

**BASIC DESIGN STUDY REPORT
ON
THE PROJECT
FOR
THE RURAL WATER SUPPLY
IN
THE REPUBLIC OF YEMEN**

DECEMBER 1991

JAPAN INTERNATIONAL COOPERATION AGENCY

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**BASIC DESIGN STUDY REPORT
ON
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FOR
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IN
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PREFACE

In response to a request from the Government of the Republic of Yemen, the Government of Japan decided to conduct a basic design study on the Project for the Rural Water Supply and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Yemen a study team headed by Mr. Takeshi Sakai, Showa Water Plant, Water Works Dept., Public Enterprise Bureau, Prefectural Government of Saitama, Japan from April 23 to June 22, 1991.

The team held discussions with the officials concerned of the Government of Yemen, and conducted a field study in the study area. After the team returned to Japan, further studies were made. Then, a mission was sent to Yemen in order to discuss the draft report and the present report was prepared.

I hope that this report will contribute to the promotion of the Project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of the Republic of Yemen for their close cooperation extended to the teams.

December, 1991

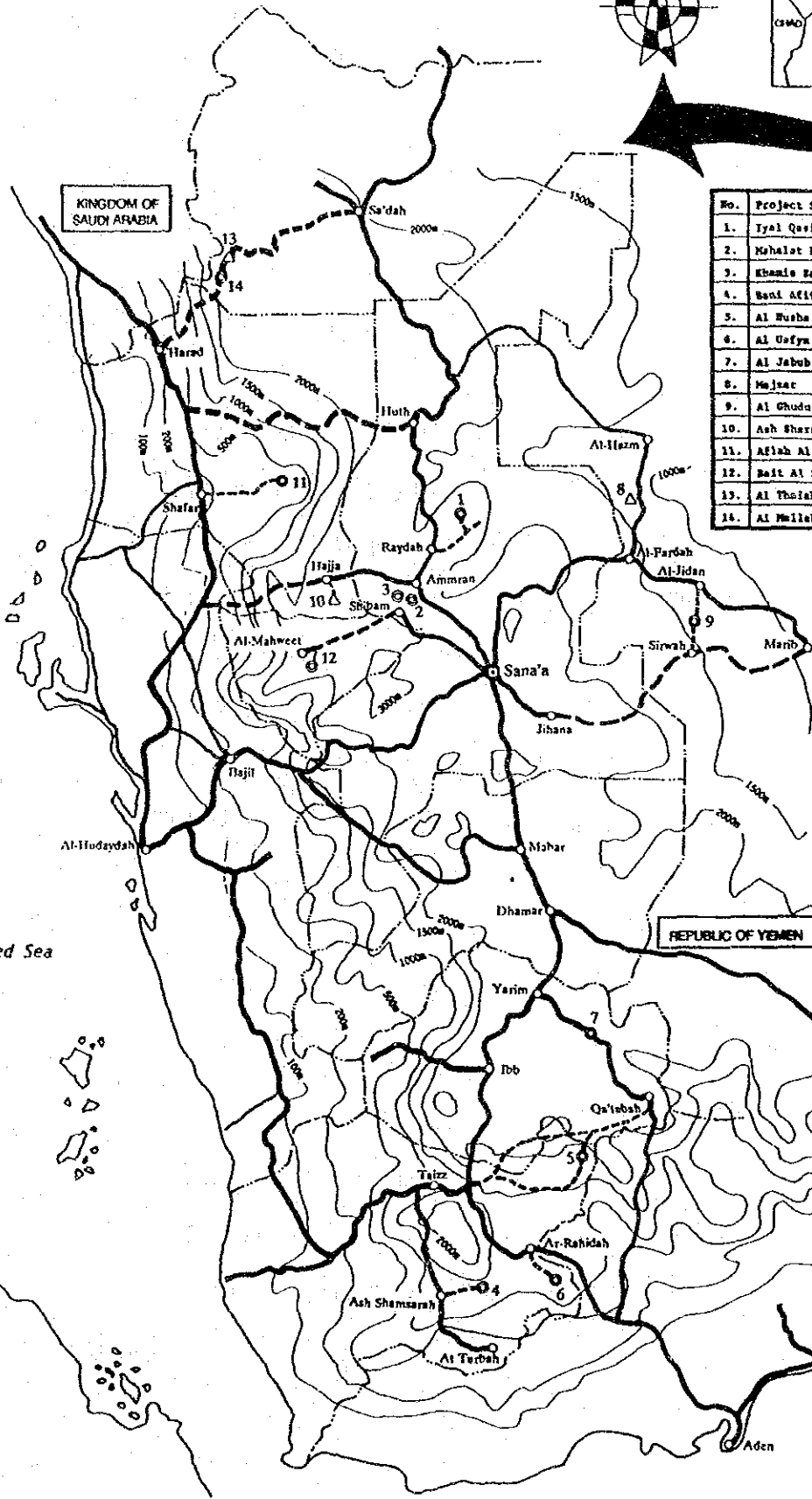
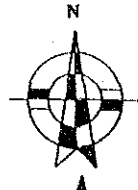
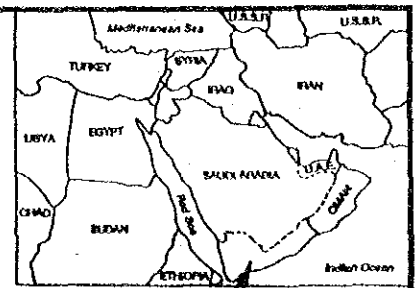
A handwritten signature in cursive script that reads "Kensuke Yanagiya". The signature is written in black ink and is positioned above the printed name and title.

Kensuke Yanagiya
President

Japan International Cooperation Agency

REPUBLIC OF YEMEN
RURAL WATER SUPPLY PROJECT

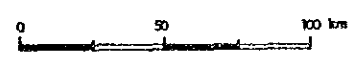
LOCATION MAP OF PROJECT SITES



No.	Project site	District	Governorate
1.	Iyal Qasim	Dhi-Bin	Sana'a
2.	Mahalat Najr	Amran	Sana'a
3.	Khamis Band Hajaj	Thila	Sana'a
4.	Bani Afif	Turbat Al Muwawit	Taizz
5.	Al Husba	Al Hasha	Taizz
6.	Al Uqayn	Al Qabwita	Taizz
7.	Al Jabub	Ar Radmah	Ibb
8.	Majzar	Majzar	Marib
9.	Al Ghuda	Sirwah	Marib
10.	Ash Sharaq	Hajjah	Hajjah
11.	Aflah Al Yaman	Aflah Al Yaman	Hajjah
12.	Bait Al Sultan	Ar Rajan	Al Mahweel
13.	Al Thalah	Al Dhaher	Sa'dah
14.	Al Millebeeth	Al Dhaher	Sa'dah

LEGEND

- Sites for Implementation & Planning
- △ Canceled Sites Due to Difficulty in Water Source
- Paved Road
- Paved Road (Under Plan or Construction)
- - - Feeder Road
- ~ 500m Contour Line



Gulf of Aden

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LIST OF ABBREVIATIONS

ACC	Arab Cooperation Council
CPO	Central Planning Organization
CYDAs	Confederation of Yemeni Development Assistance
DAC	Development Assistance Committee
HWC	High Water Council
IDA	International Development Association
JICA	Japan International Cooperation Agency
LCCD	Local Councils for Cooperation and Development
LDA	Local Development Associations
LPC	Local People's Councils
MAWR	Ministry of Agriculture and Water Resources
MEW	Ministry of Electricity and Water
MLA	Ministry of Local Administration
MOH	Ministry of Health
MPD	Ministry Planning and Development
NWSA	National Water and Sewerage Authority
NWC	National Water Committee
ODA	Official Development Assistance
OECD	Organization for Economic Cooperation And Development
OECE	The Overseas Economic Cooperation Fund
PWC	Public Water Cooperation
RWSD	Rural Water Supply Department

UNCDF United Nations Capital Development Fund
UNDP United Nations Development Programme
UNICEF United Nations Children's Fund
USAID US Agency for International Development
WHO World Health Organization

SUMMARY

SUMMARY

The Republic of Yemen is located in the southwestern part of the Arabian peninsula, bordering Saudi Arabia in the north and Oman in the east and facing the Red Sea in the west and the Indian Ocean in the south. The nation emerged on May 22, 1990 when the Yemen Arab Republic and the People's Democratic Republic of Yemen were officially merged. The united Yemen has an area of 537 thousand square km (about 1.4 times that of Japan), and its population has grown the largest in the peninsula to hardly less than 13 million, about 10 million of which live in the northern part.

On the eve of the unification, both states were respectively executing the Third Five-Year National Development Plans (1987 - 1991). Since their outset, those plans had constantly been placing the highest priority on the development of the agricultural sector, but the major target remains yet to be attained due to constraints such as the rugged mountainous terrain and desert areas occupying a greater part of the country, the absolute scarcity of water resources and the land cultivation system based upon tribalism from old times. Since more than 80 percent of the entire population dwell in rural areas where agriculture is the mainstay of their living, the Yemen government has been and is striving to promote the strategies to improve and stabilize the rural environment. Despite its efforts, however, the coverage of rural water supplies all over the country, one of its high-priority policies, was still hovering around 50 percent in 1990, and urgently needed to be accelerated, as the incidence of waterborne diseases such as enteritis and bilharzia keeps registering a high record in the medical statistics due to the use of unsanitary water in cisterns and hand-dug wells.

The sluggish progress in this sector stems mainly from the following reasons:

- (1) The country has no choice but to be dependent upon groundwater resources since it lacks major river systems under the prevailing arid climate. Groundwater occurs mainly through specific geological features called *lineaments* penetrating hard rocks, making its exploitation quite a challenging task.

- (2) The county's rural water supply projects frequently require a high level of expertise as well as vast amounts of investment, since most of water supply systems must cover extensive areas over rugged mountainsides dotted with small villages in the northern part in particular, where the construction of facilities is required to extend from deep wells in the low-lying wadi up to dwelling areas on the mountains.

The government of Japan provided economic assistance in the past for the rural water supply projects in the Yemen Arab Republic, starting in 1977 with a loan project for 42 sites, followed by grants extending for six phases during the period from 1981 to 1988. The number of beneficiaries under these projects totals about 210,000. In view of such past contribution to this sector by the Japanese government, the government of the Yemen Arab Republic sent it a request for a new project for the construction of water supply facilities in 14 rural communities (hereafter called the Project). In response to the request, the government of Japan decided to carry out the basic design study for the Project, and Japan International Cooperation Agency (JICA) dispatched the study team to the Republic of Yemen from April 23 to June 22, 1991. The team conducted the study including the discussions with the concerned authorities of the Yemen government, collection of data and information and the field survey in the project sites about their natural and social environments, water practice, hydrogeological and topographical features, etc. Further studies were made at home, and a mission was sent to Yemen for consultation on the draft report from November 1 to 13, 1991. As a result of the process of these studies, the framework of planning for the Project is presented as follows:

The sites for the planning of the Project consist of eleven (11) located in seven (7) governorates of the country among 14 proposed in the request, where safe and stable water sources have been judged to be successfully developed. For the basic design study of the Project, five (5) sites have been selected out of these eleven sites, based upon the comprehensive analysis of conditions including: (a) the priority of the site ranks higher in the listing proposed by the Yemen government due to its urgency and necessity of the water supply facilities; (b) the project for the site has a higher rate of the cost-effectiveness (a less construction cost per person); (c) and the site is expected to be able to demonstrate a sustained management, operation and maintenance, thanks to a modest rate of operation and maintenance cost as well as through its experience in the ongoing management of the existing deep well facility. The water supply planning for the remaining six (6) sites, however,

is presented in this report, with details on facilities and equipment. The listing of the Project sites thus categorized is shown as follows:

Category	No.	Site Name	Governorate	Present Population (1991)	Planned Served Population (2006)
Project Sites for the Basic Design Study	1.	Al Mallaheeth	Sa'dah	3,180	4,600
	2.	Iyal Qasim	Sana'a	1,500	2,200
	3.	Al Usfyn	Taizz	28,500	41,600
	4.	Aflah Al Yaman	Hajjah	4,500	6,600
	5.	Al Ghudu	Marib	1,770	2,600
		Total		39,450	57,600
Other Sites for Reference	6.	Khamis Bani Hajaj	Sana'a	5,400	7,900
	7.	Al Husha	Taizz	5,000	7,300
	8.	Bait Al Sultan	Al Mahweet	3,600	5,300
	9.	Bani Afif	Taizz	7,300	10,700
	10.	Al Jabub	Ibb	2,000	2,900
	11.	Mahalat Najr	Sana'a	2,000	2,900
		Total		25,300	37,000

The five (5) sites for the basic design study thus selected are all the village complexes of 7 to 20 settlements in the mountainous areas, covering extensive areas of districts/*nahiyahs* or sub-districts/*uzlahs*, where the Japanese side is to undertake the construction of their water supply systems composed of facilities for the water source, including the drilling of new wells and rehabilitation of old ones, water transmission and distribution to the central parts of the villages with public fountains and vehicle feeders for service in the respective sites. In addition, piping materials for the further extension of distribution lines to other villages constituting the sites is planned to be supplied under the Project on condition that the installation work will be carried out by the Yemeni side represented by the Rural Water Supply Department of the Ministry of Electricity and Water (hereafter called the RWSD) and the Local Councils for Cooperation and Development of the Ministry of Local Administration (hereafter called the

LCCDs), which are responsible for the execution of the Project. The RWSD is in charge of the construction of facilities under the Project, while the LCCDs are responsible for the management, operation and maintenance of completed facilities, receiving technical assistance from the former, based upon a water billing system in the respective communities in which full-time operators are to be employed for the running of facilities and proper water rates are to be charged to the beneficiaries to cover the expenditure for the operators' salaries, fuel costs and others.

The Project is based upon a planning period of 15 years, a growth rate of population of 2.55 percent per annum according to the government's statistics, a per capita per day supply rate of 30 liters (40 lit. for the 2 sites under the dominantly tropical weather) derived from the survey results).

In view of the total volume of work and the implementation period to be controlled under the rules of Japan's grant aid system, it is relevant to divide the execution of the Project composed of five (5) sites into three (3) phases. The outline of the respective phases thus divided is presented in the table as follows:

Phase	Site Name	Facilities	Specifications
1 st Phase (Con- struction period: 10.5 months)	1) Al Mallaheeth 2) Iyal Qasim	Water sources	New deep well x 1 No. Existing well x 1 No.
		Pumps	Diesel driven vertical shaft pump x 2 Nos. Generator driven submersible pump x 1 No. Generator driven horizontal pump x 1 No.
		Pump houses	New x 3 Nos. Existing x 1 No.
		Water tanks	24, 90, 120 m ³ x 3 Nos.
		Pipelines	φ1-1/2" - 4" x 11,100 m

Phase	Site Name	Facilities	Specifications
2 nd Phase (12 months)	3) Al Usfyn	Water sources	New deep well x 3 Nos.
		Pumps	Diesel driven vertical shaft pump x 3 Nos. Generator driven horizontal pump x 1 No.
		Pump houses	New x 4 Nos.
		Water tanks	48 & 120m ³ x 2 Nos.
		Pipelines	φ1-1/2" - 6" x 9,100 m
3 rd Phase (11 months)	4) Aflah Al Yaman 5) Al Ghudu	Water sources	New deep well x 1 No. Existing well x 2 Nos.
		Pumps	Generator driven submersible pump x 3 Nos. Generator driven horizontal pump x 2 Nos.
		Pump houses	New x 3 Nos.
		Water tanks	24, 48, & 75 m ³ x 1 No. each, 120 m ³ x 1 No.
		Pipelines	φ1-1/2" - 4" x 12,900 m

This Project is planned to serve safe drinking water to a population of 57,600 in the five (5) Project sites at a supply rate of 30 to 40 liters per capita per day, and is anticipated to bring about improved sanitary environments leading to the conspicuous decrease of rampant infectious diseases due to the widespread use of unhealthy water in cisterns and hand-dug wells. Upon completion of the Project, the costs for operation and maintenance of facilities to be borne by the beneficiaries are estimated at a level of YR3.6 to YR13.0 per 1 m³, producing an effect of easing their heavy economic burden of current water purchasing. In addition, since the water service facilities are installed in the precincts of settlements on the mountainsides, distances for fetching water can be reduced to a great extent, relieving women and

children of their heavy labor to obtain domestic water at sources away down their settlements. Extra labor thus produced may be employed for strengthening productive activities of rural communities.

The Project has a direct benefit to meet one of the basic human needs of inhabitants in the Project sites, and is anticipated to improve and stabilize their rural life, eventually contributing to one of the government's top-priority policies to promote the country's agricultural sector. In this view, the Project is judged to be feasible enough to be implemented under Japan's grant aid system.

CHAPTER I
INTRODUCTION

CHAPTER I. INTRODUCTION

The new Republic of Yemen started to take shape on May 22, 1990 when the unification of the Yemen Arab Republic and the People's Democratic Republic of Yemen was declared, with its location in the southwestern part of the Arabian peninsula facing the Red Sea, occupying an area of 528 thousand square km (about 1.4 times that of Japan) where a population of about 13 million live. The capital of the united Yemen is Sana'a, located in the high central uplands at an altitude of 2,300 m. Through the Five-Year Development Planning including the ongoing third plan, the government has underscored diverse policies to stabilize the rural life, giving high priority to the expansion of basic infrastructure, water resources development and conservation, irrigation projects, etc., as well as the rural water supply scheme.

The country is dominated by the arid desert climate, with more than 80 percent of its population living in rural areas, mainly relying upon unstable rainfed agriculture. The great majority of farmers dwell in the mountainsides, where they are striving to secure indispensable water from such sources as springs, hand-dug wells and artificial stone reservoirs of rain water called cisterns. Women and children have been playing a major role in fetching water daily from distant sources, some 5 to 6 km away in dry seasons. Such severe water shortage and unhealthy water use practice are raising a critical problem on the sanitation and environment of the rural life.

In 1977, the government of Japan responded to the request by the government of the Yemen Arab Republic to extend assistance to its rural water supply scheme, and executed a loan project for 42 across the country. Grant aid followed, extending for 6 phases during the period of 1981 to 1989. In addition, experts were dispatched to this sector from 1988 to 1991.

Meanwhile rural inhabitants have been making efforts to improve and upgrade their standards of living for themselves. In many places, local authorities installed water facilities such as deep wells with their own funds. Rural water supply projects in this country, however, frequently pose a great difficulty in securing stable water sources, and necessitate expertise in designing an optimum layout of facilities over the mountainous terrain dotted with numerous settlements. Such harsh environment raises a unit construction cost per capita to a higher rate, resulting in a huge investment for the implementation of the projects. These factors have constrained the progress

of the rural water supplies to a great extent, and the national coverage in this sector currently remains on a level of 50 percent. With the demand for stable and safe water supplies increasingly growing these days among the rural population, the Yemeni government has made a new request for grant aid to the government of Japan for the construction of water facilities for 14 sites in the countryside.

In response to that request, the government of Japan decided to carry out the basic design study concerning this project, and the Japan International Cooperation Agency (JICA) sent to Yemen a study team headed by Mr. Takeshi Sakai from Showa Water Plant, Water Works Dept, Public Enterprise Bureau of Prefectural Government of Saitama, Japan from April 23 to June 22, 1991. The team held discussions with the concerned authorities of the Yemen government and carried out the field survey in order to confirm the background of the request, the objectives and details of planning and the effects and feasibility of the project, and finally concluded the minutes of discussions with the representatives of the Rural Water Supply Department of the Ministry of Electricity and Water as the executing agency of the Project.

This report for the basic design study on the project has been prepared in Japan through further studies after a mission for the consultation on the draft report, headed by Mr. Shinichi Mori, Grant Aid Division, Economic Assistance Bureau, Ministry of Foreign Affairs, was sent to Yemen from November 1 to 13, 1991. It covers the feasibility of the project, the details of planning, the implementation program, the estimate of the project cost and the operation and maintenance scheme, along with the recommendations. The minutes of discussions, the itinerary of the survey, the member lists of the teams, the list of personnel interviewed, etc., are attached to Appendix to this report.

CHAPTER II

BACKGROUND OF THE PROJECT

CHAPTER II. BACKGROUND OF THE PROJECT

2.1 OVERVIEW OF THE REPUBLIC OF YEMEN

2.1.1 General

The Republic of Yemen emerged on May 22, 1990 with the declaration of the unity of the Yemen Arab Republic and the People's Democratic Republic of Yemen. The country is located in the southwestern part of the Arabian peninsula, bordering Saudi Arabia in the north and Oman in the east and facing the Red Sea in the west and the Indian Ocean in the south. The united Yemen has an area of 536 thousand square km roughly equivalent to 1.4 times that of Japan, with an estimated population of approximately 13 million in 1990, about 10.5 million of which live in the northern part and the remaining 2.5 million in the southern part. Across the central axis of the country from north to south runs the main watershed over 3,000 m in altitude, composing a vast area of rugged highlands of more than 2,000 m in height, while the coastal belt along the Red Sea called the *Tihama* zone, a greater part of the southern part and the northeastern and eastern parts, where oil exploration has recently been booming, are all the desert zones dominated by the tropical or the arid desert climate, with annual rainfall at less than 100 mm. In summer, moist air masses flowing over the Red Sea from the southwest clash against the central highlands and cause heavy precipitation over mountainous areas, in places reaching 500 to 1,000 mm per annum. This rainfall has been a precious water source supporting agriculture in low-lying belts of valleys called *wadis*, which drain either eastward or westward, cutting down mountains. Rural inhabitants accounting for over 80 percent of the entire population have mainly been making their living from such agriculture.

In the beginning of 1970s the government of the Yemen Arab Republic launched its first Five-Year Development Plan, and up to now, including the ongoing third one, has been calling for the promotion of the agricultural sector. In order to achieve this objective, it has encouraged diverse programs to improve and stabilize rural life including rural electrification, rural water supplies, the establishment of communication networks, the construction of hospitals and schools, etc. The progress of rural water supplies

among them, however, have been lagging behind, with its current national coverage at about 50 percent, because of heavy constraints stemming from the country's harsh natural and social conditions. The sluggish development in this sector has caused the widespread incidence of waterborne diseases such as bilharzia all over the country, as shown in medical statistics, and the urgent improvement of rural environment through the installation of water facilities has been badly needed.

Immediately upon the realization of the merger in 1990, the government of the United Yemen launched to reshape its economy, but was doomed soon to be faced with the Gulf crisis/war from the mid 1990 to the early 1991. Since the end of the war it has been tackling to overcome a predicament caused by the crisis including the suspended flows of aid from the Gulf states, mass repatriation of Yemeni migrant workers from there, skyrocketing domestic inflation, etc.

More than 80 percent of the total population dwell in the countryside where agriculture is the mainstay of their living. Although the country's basic infrastructure has increasingly been improved and modernization has been under way in and around larger cities through the progress of the government's development plans, it is said, therefore, that for the government steering the course of the state which has grown to have the largest population in the peninsula, the first priority in its policies is still lying in improving and stabilizing rural areas.

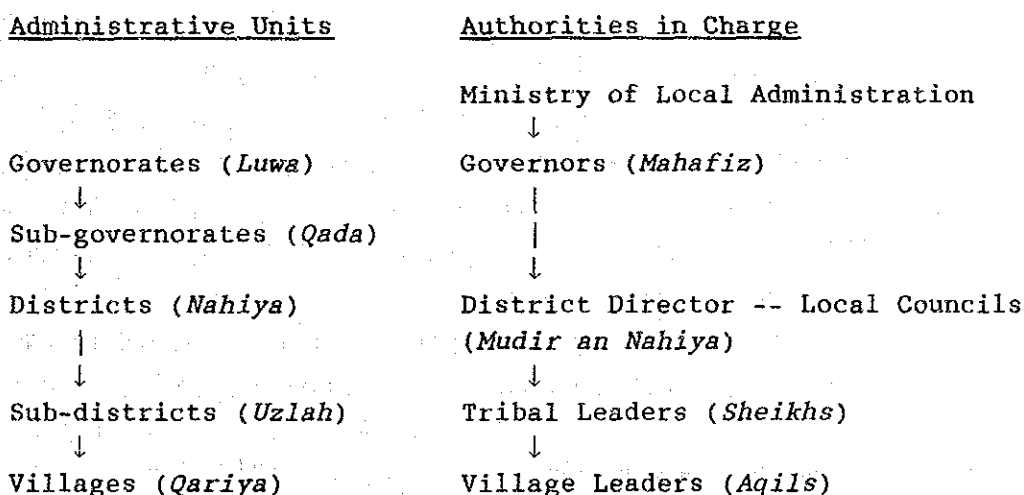
2.1.2 Population and Administrative Division

The Yemen Arab Republic have so far carried out the national level population censuses three times with the United Nations' assistance, while the People's Democratic Republic of Yemen conducted a data collection operation in 1988. According to the published data, the former in the 1981 census had a total population of 8,540,119 composed of registered domestic residents of 7,145,371 and 1,394,778 emigrants living abroad, while in the latest census of 1986 the corresponding figures were respectively 9,274,173, 8,105,974 and 1,168,199. On the other hand, the latter had a total population of 2,345,266 consisting of 2,107,116 residents and 238,150 emigrants in its 1988 census.

These censuses defined the urban population as residents living in localities having a population of 5,000 or more. According to this classification, the proportions of rural populations to urban ones in the Yemen Arab Republic were 88.6 percent in 1975 and 84.51 percent in 1986 respectively, while that of the People's Democratic Republic of Yemen was 67 percent in 1988.

The growth rate of the northern part's population was surveyed by the United Nations in 1982/1983, resulting in a figure of 2.5 percent per annum, which proved quite close to an average annual growth rate of domestic residents registered in the 1981 and 1986 censuses. For the southern part, the World Bank estimated in 1989 an annual growth rate of 2.3 percent. Taking all these data into account, the latest estimate puts the united Yemen's population in 1990 at a little less than 13 million, following those of the two states in 1989, 10.1 million for the northern part and 2.4 million for the southern part.

The new republic is divided into 17 governorates as its largest administrative units, with 11 in the northern part and 6 in the southern part, which are further subdivided into various levels of units until the smallest ones of villages. The local administration of the united government is executed by the Ministry of Local Administration through the following system:



Governors and district directors have been dispatched by the central government through the appointments of the Prime Minister's Office in Sana'a, charged mainly with functions to settle disputes among inhabitants and to supervise the levying and collection of taxes. Practical administration has been proceeding in the respective units

of districts with main officials comprising a district director, judges, tax-collectors, a military commander and a chairman of the Local Council. Meanwhile, the functions of planning, co-ordinating and executing local development projects were formerly exercised by the organizations called Local Development Associations (LDAs) belonging to the Confederation of Yemeni Development Associations (CYDA) under the chairmanship of the president. In 1986, they were reorganized into the Local Councils for Cooperation and Development (LCCDs), members of which are to be elected by popular vote. After the unification, these organizations for local development have been incorporated into the hierarchical system of the Ministry of Local Administration, along with the district directors.

Most of the country's administrative divisions have their origins in the territorial divisions of tribes. While the governors and district directors are appointed by the central government, the rules of tribal leaders (Sheikhs) are still maintained in many areas, particularly on the lower administrative levels such as sub-districts (Uzlahs) and villages (Qariyas).

This Project is intended for the rural areas in the former territory of the Yemen Arab Republic, where the number of villages, the lowest level of local administration, is reported to count about 60,000. One village (Qariya), however, is not a single settlement, but mostly a group of settlements which belong to the same unit. A sub-district (Uzlah) is composed of 10 to 30 villages, depending upon localities. The boundaries of these units of lower levels, including districts, have not yet been clearly defined, as is found in the country's basic maps of 1/50,000 in scale. Under such circumstances, the review of the present administration units including the redrawing of boundaries has been commenced by the Advisory Council to the president which includes the most prominent leaders of tribal confederations, the Hashed and the Bakil.

2.1.3 The Economy, Finance and Industry

The economies of both the Yemen Arab Republic and the People's Democratic Republic of Yemen in the past had overwhelmingly been dependent on the remittances of their migrant workers, who were much in demand in Saudi Arabia during the construction boom, together with bilateral and multilateral aid, particularly from the Gulf states.

Until the discoveries of the crude oil in the mid 1980s, both countries had no significant industries to count upon, with their GNPs falling in the category of LLDC countries ranging from \$400 to \$500, but the Yemen Arab Republic became the oil exporter and the People's Democratic Republic of Yemen, the commercial producer, respectively in 1987.

The year 1991 falls on the target year of the third Five-Year Plan of the Yemen Arab Republic. Its counterpart in the southern part launched its third plan in 1988, but as the momentum for the unification got high, a moratorium was imposed on new projects of big scale and urgent programs with priority given to rehabilitation have been promoted under the control of the united government. The development planning of both countries has shifted from the first to the ongoing third plans, partly depending upon aid from abroad. Under the planning, the real GDP growth rates of both countries ranged yearly from 5 to 7 percent. A drastic change came when the Yemen Arab Republic achieved an outstanding growth of an estimated 19.2 percent in 1988 due to the increased production and export of crude oil, with the trend for the strong growth apparently following in the succeeding years with annual rates set to a level of 6 percent on the back of a dynamic oil sector.

The united republic's first joint budget was unveiled in December 1990, which is aimed at reducing deficit with the official forecast of YR35.2 billion (about \$300 million) in aggregate revenue, a sharp rise of 43 percent compared to the sum of both countries' budgets in the preceding year and expenditure set to rise only 10 percent to YR51.0 billion (\$425 million). In the past, ordinary revenues of the northern government's budgets counted largely on indirect taxes such as customs duties, but since 1987 direct taxes continue to exceed indirect ones. Current expenditures have invariably stood at by far a higher level than current revenues, and capital expenditures have mainly been relying upon development assistance, cash loans and grants, with deficits covered with borrowing from the Central Bank.

The balance of payments had tended to widen the trade deficits, with its normal pattern constantly depending upon the migrant workers' remittances and cash loans and grants until the oil exports were recently launched. By far the largest category of imports has been foodstuffs including cereals for the former two states, accounting

for 33.3 percent of the total imports of the Yemen Arab Republic and 31.8 percent of those of the People's Democratic Republic of Yemen respectively in 1988. Despite strenuous efforts of both governments in their Five-Year Plans to promote the agricultural sectors, including operations of integrated rural development programs and irrigation schemes, agriculture long failed to live up to expectations. However, the united government confirmed top priority of this sector in its economic policy presented in June 1990, referring to it as the best means to strengthen the national economy, and encouraged the investment and self-help of the private sector.

In the beginning of 1991, the Ministry of Oil and Mineral Resources announced the forecast of oil production with an estimate of the daily total at 215,000 barrels, including 119,000 barrels for the government's share to be allocated for domestic consumption and exports. Most part of this output now comes from the Marib oil fields in the northern part, while in the southern part the installation of a 190 km pipeline is underway by the USSR from the eastern Shabwa oil fields to the export terminal on the coast, and upon its completion, its output is planned to be boosted to 120,000 barrels a day mainly for the export purpose. The official estimates of the reserves for these oil fields in 1987 put that of the northern part at about 1 billion barrels and that of the South at 3.75 billion barrels. A joint venture from Japan was offered one of the Shabwa concessions in 1990. In addition, the country's energy sector is already known to have the enormously rich reserves of natural gas.

For reference, the economic indices of the former two states are attached to Appendix to this report.

2.2 NATIONAL DEVELOPMENT PLANNING

The governments of the Yemen Arab Republic and the People's Democratic Republic of Yemen respectively launched their national development planning in the early period of 1970s, and the year 1991 falls on the final year of the former's third Five-Year Plan.

The outlines of the past and present development plans of both states are shown in Table 2.1, along with the former's real GDP growth rates and the latter's investments since no precise figures are available for its GDP during the corresponding period. The latest estimated

figures of the GDP growth rates for both states are listed in the attached table for reference.

**Table 2.1 Progress of Development Planning
Yemen Arab Republic and
People's Democratic Republic of Yemen**

Yemen Arab Republic				People's Democratic Republic of Yemen			
Plans	Period	GDP Growth Rate		Plans	Period	Investment Amount(mn YD)	
		Target	Real			Target	Real
3-Year Plan	1973/74-1975/76	6.0%	5.9%	3-Year Plan	1972 - 1974	32.4	25.1
First 5-Year	1976/77-1980/81	8.2%	5.9%	First 5-Year	1974 - 1978	75.4	317
Second 5-Year	1982 - 1986	7.0%	6.6%	Second 5-Year	1981 - 1985	508	680
Third 5-Year	1987 - 1991	9.2%	-	Third 5-Year	1986 - 1990	612	-

Estimated Recent GDP Growth Rates

Yemen Arab Republic		
1987	1988	1989
4.8%	19.2%	6.0%

(Source: World Bank)

People's Democratic Republic of Yemen					
1984	1985	1986	1987	1988	1989
5.9%	-3.0%	-9.0%	3.5%	0.3%	2.0%

(Source: UNIDO)

(Note: The outstanding growth rate of 19.2% of the Yemen Arab Republic in 1988 owed to the increased oil exports that year, while the negative ones of the People's Democratic Republic of Yemen in 1985 and 1986 were caused by the domestic turmoil.)

Throughout its planning, the government of the Yemen Arab Republic has underscored the objectives and strategies as follows:

- (1) Attainment of maximum self-sufficiency through optimal use of available resources
- (2) Development of the agriculture sector and achievement of a balanced and integrated regional development
- (3) Development of infrastructure and improvement of social services
- (4) Water resources development
- (5) Development of human resources
- (6) Popular participation in the economic and social development

However, the development and progress of the agricultural sector, one of the plans' top-priority objectives, have been stagnant and continued to fall short of the planned targets. The reasons involved the earthquake and the long drought during the second Plan. Aside from such natural and social disasters, the progress of this sector has been hampered by fundamental constraints: the absolute lack of water resources under the arid climate, difficulty in the extensive development of water resources, dependence upon rainfall, and farmland cultivated by numerous small tenant farmers. Furthermore, the country's rural areas saw a wave of migration of farm workers to the Gulf states after the revolution, resulting in the shortage of labor force and the shrink in productive activity in this sector. Soaring labor costs, pushed up by the lack of manpower inside the country, encouraged many farmers to switch from labor intensive food crops to the more immediately profitable cultivation of a special cash crop of *Qat*, which is said to have contributed to squeezing the outputs of cereals and coffee. (*Qat* is a shrub whose leaves contain a mild stimulant, and chewing its leaves by grown-up men features a daily life of the Yemeni society.)

In close connection with the promotion of agriculture, the Plans also emphasized the importance of water resources development and the expansion of the water sector, the former because of the need of irrigation water and the latter for improving and stabilizing the rural life. Integrated regional development projects implemented by the government hardly failed to include these two elements, but the stagnation in the agricultural sector has had adverse effects on them. The ongoing third Plan, however, has reconfirmed the top-priority of these two sectors, with the water sector referred to as

a basic tool of development. It aims at augmenting the coverage of water supplies, effectively developing and utilizing water in consistency with a comprehensive development and conservation plan of water resources, particularly in coordination with the agricultural sector. While the second Plan particularly pushed for the development of water resources, the third one focuses on their conservation. Such comprehensive water resources planning is now under way by the High Water Council established in 1982 as a superior authority over various sectors concerned with water use and now playing an active role with support from the UNDP. The development of the water sector from now on is anticipated to make a balanced progress consistent with the policies of the said Council concerning the water resources development and conservation.

For reference, the distributions of investments among various sectors composing the planning from the first to the third Five-Year Plans are listed in Appendix to this report.

2.3 WATER ADMINISTRATION AND WATER PRACTICE

2.3.1 Water Administration

(1) Ministry of Planning and Development (hereafter called the MPD)

The MPD is a new ministry based upon the former Central Planning Organization of the Yemen Arab Republic, which promotes and coordinates the execution of the National Development Planning. All the bilateral and multilateral assistance to this country undergoes the review and approval under its responsibilities. The requests for assistance are submitted to the MPD first by the government offices and agencies in charge of various projects; they are examined by the MPD and, after its approval, are transferred to the Ministry of Foreign Affairs; and they are eventually sent to the embassies or agencies of donor countries or organizations. The requests to Japan are handled by the MPD's Japan/Australia Division of the Regional Department, with their contents reviewed by its Technical Department.

(2) High Water Council (hereafter called the HWC)

The HWC was initially organized in 1981 by the Ministry of Electricity and Water, chaired by its minister with the members comprising deputy ministers and other representative officials from various sectors of the government related to water use and management. At that time, the government had been under pressure from donor countries and organizations to rein in the uncontrolled development of groundwater with the latest versions of drilling machines all over the country, stemming from the progress of development planning with demand for water surging in various sectors. Its establishment of the HWC was intended to steer the development and use of water resources by various sectors, which are evidently limited and scarce throughout the country. Various decisions of the HWC thereafter, however, had no substantial effects for the intended purpose until 1986 when the government decided to reorganize it, appointing the prime minister its chairman with the members including the ministers related to water administration, along with a significant arrangement to install a technical bureau composed of capable engineering staff in charge of the execution of various policies of the organization. The then chairman of the National Water and Sewerage Authority was assigned to the first general secretary of the bureau.

In 1988 after its reorganization, the HWC was offered assistance from the UNDP for its activities, based upon a program for Strengthening of the High Water Council. In order to promote the planning and practice of comprehensive water resources development and conservation in urgent need, this project is aimed at supporting the HWC's activities for: (1) the formulation of the national water resources development and conservation program, including the territory of the southern part according to the recommendation of the UNDP; (2) the establishment of a central data bank dealing with inclusive data and information on existing water sources and diverse schemes of water development and use in various sectors; (3) the preparation for the legislation of water use and development and its execution; and (4) the training of local staffs at the bureau and other concerned offices engaging in the execution of this program. For the program, the UNDP provides foreign currency amounting to \$2.7

million, while the Yemen government bears YR11 million in local currency.

With its chairman being prime minister, the HWC is in a position superior to any other offices and agencies of the government concerning water administration. Its activity is now in high gear, ranging from the preparation of regulatory bills to the organization of small committees for the legislation of water act, the establishment of a data bank, etc.

Meanwhile the National Water Committee was organized in the People's Democratic Republic of Yemen in 1981 for achieving a similar purpose, comprising the representatives of the Ministry of Agriculture and Agrarian Reform (MAAR), the Ministry of Planning (MOP) and the Public Water Corporation (PWC). After the unity, this committee is anticipated to be incorporated into the operation network of the HWC to develop the nationwide control over the water resources development and conservation.

(3) Ministry of Electricity and Water (hereafter called the **MEW**)

The MEW has such arms as the National Water and Sewerage Authority (NWSA) and the Public Water Corporation (PWC) responsible for the management of urban water supply and sewerage systems, the former for the northern part and the latter for the southern part, as well as the Rural Water Supply Department (RWSD) in charge of nationwide rural water supplies. For electricity, the two public corporations in both parts are now under the control of this ministry as well, the Yemen General Electric Corporation for the north and the Public Corporation for Electricity for the south. After the unity, an official from the northern part has been appointed its minister and a southerner, vice minister, and the public service in this sector is being promoted under the consistent policy of the central government. These public enterprises have been autonomously run by the respective organizations. Separately positioned in the former two states, they were once rivals contesting for development assistance. The ministry, therefore, is responsible for promoting the public service planning through a fair distribution of fund to its agencies.

- 1) National Water and Sewerage Authority (hereafter called **NWSA**) and Public Water Corporation (**PWC**)

The NWSA is in charge of both water supply and sewerage systems in urban areas in the northern part, while the PWC is responsible exclusively for the urban water supply, with the sewerage sector under the control of the Directorate General of Local Government. After the unity, both enterprises have been attached to the MEW. The NWSA was established in 1973 through a project for the construction of water supply system for the capital of Sana'a with the IDA's fund. Initially it's coverage was confined to the three large cities of the northern part, Sana'a, Hudaydah and Taizz, but afterwards has been extended to major local cities of over 16. Its headquarters is in Sana'a, with branch offices stationed in the country's other major cities.

On the other hand, the PWC was organized in 1970, and its service covers 11 major cities of the southern part including Aden, with the total served population of 650,000. In addition, this organization provides technical assistance to the planning and construction of the rural water supplies controlled by the local administration.

- 2) Rural Water Supply Department (hereafter called the **RWSD**)

The RWSD was set up in 1972 under the then Ministry of Public Works (the Ministry of Construction after the unity). Since its establishment, the RWSD has been promoting with the support of technical assistance of the WHO the development of the rural water supplies covering the greater part of the northern part except the three cities under control of the NWSA. In 1986, it was transferred to the present position under the MEW due to the government's policy to rally the water sector. At the outset, it engaged in drilling deep wells with its own equipment for the rural supplies, but withdrew in the early 1980s. Its main duties are currently the planning, surveying and construction of the countrywide rural water

supply projects, including those in the southern part after the unity, for which the local administration bodies had formerly been responsible. This office undertook the role of the executing agency in the previous projects with the funds from the government of Japan, and since it has been assigned the same function in the implementation of this Project, the details are described in the following clause of 2.4.

(4) Ministry of Agriculture and Water Resources (MAWR)

The MAWR has been formed after the unity, combining the Ministry of Agriculture and Fisheries (MAF) of the Yemen Arab Republic and the Ministry of Agriculture and Agrarian Reform (MAAR) of the People's Democratic Republic of Yemen. The former ministries respectively concentrated their efforts on the improvement and expansion of irrigation systems for agriculture development under the top-priority policies of the national development planning of both governments, and keep a vast data collection on water resources of both parts, particularly on groundwater development and its effective use, through the execution of numerous rural development plans and individual surveys. Particularly, the MAAR played a leading role in the National Water Committee, with its Water Resources Division of the Irrigation Department controlling the development and use of water resources in the entire southern area.

On the other hand, having been responsible for the execution of the nationwide rural development program through the Five-Year planning in the North, the MAF accomplished various projects owing to a massive inflow of the IDA's funds and other multinational assistance. Such integrated rural development projects included the rural water supplies as one component of their schemes, leading to supplementing the performance of the RWSD in this field. In fact, the Yemen government sent a request to the government of Japan in 1985 asking for grant aid for the rural water supply project in the Al Jawf governorate which had been included in the integrated development program implemented by the MAF. All of these regional development programs have now been undertaken by the respective regional development authorities belonging to the MAF (now the MAWR).

(5) Ministry of Health (MOH)

The MOH is promoting the Primary Health Care Program (PHC) with assistance of the WHO for the improvement of health and sanitation in the rural environment, under which the medical facilities called the primary health centers are being installed mainly in the centers of the districts in the northern part. Medical staffs such as doctors and nurses, mainly African and Asian expatriates, are dispatched from the MOH. For the water sector, the MOH has once provided under this program the technical assistance along with equipment and materials to the RWSD.

(6) Local Councils for Cooperation and Development (LCCDs)
/Ministry of Local Administration (MLA)

Immediately after the termination of the revolutions in the 1970s, the governments of both states respectively organized local bodies for promoting rural development programs. In the northern part, the units of this organization, corresponding to the present LCCDs, were initially named the Local Development Associations (LDAs), and in the southern part, the Local People's Councils (LPCs) or the Local Cooperatives (LAs), which formed the basic units for the socialist agricultural production. After the unity in 1990, these organizations have been incorporated in the administrative structure of the united government, under the Ministry of Local Administration, playing a major role in promoting various local development projects such as road construction, etc., for the welfare of inhabitants and improvement of rural life. Their duties include the management, operation and maintenance of water supply facilities, and even those to be built under this Project are to be transferred to the respective LCCDs upon completion through the RWSD, whose main duty covers the planning, survey and construction of facilities. The situation of the LCCDs, therefore are treated in detail, in the following clause 2.3 as one of the executing agency of the Project as well as in clause 3.4.4 for the operation and maintenance scheme.

2.4 EXECUTING AGENCY

2.4.1 Rural Water Supply Department

The Rural Water Supply Department (RWSD), the Ministry of Electricity and Water (MEW) plays a role of the executing agency for the implementation of this Project. The Department undertook the same function in the preceding projects for the rural water supplies starting in 1977 with a loan, followed by the six phases of grant aid, from the government of Japan. It was established in 1972 in the then Ministry of Public Works, and in 1986 moved to the present MEW to which the National Water and Sewerage Authority has been attached, according to the government's policy to integrate the country's water sector.

The ongoing setup of the RWSD, with the numbers of staff members in the respective offices, are shown in Fig. 2.1. The country at the time of the organization of the RWSD was in the early stage of groundwater development, when with only a few private foreign firms capable of offering modern drilling equipment in the market, demand for drilling was surging as the government launched to propel its development planning. Under such circumstances, the RWSD started to undertake the drilling work for supplying safe and stable water to rural communities with the two units of rotary drilling machines donated by the USAID. In response to this situation, the UNDP/WHO joined in the promotion of rural water supplies in Yemen, dispatching experts and volunteers to the RWSD through a project of the *Strengthening of the Department of Rural Water Supply, Ministry of Public Works*. Since then, the Hydrogeology and Drilling Division for drilling and the Project Division in charge of facilities design in the RWSD have been its two mainstays.

As the Five-Year Plan progressively advanced, a drilling boom emerged in Yemen around the end of the 1970s to the beginning of the 1980s, with the rush of drilling companies established with foreign capitals as well as local ones, packing all over the country. Moreover, keen competition among enterprises resulted in a drastic cutback in the drilling cost. The RWSD at this point made an important decision to pull out its own drilling machines, since the employment of private contractors was judged to cost less and allow it a more efficient management to meet surging demand in this sector than its direct

Fig.2.1 Organization Chart of Rural Water Supply Department

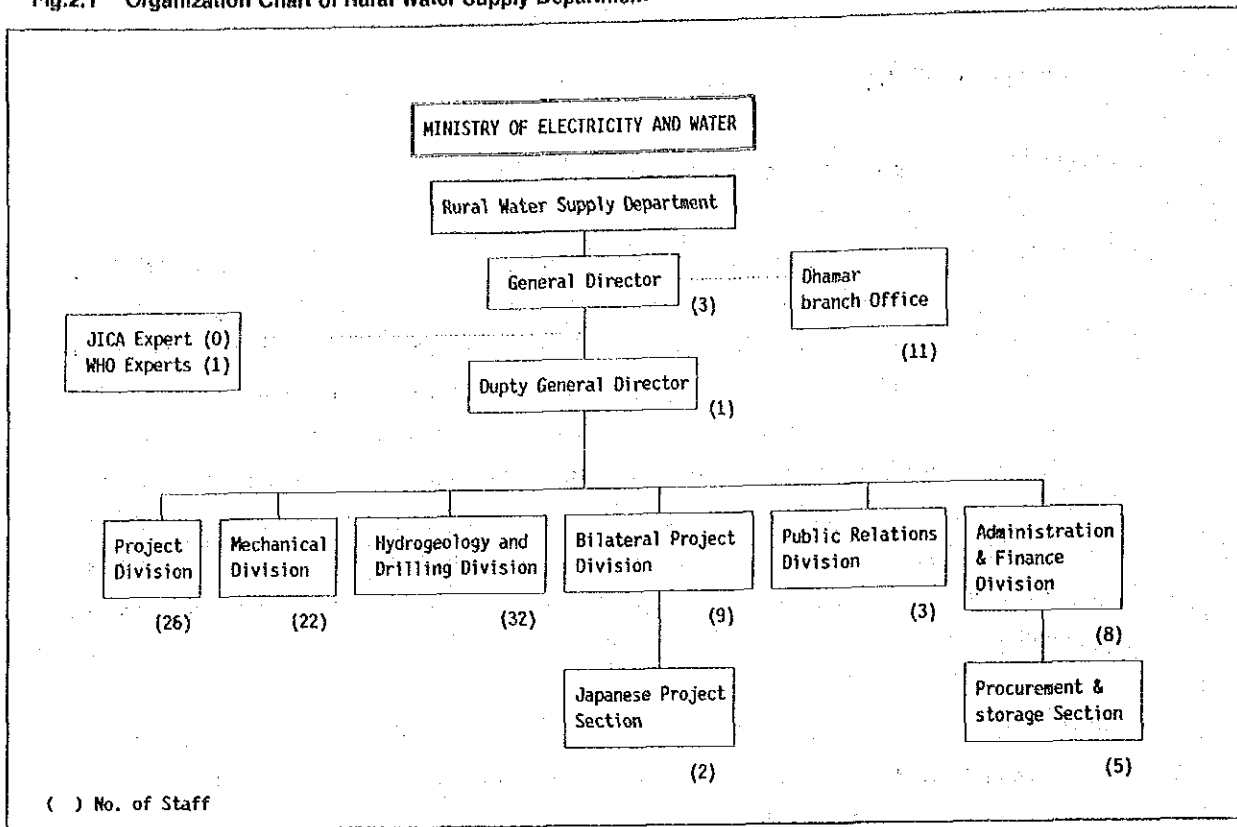
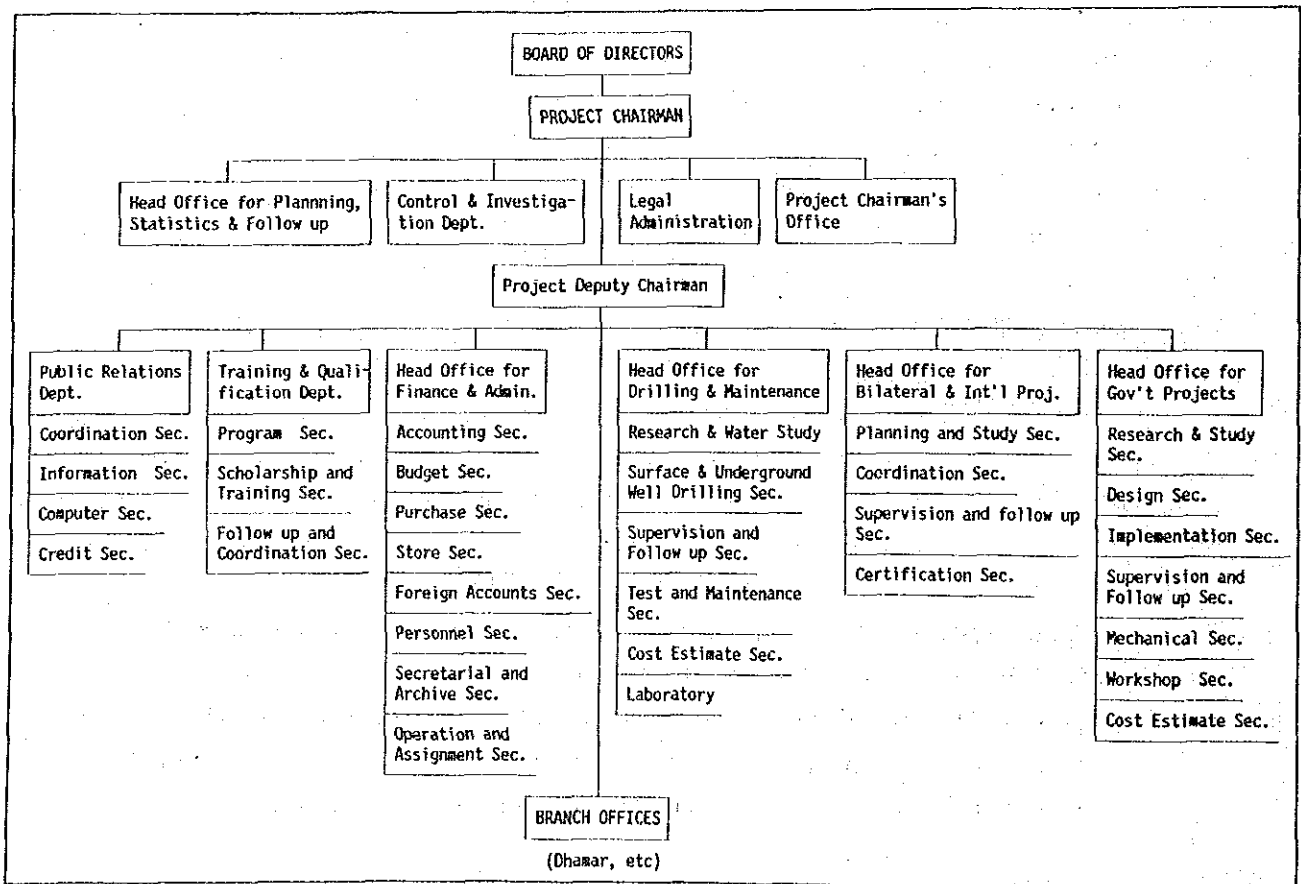


Fig.2.2 Organization Chart of Rural Water Supply Authority



engagement with limited human resources and machines. In recent years private enterprises over 100 in number at that time have shrunk, with capable ones which can be allowed to participate in the tenders in the RWSD limited to several in number, but the RWSD holds its stance to confine its duties to the planning, surveying and supervising of the projects.

Meantime the inhabitants' requirements for rural water supplies have gradually been transformed. Since the early 1980s when drilling grew a booming business, the better-off class represented by *sheikhs* among inhabitants began to install their wells with their own funds, increasing the number of successful wells across the country where the natural conditions are more favorable. With the increase of owners of available water sources among inhabitants, their main concerns started to shift to the more convenient water facilities connecting such sources in the wadi lowlands to their dwelling areas far up the mountains, particularly in the greater part of the northern part where the rugged mountainous terrain is prevalent. Meanwhile the expansion of groundwater development all over the country has nearly reached its limit in recent years, and the cases of the development in less favorable environments are growing common. As a whole, therefore, the rural water supply projects now tend to be constrained by technical difficulties as well as massive investments required for the implementation, and the activity of the RWSD has been strained by the lack of both human and financial resources.

As one of measures to cope with such difficulties, the RWSD has planned to reorganize its setup into that of an authority which can be allowed an increased volume of budget and autonomous judgement. In 1990 after it was ordered to add the merged southern part's rural areas to the northern ones, the RWSD officially proposed to the government its restructuring plan for the authority under the umbrella of the MEW. This proposal was for a while suspended amidst the flurry of the unification, but was presented to the cabinet meeting as one of the subjects for its discussions during June 1991. It is under process to be transferred from the cabinet meeting to the parliament for its final approval. A planned organization chart of the authority is shown in Fig. 2.2 for reference.

Table 2.2 shows the summary of the RWSD's past performance from 1972 to 1989. According to this table, in the end of 1989 under the third Five-Year Plan, the coverage of the rural water supplies was 53% among the rural population of 7,843,000 in total and 51% against the total number of villages (*Qaliyas*). Since the corresponding figure of that in the southern part in the same period was 23.8% against the entire rural population of 1,645,000, the RWSD estimates the coverage in the merged state to be about 50%.

For reference, the RWSD's budget planning for the year 1991 is shown in Table 2.3. Its average annual spending in local currency from 1987 to 1989 during the third Five-Year Plan is estimated to have been approximately YR80 million. For the new undertakings which can not be covered by the budget, the RWSD must seek to secure the support of the bilateral assistance, and this tendency is not likely to change any time soon. The details of such assistance so far received by the RWSD are referred to in the following clause 2.5.

2.4.2 Local Councils for Cooperation and Development (LCCDs)

Upon completion of the construction work, the LCCDs take over the facilities for the service through their operation and maintenance to the inhabitants in the respective sites. The outline of their profiles are described hereunder.

A unit of the LCCDs is respectively installed in each district (*Nahiya*) of the northern part, consisting of members elected by the popular votes in 1985. The predecessors of the LCCDs were the LDAs (the Local Development Associations) organized soon after the revolution for the promotion of local development under the direction of the CYDAs (the Confederation of Yemeni Development Associations) established in 1973 under chairmanship of president. The members of the former organization of the LDAs were decided on the basis of self and mutual recommendations among the inhabitants in the local communities, while those of the LCCDs were selected by secret ballot in the first democratic elections through the country's history with 1.5 million people involving some women casting their vote. After the unification, the LCCDs have now directly been connected to the central government through the incorporation into the bureaucratic structure of the Ministry of Local Administration.

Table 2.2 Achievement of Rural Water Department from 1969-1989

Rural Water Supply	Year	Designed Projects	Population	Implemented Projects	Number of Villages	Population Benefitted	Total Cost
Before third Development Programme	69-72	19	172,000	19	333	172,000	3,026,000
The third Development Programme	72-75	34	108,800	34	595	108,800	9,211,000
First Five Year Plan	76-81	466	1,550,000	617	10,115	1,387,000	408,556,815
Second Five Year Plan	82-86	789	2,142,000	891	15,610	2,049,000	613,883,049
Third Five Year Plan(until 1989)	87-91	375	1,661,600	275	3,963	458,000	305,958,566
Total		1,683	5,634,000	1,836	30,616	4,174,000	1,340,635,430

The percentage of beneficiaries population to the number of rural population 53%

The percentage of beneficiaries villages to the number of villages 51%

Rural population 7,834,300

Number of cities and villages in the country 60,000

Table 2.3 Summary of the RWSD's Budget Planning
for the Year 1991

	DESCRIPTION	NUMBER OF PROJECT	TOTAL REQUIRED AMOUNT (YR)	PROPOSED AMOUNT FOR 1991 (YR)
A	<u>PROJECTS UNDER IMPLEMENTATION</u>			
1	CIVIL WORKS	63	46,162,000	41,545,000
2	DEEP WELLS	49	14,000,000	11,320,000
3	PUMPS	31	10,320,000	10,320,000
	TOTAL		70,482,000	63,185,000
B	<u>PROJECTS UNDER TENDER</u>			
1	CIVIL WORKS	47	74,000,000	34,850,000
2	DEEP WELLS	169	47,000,000	33,732,000
3	PUMPS	33	20,100,000	15,110,000
	TOTAL		142,000,000	70,992,000
C	<u>PROJECTS UNDER ANNOUNCEMENT</u>			
1	CIVIL WORKS	84	104,238,000	24,750,000
2	DEEP WELLS	-	-	-
3	PUMPS	33	15,190,000	15,190,000
	TOTAL		119,428,000	39,940,000
D	<u>PROJECTS NOT YET RECEIVED LIST FOR SOUTHORN GOVERNORATES</u>			30,000,000
E	<u>RESERVE AMOUNT FOR EXCEPTIONAL ORDERS</u>			10,000,000
TOTAL			371,910,000	214,117,000

The LCCDs are responsible for the administration of local development projects ranging from the inhabitants' grass-roots movements to the construction and maintenance of the feeder roads and management of the medical facilities and schools. The rural water supplies fall within their main duties, and since the era of the LDAs they have been undertaking to install facilities with their own funds, mainly concentrating on the drilling of deep wells. The improvement of water supplies within their territories is now among their major concerns, particularly where there are no such facilities, and they are in an influential position to press for the undertakings to the governmental agency in charge. (The RWSD had formerly received numerous requests for water supply projects from local powers such as sheikhs, but its basic policy is now to accept those only from the LCCDs.)

The facilities constructed under the previous Japanese projects have since been operated and maintained mostly by the LCCDs responsible for the respective sites, supported by the function of the RWSD in this stage to offer technical service by its engineering staff in case there is a trouble with the facilities unmanageable by the LCCDs' operators as well as to provide spare parts. Furthermore, the LCCDs play an important role in the construction work of the Project, undertaking such responsibilities on the Yemeni side as the construction of accesses, the repair of roads, acquisition of lands necessary for the facilities, etc. through the coordination with the direct beneficiaries in the Project sites. During the field survey for this basic design study, the team had an opportunity to discuss with the representatives of the LCCDs in most of the sites. During the execution of the Project, further contacts with them through the RWSD are anticipated to become necessary to arrange the smooth progress of the construction work.

Meanwhile, the southern part had no agency matching the RWSD in the northern part, with its rural water supplies entirely controlled by the respective local bodies of the Local People's Councils (LPC). They had run the socialist agricultural production, occupying about 70% of the entire cultivated areas of the southern part, but a move to dissolve this system reportedly is under way. Since the united government has assigned the job of rural water supplies in this part to the RWSD as well, the function of the LPCs will be transformed to that of their counterparts in the northern part, whether they might remain in the same names or take those of the LCCDs.

2.5 DEVELOPMENT ASSISTANCE

2.5.1 Trend of Development Assistance

Development assistance for this country covers every sector involved in the government's planning, mainly as grant and loans of easier terms. International and regional organizations such as the IDA and the Arab Fund for Economic and Social Development have made distinguished contributions for the development programs of agriculture and basic infrastructure in the two states. In the past, outstanding bilateral assistance came from the gulf states represented by Saudi Arabia and the USSR, but in the wake of the Gulf war aid from the former states has drastically dwindled.

Japan provided to the Yemen Arab Republic between 1 to 2 billion yen in grant aid yearly since 1982, while Germany and the Netherlands hold annual negotiations with the country, the former pledging assistance amounting to about \$27.6 million in grant in November 1990 at the height of the Gulf crisis (nearly its half was for the road construction). The US's aid to Yemen in its 1990's fiscal year was \$43.5 million, consisting of \$20 million in concessionary commodity loan for rice and corn, \$17.25 million in development grant and \$1.5 million in military aid and training, while that for 1991 is a package of \$10 million commodity loan and \$20.5 million grant aid.

Japan's aid to the Yemen Arab Republic started with food aid in 1976. In the next year, 1977, the Exchange of Notes for the loan agreement for the rural water supply project was concluded. (With the ceiling amount of the loan set at 3.88 billion Japanese yen, it ended up in 3.844 billion yen in actual spending.) The food aid was later switched to the aid for increased food production, which up to now has continuously been offered each year. The assistance for the rural water sector was shifted to grant aid after the first loan and continued for six phases covering 20 sites across the country. For the medical sector, the National Tuberculosis Centers were installed in the three largest cities of the country including Sana'a between 1984 and 1986, and those facilities have been run through Japan's technical assistance since the commencement of their operations. On the other hand, Japan provided aid to the southern part from time to time, including those for food supply and development of fisheries. The latest one is a loan for the extension of telecommunication

network in Aden with a ceiling amount of 6.99 billion yen. In the northern part another loan project of 22.07 billion yen is now underway for the construction of the Mafraq cement factory with an annual production capacity of 500 thousand tons. This plant follows the first one, the Amran cement plant with the same capacity, which was completed in 1982 under financing by the Japan Export and Import Bank. The details of Japan's ODA to both the Yemen Arab Republic and the People's Democratic Republic of Yemen are shown Appendix II-c.

2.5.2 Assistance to the Water Sector

The real development of the water sectors in the two countries for both urban and rural areas started in the 1970s after the termination of the revolutions when updated types of drilling machines were introduced for the development of groundwater resources on which both parts are critically dependent. From the first, this sector has heavily been counting upon development assistance, and this trend is likely to stay for the time being.

The urban water supply in the Yemen Arab Republic started in the mid 1960s when a water supply system was installed in Taizz, the former capital of the Imam kingdom, with aid from the USAID. In 1973, those for the present capital of Sana'a and a northern port of Hudaydah were completed with assistance of the IDA and the Arab Fund for Economic Social Development (AFESD). On the other hand, the improvement of urban water sector in the People's Democratic Republic of Yemen is owed to the IDA, which offered \$4.1 billion by 1988 for the plan for the five large cities including Aden. Currently, the focus of this sector is shifting to the local cities for which Germany, the Netherlands, etc., have been playing an important role.

Meanwhile, assistance to the rural water sector in the northern part has been offered directly to the RWSA or through the rural development program executed by the regional development authorities under the former Ministry of Agriculture and Fisheries. Those to the former were mostly grants, while those to the latter came mainly from the IDA. Its counterpart in the southern part depended upon technical assistance from the UNDP. Its Third Indicative Planning Figure (IPF) for the period from 1987 to 1991 had a share of \$100 thousand for supporting the rural water supplies in the BHN sector out of its total amount of \$14,930 thousand.

Table 2.4 lists all the bilateral and multilateral assistance to the RWSD since its establishment for the development of the rural water sector in the Yemen Arab Republic. The major donors are Japan, Saudi Arabia, the United States, Germany and the Netherlands, all of which have continuously been extending assistance to this office, dividing it into several phases. Assistance from these countries have various features described as follows:

(1) Japan

Japan offered assistance to the country's rural water sector comprising a project of 3.844 billion yen in loan, which commenced in 1977 and completed the facilities in 42 sites in 1983, and the subsequent grants with a total amount of 3.795 billion yen for six phases during the period from 1981 to 1989 covering 20 sites across the country. These projects were executed, based upon Japan's grant aid system, taking into account various conditions of sites across the country, and most of the completed facilities, composed of quality-controlled products of Japanese make, demonstrated satisfactory performance and have been appreciated by the recipient local communities as well as the executing agency. Further details on the diverse features of Japan's grant aid are presented in Clause 2.6.

(2) Saudi Arabia

The government of Saudi Arabia began its assistance to this sector immediately after the end of the revolution in 1973 in the Yemen Arab Republic, to install water facilities featuring the deep well sources in 36 sites all over the country. This project is said to have initiated to displace the water sources of traditional hand-dug wells or cisterns with drilled deep wells in the rural areas of this country, while the supply facilities, a package of a reservoir, a public fountain and an animal feeder in the respective sites, were collectively installed around the water sources. (The project was implemented under the supervision of engineers from the Ministry of Agriculture and Water Resources Development of the Saudi government until 1978.) Further in 1983 the Saudi government started the second phase to install water supply systems in 50 sites. After the completion of 17 sites in its first stage, the work for the second stage came into halt

Table 2.4 Foreign Aid to Rural Water Supply Department

COUNTRY (ORGANIZATION)	PHASE	YEAR	TYPE	AMOUNT (F/C)	AMOUNT (YR)
ABDHABI			EQUIPMENT/MATERIALS SUPPLY		12,000,000
			E/M SUPPLY		2,670,000
STATE OF QATAR			E/M SUPPLY + TECHNICAL COOPERATION		26,000,000
UNCDF	1		TECHNICAL COOPERATION		10,000,000
WHO	2		CONSTRUCTION		215,803,000
JAPAN	1	1982-89	CONSTRUCTION	¥500,000,000	
	2		CONSTRUCTION	¥500,000,000	
	3		CONSTRUCTION	¥600,000,000	
	4		CONSTRUCTION	¥319,000,000	
	5		CONSTRUCTION	¥915,000,000	
	6		CONSTRUCTION	¥961,000,000	
GERMAN	1	1984	E/M SUPPLY CONSTRUCTION	DM5,000,000	13,016,000
	2		CONSTRUCTION	DM5,000,000	37,500,000
KINGDOM OF SAUDI ARABIA	1	1973 1983		YR43,940,000	236,940,000
	2			SR100,000,000	
KINGDOM OF THE NETHERLANDS	1		CONSTRUCTION	DG4,450,000	92,528,000
	2		CONSTRUCTION	DG7,350,000	
	3		CONSTRUCTION	DG10,000,000	
	4		CONSTRUCTION	DG8,000,000	
U. SAID	1	1980 1984-89	CONSTRUCTION	\$6,600,000	49,500,000
	2		CONSTRUCTION	\$12,500,000	90,500,000
UNICEF (PHC)			E/M SUPPLY CONSTRUCTION		13,886,000
SWISS		1974	E/M SUPPLY	\$4,950,000	3,583,000
JAPAN		1978-83	CONSTRUCTION	¥3,880,000,000	65,425,000
REPUBLIC OF IRAQ			CONSTRUCTION		25,000,000
ARAB FUND		1984	E/M SUPPLY	KD700,000	12,530,000

because of the outbreak of the Gulf crisis/war, and has since been suspended. This project involves part of the sites surveyed by Japan's social development study in 1979/1980. The facilities for this phase are intended for the improved water supply system containing distribution lines.

(3) The United States

It was in 1980 that the USAID launched the first phase for the rural water supply project, as Japan was preparing for the implementation of its loan project. The USAID's line for this sector used to supply equipment and materials such as pumps and pipe and engage in construction of supply facilities for water sources drilled by the RWSD instead of directly undertaking drilling work. The project was managed by an American contractor without hiring a consultant under the direction of the local office of the USAID. Skilled and non skilled labor was locally recruited by the contractor for the construction work in the sites, the selection of which was made through the negotiations between the RWSD and the contractor each year within the framework of the allocated budget. In 1988 when the second phase finished, the USAID announced to withdraw from this sector, but is said to intend to come back with a plan for the third phase involving 42 sites.

(4) The Federal Republic of Germany

The former West Germany joined in the rural water sector in 1977 when it started the implementation of a project for Al Mahabisha in the Hajjah governorate, with its source in mountain springs. Including the supply of electricity to the area besides the water supplies, the entire project was executed under charge of the Yemen General Electric Corporation belonging to the Ministry of Electricity and Water. A direct assistance to the RWSD was offered in 1982 as an emergency supply of equipment and materials for water supply facilities such as pumps, pipe, steel water tanks, generators, etc., to help villages in the earthquake-stricken area of the Dhamar governorate. Later in 1987, it launched a regional water development program for the entire area of the Arhab district comprising about 120 villages in Sana'a governorate. The project has so far completed the stage for the

study, and is scheduled to proceed to the drilling of 15 deep wells this year. The contractor is to be hired through the international tender. The design of water supply facilities remains yet to be done until the successful results have been obtained through drilling.

(5) The Netherlands

The Dutch project dates back to 1979 when the first phase was executed in the same style of implementation as that of the Japanese project, including drilling work which entailed a great deal of difficulty. Since the second phase, it has been concentrating on the installation of supply facilities for the deep well sources drilled by the RWSD. Its planning, designing and supervising are performed by the Dutch consultant, while the construction work is carried out by local contractors awarded the contract through the local tenders. Its operation for this sector has been promoted mainly in the governorates of Dhamar, Ibb and Hudaydah in the Tihama plain where its agricultural projects have successfully been developed.

While the bilateral projects thus continue to promote rural development through the construction of water facilities, the WHO has been offering overall support to the RWSD since its establishment through technical assistance involving experts and volunteers. Other international agencies such as the UNDP and the UNICEF also maintain a close tie with the RWSD through their branch offices in Sana'a, providing it with technical assistance including the dispatch of experts and supply of equipment and materials based upon the Primary Health Care Program, etc.

A new plan is now underway in the RWSD to construct water supply facilities for 13 sites located in the former border area between the northern and southern parts with the assistance of the UNDP/UNCDF which contributed for long to the development of the rural water supplies in the southern part as well as the northern one. Aimed at supporting one of the united government's major policies to expedite a substantial merger of this area for urgently abolishing the former border, this project plans to install common facilities to be shared by villages which were previously confronted with each other across the border.

2.6 FEATURES OF JAPAN'S ASSISTANCE

2.6.1 Features of Preceding Projects

Japan's previous assistance to the rural water sector in the Yemen Arab Republic is roughly divided into three groups: a loan project by the Overseas Economic Cooperation Fund (OECF) which commenced in 1977; grant aid projects for three phases, based upon the preliminary survey followed by the development survey by the Japan International Cooperation Agency (JICA) in 1986/1987; and grant aid projects for three phases, based upon the basic design study by the JICA in 1986/1987. The grant aid projects were executed for six phases in total. The outline of these projects are summarized in Table 2.5, and their various features are described as follows:

Table 2.5 Assistance of the Government of Japan for the Rural Water Sector in the Yemen Arab Republic

Category	Date of Exchange of Notes	Amount (Mn Yen)	No. of Sites	Planned Population	Remarks
Loan	15/ 6/1977	3,844	42	150,000	Initial plan for 50 sites; LDC untied int'l tendering
Grant I	17/11/1981	500	5	9,780	Feasibility study covered 26 sites.
Grant II	19/ 6/1982	500	2	9,110	
Grant III	30/ 7/1983	600	5	9,455	
Grant IV	14/ 4/1987	350	3	2,480	Basic design study covered 10 sites.
Grant V	21/ 7/1987	915	3	16,940	
Grant VI	5/ 9/1988	961	3	14,510	

(1) The Loan Project

The project proceeded in the following steps:

- a. Feasibility Study: June 1976
- b. Exchange of Notes: June 1977
- c. Loan Agreement: August 1977
- d. Detailed Design: From April 1978 to October 1979
- e. Construction: From 1980 to August 1983

The initial study of this project planned to focus on the installation of drilled deep wells or shallow wells in 50 sites with a package of supply facilities in the vicinity of the water source. Following a successful example of the foregoing Saudi project for 36 sites, which had been under construction since 1975 after the survey in 1973 under a control of the executing agency of the RWSD, this plan was intended to urgently develop safe and stable water sources in as many rural communities as possible in country which had long been dependent only on hand-dug wells and cisterns.

However, in the late 1970s when the implementation of the loan project started, an abrupt drilling boom had been on the rise across the country, and people's concerns began to shift to the improved supply systems complete with long transmission and distribution lines for service in dwelling areas on the mountainsides. In such circumstances, the project design was compelled to make a revision for the improved systems under strong pressure of the requests from inhabitants during the course of drilling work prior to the installation of facilities. The fund necessary for this extensive design change was entirely financed by the Yemen government. As a result of this alteration, the Japanese side was held responsible for the works from water sources in the wadi to tanks on the mountains such as drilling, pumping facilities, a major part of transmission lines and reservoirs over 100 m³ in volume, while the Yemeni side undertook the construction of pump houses, reservoirs less than 100 m³ and distribution lines and service facilities. Consequently, the water supply systems constructed under this project are all composed of the facilities combining those built with the Japanese assistance and those with the Yemeni fund.

The Overseas Economic Cooperation Fund (OECF), Japan's official lending agency, dispatched an evaluation mission of the project in 1985. While recognizing the enhanced convenience of house connections locally completed after the alteration to improved systems in the midst of rugged mountains, it presented to the Yemen government a strong recommendation on the future projects to formulate an appropriate basic plan reflecting the inhabitants' needs under the close coordination between the executing agency and the local responsible bodies such as the LDAs. According to

the mission's survey on the operation and maintenance of completed facilities with house connections, the water rates in the communities with a meter system ranged from YR9 to YR13 for one cubic meter, while those of a fixed rate charging system were from YR20 to YR50 monthly for each household. These water rates were found to have been kept at a level below 5% of an average income of households, to which the mission gave its approval. This project underwent another follow-up survey in 1989 by the Japanese expert in water administration who had been dispatched to the RWSD in 1988. He reported cases of suspended operation in part of the sites due to troubles with equipment as well as those where the water sources had drastically decreased yields or run dry, asking for urgent measures for their restorations. His survey revealed that the water rates through a meter charging then were from YR1.5 to YR30 per m³, while those of a fixed allocation to households were from YR12.5 to YR233 monthly, though most of them were less than YR100.

(2) Grant Aid Projects from Phase I to Phase III

The procedure for these projects are summarized as follows:

- | | |
|------------------------|-----------------------------|
| a. Preliminary Study: | From Nov. 1978 to Mar. 1979 |
| b. Development Survey: | From Sep. 1979 to May. 1980 |
| c. Exchange of Notes: | Phase I - November 1981 |
| | Phase II - June 1982 |
| | Phase III - July 1983 |
| d. Completion | March 1985 |

The development survey initially assumed another loan subsequent to the first one for the project, which had been named "the Rural Water Supply Project, Phase II". However, with the strong request on the Yemeni side, it was altered to grant aid, and its implementation continued for three consecutive years. The concept of the design for the projects followed the foregoing case of the loan project: the facilities were basically of improved type, but the scope of responsibilities of the Japanese side was confined to those from water sources to reservoirs on the mountains, since distribution lines from the reservoirs to villages composing the sites required spiraling costs. Accordingly, the installation of distribution lines were handed over to the Yemeni side including

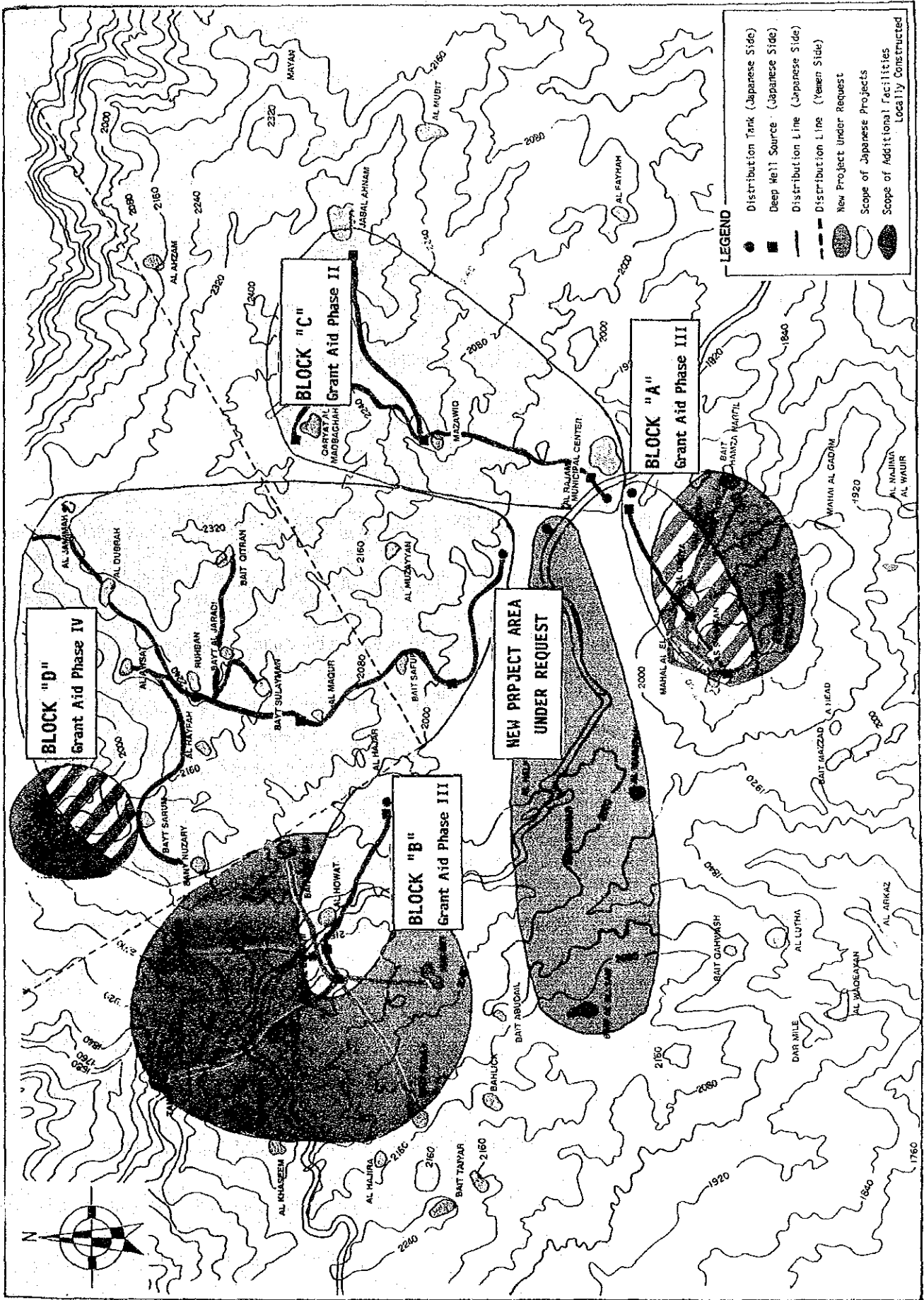
the RWSD and the LDAs, the then local authorities for development projects. The work of the Japanese side included, however, service lines of several hundred meters in length to the nearest villages to the reservoirs.

During this stage of grant aid, typical facilities were constructed in three sites of the Ar Rajam district in the Al Mahweet governorate about 120 km northwest of the capital of Sana'a. The present basic design study picked up these sites for the follow-up survey to review the current conditions of previous projects. Table 2.6 summarizes the contents of these three projects, with their locations indicated in Fig. 2.3. (This area includes a new project site, Bait Al Sultan, under the request for the study, and its location is also indicated in the same diagram.)

Table 2.6 Grant Aid Projects during Phases II and III in the Ar Rajam District

Phase	Site Name	Main Facilities	Planned Population
Phase II Completed Mar. 1984	BLOCK "C" Ar Rajam City (Center of District) and Bani Habash Area	Deep well x 1 No.	5,110
		Water tank x 4 Nos.	
		Transmission lines x 5,526 m	
		Service line x 700 m	
Phase III Completed Mar. 1985	BLOCK "A" As Sanafan Area	Deep well x 1 No.	3,420
		Water tank x 3 Nos.	
		Transmission lines x 1,870 m	
		Service line x 235 m	
	BLOCK "B" Bait Al Bishari Area	Deep well x 1 No.	3,215
		Water tank x 3 Nos.	
		Transmission lines x 2,980 m	
		Service line x 200 m	

Fig.2.3 Location Map of Grant Aid Project in Ar Rajam District



The preceding grant aid projects in the Ar Rajam district included the city zone of Ar Rajam, district's center, and the villages dispersed in the mountainous area surrounding the city in the wadi basin were grouped into four blocks, based upon their topographical and administrative divisions, where the individual water supply systems were constructed. The deep wells for their systems were all drilled in the wadi basin in and around Ar Rajam city, due to specific hydrogeological conditions of this area. (For details, refer to the descriptions in Clause 3.4.10 for Bait Al Sultan.) Therefore, their water transmission facilities contained one or two booster stations on the way from the deep well sources to the final distribution tanks on the mountains. However, distribution lines from the tanks were not provided, as explained before.

The follow-up survey of these sites were carried out in June 12, 1991, with its results described as follows:

1) BLOCK "C": Ar Rajam City and Bani Habash Area

Without distribution lines, the water supply in this area was initially carried out in the city zone only at the public fountains. In recent years, however, a committee was organized, consisting of chairman of the LCCD and the two influential sheikhs of the area, for promoting water service. Through its activity, additional facilities were installed in places, including house connections within the city, distribution lines in places and a pumping unit transmitting water to part of separate villages at a higher location. The costs were borne by the beneficiaries of such extensions within the site. The committee now employs three full-time operators for a salary of YR1,500 per person, and collects water bills at a rate of YR15 per m³ of metered consumption in each household. Large households tend to use about 6 m³ every month, and average ones, 2 to 3 m³ per month. The incomes from operation of facilities are spent for such O/M cost as fuel cost and operators' salaries. At the moment the management of the facilities is being run smoothly, thanks to their good serviceable condition.

2) BLOCK "A": As Sanafan Area ; BLOCK "B": Bait Al Bishari Area

The inhabitants in these areas waited for the installation of distribution lines through the efforts of the RWSD, refraining from using the facilities for a while. After they had been aware that the RWSD was not in a position to launch the work due to hard shortages of fund, the sheikhs of these sub-district areas took their own steps with the consent of the inhabitants to install distribution lines with the costs shared by all the beneficiaries. Due to the complicated terrain of the sites, lines have not yet reached all the villages, but each area has so far completed them to about 10 villages. The installed lines, however, are small in size, mostly 1" to 1-1/4" through which a supply rate is estimated to be only 10 to 15 liters per capita per day, in view of populations of the respective villages. Even in the center of Ar Rajam city, an average consumption is reportedly about 2 to 3 m³ per month, indicating a similar level of unit supply rate as those in these mountainous areas. A water consumption pattern, therefore, is supposed to be quite similar all through this district. The water rates in these areas are also at a similar level to that in the city.

Fig. 2.3 shows the outline of the distribution lines completed with the funds of inhabitants themselves. In this district, the LCCD is not powerful enough to exert its control over the water supply facilities, and the existing ones have been managed by the respective communities headed by sheikhs. This management system seems to have been run without causing any critical problems in the sites reviewed this time. Meanwhile the RWSD is not in a position to directly concern itself in the operation of transferred facilities. It is responsible, however, for technical service, and based upon the request from the local community, it recently dispatched an engineering staff to repair a generator in the facilities for Block B, the Bait Al Bishari area. Through the review of the facilities for the three sites this time, it is considered that the RWSD should extend continued assistance to them in both technical and administrative aspects, since the locally performed extension work as well as the ongoing management system remain yet to reach a satisfactory level.

(3) Grant Aid Projects Phase IV to Phase VI

- a. Basic design study: From Oct. 1986 to Mar. 1987
- b. Exchange of Notes: Phase IV - April 1987
Phase V - July 1987
Phase VI - September 1988
- c. Completion: March 1990

The grant aid projects during this stage from Phases IV to VI feature distribution lines extended to a larger part of the villages composing the respective sites, based upon the plan under the basic design study. In larger-scale sites, remote villages were outside the scope of distribution lines, although the pipe totaling about 40 km in length was installed in two such sites included in Phase VI. However, after the completion and delivery of the projects in 1990, the RWSD was obliged to resume the work to further extend lines to such remote villages with its own fund, in compliance with the request from the concerned local communities.

The review of the previous projects by the study team was aimed at another site in the Ar Rajam district where facilities of a large scale were completed during Phases V and VI, along with those during the preceding stage of Phases II and III. The results are reported as follows: (The location of the site are shown in the same map in Fig. 2.3, together with other three sites and a newly planned site of Bait Al Bishari.)

Table 2.7 Grant Aid Project during Phases V and VI in the Ar Rajam District

Phase	Site Name	Main Facilities	Planned Population
Phases V and VI Completed Mar. 1990	BLOCK "D" Bait Al Bishari Area	Deep well x 1 No.	6,070
		Water tank x 3 Nos.	
		Transmission lines x 3,284 m	
		Distribution/Service Lines x 12,089 m	

1) BLOCK "D" : Bait Al Jaradi Area

The project for this area was completed in March 1990. The major difference between it and those for other three areas in the district is that the former includes distribution lines stretching to 16 villages composing it, in accordance with the plan in the basic design study. However, after the completion, the RWSD further managed to extend branch lines of 2" in size with a length of about 3.5 km to another two villages outside the scope of the planning. (Refer to Fig. 2.3 about its scope.) The operation of the facilities had just started several months after the completion of this additional line when the review of the project was carried out by the study team in June 1991. The facilities are now being run by the local community itself under the control of the sheikh after they negotiated with the LCCD, since the latter proposed the facilities should be operated by the villages in the same manner as those completed in the preceding stage of Phase II and III. In this area, however, the inhabitants are yet to agree on the shares of operation and maintenance cost, and the water is now being supplied to only one fourth of 18 villages to which distribution lines have been extended. Under such circumstances, the facilities have so far been put to work only once every 10 days or so. The study team called on the representative of the RWSD who guided the site to direct the community into the earlier commencement of full-scale operation.

According to the survey in one village which is now receiving the supply from the new facilities, the water rate is YR20 per m³. Although it's slightly higher than the ongoing ones in other areas of the district, it is almost one seventh or one eighth of former prices of selling water in these mountainous areas, definitely alleviating inhabitants' economic burden. House connections are possible to be realized soon in this area, but under the present situation of the entire communities of the site, there are no such plans underway.

This area has been given a far more complete system with adequate distribution lines than other three areas through the implementation of the project. However, its management has

entirely been left to the autonomy of the community, with the facilities currently remaining far from the condition of a full-scale operation. Meanwhile, the RWSD is in a stance only to extend technical service to this area after it has transferred the facilities to the local community. However, in view of the present situation of the site, it is advised to take more positive steps for directing the community through the LCCD for the effective management of the system at this point of the beginning of the operation. (P.S. During the visit of the mission for the draft report consultation in November 1991, it was reported by the RWSD that the local community launched a full-scale operation in September with a staff of four full-time operators and four guards.)

It is noted at this point that the development survey in 1979 and 1980 conducted the study of 26 sites in the five governorates of North Yemen, among which the plans for the ten (10) sites were implemented through the six phases of grant aid from Japan.

The sites other than those implemented with Japan's assistance were handled partly by the RWSD itself (8 sites), and partly by assistance from Saudi Arabia (5 sites in Phase II), and all the sites except those where no water sources were available were implemented or is now under construction.

2.6.2 Major Points in the Preceding Projects

Major points in the preceding project with Japan's assistance are summarized as follows:

(1) Water Sources

The sources for the water supply systems in Yemen are relying upon groundwater resources, which are decisively scarce due to scanty rainfall under the prevalent arid climate in general. Furthermore, since the greater part of its land is occupied with rocky terrain, groundwater makes its course along lineaments, fissure zones through rocks, which were formed through a wave of large tectonic movements. Across the country, groundwater development through zones of major lineaments is ongoing, leading to drastic fall of water levels in places due to overexploitation. The recent development of new sources, therefore, has become

growingly difficult. Concerning Japan's preceding projects, the ratios of successful wells were about 70% in the loan project and 80% in those with grant aid respectively. One of the main reasons for unsuccessful wells was that the locations of drilling were basically confined to the limits of concerned project sites. Attempts to develop new sources beyond such limits often fell into failure due to difficulty in settling agreement among concerned communities. The basic design study on new projects this time, however, includes three (3) sites where arrangements to locate drilling points outside their limits have readily been settled between the villages through the coordination of the responsible LCCDs, reflecting their growing influence among local communities. This trend is expected to grow further from now on, although such measures would result in the expanded scale of water supply systems for rural areas, involving increased construction costs.

(2) Water Supply Facilities

The problem other than water sources in the preceding projects was raised with the scopes of distribution facilities including lines from tanks to villages in the sites of mountainous areas. The basic policy of design until the end of grant project in Phase III was as follows:

- 1) A final distribution tank shall be installed on a more elevated location of the area to enable the supply of water by gravity to most of the villages composing the site.
- 2) The tank shall have a service or a portion of distribution line reaching the nearest village with a public fountain (In most cases of grant projects, such lines were several hundred meters long, while in the loan project, facilities including pipelines were entirely installed by the Yemeni side.)
- 3) Main distribution lines from the tanks shall be installed by the Yemeni side. For this purpose, the distribution tanks were designed to have necessary connections.

For the subsequent stage of grant projects, the policy was altered to extend distribution lines to most of villages composing the sites, even those covering an extensive area. (The largest one during this stage was the Shihara district in Phase VI, comprising 22 villages, where the project installed distribution lines to 15