the execution of the Project.
h. To assign exclusive counterpart staff in the General Authority for Rural Electricity and Water for execution of the Project including siting, drilling, installation of water facilities, etc. prior to the commencement of the Project.
i. To maintain and use properly and effectively the facilities constructed and equipment

purchased under the Grant Aid for the Project..

j. To undertake all the necessary measures to secure the safety in the Republic of Yemen of Japanese nationals engaging in the implementation of the Project.

k. To provide free of charge to the Japanese side the complete set of truck-mounted pumping test equipment that was procured under the previous Japanese Grant Aid, based upon the schedule of the implementation.

(2) Project Cost Estimate for Expenses to Be Borne by the Yemen Side

The Cost to be borne by the Yemeni side in the implementation of the Project is estimated at YR36, 680 thousand. The breakdown of the cost is shown in the following table.

Table 3-2 Cost to be Borne by Yemeni Side

(Unit: one thousand Yemeni Riyal)

Land Acquisition, cleaning and grading:	YR 175
Access preparation and maintenance:	YR 900
Installation work of distribution branch lines:	YR 2,155
Personnel dispatch cost:	YR 483
Total Cost Estimate:	YR 3,668

3-2 OPERATION AND MAINTENANCE PLAN

3-2-1 Water Supply Practice at Project Sites

(1) Current Water Services in the Project Sites

The facilities to be constructed in this Project will be operated and maintained by the water committee of each project site with financing from the revenues of water fees charged to the residents. In order to formulate a plan for operation and maintenance under the Project, the current situations of actual practice in the 4 sites are described hereinafter.

Presently in 3 project sites other than As Sadarah, water is served to residents through existing water supply facilities of varying types. In Moodeyah among these, the water

committee collects water fees to compensate for expenditures of fuel, repairs and other maintenance activities but most of the personnel salaries are provided by the governorate office. In the other two sites, no subsidies from the local government are allotted whatsoever, and staff salaries and other operation and maintenance costs are all covered by fees collected from residents. The tariff systems are the metered or fixed rate methods, as shown below.

Ahwar: Fixed rate charge per household

Moodeyah: Fixed rate charge per household in 3 areas including Moodeyah
Metered charge in the Al-Qurath service area.

Al-Raidah/Shamalya: Metered charge

The present water services and their water tariffs are presented in the Table 3-3.

Table 3-3 Present Water Services and Water Fees (March, 1997)

Site	Communities	Tariff System	Present Fee	Unit Cost (YR/m^3)
Ahwar	Ahwar city and two villages	Fixed charge per household	YR150 /household /month	12
Moodeyah	Moodeyah city and 3 villages	Fixed charge per household	YR 80 /household /month	13
Al-Raidah/ Shamalya	Al-Ga'a and 3 villages	Metered charge	YR 20/m^3 (*)	20

Note: (*) The water committee for the site is now planning to increase the tariff to YR 50m^3 in the near future.

Although the tariffs vary with the sites, they correspond to a range of 1.5 - 3% of the average monthly household income of YR 5,000 as a result of the survey.

However, in reality, in both Ahwar and Moodeyah, the residents are not in a position to

receive a clean and stable supply of water through the present service due to degraded conditions of existing facilities. Therefore, the residents must rely on water from neighboring private deepwells, hand-dug wells, kareefs (or cisterns of usually concrete construction, large in size, to store surface runoff during rainfalls), or most commonly water purchased from vendors which is producing a heavy economical burden for the residents. Hand-dug wells and kareefs are susceptible to contaminants flowing in from the ground surface, and likely to become a breeding bed of Schistosomiasis (Bilharzia), causing heavy casualties among the rural population.

According to the survey, water-purchasing in the sites costs YR 250/m^3, and a per capita per day supply rate is limited to 10-20 lit. All the villages in Al-Raidah/Shamalya except those having water service heavily rely upon water vending.

IBRD/IDA recommends that for developing countries the ratio of water fees to a household income should be kept below 5%. However, in Moodeyah and Al-Raidah/Shamalya where the residents have been forced to heavily depend upon water vending, the ratios are far above this recommended value due to expensive costs, as a result of degraded water services (Moodeyah) and non-existence of water facilities (Al-Raidah/Shamalya). According to the survey, the average consumption rate in water vending practices reaches to $5m^3$ - $8m^3$ per household per month, and total expenditure amounts to YR 1,250 - 2,000, corresponding to more than 25% of average monthly income of a household.

Although the cities of Ahwar and Moodeyah are currently operating water service, they are faced with lots of problems such as extremely low yields, inferior water quality of the existing water sources, etc. As the residential areas expanded in both cities, distribution networks were extended without consideration of the poor situations of water sources. This measure has created suspension of service, water rationing and even zones without any supply, forcing the residents to rely upon water vending and refusing to pay the water tariff. All this has led to the drastic slide of revenues and financial difficulties of the committees for these cities. Their financial situations are represented by information obtained during the study this time in the following table:

Table 3-4 Financial Conditions of Ahwar and Moodeyah Committees

(March 1997)

Site	Monthly Income	Monthly Expenditure	
Ahwar	YR 195,000 (max.)	Total: YR 111,540	
		Breakdown:	
		Fuel, Oil:	YR 39,700
		Expenditure for spare parts:	YR 19,460
		Maintenance of engine:	YR 2,720
		Outside-ordered construction:	YR 4,600
		Personnel Salary:	YR 28,000
		Overtime wage:	YR 7,000
		Sundry:	YR 10,060
Moodeyah	YR180, 000 (max.)	Fuel, Oil and Personnel Salary:	YR 180 ,000

As the data in the table suggests, the Ahwar committee can recently raise a small surplus, but spends it in compensating for losses of their electricity service that have been operated with the deteriorated units of generators. As a result it has now no savings. In Moodeyah, the income has never been able to cover the expenditure due to a lower rate of water tariff. The situation has recently been aggravated by the drastic decrease in the total number of contracted users, due to the halt of operation in one of its service areas. As a result these two areas are facing precarious day-to-day management.

(2) Policy for Management of the Service

The existing water services in the project sites have steadily been worsening, even in the rural administrative centers such as Ahwar and Moodeyah where water fees cannot be raised because of inferior service, some residents refuse to pay the tariff and the majority must depend upon expensive water vending.

When the facilities are completed in this Project, management of these committees now confronting the crisis of financial management must be restructured through the establishment of the proper water tariff system which can cover not only the costs for daily operation and maintenance but for the costs of replacement of equipment in case of their breakdowns.

Donor countries and international organizations for assistance to the water supply sector of developing countries have been reviewing the policy of assistance, and have concluded that the following points are of significant importance for project implementation.

a. Sufficient cost recovery to enable a sustained operation and maintenance of facilities.
b. Evidence of definite demand, that is, a willingness to share the burden of operation and maintenance costs to meet the supplied service.
c. Community involvement at the stage of planning and implementation.
d. Promotion of women's participation.

At the stage of the site survey, efforts were made to consider the views of the water committees as well as the residents. In this respect, the actual situation of the sites were surveyed in detail and a willingness confirmation was made on the part of the residents in the case the Project is realized (during the survey period, each site was visited and inquiries were carried out).

On the other hand, as to women's participation, in Yemen where Islamic traditions are especially strong, the present situation demands that women cannot participate actively outwardly, but the experience in the North revealed that the opinions of women, who are the actual users of water in the village society, are reflected in the residents' views (examples are the decision of public water stand locations and other opinions, but more directly, the rapid spread of house connections resulted from the fact that women and children who have long been involved in water fetching strongly demanded the reduction of their work load).

The specifications of the main facilities for this Project do not require special technology and those generally constructed in Yemen were selected. The facilities can be sufficiently sustained with regular maintenance, but as for water fees which will become the foundation for a sound management of water service, an appropriate fee system and a fair and rational collection method are indispensable. The following policies will be considered for this Project.

1) Criteria for Decision of Water Fees

Water fees are determined on the basis of a proper cost of production, and the cost accounting is generally made by the "overall cost principle", where the total cost during a fixed period is divided by the accounted-for flow rate. The total cost includes personnel expenses, fuel costs, consumable costs, repair costs and other expenditures, as well as amortization or depreciation costs. More often than not, however, assets obtained through subsidies or allotments are not calculated into the cost as amortization. In actuality, in Yemen, when the GAREW hands over the facilities to water committees, financial transactions are not required. Under such circumstance, depreciation of assets is assumed to be excluded from the cost accounting of the 4 sites in the Project.

As criteria to decide the appropriateness of water fees calculated from the cost, the recommendation by IBRD/IDA that water fees in developing countries should be within 5% of household income will be used as a guideline for reference. As to the willingness of residents to pay, inquiries made to residents in the project sites revealed that if the present water services are improved they are fully willing to pay, which means that the definite demand was confirmed.

According to the survey, the average monthly income per family is prevalently in the level of YR5, 000. Therefore, 5% of YR 5,000 (=YR250) can be considered as the upper limit for the willingness to pay by a family.

2) Billing Method

As for the billing method, there are two systems; the fixed method and the metered method. The former system is mainly being employed in the project sites. In the future, this method is expected to shift to the metered one, particularly in the sites where house connections have already been installed, as urban water supplies and some rural ones both in the northern and southern parts of the country already adopt the metered method. In Ahwar and Moodeyah where rationing of a limited volume of water is taking place, the committees cannot adopt even the method of per tap fee or per capita fee as being

generally employed by other sites using fixed method sites, relying on the per-house uniform billing method. When this Project is implemented, since the water use will increase enormously as compared to the present, a differential billing system should be introduced to prevent unfair billings.

As an example, for stores and restaurants in the city zones of Ahwar and Moodeyah, a higher tariff rate than the one for households is recommended to be adopted. The rates of households can also be differentiated according to the number of family and taps.

Since the fixed charge is to be introduced at the start of the operation in this Project, the tariff rate would be examined, based on the fixed charge per household per month.

3) Accounted-For Flow Rate

Since the fixed tariff system cannot dictate an actually used volume of water, feeling of unfairness always lingers on the side of the users. The fact that this method is still widely used in Yemen shows that the feeling of solidarity is quite strong in the rural communal society of this country. To alleviate this uncertainty and introduce an objective standard in this Project, it is planned to install water meters in the distribution mains connected to each village so that these service rates can be metered on a community basis. Each community is responsible for the volume of water measured by its meter, and the water committee can charge the community for the metered consumption, using a unit flow rate. The population of the village must share the cost, either with a per tap fee or a per capita rate known by dividing the charge by its population. With this method, the unfair sense of the whole service area composed of lots of communities can be reduced for even a little bit. Furthermore, this method can arouse the residents' consciousness towards conservation of water and saving of consumption, and can also bring an opportunity to encourage good practice for proper water use in each community.

This billing method is favorable to the water committee since a high rate of return of fee collection is possible, regardless of any leakage from distribution lines installed within a

premise of a community. It is called the "effective ratio", in contrast to the "accounted-for ratio", which is the ratio comparing the production rate to the fee collection rate when the metered method at each house connection is applied. In this Project, until the changeover is actually made to the metered method, billing based on the effective ratio is recommended. The 2 sites of Ahwar and Moodeyah, where the distribution lines take shape of closely knit networks in the congested areas, can only be divided into 2 or 3 large blocks, in contrast to the other 2 sites where a territory of each village can definitely be separated, but measurements for the respective blocks are expected to help control fee collection to some degree.

The assessment of the accounted-for flow rate is of critical importance for the calculation of proper water tariff. In this Project where the accounted-for flow rate will be based upon the effective ratio, a collection rate of about 80% can be anticipated. However, for Moodeyah where the existing network is utilized, a lower collection rate of 70% is predicted.

(3) Calculation of Water Tariff

In view of the aforementioned conditions of this Project, the calculation of the water tariff for the 4 sites will be based on the following assumptions:

1) Operation and Maintenance Cost

The operation and maintenance cost is composed of the following.

a. Personnel Salaries (averaged ones, based upon the survey results)
The chairman and deputy chairman of the committee are assumed to take no compensation, as representatives of the communities. (This practice is normal in the existing committees, according to the results of this study.) The permanent employees such as operators shall receive the following salaries.

*Chief engineer or technician YR 10,000

*Operating technician YR 6,000

b. Operation and Maintenance Cost for Generators

*Fuel Cost (Operating cost of engine and generator)

= YR 6.0/lit (present fixed price)

*Lubricant Cost (Lubricants for engine and generator)

= 10% of total fuel cost

*Consumable Cost

= 5% of total fuel cost

2) Repair Cost

The repair cost is mainly assigned to the cost for pipeline repairs, and about 3% of the revenues will be allotted. This is needed for the purchase of piping materials and payment for repairs by contractors.

3) Investment for Replacement of Equipment

Equipment such as pumps and generators needs to be replaced due to wear after long periods of operation. The normal life of pumps is 15 years, but intermediate partial replacements due to unexpected troubles may be required. Therefore, at an interval of 5 years, equipment such as motors and engines are assumed to be replaced by one third of whole components.

The water tariff calculation procedures for the 4 sites based on these conditions are shown in Appendix. As a result of the calculations, the basic water tariffs viable for continuous management in the respective project sites are indicated in the following table:

Table 3-5 Water Tariff by Project Area

Parameter	Ahwar	Moodeyah	Al-Raidah/ Shamalya	As Sadarah
Actual Water Tariff (Billing Method)	YR 150/mon/hh (Fixed rate)	YR 80/mon/hh (Fixed rate)	No facilities	No facilities
Water Tariff (2000)	YR230/household /month	YR150/household /month	YR230/household /month	YR230/household /month
Ratio in expenditure/ total income	4.6%	3.0%	4.6%	4.6%
Planned number of personnel (2000)	12	16	8	8
Billing Method	Fixed method based on effective ratio	Same as left	Same as left	Same as left
Effective Ratio	80%	70%	80%	80%
Income/Month (2000)	YR483,000	YR959,000	YR766,000	YR366,000
Expenditure/Month (2000)	YR335,000	YR598,000	YR561,000	YR293,000
Ratio of Income/ Expenditure (2000)	69%	62%	73%	80%

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

CHAPTER 4 PROJECT EVALUATION AND RECOMMENDATION

4-1 PROJECT EFFECTS

Since the unification in 1990, the government of the Republic of Yemen has been posing the highest priority on the improvement of the rural water service among its major policies. The First Five-Year Plan announced in 1996 has put further emphasis on it. Following that policy in the Plan, the GAREW has set a target of boosting the overall rural water coverage to 64% by the year 2000 in its five-year program for the rural water sector.

Health and sanitation in the project sites have steadily been deteriorating, since their water sources are limited in quantity and extremely poor in quality. Moreover the practice of purchasing water as a sole source of acquiring drinking water in some sites or to supplement it in most of the sites has increased economic burden on residents as well as it has been causing various sorts of waterborne diseases.

The water supply facilities constructed under this Project is aimed at providing safe and stable water supply services for the communities in the four areas currently facing a lot of difficulty in obtaining it. The implementation of the Project can contribute to the target set by the five-year rural water program.

The Project is justified to be feasible for the implementation under Japan's grant aid program, based upon the following evaluation:

1) The targeted beneficiaries under the Project are common people including the underprivileged with a total population of approximately 94,000. Moreover, the Project contributes to the target set by the five-year rural water program aiming at improving the coverage ratio up to 64% by the year 2000.

2) In the areas where the existing water services are in operation, the revenues of water fees stay at a low level of YR 150,000-200,000/month. In due course after the implementation of the Project, revenues are expected to steadily increase with revised tariff rates and expansion of served households. Such financial improvement can

produce funding to sustain operation and maintenance of facilities and equipment. The possible savings of a part of revenues will enable to assure future investment to replace and renew the facilities and equipment. As a whole, the implementation of the Project enables to provide the satisfactory services to the residents acutely suffering at present from lack of proper services.

3) The current consumption rate in the project areas is estimated at an average 20 lit. /capita/day. In addition, the use of water of inferior quality such as one containing high chloride and another suspected of artificial contamination, is a matter of concern. Under the Project, safe water is served to the residents by more than a double rate of 50 lit./capita/day (40 lit./capita/day for Moodeyah only).

4) At present, water borne diseases, such as cholera, dysentery, bilharzia, hepatic diseases, and kidney diseases, are endemic in the Project area. Safe and sufficient water supply and consumption can produce a great effect for the decrease of those infections. In addition to those outstanding diseases, diarrhea is a chronic disease prevailing in the rural areas due to unsanitary environment and traditional water practice of residents. In particular, cases of diarrhea are concentrated among children under five. More than 36% of the under-five have diarrhea diseases, and half of under-five mortality, with a reported ratio of 101/1,000, is attributed to acute diarrhea. The provision of safe and sufficient water through the implementation of the Project can improve environment in respect of health and sanitation, and have effect on the improvement of health of both mothers and children. Although quantified data is not easily obtainable, medical expenses can be cut back, relieving the residents of heavy economic burden.

5) Approximately 60 - 100% of the households in the Project areas depend on water vending due to serious lack of available water sources. At present, the expense for the purchase of water per household per month (one family has 5 to 8 members) is estimated at YR1, 250 - 2,000, reaching about 20 - 40 % of a total monthly income of one family. The cost has really been imposing a heavy burden on the households, although water is indispensable for their life. Each of the project sites is expected to adopt a fixed flat rate per household per month for the water service. The recommended rate is YR 230 at maximum, corresponding to slightly less than 5% of the average monthly income of

one family (proposed by World Bank). It will dramatically ease the current financial burden on the residents. It will also help improve their living standard, enabling to utilize money saved from the reduced water fees for other purposes.

6) In As-Sadarah without any public water service, it is a daily work of women and children to fetch water from springs and hand-dug wells. In Al-Raidah/Shamalya, females and children engage in water fetching during the rainy season when water can be found in hand-dug wells within the villages. Although this Project plans to install public fountains for these two sites, it is anticipated that the majority of households would switch to house connections shortly after the commencement of water service under the Project. Thus it will alleviate the heavy burden on women and children with an effect on the improvement of their living condition.

Based on the view points described above, the effects of the Project are summarized in the following table:

Table 4 - 1 Effects and Degree of Improvement by the Implementation of the Project

Present Situation and Problem	Counter Measure under the Project	Degree of Effect and Improvement
(1) * Ahwar: In this site, the elevated water tank has recently broken down, and distribution network is also collapsing with corrosion and clogging, due to highly saline water, resulting in frequent leakage. Thus water service has often been suspended.	(1) * Ahwar: The major facilities for water sources, pumping and distribution will be renewed, utilizing 2 existing boreholes now not in use, in order to improve existing deteriorated water supply system.	(1) * Ahwar: Renewal of facilities gets rid of current problems and establish for the first time pertinent municipal service of safe and stable water.
* Moodeyah: In all 4 service areas within the site, the existing water sources have been short of yields, or of inferior quality, or damaged. Accordingly, the existing water services have all been in the worst shape.	* Moodeyah: Utilizing existing 5 boreholes, new facilities are to be installed to connect the water sources to the existing facilities in the 4 service areas. All the existing distribution systems in 4 areas remain intact for resume services.	* Moodeyah: Implementation of distribution plan utilizing new water source under the Project improves existing deteriorated water supply services. It assures provision of safe and stable water supply services.

Present Situation and Problem	Counter Measure under the Project	Degree of Effect and Improvement
(2) The revenues of the water committees in Ahwar and Moodeyah currently operating water services have been extremely low, ranging from YR.150,000 to 180,000 monthly. The chief reason for this low level is that residents are dissatisfactory with the present services, thus unwilling to pay. The present income compensates only expenses for operation of equipment so that the executing agency faces precarious day-to-day management.	(2) As the new facilities can put the water services on the right track, proper water tariff will be determined and accepted by the residents. The Water tariff shall be determined at YR 230 per household per month, setting its limit less than 5% of the average income of household per month, as has been proposed by the World Bank.	(2) The revenues of water fees are expected to increase to YR470, 000/month and YR 940,000/month in Ahwar and Moodeyah respectively. The increased revenues enable the water committees to accumulate fund for replacement of equipment in the future. Such Improvement of financial state sustains the proper water services for the users.
(3) Waterborne diseases are rampant in the Project sites. Those diseases include cholera, dysentery, and bilharzia and so on. The endemic of bilharzia is attributed to the use of contaminated water from cisterns, hand-dug wells and purchased water. Moreover chronic diarrheas are prevalent in the area. The disease is concentrated among children under five years, with its rate more than 36%. It is suspected that half of under-five mortality at a level of 104/1,000 has been caused by diarrhea.	(3) The water supply facilities constructed under the Project provide safe and sufficient water of improved quality and quantity. Water will be supplied at 50 lit per capita per day (40 lit per capita per day only in Moodeyah).	(3) The provision of hygienic and stable water supply realized through the implementation of the Project has effect on dramatic decrease of water-borne diseases.
(4) About 60% to 100% of residents depend on water vending in Moodeyah and Al-Raidah/ Shamalya respectively among the Project areas. The expense to purchase water amounts to YR 1, 500 - 2,000 per month per household, reaching about 30% of an average income of a household, imposing heavy economic burden on the households.	(4) The water tariff to be newly set under the Project is YR 230 per household per month at maximum, about 5% of an average income of one family, based upon the recommendation of the World Bank.	(4) Water would be served at fixed charge of a maximum YR 230 per month per household. Thus, economic burden on the residents will be drastically alleviated. It has large effect on the improvement of living condition, utilizing the saved money for expense to purchase other commodities.

Present Situation and Problem	Counter Measure under the Project	Degree of Effect and Improvement
(5) The current level of consumption per day per capita in the Project area is estimated on average at about 20 lit. The water from the existing sources, containing a high rate of chloride or contaminated artificially is raising concerns among the residents.	(5) Water is served by an average rate of 50 lit. per capita per day (40 lit. per capita per day for only Moodeyah) with the operation of new facilities under the Project.	(5) The quantity of water service will be nearly doubled. Moreover, as an important factor, water quality will be improved under the services. These improvements of water supply in quantity and quality are expected to have large effect on the improvement of sanitation, health, and living conditions of residents.
(6) In As-Sadarah and Al-Raidah/Shamalya having no water services yet, female adults and children are in the habit of fetching water from hand-dug wells. This practice is posing heavy burden on them.	(6) Public fountains will be installed in the villages of the two sites under the Project. Moreover, the majority of the residents are preparing to install individual connections in the near future as distribution mains and branches are constructed under the Project.	(6) Women and children are released from burden to fetch water. As a result, they can concentrate their attention and energy in other useful matters to improve their living conditions.

4-2 RECOMMENDATIONS

The implementation of the rural water supply projects in Yemen is in double structure. Their planning and construction are undertaken by the GAREW, while operation and maintenance of facilities are under the responsibilities of the local water committees belonging to the local governments. In the stage of operation and maintenance of the Project, the GAREW functions only to provide technical advice and guidelines to the committees, since it is not in a position to supervise them. Thus, all rural water facilities are autonomously operated and managed by the respective committees. Under such a situation, findings and recommendations for each institution and community are described below, to achieve sustainable management of the water supply system constructed under the Project.

1) General Authority for Rural Electricity and Water (GAREW)

The GAREW is not yet in a matured stage to exert its full influence in this sector, since it is rather a new establishment with its budgets constantly in short due to financial difficulties of the government. Although the Rural Water Supply Department, forerunner of the GAREW, once held a training course for the staff of the local water committees, it has been suspended at present. It is highly desirable that the GAREW resumes the training as soon as practicable.

In this Project, the GAREW shall take an active role in coordinating the Japanese side, the local governments and the water committees for the smooth implementation and sustained operation and maintenance of the Project. Above all, the GAREW shall take the consultation with the respective committees for revising or establishing water tariff rates and financial management of revenues and expenditures.

2) Local Government

The Department of Development of the local government has been involved one way or another in charge of rural water supply projects for the communities within the governorate, and for this Project undertakes a part of the Yemeni responsibilities to be locally arranged such as the construction of access roads, acquisition of land for the construction work, etc. Therefore, the GAREW shall work in closer collaboration with the Department of Development to have smooth implementation of undertakings by the Yemeni side.

3) Water Committees

First of all, the water committees shall make a plan to institutionalize and strengthen its organizational structure. The number and qualification of the staff of a committee in each site shall meet such requirements as routine operation and maintenance of facilities and equipment (those planned for the Project do not require high level of technique), financial management of revenues and expenditures, and regular

monitoring on amounts of water supplied and consumed, etc. To start a new operation of water service, the committee shall make appropriate consultation with the GAREW and pay efforts to assure the consent of residents on the important factors affecting its sustainable operation and maintenance such as water tariff rates and bill collection method. In the sites currently operating water services, occasional disagreements occur between the residents and the water committee due to its degraded level of services, but the whole communities hold a keen interest in the improvement of the services. Administrative capabilities of the water committees, therefore, would become of critical importance for sustainable operation and maintenance of the Project.

4) Beneficiaries

Rural communities in Yemen consist of homogeneous tribes and have traditional form of community participation. It can be said that the communities are so empowered that revision of water tariff rate and construction of new facilities can not be implemented without consensus of the communities. It was confirmed, in the questionnaire and interview conducted in the previous study that the communities were willing to collaborate in the Project and agreed with the new establishments in operation and management of the water supply system. However, the GAREW and the water committees are required to promote further understandings of the communities in detail. The communities in Ahwar and Moodeyah are developing into a form of semi-urban communities, while those in Al-Raidah/Shamalya and As-Sadarah take a traditional style of complex of rural communities. In a traditional system of communities in Al-Raidah/Shamalya and As-Sadarah, it seems possible for villages constituting the complex to operate and maintain distribution pipelines installed within their own territories by themselves. This practice will lead to curtailing the cost for operation and maintenance through community participation. Such cooperation and participation shall be highly encouraged.

APPENDICES

APPENDIX-1 MEMBER LIST OF THE STUDY TEAM

(1) Study for the Implementation Review

Takanobu KURODA	Team Leader	Grant Aid Div. Economic Cooperation Bureau, Ministry of Foreign Affairs
Tetsuji NIWANO	Chief Engineer	Japan Techno Co., Ltd.
Yasuo ONOZUKA	Water Supply Planner	Japan Techno Co., Ltd.
Akihiko UCHIYAMA	Coordinator	Japan Techno Co., Ltd.

APPENDIX-2 SURVEY SCHEDULE

No.	Date	Place	Movement	Activities
1	Mar. 12 (Wed)	Sana'a	Arrival in Sana'a	
2	Mar. 13 (Thu)	Sana'a		Courtesy call to the Embassy of Japan, GAREW, MPD
3	Mar. 14 (Fri)	Sana'a		Preparation for the survey trip
4	Mar. 15 (Sat)	Al-Mukalla	Move to Al-Mukalla	Courtesy call to Al-Mukalla branch of GAREW and Discussion
5	Mar. 16 (Sun)	As-Sadarah	Trip to As-Sadarah	Site survey
6	Mar. 17 (Mon)	Al-Raidah/Shamalya	Trip to Al-Raidah/Shamalya	Site survey
7	Mar. 18 (Tue)	Aden	Move to Aden	
8	Mar. 19 (Wed)	Ahwar	Move to Ahwar	Site survey
9	Mar. 20 (Thu)	Moodeyah	Move to Moodeyah	Site survey
10	Mar. 21 (Fri)	Sana'a	Move to Sana'a	Internal meeting of the study team, Team Leader in Sana'a
11	Mar. 22 (Sat)	Sana'a		Discussions with GAREW& MPD on minutes of Meeting
12	Mar. 23 (Sun)	Sana'a		Courtesy call to NWSA & NWRA /Signing of Minutes of Meeting /and Reporting to the Embassy of Japan
13	Mar. 24 (Mon)	Sana'a	Departure from Sana'a	

APPENDIX-3 LIST OF PERSONS INTERVIEWED

1. Embassy of Japan
   1) Mr. Noboru HARA, Minister
   2) Mr. Kenich OKADA, First Secretary
   3) Mr. Abdul Rehman Thabet AL-FAQUEH

2. General Authority for Rural Electricity & Water
   1) Mr. Abdul Bari SALEH, Deputy Chairman for Water Sector
   2) Mr. Ahmed Kaid AL-SABRI, Vice Chairman for Electricity Sector
   3) Mr. Abdulla A. Malik BADR, General Director for Water Supply
   4) Mr. Abdulhakim H. AL-RAMMAH, Director, Bilateral Projects
   5) Mr. A. Kader HANASH, Civil Engineer
   6) Mr. Abdul Kaaher Ali AHMED, Director of Workshop

3. General Authority for Rural Electricity & Water, Hadramout Province, Al-Mukalla Branch
   1) Mr. Mohamed Ali AL-ABIAD, General Director
   2) Mr. Nageeb Abdulla YOUSEF, Manager of Water Projects
   3) Mr. Abdulhakim Bazanboor SERUEYOR, Study Section, Water Projects
   4) Mr. Husian HATEM, Financial Manager

4. General Authority for Rural Electricity & Water, Aden Province, Aden Branch
   1) Mr. Haidrah OMAR, General Director
   2) Mr. Anwer Abdulla MARFADI, Director of Water Resources Department

5. Ministry of Planning & Development
   1) Mr. Khalid AFEEF, Director General Cooperation, Asia Department
   2) Mr. Abubakr AYASH, Director of Industry
   3) Mr. Ahmed Hussein A. JAWI, Director for Cooperation with the States of Asia, Austalia

6. National Water Resources Authority
   1) Mr. Jamal ABDO, Chairman
   2) Dr. Muhammad Aslam Chaudhry, Chief Technical Adviser, UNDP

7. National Water & Sanitation Authority

1) Dr. Mohammed AL-SAEEDI, Chairman
2) Mr. Ahmed A. IDRESS, Deputy Manager of Water Resources

8. United Nations Population Fund

1) Mr. Noaman M. AL-MASOUDI, IEC National Expert at the National Population Council Former MP

9. Local Government Offices

1) Abyan Governorate
   Mr. Ahmed Ali MOHSSEN, Governor
   Mr. Haidah Saleh ASHADAD, Planning Office
   Mr. Shahab Nasser MOHMAD, Director General, Local Council

2) Hager Center, As Sadarah
   Mr. Mohamed Saeed BAGOTMI, District Manager

3) Al Suffila
   Mr. HassanMohammed AL-GAWLE, Sheikh

4) Water Committee at Ka'a Awad
   Mr. Mubark Abdullah AL-JAWAHE, Representative of Project

5) Ahwar
   Mr. Mohamad Ali AL-MASHOR, Manager of Water Project, Local Community Chairman

6) Moodeyah
   Mr. Ali AL-MAGRAHI, District Manager
   Mr. Abdul Kadir Abu Bakr KURAIF, Water Committee Chairman

MINUTES OF DISCUSSIONS

STUDY FOR THE IMPLEMENTATION REVIEW
OF
THE PROJECT FOR RURAL WATER SUPPLY
IN THE SOUTHERN AND EASTERN GOVERNOTARES
OF THE REPUBIC OF YEMEN

In response to a request from the Government of the Republic of Yemen, the Government of Japan decided to conduct a Study for the Implementation Review on the Project for Rural Water Supply in the Southern and Eastern Governorates (hereafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Yemen a study team, which is headed by Mr. Takanobu Kuroda, Grant Aid Division, Economic Cooperation Bureau, Ministry of Foreign Affairs, and is scheduled to stay in the country from March 12 to 24, 1997.

The team held discussions with the officials concerned of the Government of Yemen and conducted a field survey at the study area.

In the course of discussions and field survey, both parties have confirmed the main items described on the attached sheets. The team will proceed further works and prepare the report of the Study for the Implementation Review.

Sana'a, March 23, 1997

Mr. Takanobu Kuroda
Leader
Study Team for the Implementation Review
JICA

Mr. Abdul Bari Saleh
Vice Chairman
General Authority for
Rural Electricity and Water
Ministry of Electricity and Water

Mr. Khalid Afif
Director General
Bilateral Cooperation/Asia Dept.
Ministry of Planning and Development

ATTACHMENT

1. Objective

The objective of the Project is to construct water supply facilities consisting of water wells as water sources, pumping facilities, water tanks, pipelines and public fountains for the people in the rural areas of the Southern and Eastern Governorates of the Republic of Yemen.

2. Project Sites

The Project sites are listed as follows:

1) Ahwar (Abyan Governorate)
2) Moodeyah (Abyan Governorate)
3) Al-Raydah/Shamalyah (Hadramout Governorate)
4) As Sadarah (Hadramout Governorate)

3. Executing Agency

The General Authority for Rural Electricity and Water, the Ministry of Electricity and Water (hereafter called the GAREW), is responsible for the land acquisition, water rights, implementation, operation and maintenance of the Project.

4. Items Requested by the Government of Yemen

4.1 Components of the Projects

1) Construction of water facilities in the aforementioned Project sites

2) Procurement of materials, equipment and spare parts for the construction of water facilities in the above Project

3) Procurement of services for the implementation of the Project

4.2 Modifications of the Previous Design

Based upon the results of the field survey in the four (4) candidate sites by the present mission, the Yemeni side has requested the Japanese side to take into consideration the following modifications of the previous designs in the Basic Design Study conducted for the Project in 1994:

1) Ahwar

Due to the intense deterioration of existing pipelines caused by corrosion in the site, the main distribution lines to be installed by the Japanese side shall be increased. In addition, the supply of piping materials for the branch distribution lines to be installed by the Yemeni side shall be increased as follows:

a. Total length: 10 km
b. Sizes of pipes: 3" and 2"
c. Material: PVC (polyvinyl chloride) rigid plastic pipes

2) Moodeyah

a. The GAREW has drilled two (2) additional water wells in this site. As a result, the Project shall employ five (5) wells in total including these wells and three (3) existing wells initially planned for the Project. This situation makes it unnecessary to drill a new well by the Japanese side.

b. In two (2) zones within the site which own the existing water supply systems, the existing water sources have lately become out of use, one well due to damage to the well, and the other due to the decrease of its discharge, and the villagers of these zones have been forced to entirely depend upon purchase of water. To save their difficulties, the new main line to be installed under the Project shall be connected to the existing reservoirs for these two zones.

c. The supply of piping materials to Moodeyah city is requested for effectively distributing water supply under the Project. The size and length of pipes shall be 2" and 6 km.

3) Al Raidah/Shamalya

a. The GAREW has completed four (4) water wells for this site up to now, and it is not considered necessary for the Japanese side to drill an additional well.

b. In addition the villagers have constructed a part of water facilities previously designed by the Japanese side for this site.

c. Under such a situation, the GAREW requests the Japanese side to shift the construction of facilities to the neighboring villages within the site, using the water wells already drilled by the GAREW. The GAREW also requests the Japanese side to install a part of the distribution lines for this area. The remaining part of distribution lines shall be undertaken by the GAREW and the local committee of the villages, while the Japanese side shall supply piping materials for some part of this work..

4) As-Sadarah

The basic design shall not be altered for this site. However, the extension of distribution lines about 4 km long is requested for three (3) additional villages within the site.

5) Pumping equipment

The use of diesel-engine-driven, vertical-shaft pumps shall be preferred to diesel-generator-driven submersible motor pumps for the wells of shallower depth in view of operation and maintenance by the local committees of the villages.

4-3The Japanese side shall take note of the aforementioned requests by the Yemeni side. However, the final components of the Project will be decided by the Japanese side after further studies.

5. Japan's Grant Aid System

1) The Government of the Republic of Yemen has understood the system of Japanese Grant Aid explained by the team and described in Annex 1.

2) The Government of the Republic of Yemen will take necessary measures, described in Annex 2 for the smooth implementation of the Project, on condition that the Grant Aid Assistance by the Government of Japan is extended to the Project.

6. Further Schedule

Based on the Minutes of Discussions and technical examination of the study results,

JICA will make the Final Report, and send it to the Government of Yemen by the end of May 1997.

7. Other Relevant Issues

1) In case it is not sure to secure the safety and security of Japanese nationals in the implementation stage, the Yemeni side shall promptly take all the possible measures to effectively eliminate unstable factors affecting them. Should the Yemeni side fail to remedy such an uncertain situation despite its efforts, the Project might be frozen partly or wholly.

2) The GAREW shall make necessary arrangements if the Japanese side requests the use of radio system during the implementation stage for the reasons for security.

3). The GAREW shall allow the Japanese side to use free of charge pumping test equipment which was supplied to the GAREW under the previous Japanese Grant Aid project in the fiscal year of 1994, based upon the schedule submitted by the latter during the implementation stage.

ANNEX - I

Japan's Grant Aid System

1. Grant Aid Procedures

1) Japan's Grant Aid Program is executed through the following procedures.

Application:	(Request made by a recipient country)
Study:	(Basic Design Study conducted by JICA)
Appraisal & Approval:	(Appraisal by the Government of Japan and Approval by Cabinet)
Determination of of Implementation:	(The Notes exchanged between the Governments Japan and the recipient country)

2) Firstly, the application or request for a Grant Aid project submitted by a recipient country is examined by the Government of Japan (the Ministry of Foreign Affairs) to determine whether or not it is eligible for Grant Aid. If the request is deemed appropriate, the Government of Japan assigns JICA (Japan International Cooperation Agency) to conduct a study on the request.

Secondly, JICA conducts the study (Basic Design Study), using (a) Japanese consulting firm(s).

Thirdly, the Government of Japan appraise the project to see whether or not it is suitable for Japan's Grant Aid Program, based on the Basic Design Study report prepared by JICA, and the result are then submitted to the Cabinet for approval.

Fourthly, the Project, once approved by the Cabinet, with the Exchange of Notes signed by the Governments of Japan and the recipient country.

Finally, for the implementation of the Project, JICA assists the recipient country in such matters as preparing tenders, contracts and so on.

2. Basic Design Study

1) Contents of the Study

The aim of the Basic Design Study, conducted by JICA on a requested project is to provide basic document necessary for the appraisal of the project by the Japanese Government. The contents of the Study are as follows:

a) Confirmation of items agreed on by both parties concerning the basic concept of the project.
b) Evaluation of the appropriateness of the project to be implemented under the Grant Aid Scheme from a technical, social and economic point of view.
c) Confirmation of items agreed on by both parties concerning the basic concept of the project.
d) Preparation of a basic design of the Project.
e) Estimation of the costs of the Project.

The contents of the original request are not necessarily approved in their initial form as the contents of the Grant Aid Project. The Basic Design of the Project is confirmed considering the guidelines of Japan's Grant Aid Scheme.

The Government of Japan requests the Government of the recipient country to take whatever measures are necessary to ensure its self-reliance in the implementation of the Project. Such measures must be guaranteed even though they may fall outside of jurisdiction of the organization in the recipient country actually implementing the Project. Therefore, the implementation of the Project is confirmed by all relevant organizations in the recipient country through the Minutes of Discussions.

2) Selection of Consultants

For the smooth implementation of the study, JICA uses (a) registered consultant firm(s). JICA selects (a) firms(s) based on proposals submitted by interested firms. The firm(s) selected carry (ies) out the Basic Design Study and write(s) a report, based upon terms of reference set by JICA.

The consulting firm(s) used for the study is (are) recommended by JICA to the recipient country to also work on the project's implementation after the Exchange of Notes, in order to maintain technical consistency and also to avoid any undue delay in implementation should the selection process be repeated.

3. Japan's Grant Aid Scheme

1) What is Grant Aid ?

The Grant Aid Program provides a recipient country with non-reimbursable funds needed to procure the facilities, equipment, services (engineering services and transportation of the products, etc.) for economic and social development the country under the principals in accordance with the relevant laws and regulations of Japan. Grant Aid is not supplied through the donation of materials as such.

2) Exchange of Notes (E/N)

Japan's Grant Aid is extended in accordance with the Notes Exchanged by the two Governments concerned, in which the objectives of the project, period of execution, conditions and amount of the Grant, etc., are confirmed.

3) "The period of the Grant" means the one fiscal year in which the Cabinet approves the project for. Within the fiscal year, all procedure such as exchanging of Notes, concluding contracts with (a) consultant firm(s) and (a) contractor(s) and final payment to them must be completed.

However in case of delays in delivery, installation or construction due to unforeseen factor such as weather, the period of the Grant Aid can be further extended for a maximum of one fiscal year at most by mutual agreement between the two Government.

4) Under the Grant, in principle, Japanese products and services including transport or those of the recipient country are to be purchased.

When both Governments deem it necessary, the Grant may be used for the purchase of the products or services of the third country.

However the prime contractors, namely, consulting, contracting and procurement firms, are limited to "Japanese nationals". (The term "Japanese nationals" means persons of Japanese nationality or Japanese corporations controlled by persons of Japanese nationality

5) Necessity of "Verification"
The Government of recipient country or its designated authority will conclude contracts denominated in Japanese yen with Japanese nationals. Those contracts shall be verified by the Government of Japan. This "Verification" is deemed necessary to secure accountability to Japanese taxpayers.

6) Undertakings required of the Government of recipient country
In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as the follows:

(1) To secure land necessary for the sites of the Project and to clear, level and reclaim the land prior to commencement of the construction.
(2) To provide facilities for the distribution of electricity, water supply and drainage and other incidental facilities in and around the sites.
(3) To secure buildings prior to the procurement in case the installation of the equipment.
(4) To ensure all the expenses and prompt execution for unloading, customs clearance at the port of disembarkation and internal transportation of products purchased under the Grant.
(5) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in the recipient country with respect to the supply of the products and services under the Verified Contracts.
(6) To accord Japanese nationals whose services may be required in connection with the supply of the products and services under the Verified Contracts, such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their works.

7) "Proper Use"
The recipient country is required to maintain and use the facilities constructed and equipment purchased under the Grant Aid properly and effectively and to

assign the necessary staff for operation and maintenance of them as well as to bear all the expenses other than those covered by the Grant Aid.

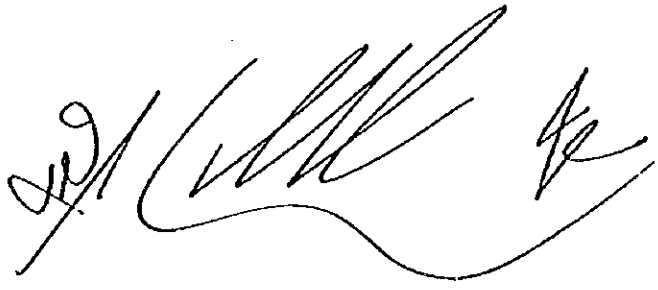
8) "Re-export"

The products purchased under the Grant Aid shall not be re-exported from recipient country.

9) Banking Arrangements (B/A)

a) The Government of the recipient country or its designated authority should open an account in the name of the Government of the recipient country in an authorized foreign exchange bank in Japan(hereinafter referred to as "the Bank"). The Government of Japan will execute the Grant Aid by making payments in Japanese yen to cover the obligations incurred by the Government of the recipient country or its designated authority under the Verified Contracts.

b) The payments will be made when payment requests are presented by the Bank to the Government of Japan under an authorization to pay issued by the Government of the recipient country or its designated authority.



ANNEX - 2

Undertaking by the Government of the Republic of Yemen in case Japan's Grant Aid is extended.

1. To provide data and information necessary for the Project.

2. To provide, secure, clear and level land and access at each construction site prior to the commencement of the construction of water facilities.

3. To ensure speedy unloading, tax exemption, customs clearance at the port of disembarkation and prompt inland transportation, of products purchased for the project in accordance with the Exchange of Notes to be concluded between the Government of the Republic of Yemen and the Government of Japan.

4. To make necessary arrangement for the entry into and stay in the Republic of Yemen, of Japanese nationals whose services may be required in connection with the supply of the products and services under the verified contracts for the Project.

5. To exempt Japanese nationals involved in the Project from customs duties, internal taxes and other fiscal levies which may be imposed in the Republic of Yemen with respect to the supply of equipment/machines and services under the verified contracts for the Project in accordance with the Exchange of Notes to be concluded between the Government of the Republic of Yemen and the Government of Japan.

6. To bear commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement for the project.

7. To bear all expenses other than those to be borne by the Grant Aid necessary for the execution of the Project.

8. To assign exclusive counterpart staff in General Authority for Rural Electricity and Water, Ministry of Electricity and Water for execution of the Project including siting, drilling, installation of water facilities, etc. prior to the commencement of the Project.

9. To maintain and use properly and effectively the facilities constructed and equipment purchased under the Grant Aid for the Project.

APPENDIX-5 CALCULATION OF OPERATION AND MAINTENANCE COST

AHWAR　Effective ratio 80%

			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Revenue	Tariff :YR/household/month		230	230	230	230	230	230	230	230	230	230	230	230	230	230
	:YR/m3		19	19	19	19	19	19	19	19	19	19	19	19	19	19
	Number of household		2,060	2,100	2,140	2,180	2,220	2,260	2,310	2,360	2,410	2,460	2,510	2,560	2,610	2,660
	Population		16,150	16,540	16,930	17,330	17,740	18,150	18,570	19,010	19,460	19,790	20,180	20,580	21,000	21,420
	annual supply (m3/d)*365		294,738	301,855	308,973	316,273	323,755	331,238	338,903	346,933	354,050	361,168	368,285	375,585	383,250	390,915
	*Total billing revenue		5,685.6	5,796.0	5,906.4	6,016.8	6,127.2	6,237.6	6,375.6	6,513.6	6,651.6	6,789.6	6,927.6	7,065.6	7,203.6	7,341.6
Expenditure	Operation and maintenansce cost															
	a. Fuel cost		1,162.3	1,190.0	1,218.7	1,246.9	1,276.6	1,306.8	1,337.0	1,368.2	1,395.9	1,425.1	1,452.8	1,481.5	1,511.7	1,541.4
	b. Maintenance cost		58.0	59.0	61.0	62.0	64.0	65.0	67.0	68.0	70.0	71.0	73.0	74.0	76.0	77.0
	c. Operators salary		888.0	888.0	888.0	888.0	888.0	888.0	888.0	1,032.0	1,032.0	1,032.0	1,032.0	1,032.0	1,032.0	1,032.0
	d. Sub-total		2,108.3	2,137.0	2,167.7	2,196.9	2,228.6	2,259.8	2,292.0	2,468.2	2,497.9	2,528.1	2,557.8	2,587.5	2,619.7	2,650.4
	Administeration expenditure	(d)x20%	420.0	430.0	430.0	440.0	450.0	450.0	460.0	490.0	500.0	510.0	510.0	520.0	520.0	530.0
	Expenditure for repair	(*)x5%	280.0	290.0	300.0	300.0	310.0	310.0	320.0	330.0	330.0	340.0	350.0	350.0	360.0	370.0
	Investment for replacement of equipment	(*)x20%	1,140.0	1,160.0	1,180.0	1,200.0	1,230.0	1,250.0	1,280.0	1,300.0	1,330.0	1,360.0	1,390.0	1,410.0	1,440.0	1,470.0
	Total expenditure		3,948.3	4,017.0	4,077.7	4,136.9	4,218.6	4,269.8	4,352.0	4,588.2	4,657.9	4,738.1	4,807.8	4,867.5	4,939.7	5,020.4
	Profit		1,737.3	1,779.0	1,828.7	1,879.9	1,908.6	1,967.8	2,023.6	1,925.4	1,993.7	2,051.5	2,119.8	2,198.1	2,263.9	2,321.2

MOODEYAH　Effective ratio 70%

			1999	2000	2001	2002	2003	2004	2005	2006	2007
Revenue	Tariff :YR/household/month		150	150	150	150	150	150	150	150	150
	:YR/m3		24	24	24	24	24	24	24	24	24
	Number of household		6,260	6,390	6,520	6,650	6,780	6,920	7,060	7,200	7,340
	Population		31,673	32,382	33,107	33,849	34,607	35,382	36,175	36,985	37,814
	annual supply (m3/d)*365		462,421	472,779	483,369	494,197	505,267	516,584	528,158	539,987	552,082
	*Total billing revenue		11,268.0	11,502.0	11,736.0	11,970.0	12,204.0	12,456.0	12,708.0	12,960.0	13,212.0
Expenditure	Operation and maintenansce cost										
	a. Fuel cost		1,867.3	1,909.2	1,951.7	1,995.3	2,040.1	2,086.1	2,132.6	2,180.2	2,229.0
	b. Maintenance cost		93.0	95.0	98.0	100.0	102.0	104.0	107.0	109.0	111.0
	c. Operators salary		1,104.0	1,104.0	1,104.0	1,104.0	1,104.0	1,248.0	1,248.0	1,248.0	1,248.0
	d. Sub-total		3,064.3	3,108.2	3,153.7	3,199.3	3,246.1	3,438.1	3,487.6	3,537.2	3,588.0
	Administeration expenditure	(d)x20%	613.0	622.0	631.0	640.0	649.0	688.0	698.0	707.0	718.0
	Expenditure for repair	(*)x5%	1,130.0	1,150.0	1,170.0	1,200.0	1,220.0	1,250.0	1,270.0	1,300.0	1,320.0
	Investment for replacement of equipment	(*)x10%	2,250.0	2,300.0	2,350.0	2,390.0	2,440.0	2,490.0	2,540.0	2,580.0	2,640.0
	Total expenditure		7,057.3	7,180.2	7,304.7	7,429.3	7,555.1	7,866.1	7,995.6	8,134.2	8,266.0
	Profit		4,210.7	4,321.8	4,431.3	4,540.7	4,648.9	4,589.9	4,712.4	4,825.8	4,946.0

(Tariff: YR;　Others: thousand YR/year)

AL RAIDAH/SHAMALYA　Effective ratio 80%

R/Al Sufila

			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Revenue	Tariff :YR/household/month		230	230	230	230	230	230	230	230	230	230	230	230	230	230
	:YR/m3		30	30	30	30	30	30	30	30	31	31	31	31	31	31
	Number of household		1,200	1,220	1,240	1,260	1,290	1,320	1,350	1,380	1,410	1,440	1,470	1,500	1,530	1,560
	Population		5,489	5,589	5,711	5,825	5,942	6,060	6,182	6,305	6,431	6,560	6,691	6,825	6,962	7,101
	annual supply (m3/d)*365		100,177	102,181	104,224	106,309	108,435	110,603	112,816	115,072	117,373	119,721	122,115	124,558	127,049	129,590
	*Total billing revenue		3,312.0	3,367.2	3,422.4	3,477.6	3,560.4	3,643.2	3,726.0	3,808.8	3,891.6	3,974.4	4,057.2	4,140.0	4,222.8	4,305.6
Expenditure	Operation and maintenansce cost															
	a. Fuel cost		917.2	935.6	953.9	973.2	992.5	1,012.3	1,032.6	1,053.4	1,074.6	1,095.9	1,117.7	1,140.0	1,163.3	1,186.5
	b. Maintenance cost		46.0	47.0	48.0	49.0	50.0	51.0	52.0	53.0	54.0	55.0	56.0	57.0	58.0	59.0
	c. Operators salary		504.0	504.0	504.0	504.0	504.0	504.0	504.0	576.0	576.0	576.0	576.0	576.0	576.0	576.0
	d. Sub-total		1,467.2	1,486.6	1,505.9	1,526.2	1,546.5	1,567.3	1,588.6	1,682.4	1,704.6	1,726.9	1,749.7	1,773.0	1,797.3	1,821.5
	Administeration expenditure	(d)x5%	70.0	70.0	80.0	80.0	80.0	80.0	80.0	80.0	90.0	90.0	90.0	90.0	90.0	90.0
	Expenditure for repair	(*)x5%	170.0	170.0	170.0	170.0	180.0	180.0	190.0	190.0	190.0	200.0	200.0	210.0	210.0	220.0
	Investment for replacement of equipment	(*)x20%	660.0	670.0	680.0	700.0	710.0	730.0	750.0	760.0	780.0	790.0	810.0	830.0	840.0	860.0
	Total expenditure		2,367.2	2,396.6	2,435.9	2,476.2	2,516.5	2,557.3	2,608.6	2,712.4	2,764.6	2,806.9	2,849.7	2,903.0	2,937.3	2,991.5
	Profit		944.8	970.7	986.5	1,001.4	1,043.9	1,085.9	1,117.4	1,096.4	1,127.0	1,167.5	1,207.5	1,237.0	1,285.6	1,314.1

R/Al Aulieb

			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Revenue	Tariff :YR/household/month		230	230	230	230	230	230	230	230	230	230	230	230	230	230
	:YR/m3		24	24	24	24	24	24	24	24	24	24	24	24	24	24
	Number of household		900	920	940	960	980	1,000	1,020	1,040	1,060	1,080	1,100	1,120	1,140	1,160
	Population		5,609	5,721	5,836	5,952	6,071	6,193	6,317	6,443	6,572	6,703	6,837	6,974	7,114	7,256
	annual supply (m3/d)*365		102,364	104,411	106,499	108,629	110,802	113,018	115,278	117,584	119,936	122,334	124,781	127,277	129,822	132,419
	**)		2,484.0	2,539.2	2,594.4	2,649.6	2,704.8	2,760.0	2,815.2	2,870.4	2,925.6	2,980.8	3,036.0	3,091.2	3,146.4	3,201.6
Expenditure	Operation and maintenansce cost															
	a. Fuel cost		937.0	955.8	975.2	994.5	1,014.3	1,034.6	1,055.3	1,076.1	1,097.9	1,119.7	1,142.5	1,165.2	1,188.5	1,212.3
	b. Maintenance cost		47.0	48.0	49.0	50.0	51.0	52.0	53.0	54.0	55.0	56.0	57.0	58.0	59.0	61.0
	c. Operators salary		504.0	504.0	504.0	504.0	504.0	504.0	504.0	576.0	576.0	576.0	576.0	576.0	576.0	576.0
	d. Sub-total		1,488.0	1,507.8	1,528.2	1,548.5	1,569.3	1,590.6	1,612.3	1,706.1	1,728.9	1,751.7	1,775.5	1,799.2	1,823.5	1,849.3
	Administeration expenditure	(d)x5%	70.0	80.0	80.0	80.0	80.0	80.0	80.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
	Expenditure for repair	(*)x5%	120.0	130.0	130.0	130.0	140.0	140.0	140.0	140.0	150.0	150.0	150.0	150.0	160.0	160.0
	Investment for replacement of equipment	(*)x20%	500.0	510.0	520.0	530.0	540.0	550.0	560.0	570.0	590.0	600.0	610.0	620.0	630.0	640.0
	*Total billing revenue		2,178.0	2,227.8	2,258.2	2,288.5	2,329.3	2,360.6	2,392.3	2,506.1	2,558.9	2,591.7	2,625.5	2,659.2	2,703.5	2,739.3
	Profit		306.0	311.4	336.3	361.1	375.5	399.5	422.9	364.3	366.7	389.1	410.5	432.0	442.9	462.3

(Tariff : YR ; Others : thousand YR/year)

R/Al Garn

			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Revenue	Tariff :YR/household/month		230	230	230	230	230	230	230	230	230	230	230	230	230	230
	:YR/m3		43	43	43	43	43	43	43	43	44	44	44	44	44	44
	Number of household		1,170	1,190	1,210	1,230	1,250	1,280	1,310	1,340	1,370	1,400	1,430	1,460	1,490	1,520
	Population		4,063	4,144	4,227	4,311	4,398	4,486	4,575	4,667	4,760	4,855	4,952	5,052	5,153	5,256
	annual supply (m3/d)*365		74,145	75,628	77,141	78,684	80,257	81,863	83,500	85,170	86,873	88,611	90,383	92,190	94,034	95,915
	*Total billing revenue		3,229.2	3,284.4	3,339.6	3,394.8	3,450.0	3,532.8	3,615.6	3,698.4	3,781.2	3,864.0	3,946.8	4,029.6	4,112.4	4,195.2
Expenditure	Operation and maintenansce cost															
	a. Fuel cost		678.6	692.5	706.4	720.2	734.6	749.4	764.3	779.6	795.5	811.3	827.1	844.0	860.8	878.1
	b. Maintenance cost		34.0	35.0	35.0	36.0	37.0	37.0	38.0	39.0	40.0	41.0	41.0	42.0	43.0	44.0
	c. Operators salary		504.0	504.0	504.0	504.0	504.0	504.0	504.0	576.0	576.0	576.0	576.0	576.0	576.0	576.0
	d. Sub-total		1,216.6	1,231.5	1,245.4	1,260.2	1,275.6	1,290.4	1,306.3	1,394.6	1,411.5	1,428.3	1,444.1	1,462.0	1,479.8	1,498.1
	Administeration expenditure	(d)x5%	60.0	60.0	60.0	60.0	60.0	60.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0	70.0
	Expenditure for repair	(*)x5%	160.0	160.0	170.0	170.0	170.0	180.0	180.0	180.0	190.0	190.0	200.0	200.0	210.0	210.0
	Investment for replacement of equipment	(*)x20%	650.0	660.0	670.0	680.0	690.0	710.0	720.0	740.0	760.0	770.0	790.0	810.0	820.0	840.0
	Total expenditure		2,086.6	2,111.5	2,145.4	2,170.2	2,195.6	2,240.4	2,276.3	2,384.6	2,431.5	2,458.3	2,504.1	2,542.0	2,579.8	2,618.1
	Profit		1,142.6	1,172.9	1,194.2	1,224.6	1,254.4	1,292.4	1,339.3	1,313.8	1,349.7	1,405.7	1,442.7	1,487.6	1,532.8	1,577.1

AS SADARAH Effective ratio 80%

			1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Revenue	Tariff :YR/household/month		230	230	230	230	230	230	230	230	230	230	230	230	230	230
	:YR/m3		20	20	20	20	20	20	20	20	20	20	20	20	20	20
	Number of household		1,560	1,590	1,620	1,650	1,680	1,710	1,740	1,770	1,810	1,850	1,890	1,930	1,970	2,010
	Population		11,767	12,002	12,242	12,487	12,737	12,992	13,251	13,516	13,787	14,063	14,344	14,631	14,923	15,222
	annual supply (m3/d)*365		214,746	219,041	223,422	227,891	232,448	237,097	241,839	246,676	251,610	256,642	261,775	267,010	272,350	277,797
	*Total billing revenue		4,305.6	4,388.4	4,471.2	4,554.0	4,638.8	4,719.6	4,802.4	4,885.2	4,995.6	5,106.0	5,216.4	5,326.8	5,437.2	5,547.6
Expenditure	Operation and maintenansce cost															
	a. Fuel cost		1,220.7	1,244.4	1,268.7	1,294.4	1,320.7	1,347.4	1,374.1	1,401.8	1,430.1	1,458.8	1,487.5	1,517.7	1,547.9	1,578.6
	b. Maintenance cost		61.0	62.0	63.0	65.0	66.0	67.0	69.0	70.0	72.0	73.0	74.0	76.0	77.0	79.0
	c. Operators salary		888.0	888.0	888.0	888.0	888.0	888.0	888.0	1,032.0	1,032.0	1,032.0	1,032.0	1,032.0	1,032.0	1,032.0
	d. Sub-total		2,169.7	2,194.4	2,220.7	2,247.4	2,274.7	2,302.4	2,331.1	2,503.8	2,534.1	2,563.8	2,593.5	2,625.7	2,656.9	2,689.6
	Administeration expenditure	(d)x10%	220.0	220.0	220.0	220.0	230.0	230.0	230.0	250.0	250.0	260.0	260.0	260.0	270.0	270.0
	Expenditure for repair	(*)x5%	220.0	220.0	220.0	230.0	230.0	240.0	240.0	240.0	250.0	260.0	260.0	270.0	270.0	280.0
	Investment for replacement of equipment	(*)x10%	860.0	880.0	890.0	910.0	920.0	940.0	960.0	980.0	1,000.0	1,020.0	1,040.0	1,070.0	1,090.0	1,110.0
	Total expenditure		3,469.7	3,514.4	3,550.7	3,607.4	3,664.7	3,712.4	3,761.1	3,973.8	4,034.1	4,103.8	4,153.5	4,225.7	4,286.9	4,349.6
	Profit		835.9	874.0	920.5	946.6	972.1	1,007.2	1,041.3	911.4	961.5	1,002.2	1,062.9	1,101.1	1,150.3	1,198.0

(Tariff : YR ; Others : thousand YR/year)

APPENDIX-6 CALCULATION OF WATER TARIFF SYSTEM

In reference to Sec.3-2 of Chap.3, "Operation and Maintenance Plan", the basic financial calculations for the respective water offices involved in the project are separately presented in this Appendix.

The basic factors assumed for calculation are listed as follows:

1. Revenues

(1)Revenues are calculated on the metered rates, assuming each case of effective ratios for the respective sites as follows:

Ahwar	80%
Moodeyah	70%
Al-Raidah/Shamalya	80%
As-Sadarah	80%

(2)The fixed monthly sate per household assumes 9 members of a family, each of which consumes 50 lcd except for the case of Moodeyah where 40 lcd is assigned.

2. Expenditures

(1)Operation and maintenance cost

a. Fuel cost

The fuel cost for the respective sites are based upon the total volume of diesel fuel required for the operation of all the diesel engines and/or diesel generators for running hours to serve the required water supply quantities ranging from 8 to 21 hours/day. The current official price of YR6.0 for one litter of diesel fuel is applied.

b. Maintenance cost

The maintenance cost includes the lubricants and replacement of consumable materials such as filters. The estimate assumes to spend 5% of fuel cost.

c. Operators' salary

Salaries: Refer to page 3-21

(2)Administration expenditure

The miscellaneous expenditures for management of the respective water offices are assumes to be confined to 20% of the total operation and maintenance cost including fuel costs and salaries.

(3)Expenditure for repair

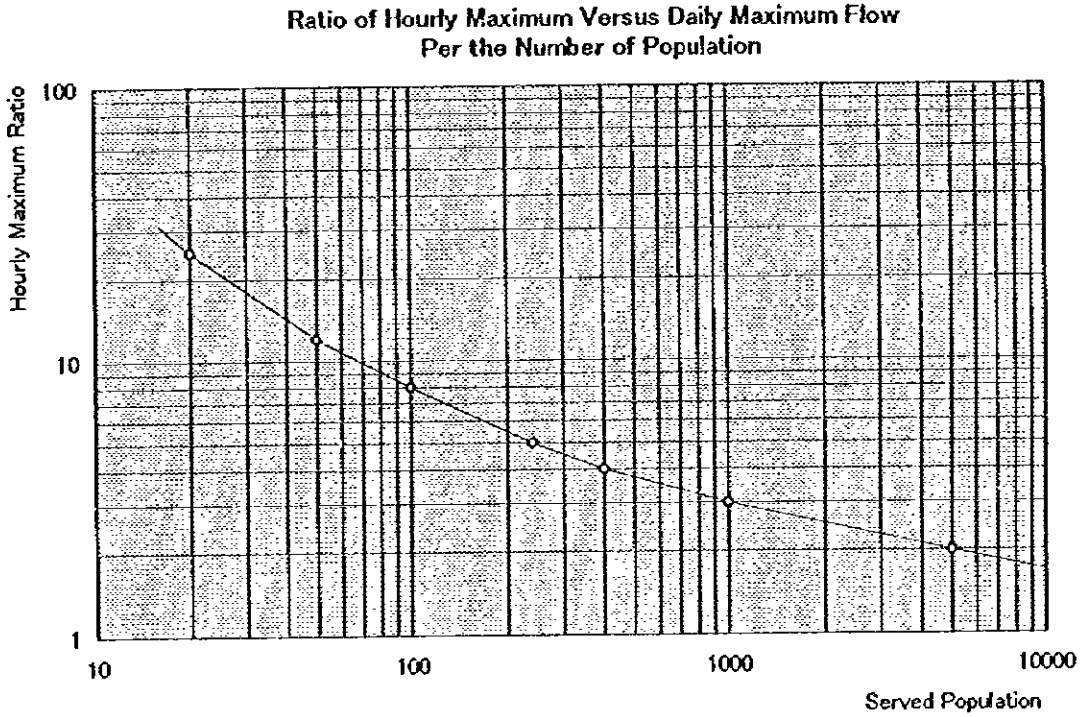
This is marked mainly for the repair of pipelines. The estimate assumes to be 5% of the revenues.

(4)Investment for replacement of equipment

This is for the savings in preparation for the replacement in case of unexpected breakdowns of equipment which may be required every 5 years. The savings are assumed to be 20% of the revenues. The cost calculation is based upon the estimated price of facilities for the project.

APPENDIX-7 CALCULATION OF HOURLY MAXIMUM SUPPLY RATE

The hourly maximum supply rate indicates one of unit flow rates for hydraulic calculation when water consumption in a given community reaches its peak. The size of distribution line needs to depend upon this flow rate. The rate is often estimated on the basis of total volumes of flow discharged through taps assumed to be simultaneously opened at households. As one of the typical calculation method, the criteria of Japan's small-scale water facilities has proposed to employ "a ratio of hourly maximum flow versus daily maximum flow", which varies with the population of the community, as shown in the following graph:



(Criteria for Small-Scale Water Facilities by the Ministry of Health and Welfare)

As a typical example, the hourly maximum flow for the central community of As-Sadarah is calculated as follows:

1) Present population:	4,850 (1997)
2) Planned serves population:	6,527 (2012)
3) Planned daily average supply rate:	6527 × 50 lcd = 326m^3
4) Planned daily maximum supply rate:	326 m^3× 1.3 = 424m^3
5) Hourly maximum ratio per population:	=1.8 (from the graph)
6) Hourly maximum supply rate:	(424m^3×1.8)/24 hours= 32 m^3/hr=530 *l*/min

According to the result of the calculation, the size of distribution main to the As-Sadarah community is determined, employing the flow rate of 530 *l*/min.