No.

GENERAL AUTHORITY FOR
RURAL WATER SUPPLY PROJECTS
MINISTRY OF WATER AND ENVIRONMENT
THE REPUBLIC OF YEMEN

RURAL WATER SUPPLY COMPONENT OF THE STUDY FOR WATER RESOURCES MANAGEMENT AND RURAL WATER SUPPLY IMPROVEMENT IN THE REPUBLIC OF YEMEN

FINAL REPORT

MAIN REPORT

NOVEMBER 2007

JAPAN INTERNATIONAL COOPERATION AGENCY

JAPAN TECHNO CO., LTD.
EARTH SYSTEM SCIENCE CO., LTD.

GE
JR
07-068

EXCHANGE RATE used in Report

Based on average of rates since 6 months from 31 October 2007

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YR1.00 = ¥0.602

where,

US$: United States Dollar

¥: Japanese Yen

YR: Yemeni Rial

PREFACE

In response to a request from the Government of the Republic of Yemen, the Government of Japan decided to conduct a study on the Rural Water Supply Component of the Study for Water Resources Management and Rural Water Supply Improvement in the Republic of Yemen and entrusted the study to Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Shoji Fujii of Japan Techno Co., Ltd. and consists of Japan Techno Co., Ltd. and Earth System Science Co., Ltd. between December 2005 and October 2007.

The team held discussions with the officials concerned of the Government of Yemen and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

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

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Yemen for their close cooperation extended to the study.

November 2007

Ariyuki Matsumoto
Vice President
Japan International Cooperation Agency

November 2007

Mr. Ariyuki Matsumoto
Vice President
Japan International Cooperation Agency
Tokyo, Japan

LETTER OF TRANSMITTAL

Dear Mr. Matsumoto:

We are pleased to submit to you the study report on the Rural Water Supply Component of the Study for Water Resources Management and Rural Water Supply Improvement in the Republic of Yemen.

The report presents the study results on formulation of a plan for rural water supply improvement for 23 rural sites in 5 governorates of Al Mawheet, Sana'a, Dahmar, Ibb and Taiz. The report also includes an action plan for capacity development of the General Authority for Rural Water Supply Projects (GARWSP) headquarters and 3 branch offices in the governorates of Al Mawheet, Sana'a and Dahmar.

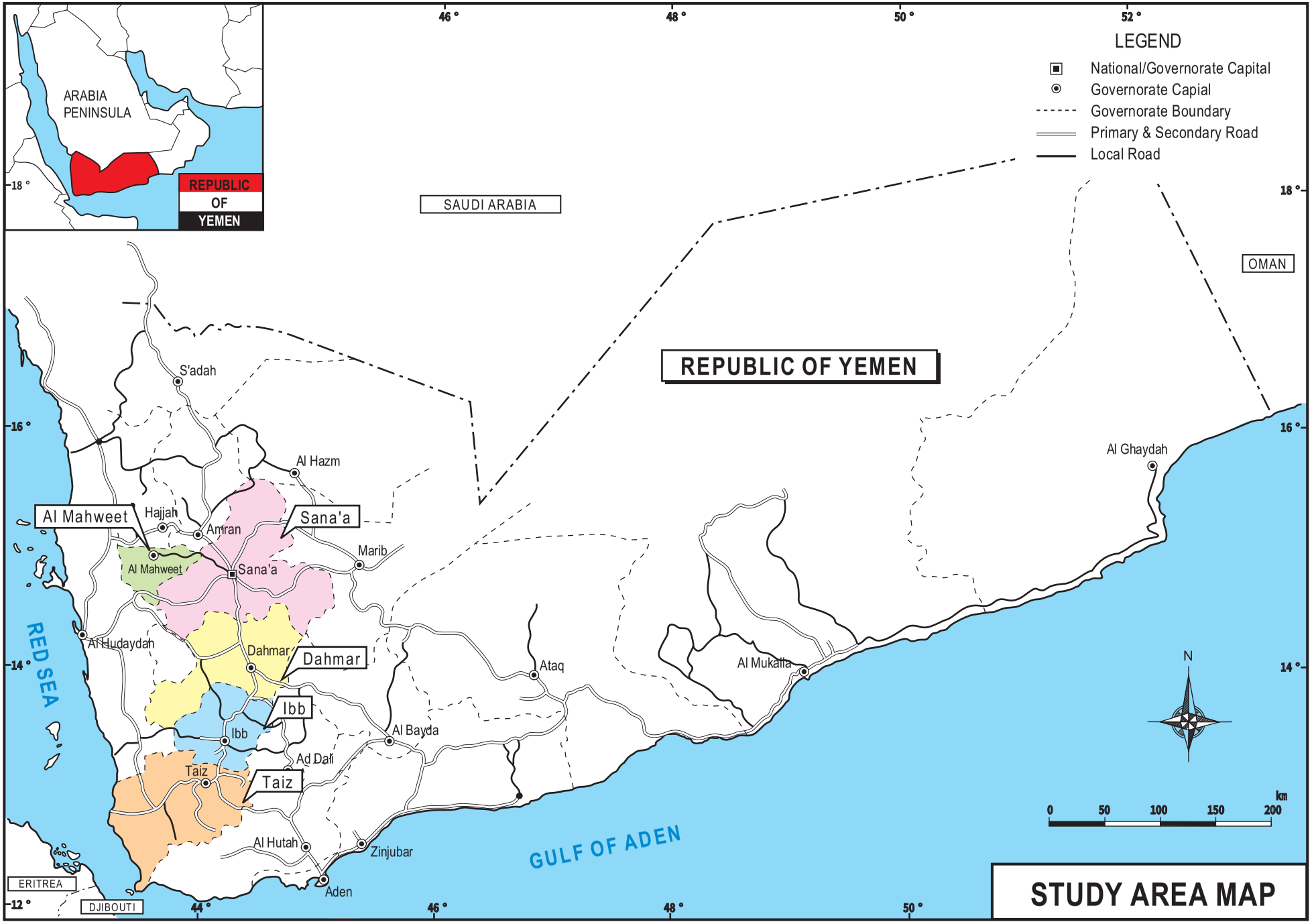
This report consists of the following volumes:

- Summary Report — A concise report on the whole study results
- Main Report — Description of the study results including rural water supply improvement plan and capacity development action plan, as well as capacity assessment results and pilot project activities
- Supporting Report — Includes field survey activities, study results, minutes of meetings, manuals used for capacity development and collected data

We are confident that the implementation of the rural water supply improvement plan and action plan for capacity development would greatly contribute to improvement of the water supply conditions in rural areas of the targeted governorates and strengthening the institutional organization of GARWSP.

We wish to take this opportunity to express our sincere gratitude to your agency, JICA Yemen Office and the Embassy of Japan in Sana'a, Republic of Yemen. We also wish to express our deep appreciation to GARWSP of the Ministry of Water and Environment as well as other authorities concerned of the Government of the Republic of Yemen for the close cooperation and assistance extended to us during our study activities in your country.

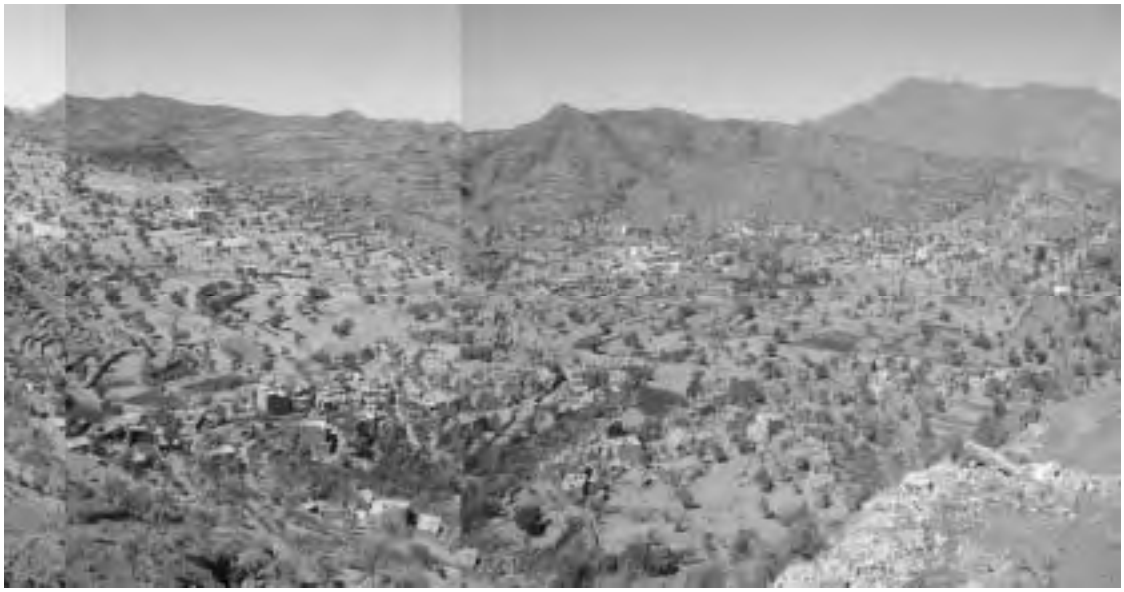
Shoji Fujii
Team Leader
Rural Water Supply Component of the Study for Water Resources Management and Rural Water Supply Improvement in the Republic of Yemen


ARABIA PENINSULA
REPUBLIC OF YEMEN
LEGEND
National/Governorate Capital
Governorate Capial
Governorate Boundary
Primary & Secondary Road
Local Road
SAUDI ARABIA
OMAN
REPUBLIC OF YEMEN
S'adah
Al Hazm
Al Mahweet
Hajjah
Amran
Sana'a
Marib
Al Hudaydah
Dahmar
Ataq
Al Mukalla
Al Ghaydah
Ibb
Al Bayda
Ad Dali
Taiz
Al Hutah
Zinjubar
Aden
RED SEA
GULF OF ADEN
ERITREA
DJIBOUTI
N
0 50 100 150 200 km
STUDY AREA MAP

PHOTOGRAPHS （1/8）

	
Fetching Water located 2.5km away from Village	Fetching Water from Hand Dug Well
	
Cistern for Collecting Rainwater	Spring Source (Seasonally Fluctuates)
	
Women Carrying Water from Wadi to Mountaintop	Water Vendor
	
Study Target Borehole (Villages in Background)	Existing Water Storage Tank

PHOTOGRAPHS (2/8)



Rehabilitation Site with Coverage Area Expanding over 5km in 4 Directions

Over 500m Height Difference from Water Source in Wadi to Villages on Mountaintops.

Access Road to Study Site

Landslide Prevented Access to Study Site

PHOTOGRAPHS (3/8)

Ministry of Water and Environment

GARWSP Headquarters

Study Team Office in GARWSP HQ

GARWSP Sana'a Branch Office

Signing Ceremony for Minutes of Meetings

Participatory Workshop for Capacity Assessment

First Seminar (Presentation of Interim Results)

Second Seminar (Presentation of Draft Final Results)

PHOTOGRAPHS (4/8)

Socio-Economic Survey
(Structured Interview with Sampled Household)

Socio-Economic Survey
(Structured Interview with Community Leaders)

Pumping Test

On-site Water Quality Analysis

Enquiry Survey on Existing Water Supply Facilities

OJT on Topographic Surveying

Identification of Present Capacities of GARWSP

Drafting Action Plan for Capacity Development

PHOTOGRAPHS (5/8)

Capacity Building on Project Supervision

Training of Social Mobilization Team for Pilot Project

Site Transfer for Pilot Project

Community Awareness Activity in Pilot Project

Sensibilization Activity in Pilot Project

Ceremony at Al Kharaba attended by GARWSP, Governorate, District, Japanese Embassy and JICA

Water Committee Office at Masneat Abul Aziz

Water Fee Receipt

PHOTOGRAPHS (6/8)

PILOT PROJECT: A-02 Jabal Al Taraf (Al Mawheet Governorate)	
	
Briefing to Residents on Pilot Project by GARWSP	OJT to GARWSP Staff on Supervision
	
Well Pump before Replacement	Booster Pump before Replacement
	
Well Pump after Replacement	Booster Pump after Replacement
	
Replaced Diesel Engine for Well Pump	Replaced Diesel Engine for Booster Pump

PHOTOGRAPHS (7/8)

PILOT PROJECT: S-03 Al Kharaba (Sana'a Governorate)	
	
Hand- Over Ceremony by GARWSP, Sana'a Governorate, Bani Matar District, EOJ and JICA	Constructed Pump House with Pump Pit
	
Installation of Submersible Motor Pump	Installed Engine Generator
	
Constructed Water Storage Tank ($50m^3$)	Constructed Public Tapstand
	
Pumping Main (left) and Distribution Main (right)	Formation of Water Committee

PHOTOGRAPHS (8/8)

PILOT PROJECT: D-08 Masneat Abdul Aziz (Dahmar Governorate)	
	
Site Transfer	OJT to GARWSP Staff on Supervision
	
Installed Control Panel for Well Pump	Rehabilitated Pump House
	
Rehabilitated Ground Water Tank ($25m^3$)	Installed Pipeline (Pumping & Distribution Main)
	
Formation of Water Committee	Sensibilization Activity

TABLE OF CONTENTS

Chapter 3 Natural Conditions

Chapter 4 Institutional Aspects

Chapter 5 Capacity Assessment

Chapter 6 Rural Water Supply Improvement Plan

Chapter 7 Pilot Project

LIST OF TABLES

LIST OF FIGURES

ABBREVIATIONS

ATP	Affordability to pay
BO	Branch office
CB	Community-based
CBO	Community-based organization
DF/R	Draft final report
DLDSP	Decentralization and Local Development Support Program
DRA	Demand responsive approach
ESAs	External support agencies
F/R	Final report
GAREW	General Authority for Rural Electricity and Water
GARWSP	General Authority for Rural Water Supply Projects
GRA	Governorate Rural Water Supply and Sanitation Authority
HQ	Headquarters
IC/R	Inception report
IFAD	International Fund for Agricultural Development
IRDA	Integrated Regional Development Authority
IT/R	Interim report
JICA	Japan International Cooperation Agency
LA	Local authority
MAI	Ministry of Agriculture and Irrigation
MDG	Millennium Development Goals
MEW	Ministry of Electricity and Water
MLA	Ministry of Local Administration
MWE	Ministry of Water and Environment
NGO	Non-governmental organization
NWRA	National Water Resources Authority

NWSA	National Water and Sanitation Authority
NWSSIP	National Water Sector Strategy and Investment Program
OJT	On-the-job training
PAWS	Program Aid to the Water Sector
PDP	Project description paper
PHAST	Participatory Health and Sanitation Transformation
PMU	Project management unit
PPP	Public Private Partnership
PR/R	Progress report
PSP	Private Sector Participation
PWP	Public Works Project
RWSSOC	Rural Water Supply and Sanitation Oversight Committee
RWSSP	Rural Water Supply and Sanitation Project
RWSS-TA	Rural Water Supply and Sanitation- Technical Assistance
SFD	Social Fund for Development
SMT	Social mobilization team
S/W	Scope of work
TOT	Training of trainers
UNDP	United Nations Development Programme
UNICEF	United Nations Children’s Fund
WHO	World Health Organization
WTP	Willingness to pay
WUA	Water user association

CHAPTER 1 INTRODUCTION

1.1 General

This report was compiled for the Rural Water Supply Component of the Study for the Water Resources Management and Rural Water Supply Improvement in the Republic of Yemen (hereinafter referred to as "the Study") in accordance with the Scope of Work agreed upon by the Ministry of Water and Environment (hereinafter referred to as "MWE") and the Japan International Cooperation Agency (hereinafter referred to as "JICA") in Sana'a on July 2, 2005.

JICA organized a Study Team (hereinafter referred to as "the JICA Study Team") consisting of ten experts in various fields related to the Study.

The Study commenced in November 2005 in Japan and is scheduled to be completed by the end of November 2007. During the course of the Study, the JICA Study Team will carry out the Work in close co-operation with counterpart personnel from General Authority for Rural Water Supply Project (hereinafter referred to as "GARWSP") under the Ministry of Water and Environment (MWE) and related agencies, with emphasis on technology transfer.

1.2 Study Background

The government of the Republic of Yemen has given development and conservation of depleting water resources as one of the main national policies to develop its economy and raise the national living standard. After formation of the Republic of Yemen with the former Socialist South Yemen in 1990, and going through the civil war, the new government announced its First Five Year Plan in 1994 with a main objective to overcome the water crisis. Since precipitation is low around the country and perennial rivers are scarce, most major towns and rural villages rely on groundwater from boreholes as their water source. In the capital city of Sana'a at an altitude of 2,500m, the crisis in groundwater depletion was widespread from the 1980's, and consequently, donor organizations rushed to conduct groundwater surveys in this area (Japan also assisted with a development study, but half way through the study, the activities had to be discontinued). Also, in the southern principal city of Taiz, at an altitude of 1,500m, almost all 20 boreholes used as water sources became depleted in 1992, and a state of emergency was called where the residents were supplied with water only once a month. In this

circumstance, the World Bank strengthened their assistance to Yemen's water sector, and gave guidance to formulate a governmental water sector policy. However, the Taiz relief project (development of new water sources) of the World Bank was unsuccessful, and after more than 10 years, presently, improvements are not yet realized. As a consequence, improvements in water supply in rural areas are delayed, and the water supply coverage for rural areas is reported as about 42% at the end of 2006.

To comprehensively cope with the water problem, the Yemeni government formulated the National Water Sector Strategy and Investment Program (NWSSIP) for 2005 to 2009. This program was initiated through the assistance of the World Bank, the Netherlands and other donors. The four sub-sectors listed below were formed by MWE in cooperation with the Ministry of Agriculture and Irrigation (MAI) to challenge the problems in the water sector.

- Urban water and sanitation
- Rural water and sanitation
- Irrigation and watershed
- Water resources management

Although the program is substantially progressing, financial problems are hindering its scheduled advancement.

The General Authority for Rural Water Supply Projects (GARWSP) is responsible for rural water supply improvements in Yemen. Presently, the Yemeni government is promoting decentralization, and development plans including rural water at the governorate level are being made. GARWSP is restructuring its organization, and branch offices are receiving power to support autonomous governorates and districts to encourage water supply improvements at selected communities.

In order to establish the implementation structure, GARWSP has requested JICA for capacity building of its headquarters and branch offices. Based on the request from the Yemeni government for implementation of a development study, JICA dispatched a Preliminary Study Team in February 2005 and a Preparatory Study Team in June 2005, and agreed to the implementation of the rural water supply component. During discussions with the Preparatory Study Team and GARWSP, the scope of works for the development study was agreed, and governorates having priority for branch strengthening by GARWSP and rural areas having urgency for water supply improvement were selected.

1.3 Study Description

1.3.1 Study Objectives

The objectives of the Study are summarized in the following table.

Table 1-1 Study Objectives

Study Objective	Description
1. Formulation of a practical rural water supply improvement plan	1. Candidate sites: 36 sites in 5 Governorates 1) Al Mahweet Governorate: 4 sites 2) Sana'a Governorate: 14 sites 3) Dahmar Governorate: 8 sites 4) Ibb Governorate: 4 sites 5) Taiz Governorate: 6 sites 2. Targeted number of sites for water supply facilities improvement plan: about 25 sites
2. Capacity development of GARWSP headquarters and branch offices	1. Targeted institutions: 1) GARWSP headquarters (Sana'a) 2) GARWSP Sana'a branch office 3) GARWSP Dahmar branch office 4) GARWSP Al Mahweet branch office 2. Method: OJT

1.3.2 Study Area and Study Sites

The Study area covers thirty six (36) candidate sites in five (5) governorates: Al Mahweet Governorate, Sana'a Governorate, Dahmar Governorate, Ibb Governorate and Taiz Governorate. The candidate sites for the study are listed in Table 1-2. The study area and candidate sites are shown on the map in Figure 1-1.

1.3.3 Scope of the Study

This Study was conducted based on the Scope of Work (S/W) for the Study which was agreed upon between the Ministry of Water and Environment (MWE) and the JICA Preparatory Study Team on July 2, 2005, as attached in the Annex. The details of the Study are described in the following sections of this report.

Table 1-2 List of Candidate Sites

No.	Code	Site	Governorate	District
1	A-01	Al Sha'afel Al Olyah & Al Sufla	Al Mahweet	Al Khabt
2	A-02	Jabal Al Taraf		Al Mahweet
3	A-03	Ozlat Al Jaradi		Al Rujum
4	A-04	Al Khamis - Bani Ali		Bani Sa'ad
5	S-01	Bani Waleed - Al Asboor	Sana'a	Al Haymah Al Kharijiyah
6	S-02	Jarban		Hamdan
7	S-03	Al Kharaba		Bani Matar
8	S-04	Qamlan - Bait Al Najrani		
9	S-05	Afesh		Belad Al Rous
10	S-06	Al Lejam		Sanhan & Bani Bahlowl
11	S-07	Bait Al Hadrami		
12	S-08	Dajah & Sarfah		
13	S-09	Ruhm		
14	S-10	Tawa'ar		Al Hesn
15	S-11	Al Hesn - Al Abyad		Jehana
16	S-12	Mahdah		
17	S-13	Al Ga'ra		Alteyal
18	S-14	Al Ghail		Nehm
19	D-01	Elow Al Mikhlaf	Dahmar	Jabal Al Sharq
20	D-02	Hamal Bait Al Jabar		
21	D-03	Hegrat Al A’asham		
22	D-04	Al Kuob		Duran
23	D-05	Mayfa'at Yaer		Ans
24	D-06	Wardasan		
25	D-07	Al Asakera		Mayfa'a
26	D-08	Masneat Abdul Aziz		
27	I-01	Asfal Bani Saba	Ibb	Al Qafr
28	I-02	Al Sana		Al Makhader
29	I-03	Mamsa Al Marqab		
30	I-04	Al Jahlah & Al Meshraq		Ibb
31	T-01	Al Muayteeb	Taiz	Mawiyah
32	T-02	Bani Al Suror		Al Ma'afer
33	T-03	Sheb Humran		
34	T-04	Yafoq Bani Hamad		Al Mawaset
35	T-05	Al Azaez		Al Shamayaten
36	T-06	Al Khunha		Al Wazieyah

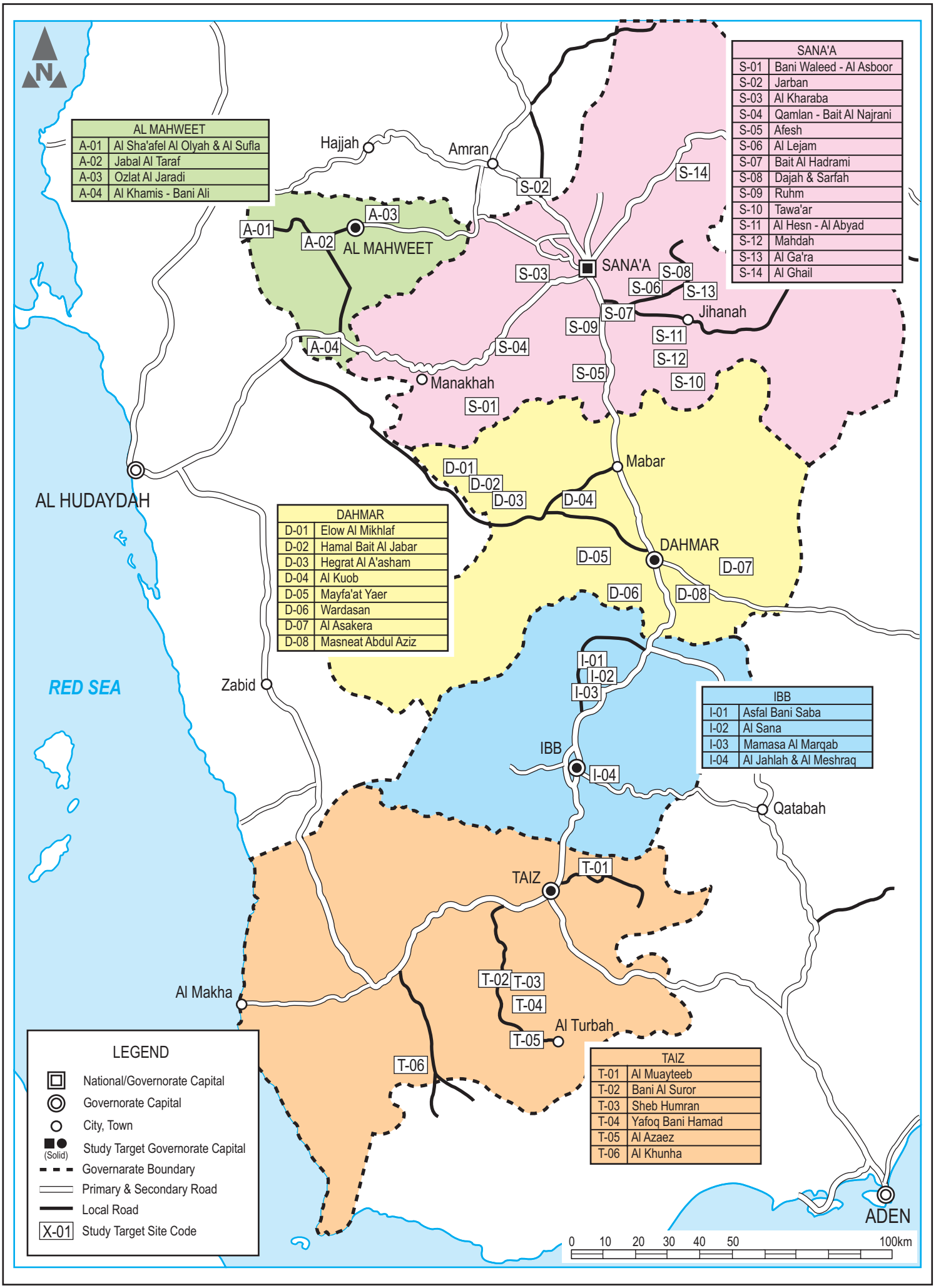


Figure 1-1 Location Map of Candidate Sites

1.3.4 Basic Study Concepts

The JICA Study Team executed the Study in accordance with the following basic concepts:

1) Existing data and information were organised systematically and used effectively to fully comprehend local conditions related to socio-economic environment, water supply, sanitation, hydrogeology and other relevant subjects. Field surveys were conducted to predict water resources potentials and collect information on socio-economic activities and community awareness. The results were compiled to formulate an optimum development plan for rural water supply improvement and capacity development. In addition, similar studies carried out through other donor organisations as well as previous projects implemented through JICA and the government of Japan related to the Study were reviewed and reflected in the present Study.

2) The Study was carried out for mutual understanding of current water supply conditions, local needs and technology transfer requirements in order to:
   (a) Establish optimum solutions to the prevailing problems of water shortage in rural areas;
   (b) Formulate a water supply improvement plan which is most suitable in terms of available groundwater resources and water supply requirements; and
   (c) Prepare an appropriate plan for institutional strengthening and capacity development of GARWSP through the pilot project.

3) The Study was executed in cooperation with counterpart personnel from MWE, GARWSP and other relevant agencies in order to complete the Study according to the schedule with emphasis on technology transfer in pursuit of capacity building for water resources survey, design and construction of water supply facilities, and its proper management.

4) Through this development study, a pilot project was implemented at sites selected through screening of candidate sites, based on the results of surveys on socio-economic conditions, existing water supply facilities, operation and maintenance, and community participation.

5) Through seminars/workshops, the results of the Study were openly disclosed and views were exchanged with stakeholders who included government personnel from the water supply and sanitation related sectors, as well as representatives from concerned donor/international agencies, NGO’s and other relevant organizations.

1.3.5 Study Schedule

The Study started in November 2005 and continued until November 2007, for a period of about twenty four (24) months with activities in Yemen and Japan. This is divided into two (2) phases: Phase I from November 2005 to January 2007, and Phase II from February 2007 to November 2007. Activities for each phase are described below and illustrated in the next page. The work schedule for this study is shown in Table 1-4.

Table 1-3 Study Schedule

Phase I: Formulation of Rural Water Supply Improvement Plan for Screened Sites and Capacity Assessment of GARWSP (November 2005 to January 2007)	
First Fiscal Year	
1. Preparatory Work in Japan (1) Existing data review and analysis (2) Determination of basic policy and methodology for the study (3) Preparation of Inception Report (IC/R)	End November to Beginning December 2005
2. First Study in Yemen (1) Explanation of IC/R (2) Basic survey of candidate sites for formulation of rural water supply improvement plan 1) Socio-economic survey of candidate sites 2) Survey of existing water supply facilities at candidate sites 3) Survey of existing water sources 4) Inventory of candidate sites (3) Capacity assessment on rural water supply improvement	Mid-December 2005 to Mid-March 2006
Second Fiscal Year	
3. Second Study in Yemen (1) Survey on formulation of rural water supply improvement plan for screened sites 1) Groundwater survey of candidate sites 2) Projection of water demand 3) Evaluation of water resources potential 4) Assistance for initial environmental examination (IEE) 5) Complementary field surveys at screened sites (2) Selection of sites for rural water supply improvement	June to End December 2006
4. First Work in Japan (1) Formulation of rural water supply improvement plan for screened sites (2) Consideration on policy for capacity building of GARWSP headquarters/branch offices (3) Preparation of Interim Report (IT/R)	End December 2006 to End January 2007
Phase II: Assistance for Formulation of Action Plan on Capacity Development (February to November 2007)	
5. Third Study in Yemen (1) Holding first seminar (2) Preparation for Pilot Project	February to March 2007
Third Fiscal Year	
1. Fourth Study in Yemen (1) Assistance for capacity building of GARWSP headquarters and branch offices 1) Implementation of pilot project 2) Assistance to water committee formation activities 3) Identification of problems in operation and maintenance and measures for their improvement (2) Preparation and explanation of Progress Report (PR/R)	Mid-April to July 2007
7. Fifth Study in Yemen (1) Preparation and submission of Draft Final Report (DF/R) (2) Holding second seminar	September to Mid-October 2007
8. Second Work in Japan (1) Preparation and Completion of Final Report (F/R)	Mid-October to End November 2007

Table 1-4 STUDY ACTIVITIES FLOW CHART

Fiscal Year	First Fiscal Year		Second Fiscal Year				Third Fiscal Year	
Mon/Year	November/2005	Mid December/2005 to Mid March/2006	June to End December/2006	January./2007	Feb./2007	Mid April to July/2007	Sep. to Mid Oct./2007	November/2007
Phase	【Phase Ⅰ】 Formulation of Rural Water Supply Improvement Plan for Screened Sites and Capacity Assessment on Rural Water Supply Improvement				【Phase Ⅱ】 Assistance for Formulation of Action Plan on Capacity Development			
Work	A. Preparatory Work in Japan	B. First Study in Yemen	C. Second Study in Yemen	D. First Work in Japan	E. 3rd Study in Yemen	F. Fourth Study in Yemen	G. Fifth Study in Yemen	H. Second Work in Japan
Activities	Study Team Orientation 【1】 Existing data review and analysis 【2】 Determination of basic policy & methodology for study 【3】 Preparation of Inception Report (IC/R)	**Formulation of Rural Water Supply Improvement Plan for Screened Sites** 【1】 Explanation of Inception Report (IC/R) 【2】 Collection and analysis of existing data and information 【3】 Socio-economic survey ・Review of existing data, enquiry to relevant organizaitons ・Household questionnaire survey 【4】 Survey of existing facilities ・Water supply service survey ・Survey on present state of operation and maintenance 【5】 Survey of water sources ・Inventory survey of water sources for water supply and ・Survey of natural conditions surrounding water sources 【6】 Compilation of inventry of candidate Sites Discussions with Yemeni Side	【1】 Groundwater survey ・Pumping tests ・Water quality analyses 【2】 Water demand projection and potential evaluation ・Water demand projection ・Water potential evaluation ・Water balance analysis 【3】 Establishment of selection criteria and screening of candidate sites for water supply improvement plan 【4】 Assistance for IEE 【5】 Complementary survey ・Topographic survey ・Construction land survey ・Supplementary social survey ・Procurement survey Discussions with Yemeni Side	【1】 Formulation of rural water supply improvement plan (design, implementation plan, O&M plan, cost estimation) ・Evaluation of formulated improvement plan ・Rough design of water supply facilities 【2】 Preparation of Interim Report (IT/R)	【1】 Holding 1st seminar	【2】 Assistance for capacity building of GARWSP headquarters and branche offices ・Implementation of pilot projet ・Assistance to water committee formation activities ・Identification of problems in O&M and measures for improvement ・Improvement of O&M manual 【3】 Preparation of Progress Report (PR/R) Discussions with Yemeni Side	【1】 Preparation of Draft Final Report (DF/R) 【2】 Holding 2nd seminar Comments from Yemeni Side	【1】 Preparation of Final Report (F/R)
		Capacity Assessment on Rural Water Supply Improvement 【7】 Capacity assessment on rural water supply improvement ・Analysis on progress of sector reform policy and roles and responsibilities of GARWSP for rural water supply ・Identification and capacity evalution of present institutional structure	【6】 Consideration of policy for capacity building of GARWSP headquarters and branch offices ・Consideration on functional and capacity requirements of GARWSP headquarters and branch offices, and policy for their achievement ・Implemenation plan for pilot project and formulation of program for capacity building of					
Submission of Reports		Mid December 2005 IC/R English 20 copies Arabic 20 copies		Beginning February 2007 IT/R English 10 copies Arabic 20 copies		End July 2007 PR/R English 10 copies Arabic 20 copies	Beginning October 2007 DF/R Summary Main Report Supporting Report Each English 10 copies Arabic 20 copies	After November 2007 F/R Summary Main Report Supporting Report Each English 20 copies Arabic 20 copies

Table 1-5 Work Schedule

Fiscal Year	First Fiscal Year					Second Fiscal Year												Third Fiscal Year							
Year	2005		2006															2007							
Month	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	July	Aug.	Sep.	Oct.	Nov.
Phase I: Formulation of Rural Water Supply Improvement Plan for Screened Sites and Capacity Assessment																									
Preparatory Work in Japan																									
Review of Existing Data and Information																									
Determination of Basic Policy and Methodology for Study																									
Preparation of Inception Report (IC/R)																									
1st Study in Yemen																									
Explanation of Inception Report																									
Collection and Analysis of Existing Data and Information																									
Socio-Economic Survey																									
Survey of Existing Water Supply Facilities																									
Survey of Water Sources																									
Inventory of Candidate Sites																									
Capacity Assessment on Rural Water Supply Improvement																									
2nd Study in Yemen																									
Groundwater Survey																									
Water Demand Projection and Potential Evaluation																									
・Projection of water demand																									
・Evaluation of water resouces potential																									
・Water balance analysis																									
Screening and Ranking of Candidate Sites																									
Assistance for IEE																									
Complementary Field Survey																									
・Topographic survey																									
・Confirmation of construction land and accessibility																									
・Supplementary socio-economic survey																									
・Survey on procurement for construction works																									
1st Work in																									
Formulation of Rural Water Supply Improvement Plan																									
Preparation of Interim Report (IT/R)																									
Preparation of Draft Action Plan on Capacity Development of GARWSP																									
Phase II: Formulation of Action Plan on Capacity Development																									
3rd Study in Yemen																									
Holding 1st Seminar																									
Preparation for Pilot Project																									
4th Study in Yemen																									
Assistance on Capacity Building of GARWSP																									
・Pilot project implementation																									
・Support for water committee formation																									
・Identification of problems in O&M																									
Preparation and Submission of Progress Report (PR/R)																									
5th Study in Yemen																									
Preparation of Draft Final Report (DF/R)																									
Holding 2nd Seminar																									
2nd Work in Japan																									
Preparation of Final Report (F/R)																									
Submission of Reports		△ IC/R														△ IT/R						▲ PR/R		▲ DF/R	△ F/R
Legend: ■ In Yemen □ In Japan																									
	← Phase I →																	← Phase II →							
Stage of Study	Preparatory Work in Japan														1st Work in Japan									2nd Work in Japan	
	1st Study in Yemen					2nd Study in Yemen									3rd Study in Yemen			4th Study in Yemen						5th Study in Yemen	

1.3.6 Submission of Reports

The JICA Study Team prepared the following reports and submitted them to GARWSP throughout the Study. In the Minutes of Meetings on Inception Report signed on 21 December 2005 between GARWSP and JICA Study Team, both sides agreed that, although both English and Arabic version reports will be submitted, in case of discrepancies in contents between the different language versions, the English version reports shall prevail over the Arabic version ones.

Table 1-6 Schedule for Report Submission

Report	Submission Period	No. of Copies Submitted	Version
Inception Report (IC/R)	December 2005	Twenty (20) Twenty (20)	English Arabic
Interim Report (IT/R)	February 2007	Ten (10) Twenty (20)	English Arabic
Progress Report (PR/R)	July 2007	Ten (10) Twenty (20)	English Arabic
Draft Final Report (DF/R)	October 2007		
➢ Summary Report		Ten (10) Twenty (20)	English Arabic
➢ Main Report		Ten (10) Twenty (20)	English Arabic
➢ Supporting Report		Ten (10) Twenty (20)	English Arabic
Final Report (F/R)	After November 2007		
➢ Summary Report		Twenty (20) Twenty (20)	English Arabic
➢ Main Report		Twenty (20) Twenty (20)	English Arabic
➢ Supporting Report		Twenty (20) Twenty (20)	English Arabic

1.4 Study Activities and Methodologies

1.4.1 Phase I: Formulation of Rural Water Supply Improvement Plan for Screened Sites and Capacity Assessment of GARWSP

(1) First Fiscal Year

Preparatory Work in Japan

1) Existing Data Review and Analysis

The preparatory work in Japan entails review and analysis of relevant data and information collected by the Preliminary Study Team and Preparatory Study Team.

2) Determination of Basic Policy and Methodology for the Study

Data and information necessary to formulate the rural water supply plan for target sites were compiled and basic policy for the study as well as study methodology were determined.

3) Preparation of Inception Report

In consideration of 1) and 2) above, an Inception Report was prepared.

First Study in Yemen

1) Explanation of Inception Report

The JICA Study Team held a series of meetings with GARSWP and other concerned governmental and international organisations concerning the basic approach and study methodologies, work schedule, organisation of counterpart personnel and any other relevant undertakings.

2) Basic Survey of Candidate Sites for Formulation of Rural Water Supply Improvement Plan

a. Socio-Economic Survey of Candidate Sites

Through a socio-economic survey, basic information related to socio-economic aspects of the 36 candidate sites, which are required for formulation of the rural water supply improvement plan, were collected and analyzed. The survey consisted of the following activities.

- Socio-economic baseline survey including review of existing data and interviews with relevant organizations
- Field survey at the candidate sites including interview with the local authorities, community leaders and households, subcontracted to a local consultant

b. Survey of Existing Water Supply Facilities at Candidate Sites

Existing water supply facilities at the candidate sites were surveyed to identify the following conditions.

- Technical aspects on the present condition of existing facilities and identification of needs for their improvement
- Present state of operation and maintenance of existing facilities and related problems

From environmental and social conditions of Yemen, water supply facilities are served mostly on Level 2 or 3, and therefore, this study will focus on these service levels.

c. Survey of Existing Water Sources

Existing water sources for water supply were surveyed. The peculiar topography and geology of Yemen has great influence on water resources, and hence topography and geology as well as meteorology of the study area were surveyed. Since the main water source for this study is groundwater, drilling data were collected to confirm conditions of boreholes as well as pumping equipment.

d. Compilation of Candidate Site Information into an Inventory

The results of surveys on socio-economic conditions, existing water supply facilities and water sources were compiled to prepare an inventory of the candidate sites.

3) Capacity Assessment on Rural Water Supply Improvement

The Ministry of Water and Environment is preparing the Rural Water Supply and Sanitation Reform Policy to clarify the responsibilities of relevant authorities. Capacity assessment in this Study was initiated through the confirmation on the progress of the sector reform policy, and clarification on new directions for rural water supply policy. Functional responsibilities of GARWSP and each stakeholder redefined under the sector reform were also confirmed. Then, capacities of present GARWSP headquarters and branch offices of Sana'a, Dhamar and Al Mawheet were evaluated and capacity gap with redefined functional responsibilities were assessed, using an assessment matrix. In the process of capacity assessment, the needs for capacity development were identified and prioritised through consultation and a workshop with relevant stakeholders. The results become basis for making policy and action plan for capacity building. Furthermore, precedent capacity building activities were reviewed to identify the problems and issues of capacity building and evaluate the needs to supplement assessment of this study.

(2) Second Fiscal Year

Second Study in Yemen

1) Survey on Formulation of Rural Water Supply Improvement Plan for Screened Sites

a. Groundwater Survey of Candidate Sites

The water source is most important for water supply planning, and without identifying the continuous capacity of the water source, water supply facilities cannot be designed. In this study, pumping tests and water quality analyses were carried out to determine the potential and assurance of candidate water sources.

b. Projection of Water Demand and Evaluation of Water Resources Potential

The following surveys were conducted to determine the demand against the capacity for water supply.

- Water demand projection
- Evaluation of water source potential
- Analysis of water balance

c. Assistance for Initial Environmental Examination

An initial environment examination (IEE) was conducted based on JICA guidelines for environmental and social consideration. Also, confirmation was made with the Environmental Protection Authority (EPA) on the necessity of an environmental impact assessment (EIA).

d. Complementary Field Surveys at Screened Sites

To formulate the water supply improvement plan, complementary field surveys were conducted at the screened sites. These surveys include the following.

- Topographic surveying
- Confirmation of land and accessibility for construction of water supply facilities
- Supplementary socio-economic survey of screened sites
- Survey on situation of procurement

2) Selection of Sites for Rural Water Supply Improvement

Using results of surveys on present conditions of socio-economic activities, water sources, water supply facilities and community awareness, the 36 candidate sites were screened to select sites to formulate a rural water supply improvement plan. Then, the selected sites were ranked for future implementation, utilising mutually agreed ranking criteria.

First Work in Japan

1) Formulation of Rural Water Supply Improvement Plan for Screened sites

The confirmed conditions of water sources, existing water supply facilities and socio-economic situation were used to prepare a rough design of water supply facilities, implementation plan, and operation and maintenance plan for the screened sites, and rough initial cost estimations were made.

2) Consideration on Policy for Capacity Building of GARWSP Headquarters and Branch Offices

Based on the capacity assessment made during the first fiscal year field survey, capacity requirements of GARWSP headquarters and branch offices necessary for planning, implementation and monitoring of rural water supply improvement projects and policy for their achievement were considered.

3) Preparation of Interim Report

The results of the First and Second Works in Yemen, and the First Work in Japan were organised and prepared as the Interim Report to conclude Phase I.

1.4.2 Phase II: Assistance for Formulation of Action Plan on Capacity Development

(1) Second Fiscal Year

Third Study in Yemen

1) Holding First Seminar

At the beginning of Phase II, participants from GARWSP headquarters, GARWSP branch offices, relevant governmental organizations, donors, NGOs, local councils, water committees and other stakeholders were invited to attend a seminar to be held in the capital city of Sana'a. In the seminar, the Interim Report, which covers the results of Phase I activities, was explained, and knowledge and experience was exchanged between the participants.

2) Preparation for Pilot Project

To facilitate commencement of the pilot project scheduled for the next fiscal year, preparations were made at this stage. The concept and implementation procedures for the pilot project were discussed with GARWSP and other relevant concerns to avoid problems and delays.

(2) Third Fiscal Year

Fourth Study in Yemen

1) Assistance for Capacity Building of GARWSP Headquarters and Branch Offices

a. Implementation of Pilot Project

Three (3) sites were selected from the screened sites for implementation as pilot project. The pilot project sites were selected from sites requiring small works such as replacement of pumping equipment and laying of pipelines. The pilot project included technology transfer to GARWSP on supervision of construction works and contributions by the residents, such as pipe distribution and house connections.

b. Assistance to Water Committee Formation Activities

At selected sites, assistance was given to GARWSP branch staff on formation of water committees and strengthening of capacity on operation and maintenance of communities. These activities were conducted as OJT to GARWSP branch staff with objectives of fostering skills for community development.

c. Identification of Problems in Operation and Maintenance and Measures for Their Improvement

Problems encountered in operation and maintenance of water supply facilities were identified and measures for their improvement were considered. As a consequence, manuals for community mobilization as well as health education were prepared.

2) Preparation and Explanation of Progress Report

The activities and results of the Fourth Study in Yemen were organised and compiled to prepare the Progress Report, and the contents of this Progress Report were discussed with the Yemeni counterpart personnel of GARWSP as well as other relevant agencies.

Fifth Study in Yemen

1) Preparation and Submission of Draft Final Report

A Draft Final Report which describes the results of the Study during Phase I and II including rural water supply facilities improvement plan for screened sites and capacity development progress was prepared. This report was submitted to the Yemeni side as document for the second seminar.

2) Holding Second Seminar

At the end of the final work in Yemen, the second seminar was held to explain the contents of the Draft Final Report and to exchange views and experiences between the participants. Representatives from GARWSP headquarters, GARWSP branch offices, relevant governmental organizations, donors, NGOs, local councils, water committees and other stakeholders participated.

Second Work in Japan

The Draft Final Report was revised as the Final Report according to the comments made by GARWSP and other relevant organizations during the second seminar. The Study is finalised when JICA sends the Final Report to Yemen through official channels.

1.5 Composition of Study Members

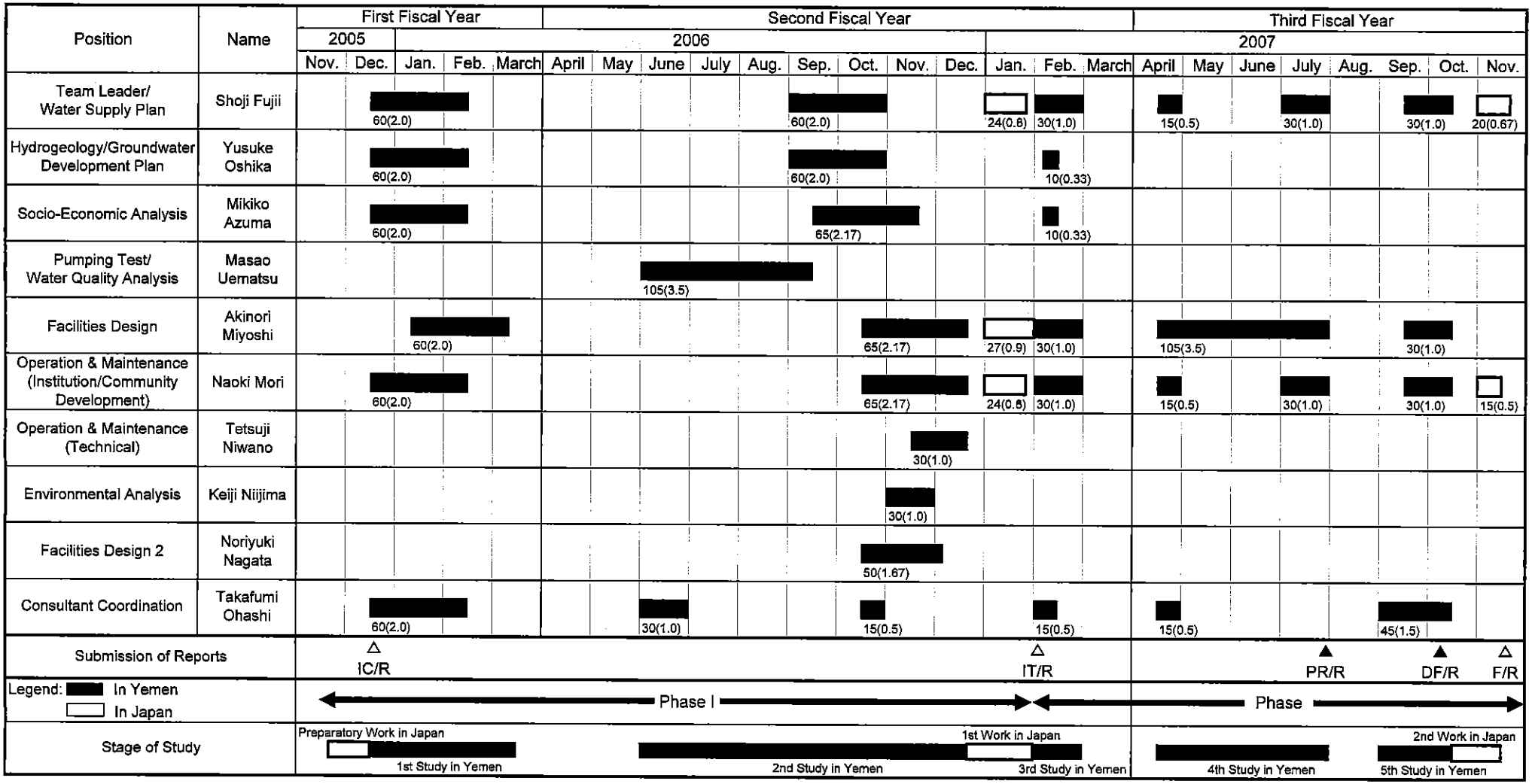
1.5.1 JICA Study Team and Advisory Committee

The Study was carried out by Japan International Cooperation Agency (JICA) through the Study Team composed of ten (10) members with advisory support from the JICA Advisory Committee. The Study Team was led by Shoji Fujii of Japan Techno, who had responsibility for maintaining a close liaison with GARWSP, MWE, JICA and other concerned parties. The JICA Advisory Committee was headed by Mr. Kenji Nagata, a JICA Development Specialist. Work functions of the members of the JICA Study Team and Advisory Committee are shown below, and the assignment schedule for the Study Team is attached in the next page.

Table 1-7 Members of JICA Study Team and Advisory Committee

Name	Function	Affiliation
JICA Study Team		
Mr. Shoji FUJII	Team Leader/ Water Supply Plan	Japan Techno Co., Ltd.
Mr. Yusuke OSHIKA	Hydrogeology / Groundwater Development Plan	Earth System Science Co., Ltd.
Ms. Mikiko AZUMA	Socio-Economic Analysis	Japan Techno Co., Ltd.
Mr. Masao UEMATSU	Pumping Test / Water Quality Analysis	Earth System Science Co., Ltd.
Mr. Akinori MIYOSHI	Facilities Design	Japan Techno Co., Ltd.
Mr. Naoki MORI	Operation and Maintenance (Institutional/Community Development)	Japan Techno Co., Ltd.
Mr. Tetsuji NIWANO	Operation and Maintenance (Technical)	Japan Techno Co., Ltd.
Mr. Keiji NIIJIMA	Environmental Analysis	Japan Techno Co., Ltd.
Mr. Noriyuki NAGATA	Facilities Design 2	Japan Techno Co., Ltd.
Mr. Takafumi OHASHI	Consultant Coordination	Japan Techno Co., Ltd.
JICA Advisory Committee		
Mr. Kenji NAGATA	Water Resources Management	Senior Engineer, Institute for International Cooperation
Dr. Hiroshi SATO	Socio-Economist	Institute of Developing Economics
Mr. Shinichi MASUDA	Task Officer	JICA Water Resources Team 1, Group 3 Global Environmental Department

Table 1-8 Assignment Schedule



1.5.2 Counterpart Team

A counterpart study team represented by members from GARWSP is important to successfully implement the present Study with mutual cooperation. GARWSP organized a counterpart team at the beginning of the Study to participate in the Study activities and receive technical knowledge in the course of the Study, and the list of members was attached to the Minutes of Meetings on Inception Report. However, during the Study, GARWSP requested changes in the members due to other commitments. The final members of the counterpart team are listed below.

(1) Counterpart Team from GARWSP Headquarters who worked directly with JICA Study Team members in Sana'a

Table 1-9 Counterpart Team Members from GARWSP Headquarters

Function Corresponding to JICA Study Team	Name	Position
Team Leader/ Water Supply Plan	Mr. Fawzi AL KHIRBASH	Hydrogeologist/ Deputy General Director of Planning and International Cooperation/Director of International Cooperation Department
	Mr. Abdullah ABDULMALEK	Hydrogeologist/ Head of Technical Office
Hydrogeology/ Groundwater Development	Mr. Kaid AL DARWISH	Hydrogeologist/ Deputy of Technical Office
Socio-Economic Analysis	Mr. Abdulkarim ABDULNOR	Financial Analyst/Technical Office
Pumping Test/ Water Quality Analysis	Mr. Hussien AL SHAABI	Geologist/ Laboratory Director of Geology and Chemistry
Facilities Design	Mr. Abdulnasser AL MAKHLAFY	Civil Engineer/ Deputy General Director of Studies, Supervision and Follow-up/Director of Studies Department
Operation & Maintenance (Institutional/Community Development)	Ms. Namat AL MAJTHOB	Civil Engineer/Engineering Section
Operation & Maintenance (Technical)	Mr. Abdulqaher ALI AHMED	Mechanical Engineer/Technical Office
Environmental Analysis	Mr. Ali TAHER	Geo-Chemist/ Laboratory Director of Geography and Environment Sector
Coordination	Mr. Mohammed Ali RAWEH	Accountant/ Chief of Registration and Expenses Division

(2) Counterpart Team from GARWSP Branch Offices who worked with JICA Study Team during field surveys at study sites

Table 1-10 Counterpart Team Members from GARWSP Branch Offices

GARWSP Branch Office	Name	Position
Al Mahweet	Mr. Mohamed AL NUZAYLI	General Director
	Mr. Fath Ali ALANISI	Geologist
	Mr. Abdul Rahaman ALDAYLAMI	Civil Engineer
Sana'a	Mr. Abdul Khaleg SHARHAN	General Director/Hydrogeologist
	(Mr. Abdul Ghani AL GAZALI)	(Former) General Director/Civil Engineer
	Mr. Ahmed ALBUDAYLI	Civil Engineer
	Mr. Ibrahem ALGABRI	Geologist
	Mr. Nazer AL MAKTARI	Socio-Economist
Dahmar	Mr. Abdul Malek FARE	General Director/Civil Engineer
	(Mr. Aref Saeed Muhsen AL HAMDI)	(Deceased) Geologist
	Mr. Yahya Husain AL SHEHARI	Civil Engineer
	Mr. Abdulaziz AL KIBSI	Financial Director/Accountant
Ibb	Mr. Najeeb DAMAG	General Director/Civil Engineer
	Mr. Abdul Hamid AL GAZALI	Civil Technician
	Mr. Abdul Mogni AL BASHIRI	Geologist
Taiz	Mr. Samir AL SHAHSI	General Director
	Mr. Khaled Mohamed SAID	Geologist
	Mr. Said HASAN	Mechanical Engineer

CHAPTER 2 SOCIO-ECONOMIC SITUATION

2.1 Demography

According to the population census of 2004, the national population of Yemen is approximately 19.6 million with the annual average growth rate of 3.0% from 1994 to 2004. Table 2-1 shows distribution of population at the governorates covered in this study.

Table 2-1 Distribution of Governorate Population

Governorate	Population		Average Annual Growth Rate (1994-2004)	Ratio of Population Distribution (2004)
	1994	2004		
Al-Mawheet	371,595	495,045	2.87%	2.5%
Sana'a	746,812	918,727	2.07%	4.7%
Dahmar	981,674	1,330,108	3.04%	6.8%
Ibb	1,665,054	2,131,861	2.47%	10.8%
Taiz	1,870,057	2,393,425	2.47%	12.2%
Total, Yemen	**14,587,807**	**19,685,161**	**3.00%**	

Source:
- Website for the Central Statistical Organization, Final Results of the General Census for 2004 at Governorate Level
- Central Statistical Organization (2004), 2004 Statistical Year Book, Sana'a

From results of socio-economic surveys and reference to the population census of 2004 as well as other information, the populations of screened sites for 2006 are listed in Table 2-2. The population size varies from a minimum of 400 to a maximum of almost 24,000. The average population of the screened sites is about 5,600 while the median population is 2,550. Based on the population for 2006, a projection was made to estimate the population of each site at 2016 with applying the annual average growth rate of 1994-2004 at the governorate level from the latest census. This information was used as basis to formulate the rural water supply improvement plan.

Table 2-2 Population of Screened Sites

Governorate	No.	Code No.	Site Name	Present Population (2006)	Population Growth Rate (%)	Population Forecast (2016)
Al Mawheet	1	A-02	Jabal Al Taraf	2,727	2.87	3,619
	2	A-03	Ozlat Al Jaradi	20,786	2.87	27,584
Sana'a	3	S-02	Jarban	1,611	2.07	1,977
	4	S-03	Al Kharaba	1,361	2.07	1,670
	5	S-04	Qamlan-Bait Al Najrani	629	2.07	772
	6	S-05	Afesh	3,680	2.07	4,517
	7	S-07	Bait Al Hadrami	2,550	2.07	3,130
	8	S-09	Ruhm	4,567	2.07	5,605
	9	S-11	Al Hesn-Al Abyad	2,372	2.07	2,911
Dahmar	10	D-01	Elow Al Mikhlaf	926	3.04	1,249
	11	D-02	Hamal-Bait Al Jabar	2,475	3.04	3,339
	12	D-03	Hegrat Al A'asham	1,592	3.04	2,148
	13	D-05	Mayfa'at Yaer	1,515	3.04	2,044
	14	D-07	Al Asakera	1,944	3.04	2,623
	15	D-08	Masneat Abdul Aziz	406	3.04	548
Ibb	16	I-01	Asfal Bani Saba	9,311	2.47	11,884
	17	I-02	Al Sana	6,026	2.47	7,691
	18	I-04	Al Jahlah & Al Meshraq	10,467	2.47	13,359
Taiz	19	T-02	Bani Al Suror	9,385	2.47	11,978
	20	T-03	Sheb Humran	23,732	2.47	30,290
	21	T-04	Yafoq Bani Hamad	6,844	2.47	8,735
	22	T-05	Al Azaez	11,784	2.47	15,040
	23	T-06	Al Khunha	1,579	2.47	2,015
			Total	**128,269**		**164,728**

2.2 Social Structure

Each governorate is administratively divided into districts (moderiah). A district consists of numbers of sub-districts (ozlah) which contain groups of villages (qaryah) and their attachments (mahallah). The administrative division of Yemen is shown below Table 2-3.

Table 2-3 Yemen Administrative Division

Administrative Level		Remarks
English	Arabic	
Country	Balad	Republic of Yemen
Governorate	Muhafda	22 Governorates
District	Moderiah	336 Districts, of which 305 are Rural Districts
Sub-District	Ozlah	
(Commune)	(Mamsa)	Only for Ibb Governorate
Village	Qaryah	A group of villages is called Kolah
Hamlet or Sub-Village	Mahallah	

Sub-districts, villages and hamlets are group of communities which usually share common tribal identity. Therefore, most of the project sites are formed by the homogeneous group based on the traditional tribal structure with the extended family system. Villages were originated with one family and extended to the surrounding areas by their family members as the population increased. An exception is the sites located near to Sana'a City such as Bait Al Hadrami and Ruhm where people from different places migrate and settle in the villages for ease of accessibility to Sana'a for work.

One third of the screened sites cover the entire area of a single village with several hamlets while others have extended service areas for water schemes to cover more than one village or an entire sub-district. The project area of Ozlat Al Jaradi and Sheb Humran cover part of neighbouring sub-districts as well as its own sub-district, which results in increase of the population to be served by the project scheme as listed in Table 2-2. Composition of the villages forming each project site is shown in the Supporting Report Annex. Many cases were found in the project area that villages and hamlets are not clearly distinguished by the residents.

Communities are traditionally led by head (sheikh) of the village or sub-district while the local council members elected from the respective constituencies represent the community members to form the district council. The sheikhs have strong influence to the community members through taking the initiative in development of the community including contribution of necessary resources, settling conflicts, and acting as an interface with the local authority and government. Under the leadership of the sheikhs, Aqil or Adel usually appointed in each village or hamlet serves for the community members for notarization of documents and collection of taxes. In case that there is no sheikh at village or sub-district level, they also play as the mediator of conflicts in the community and interface with external organizations. While the traditional leadership structure is maintained in most part of the project sites in Al Mawheet, Sana'a, Dahmar and Ibb as it characterizes the society of the northern part of Yemen, local council members play more vital role in facilitation of the development projects in the communities in Taiz rather than the sheikhs are directly involved in the process of the projects. The social and leadership structure in the target area is depicted in Figure 2-1.

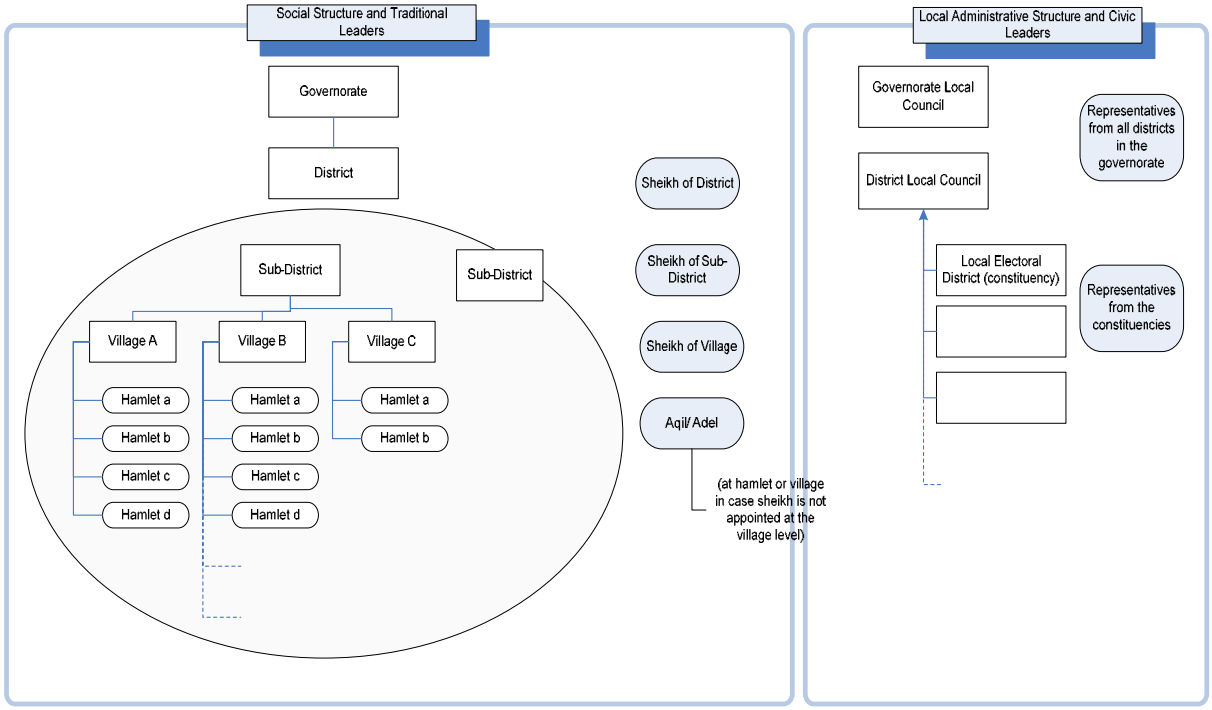


Figure 2-1 Social and Leadership Structure in Target Area

2.3 Village Settings and Infrastructure

Since the proposed water supply area of the screened sites are very different from each other such as covering only one village or targeting the entire sub-district, area of the sites also varies from less than 2 km^2 to around 50 km^2. Most of the project sites are located in steep mountainous areas. Clusters of settlements are scattered along a ridge and slope of mountains or hills. Old settlements which originated the village are usually located at the top of the mountain or hill and other houses form a number of hamlets downwards to the bottom of mountains. Due to its geographical features, the road network within the sites is poorly connected with narrow dirt roads. The approach roads from the governorate capital to the sites is paved with asphalt apart from Elow Al Mikhlaf, Hamal-Bait Al Jabar, Hegrat Al A'asham and Al Asakera where dirt roads stretch from the branch of the main road to the sites for approximately two to two and half hours by vehicle.

Infrastructure and social services available in the project sites is indicated in Table 2-4. Even if the site is indicated as that the power supply and telecommunication network are available, several small villages or hamlets without accessibility to those infrastructure are dotted at the remote areas from the centre of the communities in the sites. For the households which cannot have access to power supply from public networks or generators, their alternative for lighting is kerosene or gas lamp.

Table 2-4 Infrastructure and Social Services in Screened Sites

Code No.	Site Name	Power Supply			Telecom-munication		Public Facilities				Banking Service	Place to Buy Diesel Fuel
		Public Network	Generator by Community Project	Private Generator	Land phone line	Mobile	School	Health Facility	Mosque	Market		
A-02	Jabal Al Taraf	-	-	-	x	x	5	2	16	-	Mawheet	Mawheet
A-03	Ozlat Al Jaradi	-	x	-	x	x	10	1	22	-	Mawheet	Al Rujum
S-02	Jarban	x	-	-	x	x	2	0	7	-	Sana'a	Matrah Jerban
S-03	Al Kharaba	x	-	-	-	x	1	0	4	-	Sana'a	Matnah
S-04	Qamlan-Bait Al Najrani	x	-	-	-	x	0	0	4	-	Sana'a	Souq Al Aman
S-05	Afesh	x	-	-	x	x	1	1	7	-	Sana'a	Walan
S-07	Bait Al Hadrami	x	-	-	x	x	2	0	4	-	Sana'a	Souq Dar Salam
S-09	Ruhm	x	-	-	x	x	4	0	9	-	Sana'a	
S-11	Al Hesn-Al Abyad	x	-	-	x	x	5	0	3	-	Sana'a	Asfan
D-01	Elow Al Mikhlaf	-	-	-	x	x	1	0	13	-	Dahmar	Sayhan
D-02	Hamal-Bait Al Jabar	-	-	-	x	x	1	0	10	Weekly	Dahmar	Within the site
D-03	Hegrat Al A'asham	-	-	-	-	x	1	0	7	-	Medina Al Sharq	
D-05	Mayfa'at Yaer	x	-	-	-	x	1	0	2	-	Dahmar	
D-07	Al Asakera	-	-	x	x	x	2	0	12	-	Dahmar	Allasy
D-08	Masneat Abdul Aziz	x	-	-	x	x	1	0	3	-	Dahmar	Qa Samah
I-01	Asfal Bani Saba	-	-	-	-	x	4	0	10	-	Ibb	Rehab
I-02	Al Sana	-	-	-	-	x	2	0	13	-	Ibb	Sumarah, Rehab
I-04	Al Jahlah & Al Meshraq	x	-	-	x	x	3	1	26	Permanent x 2	Ibb	Within the site
T-02	Bani Al Suror	x	-	-	x	x	6	1	20	Permanent x 1	Taiz	Within the site
T-03	Sheb Humran	-	x	-	x	x	14	3	29	Permanent x 1, Weekly	Taiz	Within the site, Souq Al Nashamah
T-04	Yafoq Bani Hamad	-	x	-	x	x	6	1	15	Permanent x 1	Taiz	Within site
T-05	Al Azaez	x	-	-	x	x	4	1	30	Weekly	Taiz, Al Turbah	Al Markez
T-06	Al Khunha	-	-	-	-	x	1	0	2	-	Taiz	Al Barh

With regard to the social services, there is at least one primary school in the site except for Qamlan-Bait Al Najrani. Meanwhile, the number of health facilities is very few in the sites. The sites located in the centre of district or sub-district such as Bani Al Suror, Sheb Humran and Yafoq Bani Hamad have a government's rural district hospital. Public health centers are available in Jabal Al Taraf, Ozlat Al Jaradi, Sheb Humran, and Al Azaez, and others have private clinics. At the center of Al Ma'afer District, there is a district council office as well as in Bani Al Suror.

2.4 Community-Based Organizations

There are existing community-based organizations in two thirds of the screened sites. These committees were established to manage specific development issues common to the residents in the villages such as water committee, parents council for school, farmers cooperative and others as shown in Table 2-5.

Table 2-5 Types of Existing Community-Based Organizations in Screened Sites

Code No.	Site Name	Village Development Committee	Water Committee	Women's Group/ Mothers' Group	Farmers' Cooperative	School Committee (Parents Council)	Cultural/ social group	Others	None
A-02	Jabal Al Taraf	M	M			M			
A-03	Ozlat Al Jaradi		M						
S-02	Jarban		M			M			
S-03	Al Kharaba								x
S-04	Qamlan-Bait Al Najrani								x
S-05	Afesh				B	M			
S-07	Bait Al Hadrami					M			
S-09	Ruhm				B	M			
S-11	Al Hesn-Al Abyad		M						
D-01	Elow Al Mikhlaf								x
D-02	Hamal Bait Al Jabar				M	M			
D-03	Hegrat Al Asham								x
D-05	Mayfa'at Yaer			F					
D-07	Al Asakera					M			
D-08	Masneat Abdul Aziz								x
I-01	Asfal Bani Saba								x
I-02	Al Sana								x
I-04	Al Jahlah-Al Meshraq					B	M		
T-02	Bani Al Suror	M	M						
T-03	Sheb Humran	B	B	F		B			
T-04	Yafoq Bani Hamad		M			M		M (Solidarity fund committee)	
T-05	Al Azaez		M			M			
T-06	Al Khunah								x

M: formed by male members only, F: Formed by female members only,
B: formed by both male and female members

The village development committees in Jabal Al Taraf, Bani Al Suror and Sheb Humran are responsible to coordinate the development projects planned and implemented within the community in conjunction with other groups organized for specific issues such as water supply and school education.

Membership of these existing community-based organizations is mostly male dominated with a few exceptions. Due to the values of Islamic culture, women cannot be a part of meetings together with men. Community members also traditionally regard that participation in the communal activities and decision making in such occasions are supposed to be done by men. With these cultural and traditional backgrounds, there are few cases that the community-based organizations are formed jointly by male and female members or women organize women's group or mothers' group to exchange information and mutual cooperation for improvement of their living conditions.

Development projects ever been conducted in the sites are construction of schools, water supply facilities, road, mosques and health facilities. Households in the villages contributed for part of the construction costs in cash and/or provision of labour force in most cases. They contributed YR 2,700/ household on average for the construction costs.

2.5 Household Characteristics

Number of family members in a household is eight on average and half of the members are 14 years old and below according to the results of the sample household survey. One house is often shared with more than one generation when a son of the household head gets married to have a separate household. Around 90% of the sample households are male-headed in their early forties. Marital status of the household heads is monogamous at more than 80% of the households interviewed in the survey.

Approximately 1,800 boys and 1,550 girls at basic school-age (6-14) were confirmed in the sample households. Among them, around 90% of boys and 70% of girls are attending the basic school. The enrolment rate of boys is higher than the one for girls in all the target governorates. Enrolment rate of girls in Dahmar is less than 40% while the one for boys is 87%, which shows the biggest gap among five governorates. Meanwhile, there is the smallest gap of the enrolment rate of boys and girls in Taiz.

Common reason of non enrolment of school-aged boys and girls is difficulty for the household to afford the education costs. In addition, boys cannot attend school to help families earn their living. On the other hand, in case of girl child, parents regard that their child is still young to send school even though she is at the school-age and keep her at home. Also, girls are, in most cases, busy to help mothers in household chore including water fetching for their families. Other main factors to hinder girls to attend the school are long distance from the house to school and no female teachers at the school.

With regard to the literacy level of the family members at age 15 and above in the sample households, illiteracy rate of women is higher (70%) than the one for men (30%). 11% of women completed the primary education up to grade 6 of the basic school, of which 58% graduated the basic school (up to grade 9) and proceeded to the secondary school. For men, 43% completed the grade 6, of which 78% finished the basic school and proceeded to the secondary school. While 10% of men have attainment of higher education or technical/vocational institution, only 1% of women do.

2.6 Economic Conditions

Main income sources for the communities in the screened sites are farming and day labour according to results of the socio-economic survey as shown in Table 2-6. Livestock rearing and employment in the army are also part of the income source for many households. Most of the sample households interviewed have more than one income sources.

Table 2-6 Types of Income Source for Sample Households

Type of Income Source	No. of Response		Ratio of Cases
	No.	Ratio	
Agriculture	883	31.9%	58.9%
Day labor	660	23.8%	44.0%
Livestock rearing	387	14.0%	25.8%
In the army	337	12.2%	22.5%
Civil servant	176	6.4%	11.7%
Retail (running shops)	85	3.1%	5.7%
Money transfers from abroad	75	2.7%	5.0%
Employee of private company	23	0.8%	1.5%
Other	142	5.1%	9.5%
Total	2,768	100.0%	184.5%

N.B.: As multiple answers were applied, the total number of responses above is not consistent with the total number of interviewed households, which was 1,500.

Mean monthly income is YR42,000/household and median is YR30,000. For monthly expenditure, the average figure is YR39,000/household while median is YR31,000.

The type of agriculture dominated in the target areas is subsistence farming by growing food crops such as sorghum, millet, wheat and barley. Qat is the source of cash income for mainly the sites in Sana'a and Dahmar. Vegetables and fruits are also planted in the communities in Sana'a for cash income while coffee plantation is found in a few sites in Dahmar and Ibb. Around 75% of the sample households own agricultural land.

2.7 Water Use Patterns

Types of existing water sources in each screened site are shown in the next page. Residents in the sites where they have no public piped water scheme rely on unprotected water sources such as cistern to keep rainwater, unprotected hand dug well and spring to obtain water for domestic use. These sources are usually seasonal and water is mostly available during rainy season of around April-May and August-September though it varies between governorates. When these seasonal water sources have dried up, they are forced to seek water from other sources located outside the village or buy water from water vendors if they can afford the cost.

Even in case that they have a communal piped water scheme, supply conditions is erratic due to the limited supply capacity against the demand as well as break down of the facilities. Currently, restriction of water supply is executed through water rationing according to the schedule in all the sites where they run the public scheme.

Other water sources available in the target communities are private motorized boreholes for irrigation of qat. The owner of the boreholes allows other community members to draw water from the source while the pump is operated to irrigate the field. Though these boreholes can supply water perennially, the owner of the facility normally run the pump in dry season and use rainwater during the rainy season to save running costs of the motor pump.

Where they can access to more than one type of water sources, the residents separate the water source for domestic use from other purposes such as animal watering and irrigation. Boreholes and springs are perceived safe for drinking while hand dug wells and rainwater kept in cisterns are mainly used for washing and animal watering. Water for irrigation is mainly from rainwater apart from the households which have their own private boreholes or shallow wells.

Volume of daily water consumption for domestic use is approximately 165 liters/household/day (l/hh/d) and 20 liters/person/day (l/pers/d) at the median level. In order to obtain water for domestic use, 48% of the sample households spend money at a median amount of YR1,400/household/day which accounts for about 4.5-5% of the monthly household income. Other households obtain water for domestic use free of charge.

Table 2-7 Type of Existing Water Sources in Use at Screened Sites

Code	Site Name	a) Located in the Site										b) Located outside the Site				Operational Condition of Existing Public Water Scheme
		Stream/Dam	Rainwater Stored in Reservior/ Cistern	Unprotected Spring	Protected Spring	Unprotected Well	Borehole with Motor Pump (point source)	Piped Water Scheme with Connection to Public Taps	Piped Water Scheme with House Connections	Buying Water from Water Vendor (water tanker)	Other	Stream/Dam	Unprotected Spring	Borehole with Motor Pump (point source)	Buying Water from Water Vendor (water tanker)	
A-02	Jabal Al Taraf		H, A, I			H, A, I			D							Working
A-03	Ozlat Al Jaradi		A, I	D, H, A, I					D, H							Working
S-02	Jarban		D, H, A				D, I								D, H	Not working
S-03	Al Kharaba		H, A, P	D			D, I									Not working
S-04	Qamlan-Bait Al Najrani			D, H, A		H									D, H	Not working
S-05	Afesh		H	D, A, I												Not working
S-07	Bait Al Hadrami		A				D, H, I			D, H						No existing scheme
S-09	Ruhm		P, A			D, H, A	D, H, A, I			D, H						No existing scheme
S-11	Al Hesn-Al Abyad					D, H, A	I		D, H						D, H	Working
D-01	Elow Al Mikhlaf		D, H, A	D, H, A								H, A		D		No existing scheme
D-02	Hamal-Bait Al Jabar		A	H, A			D, H, I									Not working
D-03	Hegrat Al A'asham		A		D, H, A						I (private piped scheme)			D, H, A		No existing scheme
D-05	Mayfa'at Yaer		A					D, H, A					H, A			Working
D-07	Al Asakera		D, H, A				D, H, I									No existing scheme
D-08	Masneat Abdul Aziz		H, A											D, H		No existing scheme
I-01	Asfal Bani Saba		1	3			1									No existing scheme
I-02	Al Sana		H, A	D, I							D, I (private piped scheme)			D		No existing scheme
I-04	Al Jahlah & Al Meshraq	D, H	P	D, H		D, H, A, I	D, H, A, I			D, H, A						No existing scheme
T-02	Bani Al Suror		A	D, H, A		H, A	I		D, H	D, H						Working
T-03	Sheb Humran		A	D		D, H, A, I			D, H	D, H						Working
T-04	Yafoq Bani Hamad		D, H, A, I	D, H, A, I		D, I	D, A, I		D, H, A							Working
T-05	Al Azaez		A				D, H, I		D, H							Working
T-06	Al Khunha					D, H, A, I	D, H, A									No existing scheme

Keys for Usages of the Water Sources:
D: Drinking, cooking, H: Other usage for household chores such as washing and cleaning,
A: Animal watering, I: Irrigation, P: Ablution for prayer

Water fetching is primarily one of the responsibilities of adult women in the household and girl children often help their mothers collect water. They reply on donkeys to carry water kept in plastic containers from the source to their houses at the households which are not connected to the piped water scheme. As it is difficult for them to carry water at once enough for daily consumption, they need to fetch water four times a day on average with approximately 30 minutes to one hour for one trip including the time to wait at the water point. It therefore takes two to four hours a day for the household to collect their water.

2.8 Sanitation and Health Conditions

Main diseases for the community members in the screened sites are malaria, respiratory diseases and kidney diseases for adult men and women and diarrhoea for children. As the measures to prevent diarrhoea, half of the sample households practice hand washing before eating, drinking clean water, and protecting food from contamination, respectively. On the other hand, hand washing after using toilet is not common to the households surveyed. Treatment of drinking water is hardly practiced in the project sites. 90% of the sample households answered that they drink water as it is while those who treat water normally boil or filter it with cloth.

With regard to the sanitation environment, Table 2-8 shows distribution of sample households by type of toilet which are owned by them. Nearly 75% of the households surveyed have toilet which is pour flush type to discharge to open land or soak in a pit in most cases. Remaining households do not have latrine as they cannot afford construction cost or enough water is not available for them. If the household does not have latrine, family members usually defecate outside their compound while children sometimes use yard for defecation.

Table 2-8 Types of Toilet Owned by Sample Households

Type of Toilet	No.	%	Valid %
Flush discharging to open land	450	30.0%	40.1%
Flush connected to pit	405	27.0%	36.1%
Dry pit latrine	120	8.0%	10.7%
Uncovered pit	82	5.5%	7.3%
Covered pit	54	3.6%	4.8%
Flush connected to sewage network	6	0.4%	0.5%
Other	4	0.3%	0.4%
Total	1,121	74.7%	100%
N/A (no toilet at the house)	379	25.3%	
Grand Total	1,500	100%	

2.9 Valuation for Improved Water Supply

All the screened sites where they do not have protected water source ranked the water supply as the highest priority to improve their living conditions. Meanwhile, other needs such as job opportunity and power supply are higher than the one for water supply in the sites where the public water scheme is relatively well managed and operational such as Jabal Al Taraf, Bani Al Suror and Al Azaez.

In the sample household survey, around 90% of the sample households expressed their needs for improvement of existing water supply conditions. They mostly expect increase of water quantity which can be used, availability of water perennially, and reduction of time for water fetching. Further, 95% of them are willing to pay at a median amount of YR150/m^3 for user fee for operation and maintenance cost and 82% also showed willingness to contribute for part of the construction cost of the facility. Contribution for part of the construction cost of the facility can mainly be done in manner of provision of labour force or payment in cash at YR2,000/household.

Additional water demand for domestic use averages 160 l/hh/d (100 l/hh/d at median level) and 23 l/hh/d (16 l/hh/d at median level) in case the water supply condition is improved through construction or rehabilitation of piped water schemes.

CHAPTER 3 NATURAL CONDITIONS

3.1 Geography and Topography

In accordance with the topographical and geographical features of Yemen, the country can be divided into 4 main regions from west to east as follows.

Table 3-1 Topographical/Geographical Division of Yemen

Region	Location	Characteristic	Elevations (m above sea level)	Covered Study Target Governorates
Coastal Plains	Long coastal strip along the Red Sea to the West, from northern border to Gulf of Aden in the South	Widths of 30 km to 60 km. Very arid and flat. Tropical climate which becomes hot and humid during summer and warn in winter.	0-500	Al Mawheet Taiz
Western Highlands (otherwise indicated as Western Mountains and Central Highlands)	The coastal plains region ends abruptly at the escarpment of the western highlands region, which stretches in parallel to the east of the coastal plains region with a portion intruding to the east at the southern area of this region, in an "L" shape	Highest mountains in Arabian peninsula. Precipitation rates are highest in country. Subtropical climate with temperatures being hot in the day but dropping at night.	1,000-3,700	Al Mawheet Sana'a Dahmar Ibb Taiz
Eastern Mountains	Lies east and north of western highlands region	Elevation gradually descends from west to east. Subtropical climate similar to Western Highlands, but drier.	1,000-2,000	Sana'a Dahmar
Desert	Sandy region to the east of the eastern highlands region and covers the eastern half of the country	Desert climate with almost no rain, high temperatures and low humidity	500-1,000	None

3.2 Geology and Hydrogeology

3.2.1 Geological Conditions

The stratigraphical profile of the geology of Yemen is shown in Table 3-2.

Basement complex of Yemen consists of granite, gneiss, schist and other formations of the Precambrian age, and is overlain by various younger rocks. One of the youngest rocks, basalt formed during Quaternary volcanic activities, forms an extensive lava plateau along the northern edge of Sana'a basin in the central part of the country. Similar patterns of lava plateaus have been formed farther south around Dahmar, Taiz and Aden. These Quaternary lave regions show a prominence of volcanoes created through fissure eruptions with most of their cinder cones maintaining their primary forms. Another Quaternary group is sedimentary formations including eolian sand widely spreading along the coastal plains region and desert area. These deposits have developed alluvial fans with thicknesses of more than 100m along the fringe of the eastern highlands, while belts of alluvium along wadis are usually thin with thicknesses mostly ranging from 5 to 10m. On the other hand, Yemen volcanics broadly distributed in the mountainous area south of Sana'a have thicknesses exceeding 2,000m.

Table 3-2 Stratigraphy of Yemen

Age		Formation	Thickness	Lithology
Quaternary	Holocene Pleistocene	Quaternary deposits	5-100m	Eolian sand, sand, gravel
		Quaternary volcanics	100-500m	Basalt lava and scoria
Tertiary	Miocene Eocene	Yemen volcanics	+2,000m	Basalt, rhyolite and dacite Ignimbrite and ashflow deposits
		Tawilah Group	300m	Sandstone, conglomerate, clay, limestone, dolomite
Cretaceous				
Jurassic	Upper	Amran Series	+600m	Limestone, marl and shale with sandstone
	Lower	Kholan Series	300m	Green shale with sandstone and conglomerate
Ordovician		Wajid sandstone	250m	Crossbedded, locally conglomerated sandstone
Pre-Cambrian		Precambrian system	?	Granite, gneiss, schist, quartzite, shale, meta-andesite with pegmatite, quartz dyke

3.2.2 Hydrogeological Characteristics

Groundwater occurrence in Yemen is largely divided into confined and unconfined aquifers.

Table 3-3 Groundwater Types in Yemen

Groundwater Type	Definition	Remarks
Confined	Mostly fissure water flowing through cracks or fissures.	Water pumped from boreholes
Unconfined	Shallow groundwater mainly occurring in belts of Quaternary deposits consisting of sand and gravel along wadis. These have high permeability with thickness usually from 3 to 5m. Water level can sharply decline in dry season.	Water is collected from dug wells, but many dry up during the dry season.

The target aquifers in the project sites are confined aquifers occurring mainly in the Tertiary volcanics and partly in the Cretaceous Tawilah Group. Though some of the wells have been drilled in wadi beds, the developed aquifer is a deeper fissure aquifer not of quaternary wadi deposits. Tertiary volcanics are categorized as moderately productive aquifers and Tawilah Group is a productive aquifer. Hydrogeological information of these formations is summarized in Table 3-4.

Table 3-4 Hydrogeological Characteristics in Candidate Sites

Formation	Lithology		Hydrogeological Description	Covered Candidate Sites
Quaternary deposits	Q11	Active alluvium, sand and gravel	Unconfined aquifers are common, but semi-confined aquifers occur in places. Originally highly productive, but recently falling water-tables are found throughout the alluvial aquifer. Water level fluctuations show a rapid response to rainfall.	S-14, D-06
	Q9	Gravel sheets, gravel plains and alluvial fans generally in areas of low relief with a stony surface		None
	Q6	Loess and ancient dunes: areas of wind-blown soils and sands (generally fertile land)		S-07, S-08, S-09, S-13
Quaternary volcanics	Qvτ	Trachytic flows and domes	Petrographically similar to Tertiary volcanics, but relatively unweathered and less permeable. Local and limited groundwater potential.	(S-02), (S-08), (S-10), D-07, D-08,
	Qvβ	Basaltic lavas		
Tertiary volcanics	Tv4	Gabbro	(Tertiary intrusive; no groundwater)	(D-06)
	Tvi	Ignimbrite and ash-flow deposit	Fracturing is widespread. Groundwater occurs in bedded ashes and tuffs, fractured lava flows, boundary zones between flows and major fault zones. In Dahmar area, particularly productive. Rhyolitic aquifers seem to provide higher yield. Overlie Tawilah group	A-04, S-01, (S-03), S-04, S-06, S-10, D-01, D-02, D-03, D-04, D-05, T-02, T-06
	Tvλ	Rhyolite and dacite		(S-09), (D-04),
	Tvτ	Trachyte		(I-04)
	Tvβ	Basalt		S-03, (S-04), S-05, (S-08), (S-09), (S-11), (S-12), (S-13), (S-14), (D-01), (D-02), (D-04), (D-05), (D-06), I-01, I-02, I-03, I-04, T-01, T-03, T-04, T-05
Tawilah Group	K	Sandstones with minor calcareous horizons.	White, yellow or reddish fine to coarse grained sandstone. Generally productive aquifer, but highly anisotropic.	A-01,A-02,A-03, S-11, S-12,
(Mukalla-Hallah Formation)	Kk			T-05
Amran Group/Nayfa and Hajur Formation	Jn	Bituminous limestone, dolomitic marl and sand	Fracture zones and bedding plane discontinuities, poorly productive aquifer	(A-02)

3.3 Meteorology

Yemen is located within the tropical and subtropical climate zones. Although Yemen has no major seasonal difference, we can broadly divide it into summer from April to October with very high temperatures and a milder winter season from October to April. There are 2 rainy periods: one from March to May, and the other from July to September (see Figure 3-1).

Temperature and humidity are high in the coastal plains during the summer, while the climate is moderate during winter. In the highlands and mountain regions, the weather is moderate in summer, but in winter, it is moderate during the day and cold during the night and early morning.

Table 3-5 Meteorological Conditions of Yemen

Region	Mean Annual Temperature (^{o}C)	Mean Annual Rainfall (mm/year)	Annual Humidity (%)
Coastal Plains	25 - 40	0 – 200	Over 80
Western Highlands	35 (day) and 20 (night); In winter, goes down to 0 or below freezing at night	100 - 1,000	
Eastern Mountains	30 (day) and 9 (night)	100 – 400	35 – 54
Desert	22 – 28	0 – 200	About 15

Figures 3-1 and 3-2 show the monthly rainfall and temperature of the main cities in Yemen for 2003.

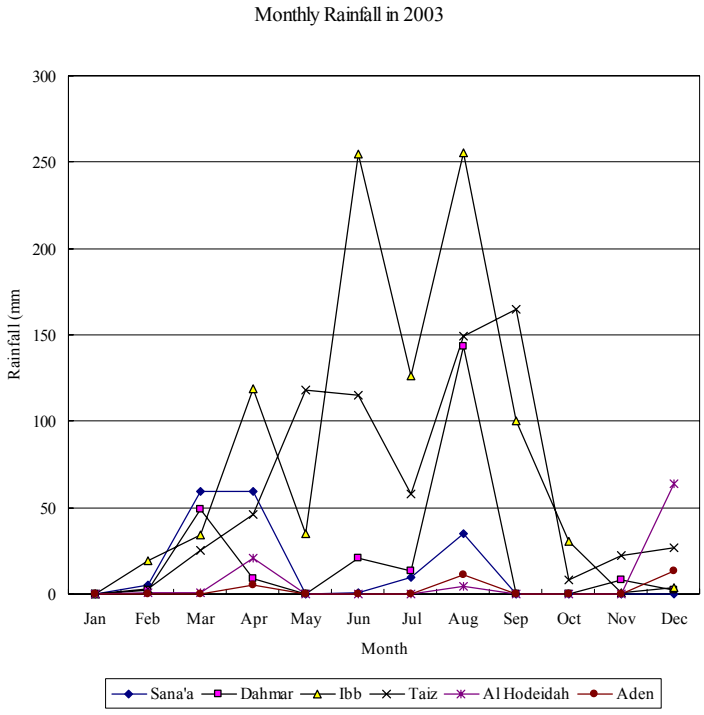


Figure 3-1 Monthly Rainfall

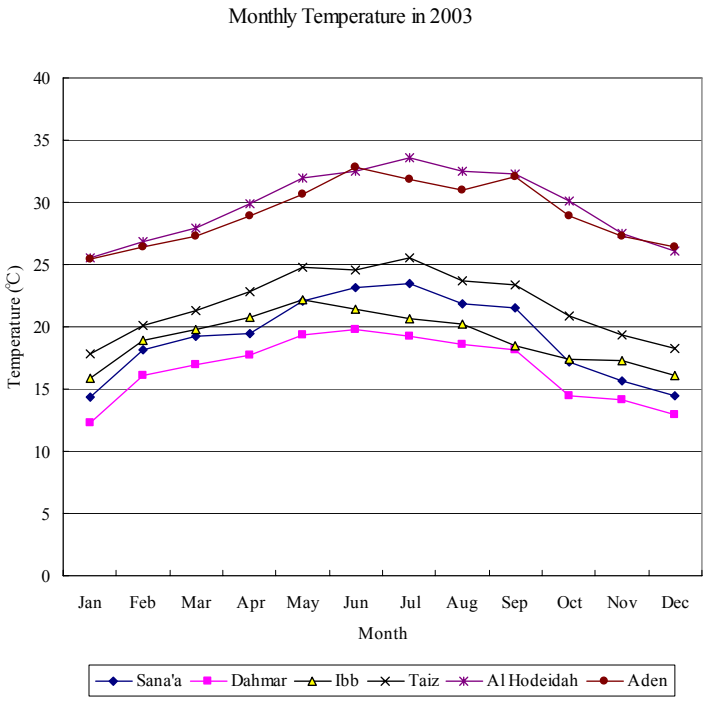


Figure 3-2 Monthly Temperature

Figure 3-1 shows that the highest rainfall was recorded in Ibb Governorate followed by Taiz, Sana'a and Dahmar Governorates which are the study areas. The isohyet map, Figure 3-4, reveals the same tendency, and indicates that rainfall in Al Mahweet Governorate may be the same level as Taiz or Ibb in a long term, although collected average records show somewhat lower values than as shown in the figure. Actually, however, annual rainfall is varying widely between years. As an example of this fluctuation, Figure 3-3 shows the annual rainfall in Wallan located in the southern part of Sana'a Governorate, which varies from 58mm to 441mm with an average of 220mm. At the present, NWRA, TDA (Tihama Development Authority), and CAMA (Civil Aviation and Meteorological Authority) are continuously making meteorological or hydrological observations.

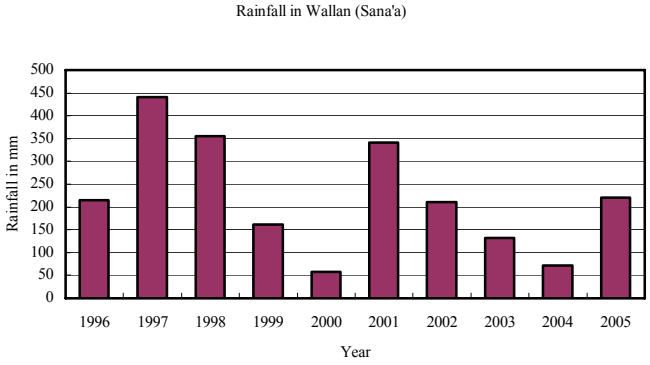
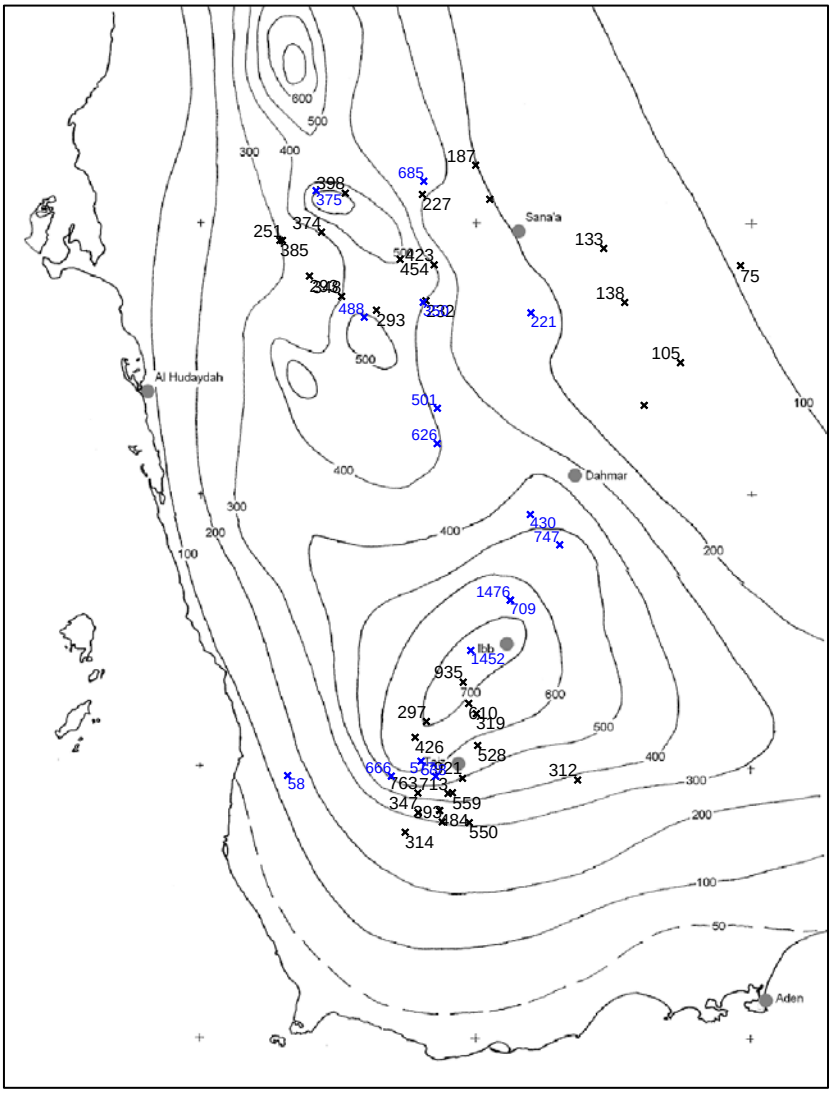


Figure 3-3 Annual Rainfall in Wallan (Sana'a)



Source: NWRA, TDA, Report WRAY-35 (The water resources of Yemen, 1995)

Figure 3-4 Isohyet Map of Study Area

Evapotranspiration was estimated by the Thornthwaite method using temperature data of 2003 for reference, and Table 3-6 shows the results. Another estimation using the Penman method shows evapotranspiration of more than 2000mm in the area.

Table 3-6 Evapotranspiration (Thornthwaite method)

Unit: mm

Area	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Total
Sana'a	37	56	72	75	103	110	118	99	90	56	44	38	898
Dahmar	36	53	66	71	88	89	88	80	72	49	44	39	775
Ibb	47	62	77	86	105	95	91	84	67	59	54	48	875
Taiz	49	62	81	97	127	122	138	111	101	76	59	52	1,075

3.4 Water Resources

3.4.1 Available Water Sources

Water sources presently used by residents of the target villages include boreholes (public and private), dug wells, springs, streams, rainwater and water from vendors. Some villages separate the use of these sources for drinking and irrigation, while many are using the same source for both purposes. Sources such as dug wells, streams and rainwater are easily susceptible to contamination, and high fluctuations in flow rates can be seen throughout the year, where water becomes deficit during the dry season. Therefore, these sources are not given priority as reliable sources for water supply planning, but groundwater pumped up from public boreholes and spring sources were evaluated to be feasible as water sources for this study due to their sustainability, as explained in the comparison table below.

Table 3-7 Comparison of Available Water Sources

Water Source	Feature	Advantage	Disadvantage	Evaluation
Public Borehole	Machine-drilled deep well for use by community	Available to all Good quality	・Pumping equipment needed ・Requires proper O&M	Feasible as public drinking source
Private Borehole	Machine-drilled deep well owned privately, but in some cases, the owner sells water to public	Good quality	・Often cannot be used by community ・If water is sold to public, can be expensive	Difficult for community use
Dug Well	Shallow well usually dug by hand and is either protected (concrete-lined) or unprotected	Easy to construct	・Often seasonal ・Easily contaminated	Often not sustainable, but appropriate for irrigation
Spring	Naturally flowing out from mountain side or in valley	Good quality if properly protected	・Often seasonal	Feasible if perennial
Stream	Flowing along valley floor	Can be accessed by all	・Often seasonal ・Easily contaminated	Often not sustainable, but appropriate for irrigation
Rainwater	Collected by collecting systems (rainwater harvesters) installed on house roof	Easily collected	・Available only during rainy season ・Improper storage can evoke contamination	Feasible if rainfall is abundant throughout year
Vendor Water	Buying water from vendors who visit village	Profitable for vendor	・Tend to cost more than other sources ・Sometimes irregular	Economically unviable

In accordance with the water resource survey made by the Study Team, the candidate sources for planning are public boreholes and spring sources. Some sites have more than one water source available to be used for designing. The results of pumping tests determine the extent of coverage possible with the target water source, and results of water quality analyses reveal the possibility for drinking. The water sources targeted for the candidate sites are listed in Table 3-8.

Table 3-8 List of Study Target Water Sources

Governorate	Site Name	Source Code	Well depth (m)	Casing Diameter (inch)	Pumping Rate (l/s)	Static water Level (G.L.-m)	Pumping Water Level (G.L.-m)
Al Mahweet	Al Sha'afel Al Olyah& Al Sufla	A-01	192	8	4.4	20.12	66.21
	Jabal Al Taraf	A-02	165	8-5/8	4.4	26.00	33.76
	Ozlat Al Jaradi	A-03	150	10	10.4	50.80	55.86
	Al Khamis-Bani Ali	A-04	92	10	4.4	6.66	42.50
Sana'a	Bani Waleed - Al Asboor	S-01/1	348	8	1.6	115.79	142.93
		S-01/2	300	8	3.4	52.78	106.18
	Jarban	S-02	450	10	>2.0	345.31	345.37
	Al Kharaba	S-03	150	8-5/8	3.5	44.93	80.82
	Qamlan-Bait Al Najrani	S-04	145	8	5.6	10.01	10.92
	Afesh	S-05	300	8	3.2	212.97	231.21
	Al Lejam	S-06	300	8	4.2	148.09	149.59
	Bait Al Hadrami	S-07	410	8	3.2	193.22	197.12
	Dajah & Sarfah	S-08	665	10	(6.0)(1	(500.00) (1	(620.0)(1
	Ruhm	S-09	470	8	3.0	192.45	227.9
	Tawa'ar	S-10/1	280	8	2.2	134.78	180.62
		S-10/2	310	8	4.1	144.83	155.96
	Al Hesn-Al Abyad	S-11/1	350	8	3.8	154.11	219.12
	Mahdah	S-12	350	8	2.2	57.78	76.52
	Al Ga'ra	S-13	840	10	(5.4)(1	(520.00) (1	(600.00)(1
	Al Ghail	S-14	185	Borehole collapsed			
Dahmar	Elow Al Mikhlaf	D-01	273	8	2.4	184.13	185.83
	Hamal Bait Al Jabar	D-02	310	8	3.5	185.80	209.3
	Hegrat Al A'asham	D-03	320	8	5.0	163.05	183.95
	Al Kuob	D-04	152	8	0.3	84.90	91.42
	Mayfa'at Yaer	D-05	127	8	2.6	59.56	62.78
	Wardasan	D-06	220	8	0.5	89.65	131.90
	Al Asakera	D-07	304	8	4.5	193.63	195.18
	Masneat Abdul Aziz	D-08	268	8	4.5	61.98	123.68
Ibb	Asfal Bani Saba	I-01	305	8-5/8	4.5	106.40	112.70
	Al Sana	I-02	272	8-5/8	3.9	35.58	140.48
	Mamsa Al Marqab	I-03	78	8	1.6	47.78	54.35
	Al Jahlah & Al Meshraq	I-04	305	8-5/8	4.1	14.85	110.15
Taiz	Al Muayteeb	T-01	300	8	(3.0)(2	140.09	(169.33)(2
	Bani Al Suror	T-02/1	230	8	5.1	183.88	186.42
		T-02/3	251	8	2.6	118.55	139.66
		T-02/4	190	8	5.4	137.23	139.48
	Sheb Humran	T-03/1	400	8	4.0	22.53	44.82
		T-03/4	260	8	4.2	24.42	28.46
	Yafoq Bani Hamad	T-04	220	8	3.0	124.80	126.71
	Al Azaez	T-05/1	120	8-5/8	2.0	8.41	53.60
		T-05/2	120	8-5/8	(2.0)(3	(9.00)(3	(50.00)(3
		T-05/4	Spring	-	2.4 - 5.5(4	-0.05	-
	Al Khunha	T-06	200	8	8.8	0.00	5.62

1) GARWSP data
2) Estimated figures by step drawdown test
3) Estimated from GARWSP data
4) Estimated yield of dry–rainy season

3.4.2 Groundwater Potential

The water sources targeted for the candidate sites were evaluated for their potential as reliable water sources. Evaluations were made for transmissivities, water level recovery rates and depths of water tables from results of pumping tests, as well as analysis of water balance from ratios of projected discharge to estimated recharge.

The water balance was analyzed by taking the ratio of groundwater consumption for irrigation and domestic use against the estimated annual groundwater recharge in a catchment. A ratio of 100% means that discharge is equal to recharge in the area, and a ratio above 100% means that groundwater storage is unlikely to be sustainable in a long term. At sites showing more than 200% discharge ratio, the design pumping rate may cause critical conditions to the aquifer within a short period.

The recovery time ratio should recover to its original static water level as soon as possible after the pump is stopped. If the ratio is greater than 1, then the water level will probably lower continuously to drain off the aquifer.

A transmissivity value of $10m^2$/day implies good potential which is sufficient for rural water supplies. A value below 0.1 m^2/day is considered to be infeasible for water supply.

The pumping water level is the level of water which lowers from the static water level when a pump is in operation. The pumping water level has effect on pump cost and operation cost.

The evaluation results were grouped into potential levels as shown in Table 3-9.

Groundwater consumption for irrigation, which is mainly used for qat cultivation, is probably the main cause of the present over discharge of some catchments. The volume of water used for qat irrigation can supply a population living in an area more than 100 times that of the qat field. Therefore, an efficient and conservative irrigation water use is the most important issue for groundwater management.

For some catchments in Yemen, if construction of an additional well is to be planned due to insufficiency of the existing production well, then exploring other catchments to develop another aquifer may be a better solution rather than to construct another production well near the existing borehole. Especially at sites where the water balance may be critical, it is advisable to construct an additional well in another larger catchment.

Table 3-9 Potential Evaluation of Water Sources

Site Name	Code	Water Balance	Recovery	Transmissivity	Water Level	**Potential**
Jabal Al Taraf	A-02	A	A	A	A	**High**
Qamlan-Bait Al Najrani	S-04	A	A-	A	A	
Mahdah	S-12	A	A	B	A	
Al Muayteeb	T-01	A-	A	(B)	B	
Masneat Abdul Aziz	D-08	A-	A	C	B	**Moderately High**
Al Sana	I-02	A-	B	C	B	
Al Jahlah & Al Meshraq	I-04	A-	B	C	B	
Mayfa'at Yaer	D-05	B	A	A	A	**Moderate**
Sheb Humran	T-03	B	A	A	A	
Asfal Bani Saba	I-01	B	A	A	B	
Ozlat Al Jaradi	A-03	B-	A	A	A	
Elow Al Mikhlaf	D-01	B-	A	A	B	
Yafoq Bani Hamad	T-04	B-	A	A	B	
Bani Al Suror	T-02	B-	A	A	B	
Jarban	S-02	B-	A	A	D	
Al Khamis-Bani Ali	A-04	B-	A	B	A	
Al Kharaba	S-03	B-	B	B	A	
Bait Al Hadrami	S-07	C	A	A	B	**Fair**
Afesh	S-05	C	A	A	C	
Al Khunha	T-06	C-	A	A	A	
Al Asakera	D-07	C-	A	A	B	
Hamal-Bait Al Jabar	D-02	C-	A	A	C	
Al Azaez	T-05	C-	A	C	A	
Ruhm	S-09	C-	A	C	C	
Al Lejam	S-06	C-	A-	A	B	
Hegrat Al A'asham	D-03	C-	B	A	B	**Low**
Al Hesn-Al Abyad	S-11	C-	B	C	C	
Mamsa Al Marqab	I-03	C-	C	A	A	**Very Low (Not Sustainable)**
Dajah & Sarfah	S-08	C-	−	−	(D)	
Al Ghail	S-14	C-	−	−	−	
Tawa'ar	S-10	D	A	A	B	
Al Kuob	D-04	D	A	C	A	
Wardasan	D-06	D	B	C	B	
Al Sha'afel Al Olyah & Al Sufla	A-01	D	C	B	A	
Al Ga'ra	S-13	D	−	−	(D)	
Bani Waleed-Al Asboor	S-01	B-	D	B	B	
Classification	A	R≦50%	t_R≦1.0	T≧10	PWL≦100	
	B	50%<R≦100%	1.0<t_R≦1.5	5<T<10	100<PWL≦200	
	C	100%<R≦200%	1.5<t_R≦2.0	1<T<5	200<PWL≦300	
	D	R>200%	t_R>2.0	T<1	PWL>300	
		Ratio (discharge/ recharge)	Recovery time ratio	Transmissivity in m^2/day	Pumping water level in m	

3.4.3 Water Quality

The main source to be used for formulation of rural water supply improvement plan is groundwater from boreholes. Compared to surface water and groundwater from dug wells, boreholes are regarded to be clean and safe. However, quality of groundwater from boreholes is known to have problems in some parts of Yemen. The following parameters may give cause for problems with water quality in Yemen.

Table 3-10 Parameters Causing Problems with Water Quality in Yemen

Parameter	Distributed Area	Remarks
Fluoride	Southern area of Sana'a Governorate Northern area of Dahmar Governorate Northern area of Ibb Governorate	Concentrations over 3 mg/l are reported for possibilities of mottling of teeth.
Iron	Southern area of Sana'a Governorate	According to WHO reports, high concentrations of iron do not have effect on health, but may color clothes when washing, and taste and appearance may become objectionable.
Hardness	Most of groundwater in country	Hardness is usually high, which is probably due to broad distribution of limestone areas.
Chloride ion	Along coastal plains and areas with low rainfall and high evapotranspiration	High concentrations impart salty taste and can corrode iron pipes.
pH	Southern area of Sana'a Governorate. Northern area of Dahmar Governorate. Northern area of Ibb Governorate	High values of pH are reported, which can give slightly soapy taste. Incidents of diarrhea are reported in high pH areas.

Water qualities were analyzed for samples taken from target groundwater sources as well as other sources presently used by residents of the candidate sites. The tendencies explained in the above table were found in the analyzed samples and candidate sites with target water sources of poor quality were screened out from the list of sites for rural water supply planning.

3.4.4 Relationship between Catchment and Basin

The definitions of catchment and basin and their relationship used in this study are explained in the following table.

Table 3-11 Relationship between Catchment and Basin

Water Retention Area	Definition and Characteristics
Catchment	Small branch area within a Sub-basin
Sub-basin	Small-scale, independent basin within a Basin
Basin	Natural water retaining system

In this study, water balance analyses were based on catchments in which the target water source is located. Water balance of catchments does not have direct relationship with water balance of principal basins (such as that which was conducted for the Sana'a Basin in the water resources component of this study, which is a separate study component). Water balance calculations made in the past for principal basins (such as Sana'a Basin) are rough calculations based on data such as basin area, rainfall rate and irrigation area, and relations with smaller basins, or sub-basins, and catchments within the basin are not reported.

Groundwater level lowering is reported in many aquifers in Yemen, but this phenomenon cannot always be generalized to their catchments. In many areas of Yemen, especially groundwater targeted for this study, water sources are developed in fractured zone aquifers. Therefore, area-wise differences in groundwater level lowering are highly probable.

However, according to the Sana'a Basin Water Management Project (SBWMP), survey results reveal that, within Sana'a Basin, 84% of the residents feel that groundwater level is lowering. This may correspond to results of the present Study, where for most of the sites located to the south and east of Sana'a capital, which are sites S-05 to S-14, water balances were evaluated as C or less (meaning water consumption rate is more than recharge rate). On the other hand, those sites located to the west of the capital (sites S-01 to S-04) were rated higher than C, and these sites are located on the peripheral or outside of the Sana'a Basin.

CHAPTER 4 INSTITUTIONAL ASPECTS

4.1 Administrative Division of Yemen

The Republic of Yemen has administrative divisions as shown below. The country is divided into 22 governorates including the capital city of Sana'a as one special governorate called the Capital Secretariat.

Table 4-1 Yemen Administrative Division

Administrative Level		Remarks
English	Arabic	
Country	Balad	Republic of Yemen
Governorate	Muhafda	22 Governorates (see list below)
District	Moderiah	336 Districts, of which 305 are Rural Districts
Sub-District	Ozla	
(Commune)	(Mamsa)	Only for Ibb Governorate
Village	Qaryah	A group of villages is called Kolah
Hamlet or Sub-Village	Mahallah	

List of Governorates

1. Capital Secretariat (Sana'a City)	9. Ibb	17. Sada'a
2. Sana'a	10. Abyan	18. Marib
3. Aden	11. Dahmar	19. Al Jawf
4. Taiz	12. Shabwa	20. Amran
5. Hadramaut Coastal	13. Al Beida	21. Al Dhala
6. Hadramaut Al-Wadi	14. Al Mahra	22. Raimah
7. Hodeidah	15. Al Mahweet	
8. Lahj	16. Hajja	

The 36 candidate sites for this study are classified either as Sub-District, Commune (for Ibb Governorate) or Village, and the sites are composed of a number of villages or hamlets (or sub-villages) depending on its classification.

4.2 National Strategy/Policy for Rural Water Supply Sub-Sector

The main national policies and plans related to the rural water supply and sanitation sub-sector of Yemen are documented in the "Draft National Rural Water Supply and Sanitation Policy-Strategy (2004)". Further, the "Draft Rural Water Supply and Sanitation Reform Policy (2004)" and "National Water Sector Strategy and Investment Program (NWSSIP), 2005-2008" promote decentralization and sector reform for this sub-sector. The strategic problem for development of this sub-sector resulting from two different implementation bodies (GARWSP branch offices under MWE and governorate/district local authorities under MLA) for rural water supply projects under the decentralization strategy is explained in Chapter 5.

These sectoral strategies are linked from the Millennium Development Goals (MDGs) and Poverty Reduction Strategy. Under one of the MDGs which is "to ensure environmental sustainability", an important target is set as "Reduce by half the proportion of people without sustainable access to safe drinking water by 2015". The goals for rural water supply and sanitation are shown below.

Table 4-2 Millennium Development Goals for Rural Water and Sanitation Sub-Sector

Year	Rural Water Coverage Rate	Rural Sanitation Coverage Rate	Rural Population with Access to Safe Water	Rural Population with Access to Sanitation	Total Rural Population
2003	25%	20%	3.4 million	2.8 million	13.8 million
2009	47%	37%	8.2 million	6.5 million	17.5 million
2015	65%	52%	13.6 million	10.9 million	20.9 million

The policy issue for a sustainable rural water supply and sanitation is based on the principles of decentralization, community participation and demand responsive approach. The approach for achieving the above goals is listed below.

1. Increase coverage and implementation capacity
    - Formulate sector strategy and establish coordination
    - Improve project implementation
    - Expand the range of partners
2. Improve technology choices
    - Widen and adapt technology choices
    - Factor in sanitation and hygiene
3. Ensure water resources and their quality
4. Improve targeting of the communities and sustainability of the schemes
    - Adapt bottom up approaches throughout and ensure that gender is mainstreamed
    - Promote sustainability through strengthening the role of community institutions
    - Target finance to the greatest need

4.3 Organization for Water

Water supply and management of water resources is under the responsibility of the Ministry of Water and Environment (MWE). This ministry is divided into two sectors of water/sanitation and environment with each possessing a Deputy Minister. The organization chart of the ministry is shown below.

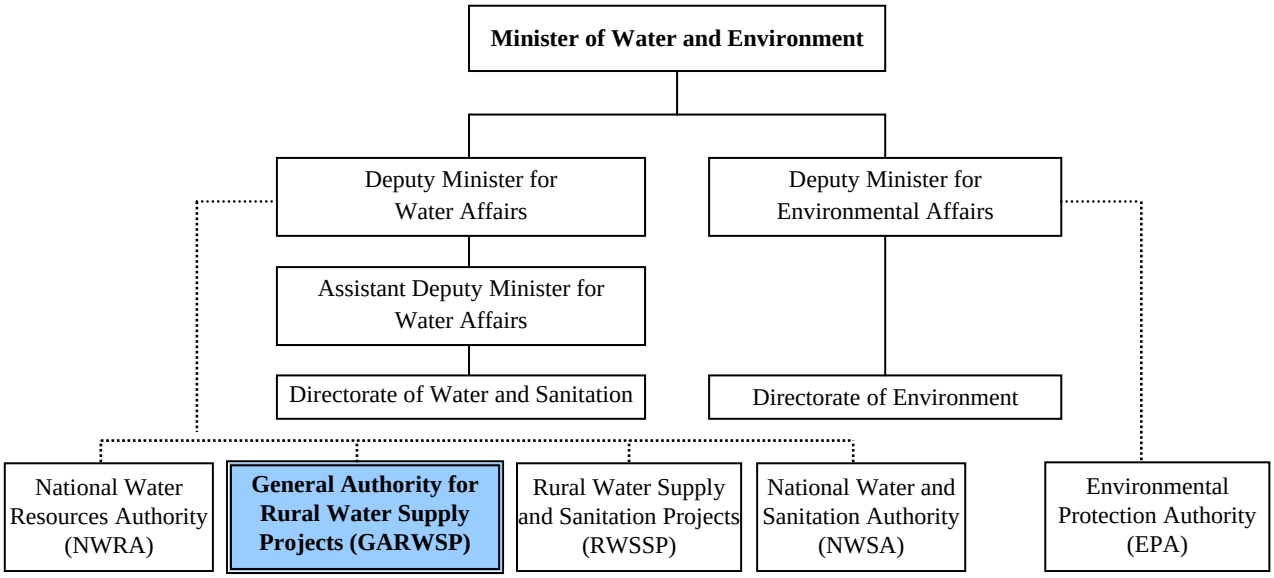


Figure 4-1 Organization Chart of MWE

The body responsible for supply of safe drinking water to the rural population is the General Authority for Rural Water Supply Projects (GARWSP). GARWSP headquarters is located in Sana'a for planning and coordination of projects, and branch offices are located in 19 governorates for actual implementation of rural water supply projects at selected sites. As of 2005, headquarters has 280 staff and 245 staff at branch offices for a total of 525 persons employed. See Chapter 5 for information on the organization of GARWSP branch offices of study target governorates.

4.4 Related Organizations

4.4.1 Assistance from International Organizations and Donor Countries

International organizations such as World Bank and UNICEF, as well as European countries such as the Netherlands and Germany have continuously assisted the water sector of Yemen. For the rural water sector, the Netherlands has given assistance on a long-term basis since 1980 along with Japan. Japan has mainly assisted in construction of water supply facilities, and assistance for software-component such as capacity building was very limited. On the other hand, the Netherlands' strategy is water supply promotion and expansion including software assistance to one governorate at a time (Dahmar governorate in the 1980's and Hodeidah governorate in the 1990's, while branch offices were also established in each governorate). This study aims to contribute to the promotion of the National Water Sector Strategy and Investment Program (NWSSIP) as the national program for the water sector.

4.4.2 Public Works Project

Public Works Project (PWP) is a Project Management Unit (PMU) established in 1996 by the Ministry of Planning and International Cooperation with objectives of job creation and construction of small scale social infrastructures. The whole country is divided into 2 Areas and each area is sub-divided into 3 Sub-areas with each sub-area covering about 3 governorates. Projects being implemented are in the fields of public works on infrastructures, water supply, education, agriculture, roads, social works, and health and sanitation. The procedures for project implementation are as follows.

- For site selection, based on demand driven approach (DRA), communities submit requests to PWP through local council, and the requested sites are screened to select the most urgent sites. The screening is carried out using geographical criteria for budget constraints and poverty line criteria.
- A pre-construction survey is conducted. This survey includes survey on procurement of materials, socio-economic survey and willingness-to-pay survey.
- Roles and responsibilities in construction of supply scheme among community, local council, PWP, and GARWSP are determined and agreed. In general, the community pays 5% of the construction cost. Since one of the objectives of PWP is job creation through enhancing public works, project implementation should concentrate on labor-intensive

civil works. Thus, for the implementation of development project, PWP collaborates with relevant national sector institutions. In the implementation of rural water supply project, GARWSP is requested to provide pumps and pipes from its own fund. Local councils are sometimes responsible for a certain portion of the construction cost of the supply schemes, while the rest of it is funded by PWP.

- Technical and social consultants are hired for project implementation. Tendering is announced in a newspaper, tender documents are received by sub-area offices, and evaluation and contract signing are held at the central office.
- Since one of the objectives of PWP is job creation, project implementation should concentrate on labor-intensive civil works. For water supply projects, procurement of pumps and pipes are requested to GARWSP since purchasing is not a responsibility of PWP.
- The extent of responsibility of PWP for water supply projects is laying pipes, making house connections and training on management.

The budget for Phase 1 (December 1996 to June 2000) was US$32,400,000 and that for Phase 2 (July 2000 to 2004) was US$115,680,000. The fund is broken down as 50% from donor loans, 38% from donor grants, 6% from Yemeni government fund and 5.5% from beneficiaries. Phase 3 started in 2005 and is scheduled for completion in 2009. The budget for Phase 3 is US$72,500,000 with US$32 million allotted for the water supply sector.

Training to local councils for all sectors started in 2003, and includes local resources mobilization, awareness, priority needs and planning. The training is carried out by a consultant. For community training, some are handled by PWP and others through coordination with SFD (Social Fund for Development). The training subjects for management of water supply facilities include formation of water committees, election of members, setting water tariffs, meter reading, billing of water fees, operation and maintenance and opening bank accounts. The preparation of a manual for operation and maintenance funded by UNDP, World Bank and SFD is scheduled to start in 2006 and will continue for 3 years

4.4.3 Social Fund for Development

Social Fund for Development (SFD) is, similar to PWP, a highly independent organization, both administratively and financially, established in 1997 directly under the presidential office. SFD is comprised of 3 main project components: 1) community development (fields of water supply, environment, public health, social security, cultural heritage and agriculture), 2) job creation through micro-financing and 3) capacity building and institutional strengthening. The objectives of SFD are to raise the standard of living of the poor and poverty reduction through provision of basic social and economic services such as education, health, water supply, micro-financing and job creation. Millennium development goals and realization of the poverty reduction strategy are the present aims. Since activities are similar to those of PWD, joint projects are being promoted.

Funding sources of SFD include the Yemeni government, World Bank, Arab fund, EU, OPEC, Islamic Development Bank, the Netherlands, the United States, England, KfW and Japan. The budget for Phase 1 and 2 (1997 to 2003) was US$250 million and US$400 million is planned for Phase 3 (2004 to 2008). Allocation to the water supply sector is 15%, which is second to the education sector (53%).

Presently, SFD is promoting low-cost technology such as rainwater harvesters and small-scale water systems using boreholes fitted with motorized pump for rural water supply. The training program provided to communities includes formation of community organizations, project management and education on public health and sanitation.

4.4.4 RWSS-TA of Netherlands Support

RWSS-TA (Rural Water Supply and Sanitation-Technical Assistance) is a program started in 1982 through funding by the Netherlands government for capacity development of GARWSP headquarters and 5 branch offices (Hajjah, Abyan, Hodeidah, Taiz and Ibb). From 2005, support is being given to Ibb and Taiz governorates for rural water supply improvement and capacity building of GARWSP branch offices in the 2 governorates. In 2005, 3 million Euros was invested in equipment and tools as well as construction of 34 water supply schemes to benefit 130,000 persons. Procedures for implementation of technical assistance are shown below.

- The Royal Netherlands Embassy deposits funds into the Central Bank of Yemen as a revolving fund. Under the control of the Ministry of Finance, the fund goes into the current account of GARWSP and this is allotted to the branch offices.
- During the technical assistance, a midterm evaluation is made to reflect achievements upon future plans.
- A financial expert reviews the financial procedures and system, and identifies the constraints and weaknesses.

As the modality for implementation, the budget is allocated based on the plans by GARWSP. However, plans are not actually being formulated by GARWSP.

4.4.5 RWSSP of World Bank

RWSSP (Rural Water Supply and Sanitation Project) of World Bank is managed by PMU's in 6 governorates (Ibb, Abyan Hajjah, Amran, Lahej and Al Dahl). For Ibb governorate, which overlaps with this study, the status of project implementation in the last quarter of 2005 is 60 completed, 34 under construction, 17 going through tendering, 39 under technical study, and 18 under social study, for a total of 168 projects. These projects are scheduled for completion in 2007 aiming to cover 400,000 persons.

Implementation procedures involve the following.

- Campaigning is conducted to the community
- A 5% contribution in cash or kind is needed from the community
- World Bank will open an account (which will be handed over to the community at the end of the project)
- A water committee is formed
- Rules and methodology are explained
- Contract is signed between RWSSP branch unit, water user association (WUA) and local council
- A social mobilization team (SMT) consisting of a coordinating engineer, a social specialist and a health and hygiene specialist who were hired by World Bank conducts a survey
- Tender procedures (tender opening, evaluation and recommendation) are handled by branch units, while headquarters advertises and gives approval

Water sources are mostly boreholes but springs and rainwater harvesting are also used, and water service level is mostly Level 3. Budget is transferred from headquarters to branch offices every 3 months.

4.4.6 UNICEF

UNICEF has activities in 9 governorates (Sana'a, Amran, Hajjah, Hodeidah, Ibb, Lahej, Abyan, Al Mawheet and Al Dahl). One or two schemes are implemented in each governorate and GARWSP has responsibility for social mobilization. The governorates of Sana'a and Ibb overlap with this study.

A rural water supply component is included in the on-going Child Development Program, but this component expired on 31st December 2005. However, UNICEF support will continue until the end of 2006, and the next program is scheduled for 2007 to 2010.

The rural water supply methods adopted by UNICEF are mostly motorized schemes (Level 3: house connections) using boreholes as water sources, but handpumps, solar powered systems, gravity fed systems using springs and rainwater harvesting are also used.

4.4.7 Monitoring and Follow-up

All water supply schemes constructed in collaboration with other sub-sector development institutions mentioned above, such as PWP, SFD, and RWSSP, and international organizations such as UNICEF, are handed over to the community. Communities become responsible for operation and maintenance, and in many cases, form community-based organizations. Local authorities, in particular local councils, and GARWSP branch offices are expected to monitor and follow-up the community-based management of the supply schemes, providing technical guidance to the communities after completion of the project. However, as it is explained in Chapter 5, "Capacity Assessment", the capacity of local authorities for monitoring and follow-up is limited.

4.4.8 UNDP

UNDP does not directly assist the rural water supply sub-sector, but through execution of the Decentralization and Local Development Support Program (DLDSP), promotion of the decentralization policy is supported and a significant contribution is made to building an institutional-administrative framework for implementation of rural water supply projects in the future.

The decentralization policy of Yemen is defined in the revised Local Authority Law (Local Authority Law/No. 4/2000) enacted in 2000, in which the framework for institutional and administrative organization is explained and responsibilities for implementation of social infrastructure service projects which include rural water supply are transferred to local authorities (governorates and districts). DLDSP is a program based on this decentralization policy, and transfer of major infrastructure development projects, including rural water supply projects being implemented by PWP, SFD and other organizations, into the planning and implementation structure of local authorities is part of the program. Allocation of development budgets and reorganization of staff related to implementation of social infrastructure projects by local authorities are also included in the program. Implementing rural water supply projects in the future will require careful consideration of organizational, institutional and administrative matters.

DLDSP is presently giving support to the Ministry of Local Administration (MLA) as the body responsible for rural administration and local authorities of 28 districts in 6 governorates, including Taiz governorate which is one of the target areas of this study. At the target districts of DLDSP, assistance to formulation of District Development Plans, which include rural water supply sub-sector development plans, is being carried out.

CHAPTER 5 CAPACITY ASSESSMENT

5.1 Concept of Capacity Assessment

To make a comprehensive assessment of the capacity for rural water supply improvement in this study, an analysis on interrelated hierarchical capacity levels such as policy/social system level, institutional level and individual level was attempted. Therefore, the analysis was conducted from 2 separate viewpoints of (1) issues related to the sub-sector handled by GARWSP (headquarters and branch offices) and governorate/district local authorities and (2) institutional and individual capacities of GARWSP and local authorities as listed below.

Issues Relevant to Sub-Sector

- Sub-Sector Policy, Administrative Framework and Decentralization Strategy
- Other Main Organizations and Agencies in Sub-Sector

Institutional Capacity

- Institutional Organization
- Leadership
- Human Resources
- Financial Aspects
- Facilities and Equipment
- Program and Service Management
- Process Management
- Organizational Culture, Style and Mission

The capacity hierarchy and analysis factors are diagramed below.

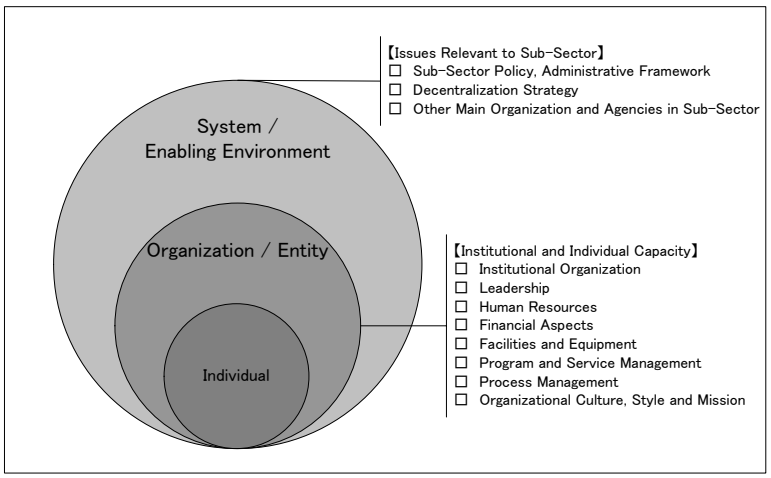


Figure 5-1 Conceptual Diagram for Capacity Assessment

5.2 Issues Relevant to Rural Water Supply Sub-Sector

5.2.1 Sub-Sector Policy, Administrative Framework and Decentralization Strategy

The main policies and laws which make up the administrative framework for the rural water supply and sanitation sub-sector are as follows.

- Water Law (2002)
- Decree No.60 of 2002 establishing GARWSP
- Decree No.218 of 2004 establishing Ministry of Water and Environment
- Law No.4 of 2000 on Local Authority
- Draft National Rural Water Supply and Sanitation Policy-Strategy (2004)

Furthermore, the papers to promote administrative and institutional strategy, especially decentralization and sector reform of this sub-sector, are the following.

- Draft Rural Water Supply and Sanitation Reform Policy (2004)
- National Water Sector Strategy and Investment Program (NWSSIP), 2005-2008
- Law 1 of 2001 regarding NGO and Societies Law
- Rural/Local Development Strategy (2003)
- GARWSP Branch Office Decentralization Plan (2005)

In this study, these policies, strategies, laws and related reviews were analyzed, and the main issues for promoting sector reform were compiled. Then, the roles and responsibilities to be assigned to GARWSP headquarters and branch offices as well as governorate/district local authorities were studied.

The strategic problem for development of this sub-sector is that there are 2 separate main implementation bodies for rural water supply projects under the decentralization strategy, which are GARWSP branch offices under MWE/GARWSP as one body, and governorate/district local authorities under MLA as the other body. Also, in the Draft National Rural Water Supply and Sanitation Policy-Strategy (2004) and Draft Rural Water Supply and Sanitation Reform Policy (2004), both formulated by World Bank, a governorate rural water supply and sanitation authority (GRA) is to be newly established under the governorate local authority to become the main implementing body for rural water supply and sanitation projects, and proposes the function of GARWSP branch offices (under MWE) to be integrated into GRA (under MLA). The different roles and functions of bodies appointed in each strategy and plan are shown below.

Table 5-1 Different Decentralization Policies of Rural Water Supply and Sanitation Sub-sector

Policy/Strategy/Plan	Main Body	Main Decentralization Issue
GARWSP Branch Office Decentralization Plan (2005)	GARWSP MWE	Project implementation role to be transferred from GARWSP headquarters to branch offices by 2010
Draft National Rural Water Supply and Sanitation Policy-Strategy (2004)	MWE World Bank	Function of GARWSP headquarters to be limited to policy decision, regulation and monitoring
Draft Rural Water Supply and Sanitation Reform Policy (2004)		Project implementation role to be transferred to GRA which will be established under governorate local authorities
Law of No.4 of 2000 on Local Authority, and its By-law of Local Authority	MLA	The main body for planning, implementation, supervision and monitoring of infrastructures including rural water supply facilities will be governorate/distrct local authorities

Table 5-2 Assigned Roles and Responsibilities of Bodies in Each Strategy/Plan

Policy／Strategy／Plan	Policy/ Strategy Decision	Regulation, Monitoring	Project Planning	Project Execution	CBO Formation, Capacity Building	Project Monitoring
GARWSP Branch Office Decentralization Plan	MWE GARWSP	MWE GARWSP	GARWSP Branch & Local Authority	GARWSP Branch & Local Authority	Local Authority	Local Authority
Draft National Rural Water Supply and Sanitation Policy-Strategy	MWE GARWSP	MWE GARWSP	GRA	GRA	GRA	GRA
Draft Rural Water Supply and Sanitation Reform Policy	MWE GARWSP	MWE GARWSP	GRA	GRA	GRA	GRA
Law of No. 4 of 2000 on Local Authority, and its By-law	-	-	Local Authority	Local Authority	Local Authority	Local Authority

Supported by UNDP and other donors, decentralization is being promoted by MLA, and at the same time, MWE/GARWSP with World Bank is also promoting decentralization independently. Consequently, strong political willingness and donor support can be confirmed. However, since a lack of consistency between policies and strategies to make decisions by project execution agencies for sub-sector development is apparent, coordination between ministries becomes an important issue. Moreover, from differences in policies and strategies, the roles and responsibilities of GARWSP branch offices and local authorities for water supply projects are overlapping. Therefore, this can have negative impacts on improvement of local bodies of both ministries.

According to the inquiry with the policy decision advisor of UNDP, although the final objective for decentralization of the rural water supply sub-sector is to transfer project implementation responsibilities to governorate/district local authorities, the function transfer to branch offices presently being advanced by GARWSP is transitional for institutional strengthening of local authorities, and does not contradict the policy being promoted by MLA. That is, according to the decentralization plan of GARWSP, when the transfer of project implementation responsibilities to GARWSP branch offices is ascertained, then integration into local authorities is to be decided thereafter (refer to the figures shown in the next page).

Although future integration of GARWSP branch offices into local authorities is not specified in the policies and strategies of MWE and GARWSP, the concept is not denied. As a consequence, since the capacity of GARWSP branch offices is to be established within the local authorities, the assistance to formulation of a capacity development plan for GARWSP headquarters and branch offices from this study has policy-wise feasibility within the visualized institutional framework of decentralization.

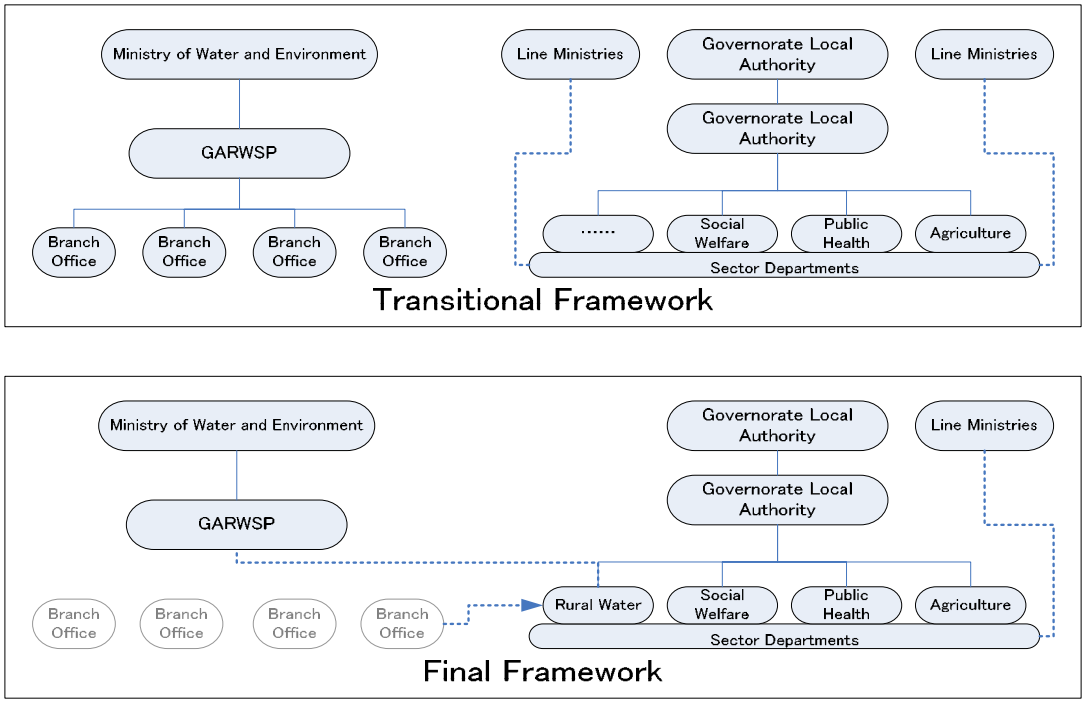


Figure 5-2 Decentralization of Rural Water Supply Sub-Sector and Integration into Local Authorities

5.2.2 Other Important Bodies in the Sub-Sector

In the latter half of the 1990's, development of the rural water supply sub-sector was executed by 2 ministries: the Ministry of Electricity and Water (MEW) and the Ministry of Agriculture and Irrigation (MAI). GAREW (General Authority for Rural Electricity and Water), the predecessor to GARWSP, was the implementing agency of MEW, while RDA (Rural Development Authority) handled projects under MAI. Each RDA office had responsibility for one or more governorates, and was relatively autonomous both administratively and financially to execute projects for development of infrastructures including rural water supply as well as agriculture, irrigation, schools and health centers. Development investments through RDA made multi-sector regional integration development possible and the autonomous capacity of this organization was highly evaluated to concentrate development assistances into the rural water supply sub-sector by many donors. However, at the end of the 1990's, the effectiveness of multi-sector regional development was criticized, and donors lead by World Bank began to plan sector-specific (targeting the rural water supply sector) and community-based projects.

While donors became more involved in planning sector-specific, community-based projects, the situation of project implementation and institutional management of GAREW became very critical. This was the consequence of evidence of the weak organizational capacity of GAREW for development of rural water supply projects, and dispersion of limited development sources and cancellation of projects due to political pressures on selection of priority areas and communities. In 2001, the function of GAREW stopped and all responsibilities for rural water supply were temporarily transferred to MLA.

In this situation, as sub-sector assistance, World Bank started the Rural Water Supply and Sanitation (RWSS) Project in 2000. However, instead of allowing GAREW to be the executing agency, a highly independent project management unit (PMU) was established at headquarters as the decision making agency and project implementation units (PIUs) were set in each project area. This formed a project implementation system which is still continuing now. Also, SFD（Social Fund for Development）and PWP（Public Works Project）, which were established for community-based project implementation, maintain rural water supply projects as one of their larger components through World Bank assistance and independently formed PMUs and PIUs are executing the projects.

Furthermore, governorate/district local authorities are also implementing rural water supply project through independent budgets and assistances from SFD and PWP, which indicates that numerous sector development agencies are available for the rural water supply sub-sector. Each agency has differences in assistance modality, financial flow and decision making process for planning and implementation to cause difficulties for coordination within the sub-sector.

Due to the restructuring of the water administration, in 2002, the present GARWSP was established under MAI, and in 2004, when the Ministry of Water and Environment (MWE) was formed, GARWSP was placed under this new ministry. Now, jurisdiction of the rural water supply sub-sector is integrated as MWE/GARWSP.

Although the responsible agency for the rural water supply sub-sector is MWE/GARWSP, many sub-sector development agencies still exist as explained above. Since the actual powers of MWE are limited, to effectuate development investments and promote common ownership of development strategies, the National Water Sector Strategy and Investment Program （NWSSIP） for 2005-2009 was formulated by RWSS-TA（Rural Water Supply and Sanitation –

Technical Assistance）through the assistance of the Netherlands and World Bank. Also, conferences on sector coordination between donor programs led by GARWSP are being held for mutual sharing of strategies and effective investments. Furthermore, at the local level, joint projects are planned and implemented by GARWSP branch offices with district local authorities/SFD/PWP and RWSS to realize cooperation between MWE/GARWSP and other development agencies.

Nevertheless, the sector coordination capacity of MWE/GARWSP has limitations, and since each sub-sector development agency has its own budget flow and decision making process, MWE/GARWSP will have difficulties to carry out efficient and integrated strategy formulation and effective project implementation. Moreover, as explained later, the limitations in institutional capacity of MWE/GARWSP, including capacity for strategy formulation and project implementation, further complicates the problem.

5.2.3 Roles of Bodies in Rural Water Supply and Sanitation Sub-Sector

Within the policies and strategies in the rural water supply sub-sector, the roles and responsibilities of relevant organizations are not comprehensively defined. In the Draft National Water Supply and Sanitation Policy-Strategy, the roles and responsibilities of each organization are defined, but are yet to be approved. However, many duplications and omissions are found in assignment of roles and responsibilities, and the mechanism for coordination between organizations is weak, and therefore, this cannot be considered as a clear definition. The following table is quoted from the National Water Supply and Sanitation Policy-Strategy (Draft), which describes roles and functions of institutions involved in the rural water and sanitation sub-sector. As observed in the table, however, roles and functions for each sector development institutions are not adequately demarcated and clarified with a number of duplications and omissions in allocation of functional roles and responsibilities.

Table 5-3 Roles and Functions of Bodies Related to Rural Water Supply Sub-Sector (from Draft National Water Supply and Sanitation Policy-Strategy)

Sector Roles and Functions	Planning	Financing	Policy Formulation	Implementation	Supervision	Regulation	System O&M	System Management	Technical Assistance	M&E / MIS	Training	Communications	Research	Coordination	Consumer Advocacy	Emergency Management
MWE	×	×	×		×	×				×		×	×	×	○	×
GARWSP	×	×	×		×	×	○	○	×	×	×	×	×	×	○	×
Other MWE Authorities	○		○			○	○	○	×	×	○	○	○	○		×
Regional RWSS Authority	×	×	×	×	×	○	○	○	×	×	×	×	○	×	○	×
Governorate RWSS Authority	×	×	○	×	×		○	○	×	×	×	×	○	×	○	×
Local Governorate Authority	×	×	○	×	×	○	○	○	×	×	×	×	○	×	○	×
District Local Authority	×				×		○	○		×	○	×		○	○	×
Other Ministries / Agencies	×	×	○			○	○	○	×	○	○	○	○	○		×
Social and Works Funds		×		×						○	○	○		○		○
Bilateral Donors	○	×	○		○				×	○	○	○		○		○
Multilateral Institutions	○	×	○		○				×	○	○	○		○		○
Private Sector	○	×	○	×	×	○	×	×	×	○	○	○	○	○		
National NGOs	○	×	○	×		○			×	○	○	○	○	○	×	○
International NGOs	○	×	○	×		○			×	○	○	○	○	○	×	○
Civil Society	○		○		×	×	○	○	×	○	○	○		○	×	○
Communities	×	×	○	×	×		×	×		×	○	○	○	○	×	○
Educational/Research Organizations	○		○			○			×	○	○	○	×	○	×	

×=Responsible
○=Participating

In the RWSS-TA (Rural Water Supply and Sanitation-Technical Assistance) Project being implemented through the assistance of the Netherlands government, roles and responsibilities of organizations/agencies were compiled in accordance with analysis of each sub-sector policy and strategy, as well as meetings between relevant ministries and donors/communities as shown in the following table. Also, from reviews of each sub-sector policy/strategy and discussions with MWE/GARWSP and other related sub-sector organizations made in this study, the roles and responsibilities of each organization/agency were similarly comprehended, and therefore, formulation of the capacity development plan will be in line with this institutional framework.

Table 5-4 Characteristics of Stakeholders involved in Water Sector Development

Type of Institutions	Current Characteristics	Emerging Characteristics
Service Providers		
Water User Associations (WUAs) established to operate and maintain new water supply schemes	Establishment of WUAs before financing a new water supply scheme is now a requirement for all GoY and donor financed projects. Under the RWSS, WUAs are expected to participate in project design and technology choice. WUAs are registered with Ministry of Social Affairs under the NGO Law. They have an elected executive board and various employees for pump operation, security, fee collection and book keeping. For systems designed with house connections, tariffs are based on volumetric use of water and minimum monthly charges.	All new public financed rural water schemes will be managed by WUAs registered with the Ministry of Social Affairs under the NGO Law. WUAs will participate in project design and technology choice, and commissioning of new infrastructure will be done through a contract between Local Authorities WUA including an opening balance sheet and business plan. WUA will be supervised and supported by new Governorate WSS Authorities (GRAs) on behalf and in cooperation with Local Authorities.
Community Based Organizations (CBOs)	Some water supply schemes are managed by pre-existing CBOs which initiated the request for a new scheme or the expansion of an existing scheme. Some CBOs and "Charitable Societies" mobilized private and community financing to develop water schemes without public support. The number of schemes initiated and managed by CBOs is not known.	Registered and informal CBO water suppliers will be registered with the GRAs and District LAs. They will be supervised and supported by the GRAs on behalf and in cooperation with Local Authorities.
Small Private Water Providers	In rural areas not covered by water schemes developed with public or communal support, households are either relying on family labour to fetch water or different types of private service provider: water trucks delivering water to villages near main roads, small private piped networks, and free public standpoint usually attached to private agriculture pumping stations. The number of private service providers and the quality of service is not known.	In rural areas, private water providers will be registered with GRAs and LAs. GRA will supervise the quality of service to identify potential needs for new water supply and sanitation schemes. Programming of new RWSS schemes would be based assessing the capacity of existing CBOs and Small Private Providers to develop private / public partnership.
Sector / Development Institutions		
General Authority for Rural Water Supply Projects (GARWSP)	Created under the Ministry of Agriculture and irrigation (MAI) in 2002, GARWSP inherited rural water activities from the General Authority for Rural Electricity and Water Supply (GAREWS). GARWSP was transferred under the newly established Ministry of Water and Environment (MWE) in 2003. By Presidential Decree No 60 of 2002, GARWSP mandate is limited to water supply services in rural areas (settlements under 15,000 inhabitants) and does not include sanitation. GARWSP intervenes in all governorates and districts and has a project cycle extended over two or three years. After GAREWS left many water schemes unfinished, GARWSP reform program is hampered by GAREWS legacy. GARWSP has launched a reform program based on decentralization to strengthen governorate branches, partnership with Local Authorities, co-financing, and establishment of user groups for O&M of the schemes. GARWSP has a long experience and recognized expertise in borehole drilling and most of the boreholes used by other development institutions are provided by GARWSP. Former GAREWS or GARWSP staff constitutes the core technical teams of other Development Institutions involved in rural water supply development.	GARWSP Headquarters shall be the primary custodial agency for RWSS, responsible for sub-sector planning, policy and strategy (re) development, ensuring compliance with national sub-sector norms and standards, monitoring, evaluation and oversight. GARWSP will also add sanitation (and hygiene) to its mandate.
Governorate Rural Water Supply and Sanitation Authorities (GRA)		Governorate Rural Water Supply and Sanitation Authorities (GRA) will be responsible for all RWSS executive functions at the governorate level, entrusted with core responsibilities for: implementation of determined RWSS policies, strategies and plans, assist and support community based initiatives and carry out other activities in support of development and delivery of sustainable water supply and sanitation services.
Rural Water Supply and Sanitation Oversight Committee (RWSSOC)		Rural Water Supply and Sanitation Oversight Committee comprised of various RWSS stakeholders will be established in each governorate to support and facilitate sub-sector development and implementation functions.

Type of Institutions	Current Characteristics	Emerging Characteristics
Rural Water Supply and Sanitation Project (RWSSP)	The RWSSP implements a World Bank Credit Agreement between the GOY and IDA fully dedicated to rural water and sanitation. The Project was designed to support the preparation of RWSS sub-sector policy and strategy while at the same time implementing water supply and sanitation schemes using the Demand Responsive Approach (DRA). The Project focuses on construction of motorized water supply and sanitation schemes and uses Social Mobilization Teams to promote a Demand Responsive Approach (DRA) and establish Water User Associations.	In line with NWSSIP and Rural/Local Development Strategy, the RWSSP, SFD, and PWP will be key partners of GARWSP in implementing the DRA and their programs will be closely coordinated with GRAs. As transitory institutional arrangements, special Cooperation Agreements between GARWSP and RWSSP, PWP and SFD will be implemented. Before GRAs are established and operational, RWSSP, SFD, and PWP will cooperate with GARWSP Branch Offices in supporting and supervising WUAs and CBO service providers.
Social Fund for Development (SFD)	Established in 1997, the SDF is a major contributor to the RWSS sub-sector, through capacity building of WUAs and development of piped water schemes and rainwater harvesting schemes. For allocating resources, the SDF uses three types of targeting: geographical targeting based on poverty indicators, sector targeting (special focus on water harvesters for RWSS sub-sector) and social targeting on groups with special needs.	
Public Works Project (PWP)	Established in 1996 to administrate a World Bank IDA Credit for developing small-scale development projects for basic infrastructure services in education, health, water, and sanitation, in order to generate temporary jobs in rural areas. For rural water schemes, the PWP cannot finance mechanical equipment but can collaborate with other institutions by supporting labour intensive components. PWP operates in the entire country following a targeting mechanism based on population density, poverty indicators, remoteness and deprivations.	
Development Projects	Several development projects are or have been implementing new rural water and sanitation schemes either as their exclusive activity (Ibb-Lahj Water Project, Lahj Water supply Project, ICS Water Project in Hajjah, CARE Water Projects) or as important components of rural development projects (Southern Governorates Rural Development (SGRDP), Southern Uplands Rural Development Unit / Taiz Pilot Water Supply Project (SURDU), Child Development Project (CDP), Al Mahara Area Development Project (AMADP), Raima Rural Development Project, and Central Highland Integrated Rural Development Project (CHIRDP). Most projects follow some sort of demand responsive approach (DRA), require beneficiary participation in investment cost and establish WUA to handle and support O&M costs. There is little coordination at the planning stage and communities may "shop around" projects to attain better conditions.	Development Projects implementing new rural water and sanitation schemes will share their work program with MWE and GARWSP to improve coordination. All Project Management Units will be invited to regular coordination meetings organized by GARWSP. Targeting and project selection criteria will be compared and coordinated at district level. New Development Institutions such as the Dahmar Rural Development Project, Al Dahla Rural Development Project, and the Rural Infrastructure Project supported by IFAD will have important RWSS components. In addition, UNDP will implement a rural water supply project in Hadramout supported by Nexen.
Local Authorities (LAs)	Local Authorities (LAs) are autonomous, self-governing entities generated under Law 4 of 2000 on Local Authority and regulated by the Ministry of Local Administration (MLA). Elected Local Councils are more associated in review of community requests and some Local Authorities are contracting GARWSP Branch Offices to implement rehabilitation programs. In Yemen, LAs are not directly involved in ownership or management of rural water supply schemes.	With the assistance of UNDP and other donors MLA is piloting the preparation of District Development Plans with the goal of pooling donor's financial support in a Local Development Fund. LAs will be systematically involved in establishing WUAs and in their monitoring. LAs are empowered to review and audit the accounts of any service project managed by beneficiary committees. GRAs would provide technical expertise to LA's executive organs to carry out this task.
Ministry of Water and Environment (MWE)	The MWE was established in May 2003 to regroup water related activities and overview the various authorities involved in the sector: the National Water Resource Authority (NWRA) for overall water resources management, the National Water and Sanitation Authority (NWSA) for urban water supply, GARWSP and the Environmental Protection Authority. In 2004 the MWE coordinated the preparation of the National Water Sector Strategy and Investment Program (NWSSIP). MWE is an active partner with MLA in implementing the Decentralization Law. MWE has initiated the establishment of MWE Representations in selected Governorates. Under current planning and budgeting arrangements, MWE has little control over resources allocation in the sector, however, in the RWSS sub-sector, it uses NWSSIP as a tool for coordinating the GARWSP program with major programs carried out by independent institutions (SFD, PWP).	The MWE will establish a Representation/Branch in each governorate. The MWE representative will be the executive secretary of Governorate Oversight Committee. At the national level, MWE has established an Assistant Deputy Minister position to oversee the RWSS sub-sector.

5.3 Institutional Capacity

5.3.1 Institutional Organization

GARWSP was established under MAI in 2002, and when MWE was established in 2004, GARWSP was reorganized into this ministry. However, the organizational structure and capacity was passed on from the weak foundation of the former GAREW. The number of staff of GARWSP (excluding temporary staff) as of 2005, is 280 persons at headquarters and 245 persons at the 19 branch offices for a total of 525 persons, but as an example of organizational weakness, a definite organization chart for the headquarters is presently not available. Factors important for organizational management such as mutual understanding, decision making process, system for giving orders, and interdepartmental coordination/cooperation are being hampered. In 2005, GARWSP formulated an organizational agreement which included an organization chart with mission statements and work allocations of each department, and its approval is scheduled for 2006. The provisional organization chart of GARWSP headquarters is shown below.

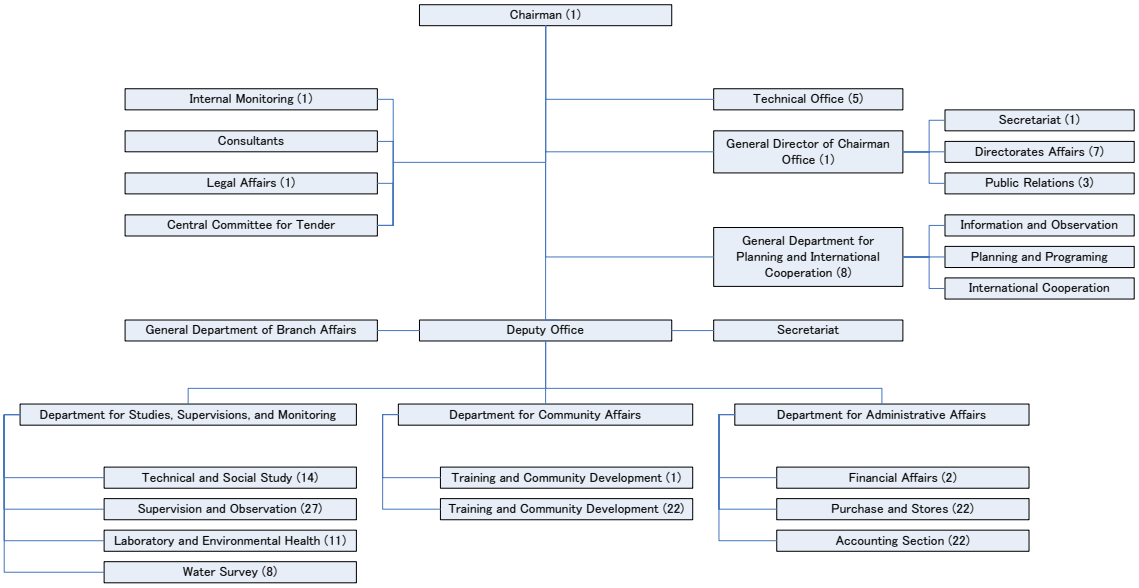


Figure 5-3 Provisional Organization Chart of GARWSP Headquarters (Proposed in December 2005)

The proposed organization chart of GARWSP headquarters consists of 3 major departments: (1) Department of Studies, Supervision and Monitoring, (2) Department of Community Affairs, and (3) Department of Administrative Affairs. This is a simple structure, but is a well-balanced organization concentrating on policy decision, planning and supervision/monitoring. In consideration of headquarters responsibilities under the decentralization strategy, staff number is appropriate. Furthermore, as an important issue of the national development strategy of this sub-sector, the approach which responds to community needs (DRA: demand responsive approach) was adopted for project development, and establishing the Department for Community Affairs as one of the main component is commendable.

Strategy/planning formulation, internal auditing, legal affairs, public relations as well as technical affairs and external consultants are placed under the chairman to strengthen leadership, but this formation questions the nature of top management. Also, since departments for personnel affairs and human resources development are not included, establishment of these sections is anticipated.

On the other hand, MWE/GARWSP is planning to transfer powers and responsibilities for rural water supply project implementation from headquarters to the branch offices for institutional strengthening of the branch offices. In 2005, GARWSP formulated the GARWSP Branch Office Decentralization Plan as a transition stage. This plan categorizes the branch offices (into A, B and C) according to capacity in staff number, possession of office equipment and machinery, and level of transfer of powers. Institutional strengthening of and transfer of powers to all branch offices is scheduled for completion by 2010. Of the study areas, Al Mawheet branch office is ranked as Category B, while the other branch offices of Sana'a, Dahmar, Ibb and Taiz are placed in Category A. The permanent staff numbers of each target branch office (as of 2005) are shown below.

Table 5-5 Number of Permanent Staff in GARWSP Branch Offices (as of December 2005)

Branch Office	Permanent Staff Number
Sana'a	23
Taiz	43
Dahmar	19
Ibb	13
Al-Mahweet	1

In the GARWSP branch office strengthening plan (2005), the number of staff required to obtain power for project implementation is about 22 persons for each branch office (maximum of 25 persons). Therefore, Ibb and Al Mawheet branch offices are planning to increase their staff, while Taiz branch office plans to transfer their staff. Staff increase is scheduled through staff transfer from headquarters and recruiting new staff. For 2006, recruitment of about 40 new staff is being programmed. As of December 2005, the number of permanent staff of Al Mawheet branch office is only 1 person which is not an appropriate organization and this requires immediate resolution.

The organization chart for each branch office is prepared (from enquiries to branch offices), but the organization charts are not unified (refer to the figures below). According to the decentralization strategy, for each branch office to possess capacity for project implementation, at least the following sections need to be established: (1) Planning, supervision and monitoring, (2) Technical affairs (hydrogeology, civil engineering), (3) Community development, (4) Financial affairs and accounting, and (6) Internal auditing. However, these sections are not established in the branch offices of the 5 study governorates, and the 3 branch offices (Al Mawheet, Sana'a and Dahmar) targeted for capacity assessment and assistance for formulation of capacity development plan are especially weak in institutional and personnel organization.

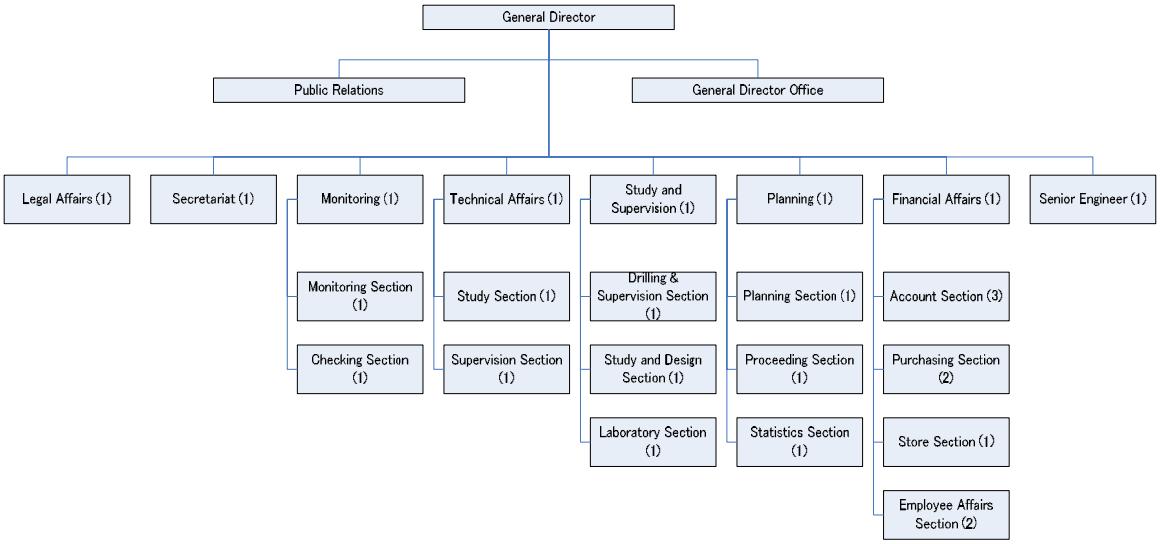


Figure 5-4 Organization Chart of GARWSP Taiz Branch Office (as of December 2005)

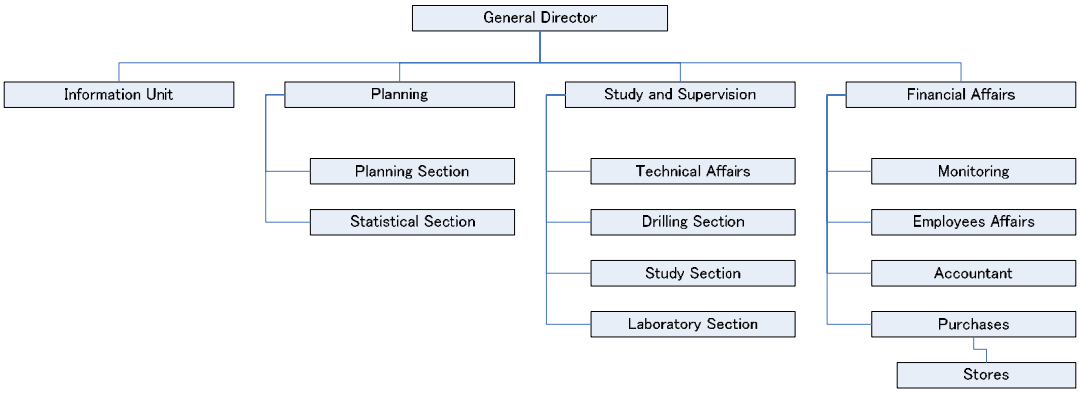


Figure 5-5 Organization Chart of GARWSP Ibb Branch Office (as of December 2005)

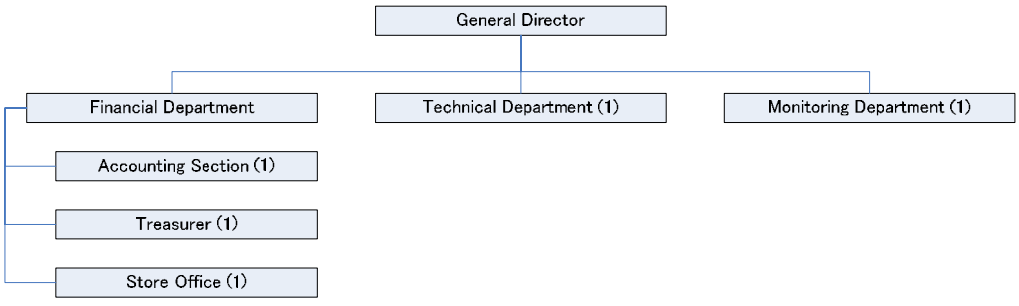


Figure 5-6 Organization Chart of GARWSP Al Mahweet Branch Office (as of December 2005)

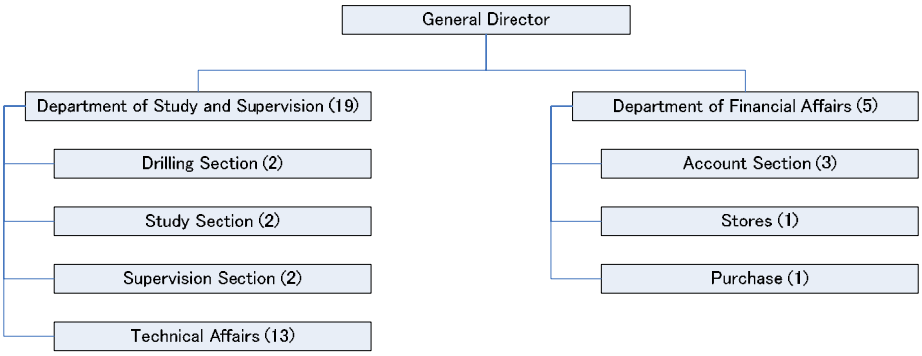


Figure 5-7 Organization Chart of GARWSP Dahmar Branch Office (as of December 2005)

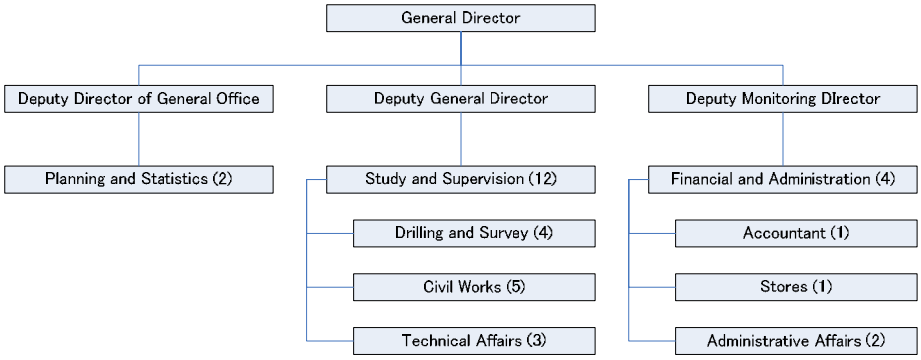


Figure 5-8 Organization Chart of GARWSP Sana'a Branch Office (as of December 2005)

On the other hand, district local authorities which have responsibility for local infrastructure development projects were established under the Local Authority Law of 2000, and similar to GARWSP branch offices, they are relatively new organizations. Local authorities having jurisdiction over study target communities do not have any infrastructure development units under their organizations to manage these projects. Also, these local authorities do not have budget to implement rural water supply projects.

5.3.2 Leadership

Leadership is indispensable to activate an organization, and for appropriate organizational development, leadership within an organization should consist of formal leadership and informal leadership. As leadership within GARWSP headquarters, all decision making and approval of pending problems are made by the chairman, which is not a sufficiently effective process. Furthermore, since department heads are not handed over power to make own decisions, as an organization, decision making is very rigid (especially for budget planning, human development planning and project implementation planning). Also, while the organization is not yet completely established, the relationship and cooperation between departments is weak to hinder development of informal leadership.

5.3.3 Human Resources

The total number of permanent staff of GARWSP headquarters and branch offices is 525 persons (as of 2005) and as a ministerial body, this is a relatively large organization. Of the permanent staff, about 1/3 are engineers and other degree holders (recent recruited staff are mostly degree holders) which implies that individual capacity background is relatively high. Further, many of them are qualification holders of training courses offered by other donors and government supported diploma holders. However, due to organizational structure weakness and poorly managed directions to departments and staff, individual capacity is not fully utilized.

Moreover, an organizational human resources evaluation system is nonexistent; proper organizational allocations through human resources evaluation on appropriateness and performance are not made; and a system for salary rise and promotion is not available. Therefore, individual motivation is difficult to maintain. Also, salaries are kept lower than the governmental standard at about USD200 to 300 on the average (from GARWSP Human Resources Plan, 2005), which seems to have differences of more than 6 to 8 times as compared to those of private companies and development organizations (such as RWSS, SFD and PWP) active in the same sub-sector, and this situation provides low incentive for working. Due to this low incentive, the outflow of competent human resources to private companies and other development organizations is creating serious problems.

From the viewpoint of human resources development and training, the training provided by MWE/GARWSP is centered on basic skill training such as for computer skills and language (English), and programs to improve technical capacity are very few (according to GARWSP Training Plan and Achievements). Also, needs analysis for institutional training is presently not carried out.

5.3.4 Financial Aspects

The overall budget of GARWSP for both 2004 and 2005 was about YR3,700 million, and a similar amount is expected for 2006 (although it was about YR4,600 million in 2003, this was due to additional cost for carryover activities of former GAREW). Of this amount, budget for development was about YR3,500 million, which accounted for about 90% of the total budget (refer to the table below).

Table 5-6 GARWSP Budget, 2003 to 2005

Description	Actual Budget 2003	Sanctioned Budget / 2004	Sanctioned Budget / 2005	Description	Actual Budget 2003	Sanctioned Budget / 2004	Sanctioned Budget / 2005
Recurrent Expenditure				**Recurrent Income**			
Chapter One) Salaries, Wages, and Other Personnel Costs	160,749,338	180,389,000	211,916,000	Chapter One) Current Activity Returns	13,347,000	5,460,000	9,000,000
Chapter Two) Production Requirements, and Purchases for Sell	42,420,505	56,300,000	70,000,000	Chapter Two) Miscellaneous Income	5,780,698	2,730,000	3,000,000
Chapter Three) Transferable Recurrent Expenditure	22,443,156	24,000,000	27,000,000	Chapter Three) Stock and Returns			
				Chapter Four) Transferable Recurrent Income	214,934	1,810,000	3,000,000
Sub-total for Recurrent Expenditu	**225,612,999**	**260,689,000**	**308,916,000**	**Sub-total for Recurrent Income**	**19,342,632**	**10,000,000**	**15,000,000**
Account of Allotment				Account of Deficit	206,270,367	250,689,000	293,916,000
Total for Recurrent Expenditure	**225,612,999**	**260,689,000**	**308,916,000**	**Total for Recurrent Income**	**225,612,999**	**260,689,000**	**308,916,000**
Capital Expenditures				**Capital Resources**			
Chapter Four) Project under Implementation	4,095,921,011	3,316,134,000	3,450,000,000	Chapter Five) Capital Income	4,595,686,205	3,450,000,000	3,450,000,000
Chapter Five) Transferable Capital Expenditure	523,665,284			Chapter Six) Transferable Capital Income	23,900,090		
Total for Capital Expenditure	**4,619,586,295**	**3,316,134,000**	**3,450,000,000**	**Total for Capital Resources**	**4,619,586,295**	**3,450,000,000**	**3,450,000,000**
Ground Total for Recurrent and Capital Expenditure	**4,845,199,294**	**3,576,823,000**	**3,758,916,000**	**Ground Total for Recurrent and**	**4,845,199,294**	**3,710,689,000**	**3,758,916,000**

Source: GARWSP Annual Budget Reports

Calculation of development budget is based on the project implementation plan formulated by GARWSP branch offices and calculated project cost, and is carried out by the budget committee formed mainly by regional project managers of GARWSP headquarters. However, within the study target areas, other than Ibb and Taiz branch offices, none of the branch offices have formulated a systematic project implementation plan based on development needs studies for the whole governorate. Also, these branches have not strategically formulated community prioritization and budget plans.

On the other hand, the expenditure of GARWSP within the total amount for development of the rural water supply sub-sector from 2000 to 2004 accounts for 64% of the total amount for the whole country, which is outstanding as compared to other sector development organizations (such as RWSS, RWSS-TA, PWP and SFD). Refer to the following table.

Table 5-7 Investment Costs of Sub-Sector Development Organizations (2000 to 2004)

Development Agency	Recurrent Expenditure		Development Expenditure		Total Expenditure	
	In thousand US$	Share of Total Expenditure (%)	In Thousand US$	Share of Total Expenditure (%)	In Thousand US$	Share of Total Expenditure (%)
GARWSP	N/A	N/A	102,445	61.9	102,445	44.3
SFD	N/A	N/A	25,135	16.6	25,135	10.9
PWP	N/A	N/A	15,144	9.5	15,144	6.8
RWSSP	N/A	N/A	653	4.3	6,653	2.9
UNICEF	N/A	N/A	5,709	4.2	5,709	2.5
SGRDP	N/A	N/A	2,545	1.7	2,545	1.1
Other Projects	N/A	N/A	2,974	1.8	2,974	1.3
TOTAL	-	-	160,604	100.0	160,605	67.6

Source: GARWSP RWSS-TA (2005), Rural Water Supply and Sanitation Finance and Resource Flows Review

In other words, GARWSP which expends more than 60% of the sub-sector development costs is in the position to head sub-sector development within the number of development organizations. Nevertheless, while possessing a relatively abundant budget, development budget based on systematic development strategy and project implementation plan is not allocated which is a serious issue in terms of effective use of resources. As a development undertaking of GARWSP, only construction of boreholes for water source development is carried out, and in most cases, the subsequent works including facilities construction and equipment installation until project completion takes over 5 years. Not being able to effectively and consistently implement projects justifies the inefficiency of budget allocations and lack of planning.

It may be the fact that inclination of budget allocation concentrating on construction (i.e. capital cost) reduces the budget for other important undertakings required for strategic planning, investment, and implementation of development projects. Relatively less budget for socio-economic and technical survey, development and introduction of DRA (demand responsive approach), and human resource development would hinder strategic planning and investment, resulting in longer period for completion of the water supply schemes and construction of boreholes solely without distribution facilities and networks.

Furthermore, allocation of development budgets in line with transfer of powers for project implementation to GARWSP branch offices is not yet provided. From 2005, as part of decentralization of project implementation, GARWSP is allocating operation expenses to each branch office (refer to table below), but since development budget is not included, costs for technical support to communities and monitoring cannot be sufficiently covered.

Table 5-8 Expenditures of Study Target Branch Offices (for Fourth Quarter, 2005)

Unit: YR

	Category A				Category B
Item	**Sana'a**	**Taiz**	**Dahmar**	**Ibb**	**Al Mahweet**
Chapter One					
Bonuses	150,000	150,000	150,000	150,000	75,000
Overtime Allowance	120,000	120,000	120,000	120,000	60,000
Other Allowance	15,000	15,000	15,000	15,000	
Chapter Two					
Goods	150,000	150,000	150,000	150,000	115,000
Services	120,000	120,000	120,000	120,000	105,000
Chapter Three					
Residence Rents	45,000	45,000	45,000	45,000	45,000
Office Rents				150,000	
Store Rents				45,000	60,000
Total/Quarter	**600,000**	**600,000**	**600,000**	**795,000**	**460,000**
Total/Year	**2,400,000**	**2,400,000**	**2,400,000**	**3,180,000**	**1,840,000**

Source: Budget Report of GARWSP for each year

The inconsistency between the collective management of development budget and financial affairs by MWE/GARWSP, and the decentralization strategy being promoted by GARWSP is receiving criticism. In this predicament, since branch offices have no development budget, capacity for project implementation by branch offices is very low. Also, project

implementation through a demand responsive approach (DRA), prescribed as a sub-sector national development strategy, requires carrying out of activities such as community dialogue/agreement, formation of community organization, fostering of operation and maintenance capacity and monitoring promotion. However, budget constraints are causing difficulties for this implementation.

In the GARWSP branch office strengthening plan of 2005, one of the study target areas, Taiz branch office, which is ranked as Category A, is scheduled to receive development budget allocation and partial transfer of power. The other branch offices are scheduled to be allotted development budgets in succession from 2007.

On the other hand, of the local authorities who are scheduled to receive responsibilities for project implementation in the future according to the decentralization policy, for those within the study area, since only a few local authorities in Taiz governorate are receiving infrastructure development budgets, realization of project implementation through collaboration with GARWSP branch offices is presently very unlikely.

5.3.5 Facilities and Equipment

Evaluation of facilities and equipment owned by GARWSP headquarters and branch offices is being conducted through this study. Especially the facilities and equipment of branch offices are insufficient for project implementation by the branch offices, and therefore, the study results will be reflected in the equipment procurement plan.

5.3.6 Program/Service Management

In the rural water supply sub-sector development under the decentralization policy, the implementing function for development project/service provision is transferred from GARWSP headquarters to branch offices and local authorities. Hence, the responsibilities of headquarters are concentrated on formulation, regulation and monitoring of policies and strategies. Each decentralization policy of MWE, GARWSP and MLA has differing development project implementation procedures as explained previously. However, GARWSP is not denying the transfer of project implementing responsibilities to local authorities in the future.

Although in the transitional stage, implementation structure and roles are determined as follows, and mutual project implementation between GARWSP branch offices and local authorities is planned. The following table is developed and recommended by GARWSP to clarify functional roles and responsibilities of GARWSP (headquarters and branch offices), Local Council (Governorate and District), and community at each stage (planning and preparation, implementation, handing over to community, operation and maintenance) in mutual project implementation. It is observed from the table that functional responsibilities required for project implementation for each institution and community is clearly defined and appropriately

shared, although supervision of community work, of which responsibility is taken mainly by GARWSP branch office in collaboration with District Local Council, seems to be omitted in the table. However, it is clear indication that decentralization at the transitional stage would take this institutional arrangement and framework.

Table 5-9 Responsibilities and Roles of Organizations at Each Level for Rural Water Supply Project Implementation

Stage	Activity	Determined Responsibilities and Roles			
		Community (CBO)	Local Council		GARWSP (Branch)
			District	Governorate	
Preparation and Drafting	Submitting project application	By community according to GARWSP forms to Local Council in District for approval, submit it to Local Council in Governorate	Receiving the application, evaluate and approve it if it is appropriate and deliver it to Local Council of Governorate.	Receiving the application and insert it into required project list and deliver it to GARWSP Branch Office for study and community mobilization.	Receiving the application and dealing with it.
	Community Mobilization	Provide required information to Community Mobilization Team. Responding the invitation for the General Assembly meeting to elect CBO for the project.	Providing necessary supports or information to Community Mobilization Team. Adopting and supervising the General Assembly meeting to elect CBO for the project.	Securing necessary finance for Community Mobilization Team including transportations. Participating in General Assembly meeting and authorize the representative from office of Social Affairs in Governorate to supervise and prepare agreed minutes for the meeting.	Formation of Community Mobilization Team to undertake the following tasks; - confirming DRA of project - recognizing the water source if it is available. - determining project area, number of served villages and population in the served area. - estimating volume of water consumption. - preparing invitation to hold General Assembly meeting to select CBO and participating in it. - providing training for elected CBO
	Technical Study	Provide required information	Securing the cost of study, and providing necessary information of the study.		Undertaking technical and financial study for the Project. Preparing the specification and announcing tenders of important supply and implementing the project components.
Implementation	Supervision and Implementation of the Project	Contributing pump house construction. Digging trenches for pipe laying. Providing means of transport for the piping material. Paving roads to the tank sites. Transporting tank materials to the sites. Solving any other obstacles.	Interfering to solve any problems delaying the progressive works of the implementing the project by community. Helping GARWSP by necessary support to assure the implementation schedule.	Financing economic, technical, environmental study for the Project. Securing transportation. Constructing (paving) necessary roads to the sites of project construction or transporting the construction materials to the sites.	Providing and installing water pipes and pump units including electrical generators. Constructing necessary tanks to the project and testing them to confirm their fitting to specifications and conditions of their contracts.
Receiving and Handing Over	Preparation for Handing Over	Receiving the completed project from GARWSP (Branch) and arranging to operate and maintain it.	Supervising handing over the project for CBO from GARWSP / Branch	Approving handing over procedures of project and following up Local Councils in District.	Receiving the completed project or components, and handing over it to CBO by coordination with local council.
Operation and Maintenance	Monitoring, Follow-up and Project Evaluation	CBO of the project start managing the project according to financial, administrative and technical regulation of GARWSP to guarantee its sustainability and replacing any parts broken down.	Providing supervision, follow-up and monitoring on functional management of project and correcting any decline in its management.		Supervising and monitoring the functional process of management, operation and maintenance of the Project and providing necessary technical supports and collecting information and registering it and evaluate it periodically.

Source: GARWSP（2005）, Roles and Responsibilities of GARWSP Social Mobilization Team

In this study, based on the above plan for allocation of roles and responsibilities, the capacities for project implementation of GARWSP branch offices, local authorities and community organizations of the 3 governorates (Sana'a, Al Mawheet and Dahmar) targeted for capacity assessment were divided into activities for each stage of the project cycle as shown below. Evaluation of capacity for each activity was made according to the scoring as defined below. The scoring is made for initial evaluation purposes and through workshops and seminars, detailed studies of relevant parties will be conducted to be used as basis for problem analysis to formulate the capacity development plan.

SCORE DEFINITION
0=Capacity is not in place or allocated
1=Clear need for increasing capacity
2=Basic level of capacity in place
3=Moderate level of capacity in place
4= High level of capacity in place

Table 5-10 Capacity Assessment on Program/Service Management

Stages and Activities	Responsibility				Initial Assessment	Narrative Review of Capacity
	GARWSP HQ	GARWSP BO	Local Council	Community		Strength and Weakness
Planning Stage						
Preparation of Community-Request for Project Implementation		○		◎	1	☐ The format of community-request for project implementation is prepared . ☐ Community-request format is distributed to each Local Council for fair distribution to the communities in the area. ☐ Procedure for community-request is not well recognized by the community. ☐ There is some confusion in receiving procedure of community-request between local council and GARWSP branch offices. ☐ Currently GARWSP Headquarters and Branch Offices, instead of Local Authority decided under new procedure, receives petition from communities. There are a considerable number of communities petitioning for a long period, sometimes taking 5 to 10 years.
Identification and prioritization of Development Needs for Rural Water Supply		◎	◎		1	☐ There are technical and socio-economic criteria developed for prioritization of communities for project implementation. However, those criteria have to be reviewed, and improved. ☐ Priority is often decided without technical and socio-economic criteria developed. ☐ Mid-term development plan and investment program is not prepared in coordination between GARWSP Branch Office and Local Authority. ☐ Considerable political and communal pressure hampers proper identification and prioritization of communities. ☐ Significance of DRA (Demand-Responsive Approach) is well recognized, although its introduction to the project planning is not realized.
Acceptance of Community-Request for Project Implementation		○	◎		1	☐ Criteria for acceptance are not developed. ☐ Internal procedure and communication system between Local Authority and GARWSP are not well established. ☐ Proper dialogue is not facilitated with the communities for agreement on the responsibility sharing in the implementation of the Project.
Reconnaissance Survey		◎	○		2	☐ Funds and transport are not allocated. ☐ Equipments necessary for reconnaissance survey, such as GPS and altimeter, are not enough. ☐ Formal census data at community (village) level is not available at present. ☐ Proper dialogue in some governorates is not facilitated with the communities for agreement on the responsibility sharing in the implementation of the Project.

Stages and Activities	Responsibility				Initial Assessment	Narrative Review of Capacity
	GARWSP HQ	GARWSP BO	Local Council	Community		Strength and Weakness
Preparation and Submission of Project Proposal		◎	○		2	☐ Format for project study and proposal is under preparation. However, in the format, some important items such as socio-economic condition are missing. There are needs for improvement. ☐ Proposed design of the supply scheme is often made without technical and census data and information. ☐ Proposal is often prepared without agreement with community on the task sharing in the construction of the scheme.
Approval of Proposal / Identification of Development Needs	◎		◎		2	☐ There are some technical and socio-economic criteria developed for prioritization of communities for project implementation, although those criteria, particularly socio-economic criteria shall be improved for fair prioritization. ☐ Local Authority is not cooperative in cost and responsibility sharing in the implementation of the project (Sana'a). ☐ Mid-term development and investment plan is not prepared by GARWSP Branch Office and Local Authority. Approval is often made on the project list prepared yearly by branch offices without strategic concerns. Thus, the budget is not distributed in a strategic and efficient manner.
Project Implementation Financing	○	◎	◎	◎	1	☐ Currently development fund for implementation of the project is centrally managed by GARWSP Headquarters, which contradicts with the decentralization strategy. ☐ Funding and Fund flow system for development budget from central government to the Local Authority is not established. ☐ Financing, accounting, and auditing systems in GARWSP Branch Office and Local Authority for project implementation are not in place. ☐ Agreement is not often made with community on cost and responsibility sharing in the implementation of the scheme construction. ☐ Fund disbursement is often delayed.
Project Implementation Finance Management	○	◎	◎		1	☐ Fund flow mechanism for development budget from the central government to the local government or GARWSP Branch Office is not established. ☐ Unit for accounting and audit established in GARWSP headquarters, which is currently dealing with fund flow and monitoring for operational budget (recurrent fund) for branch offices distributed headquarters. This unit will deal with accounting and audit on development fund of branch offices in future.
Detail Design Work (Technical)		◎			2	☐ Branch offices are able to prepare technical design. However, design is often prepared by staff without proper technical expertise, or not employing proper technical survey such as geographic and hydro-geological survey. ☐ Borehole locating is often carried out without any geo-electric survey. ☐ Technical design of the supply scheme is often undertaken without topographic survey.
Detailed Design Work (Socio-Economic)		◎			1	☐ Although the importance of socio-economic survey including willingness-to-pay survey is well recognized, any socio-economic survey was not carried out due to limits in budget to employ consultants and/;or limits in human resources of GARWSP to carry out the survey.. Thus, the project design is often prepared without socio-economic conditions. ☐ Operation and maintenance plans are omitted. ☐ There are no funds allocated for socio-economic survey. ☐ SMT (Social Mobilization Team) of GARWSP is formed and trained. Currently, there are five teams each with five persons, of which number of staff is still not adequate to satisfy the needs. ☐ Trainings for socio-economic survey and social-mobilization were not adequately provided to the branch office.
Implementation / Service Delivery						
Procurement of Consultant and Contractor (Tender)	○	◎	◎		2	☐ Currently, all the procurements of consultants and contractors are centrally managed by GARWSP headquarters, instead of GARWSP Branch Office Decentralization Plan. ☐ Procurement is often delayed in central funding system. ☐ There is no guideline for GARWSP Branch Office prepared for procurements of consultants and contractors. ☐ Evaluation system for bidders is not established. ☐ Accounting and auditing system is not systematically established.

Stages and Activities	Responsibility				Initial Assessment	Narrative Review of Capacity
	GARWSP HQ	GARWSP BO	Local Council	Community		Strength and Weakness
Procurement of Material and Equipment (Tender)	○	◎	◎		2	☐ Currently, all the procurements of materials and equipment are centrally managed by GARWSP headquarters, instead of GARWSP Brach Office Decentralization Plan. ☐ Procurement is often delayed in central funding system. ☐ There is no guideline prepared for procurement of material and equipment. ☐ Evaluation system for bidders is not established. ☐ Accounting and auditing system are not systematically established.
Construction of the Supply Scheme		◎	◎	◎	3	☐ Local standard for the scheme construction is assured. ☐ Transportation of piping materials from GARWSP Branch Office to the target community and pipe laying are often delayed or not carried out, which is regarded as community responsibility. It is because of lack of agreement with community on task sharing, failure in community fund raising, and/or inaction of community. ☐ Construction work is often delayed due to delay in tender procedure.
Installation of Equipment		◎	◎	◎	3	☐ Installation of equipment such as pump unit and generator is often delayed or not carried out, which is regarded as supplier's responsibility. It is because of delay in pump house construction to be carried out by the community, where the pump unit is installed. ☐ Installation work is often delayed due to delay in tender procedure.
Supervision of the Construction / Installation Work		◎			3	☐ GARWSP Branch Offices are able to provide supervision and inspection work.
Operation and Maintenance / Service Delivery						
Provision of Technical Guidance for the Community ☐ Formation of Water User Association (WUA) ☐ Provision of Training for WUA ☐ Provision of Hygiene and Sanitation Education		◎	◎		1	☐ There is less skilled and trained personnel in branch offices for community mobilization. ☐ Manual for technical training targeting community is developed and available, while the one for organizational and financial management is not fully developed. ☐ Trainers and facilitators for the community training course and development of community participation skills are available in GARWSP Headquarters. ☐ GARWSP Branch Office and Local Authority are not equipped with human, material, and financial resources for provision of community training. ☐ Guideline for formation and registration of WUA through proper procedures set out by Local Authority Law is not introduced in the implementation of the project. ☐ Community facilitation skills are not in place in the GARWSP Branch Office and Local Authority. ☐ Guideline, action plan, comprehensive manual, and activity modules for community capacity development in the scheme management are not developed. ☐ Under current jurisdictional law and decree, GARWSP are not responsible for provision of hygiene and sanitation service in the implementation of the project. ☐ Guideline, manual, activity modules for hygiene and sanitation education are not prepared. ☐ GARWSP Branch Office and Local Authority are not equipped with human, material, and financial material for provision of hygiene and sanitation education.
Project Handing-Over and Ownership Arrangement (Registration and Memorandum of Understanding)		○	◎		1	☐ Guideline and procedures for ownership arrangement for WUA set out by Local Authority Law is not introduced in the implementation of the project.

Stages and Activities	Responsibility				Initial Assessment	Narrative Review of Capacity
	GARWSP HQ	GARWSP BO	Local Council	Community		Strength and Weakness
Scheme Management (Operation and Maintenance)		○	○	◎	1	☐ Communities are not fully trained for the scheme management. ☐ WUA is not properly formed through community election. ☐ Transparency in the scheme management is not fully assured. ☐ Constitutions and by-laws of WUA are not adequately prepared. ☐ WUA is not registered through community dialogue/consensus and proper procedures as set out by Local Authority Law. ☐ Capacity for tariff setting and financial management are lacking. ☐ Accountability in community financing is not fully assured.
Monitoring and Evaluation						
Provision of Follow-up Activities and Monitoring on the scheme management (technical matters)		◎	○		1	☐ Monitoring check list is prepared, although not in use on the field. ☐ Monitoring and follow-up activities are not programmed. ☐ Communities in remote areas are not supported with transport. ☐ Roles and responsibilities of branch office and local council are not clearly defined and agreed.
Provision of Follow-up Activities and Monitoring on the scheme management (organizational management matters)		○	◎		1	☐ Monitoring check list is prepared, although not in use on the field. ☐ Monitoring and follow-up activities are not programmed. ☐ Communities in remote areas are not supported with transport. ☐ Roles and responsibilities of branch office and local council are not clearly defined and agreed.

An issue requiring attention concerning capacities of GARWSP and local authorities in relation to program/service management is that GARWSP plans to transfer responsibilities for rural water supply project implementation to branch offices within the next 5 years (according to GARWSP Branch Office Decentralization Plan, 2005). However, the present structure for project implementation is centrally powered.

Project planning formulation and implementation supervision are handled by branch offices, but ordering of materials for implementation is presently carried out by GARWSP headquarters. To reduce costs, orders for materials are not made until a certain amount is required from a number of projects. Also, after delivery of materials to the headquarters, transportation to branch offices and project sites are often delayed. Therefore, at the project site level, schedule management become difficult due to delays in materials procurement. Pipe materials piled up and left alone at GARWSP headquarters tells the story.

Furthermore, without formulating a strategic plan, trying to allocate the limited development budget to many communities due to strong requests from communities and political pressure, only partial facilities are constructed (in many cases, only a borehole is constructed). At many sites in the study area, more than 5 years have elapsed after construction of the water source, but no other construction works have been carried out.

The project cycle from implementation to completion by other sub-sector development organizations is usually 1 to 2 years, but many projects of GARWSP are lasting over 5 years. Consequently, community trust decreases, and contributions/participation from beneficiaries for construction and materials procurement become difficult.

On the other hand, in the national development strategy for rural water supply sub-sector, in the process of water supply facilities improvement, changing from a supply driven approach to a demand responsive approach (DRA) is one of the most important strategic issues. The basic concepts for DRA are as follows.

- ☐ Community initiates and makes informed choices about service options based on their willingness to pay and acceptance of responsibilities for operation and maintenance
- ☐ Community contributes to investment cost relative to the level of service and has control over how funds are managed
- ☐ Adequate flow of information to the community as well as procedures for collective decision-making within the community are carried out
- ☐ Communities can choose how water and sanitation services are managed
- ☐ Government has facilitating roles, sets clear national policies and strategies, and creates an enabling environment for all participating groups
- ☐ Community owns and is responsible for sustaining its water (and sanitation) facilities
- ☐ Community capacity is appropriately strengthened
- ☐ The approach promotes innovation and recognizes the need for flexibility

For project implementation of RWSS, SFD and PWP, the concept of DRA was adopted earlier and currently, since the know-how of this development method has accumulated, improvements are being made in the activity modules for each stage of the project cycle. On the other hand, for GARWSP, formation of a social mobilization team (SMT) to promote DRA has just started, and therefore, the method is not yet developed and know-how is still to be accumulated. Also, GARWSP is using DRA in a limited sense as partial payment of the initial fee by the community and contribution in labor. In some GARWSP implemented projects, the community has contributed over 40% of the cost. GARWSP is obliging the community for construction of pump house, transport of pipe material and pumping equipment from the branch office to the site, pipe distribution, and installation of pumping equipment, but main components of DRA such as community dialogue, agreement, formation assistance for community organization and capacity building training are not being conducted.

In relation to DRA, establishment of its basic concepts, manual preparation, activity modules creation and introduction into the project implementation process are highly required to be included in capacity development of GARWSP headquarters/branch offices and local authorities. The capacity development subjects expected to be necessary at this time for GARWSP and local authorities pertaining to DRA are listed below.

- ☐ Community participation and mobilization techniques
- ☐ Village level planning
- ☐ Demand response methodology
- ☐ Water user associations (WUA) development
- ☐ Willingness-to-pay survey
- ☐ Community financing
- ☐ System operations and maintenance
- ☐ Gender aspects
- ☐ Sanitation service options
- ☐ Participatory hygiene education and promotion
- ☐ Participatory monitoring and evaluation

5.3.7 Process Management

Within the framework of decentralization for the near future, formulation, implementation and supervision of project implementation plans will be carried out by GARWSP branch offices, and thereafter, ownership of facilities will be transferred to community organizations through local authorities. Monitoring of management activities by community organizations is to be initiated by local authorities, but periodic technical guidance by GARWSP branch offices is anticipated.

In actuality, GARWSP branch offices and local authorities are not properly conducting technical guidance and monitoring (some local authorities are enforcing communities to make financial reports). As an example, overpumping due to population increase applied a heavy load on the pumping unit to damage the unit, and this shows that periodic technical monitoring is essential.

Moreover, in relation to formation of community organizations, formulation assistance for community organization agreements, and provision of capacity building training on operation and maintenance, the capacities of GARWSP branch offices and local authorities are extremely limited that capacity development of these activities is the utmost priority.

5.4 Recommendation towards Capacity Development of the Sub-Sector and GARWSP

Reviewing the capacity of rural water supply and sanitation sub-sector and its relevant national development institution, GARWSP, in this Chapter, the following major recommendations are made through the Study for its capacity development. Those recommendations and suggestions are incorporated and advocated in preparation of the capacity development plan of GARWSP, which is further discussed in Chapter 8.

5.4.1 Integration of Sub-Sector Development, Reform Policies and Organizational Plan of GARWSP

Decentralization becomes one of the key issues both in sub-sector development and reform policies and institutional development plan of GARWSP. It is observed, however, that GARWSP's Decentralization Plan has been developed in inconsistent manner with the sub-sector development and reform policy. The National Rural Water Reform Policy (draft) and the National Rural Water Supply and Sanitation Policy-Strategy (draft) advocate establishment of GRAs (Governorate Rural Water Supply and Sanitation Authorities) under local councils, while GARWSP enhances organizational capacity of its branch offices for project implementations, under headquarters and its line ministry of MWE. The National decentralization policy, which is in effect and implemented according to Law No. (4) of 2000 concerning the Local Authority, may support ideas underlined in the National Rural Water Reform Policy, since it advocates that local council shall be responsible for implementation of any development projects including water and sanitation sector development.

However, taking into consideration that each sub-sector policy and strategy is yet to be finalized, there are opportunities that GARWSP, led by MWE, as the sole national relevant sector authority, will further facilitate policy dialogue with central and local as well as internal and external stakeholders to clarify the issues. It is suggested that GARWSP's Decentralization Plan be a mainstream in the national sub-sector development and reform policy-strategy as transitional institutional framework. Reviewing its performance and effectiveness with stakeholders at the completion of GARWSP Decentralization Plan in 2010, final institutional arrangements shall be determined and incorporated into the sub-sector policy-strategy. GARWSP and MWE shall actively facilitate policy dialogue focusing the issues, and integrate the sub-sector policy into GARWSP's organizational plan, and vice versa.

5.4.2 Robust Sub-Sector Coordination under National Policy and NWSSIP Initiative

As the environment for sub-sector development is overviewed in previous sections, there are a considerable number of national institutions, in addition to GARWSP, who are involved in sub-sector development, such as RWSSP, SDF, and PWP. Each of those national development agencies and their project implementations are governed under independently established Project Management Units (PMUs), having different modalities in decision making and financing. In the decentralization framework being developed in the country, Local Councils at governorate and district level are also expected to function as institutions responsible for regional development including the rural water and sanitation sub-sector, along with Branch Offices of GARWSP being responsible for sub-sector project implementation according to GARWSP Branch Office Decentralization Plan. In a circumstance where a considerable number of sub-sector development institutions at national and local level are involved, establishment of a firm sector coordination mechanism and robust leadership of 'relevant' national authorities through sub-sector planning, implementation, monitoring and evaluation become key elements for effective and efficient development of the sub-sector.

Dissolution of GAREW (General Authority for Rural Electricity and Water) as a relevant national sub-sector development institution in 1991, and twists and turns for establishment of the present GARWSP under MWE (Ministry of Water and Environment) until 2002 resulted in creation of various national sub-sector development institutions each with independent PMUs supported by donor communities. In this sub-sector environment, it has been considerably difficult for newly reorganized GARWSP to take leadership in sub-sector development among various institutions. However, legislative basis of the country and initiatives undertaken under current development of NWSSIP, defining GARWSP as sole and the most 'relevant' national institution responsible for sub-sector development, gives increasing opportunities for GARWSP to take leadership among other national institutions. There are considerable necessities and relevancies to integrate each and every sub-sector development effort into GARWSP in the future along with its capacity development, instead of developing other national institutions and facilitating different modalities in decision making and financing for sub-sector development. At least, the enabling environment, in which GARWSP takes leadership in sub-sector coordination, shall be further developed. In order to realize the development strategy under NWSSIP enhancing initiatives of GARWSP in the sub-sector development and coordination among various development partners, GARWSP shall also increase its capacity to prepare and manage national development and investment program, under which the sub-sector strategy, planning, development/implementation, and financing among development partners are unified. Strategy and approaches to facilitate sub-sector coordination and develop national development/investment program of the sub-sector under GARWSP's initiatives are further discussed in Chapter 8 "Action Plan of GARWSP for Capacity Development".

5.4.3 Institutional Development of GARWSP

Improved institutional structure and mechanism in the national relevant authority is also one of the key capacity issues for sector development. It is observed in Capacity Assessment that institutional capacity of GARWSP headquarters and its branch offices are inadequately equipped in order to achieve the organization's mission and goals efficiently and effectively. Organizational structure, job descriptions, and operation manuals/guidelines are yet finalized not only for branch offices but also even headquarters, though they are under preparation. Process to review and finalize current drafts of organizational structure, job descriptions, and operation manuals/guidelines shall be further enhanced to establish improved organizational arrangement, assessing current process and quality for decision making, planning and organizational operation, project implementation, and internal and external coordination.

5.4.4 Strategic Planning, Investment and Implementation by GARWSP

As it is reviewed in the previous sections, there is considerable inadequacy of capacity in GARWSP for strategic planning, investment and implementation, resulting in delays in completion of projects, bias in the project component for implementation (construction of boreholes are extremely emphasized), and inappropriate distribution of development funds. Capacity of GARWSP for strategic planning, investment, and implementation shall be further enhanced, through improvement of regional (at governorate level) sub-sector development and investment plan. Capacity of GARWSP branch offices shall be improved for preparation and implementation of the mid-term regional development and investment plan in a DRA (demand responsible approach) manner, as well as in collaboration with other development partners, in particular, with local councils. Based on the regional sub-sector development and investment plan, GARWSP headquarters shall prepare the national mid-term development and investment plan, which could serve as the national strategic plan in order to achieve requirements set in NWSSIP (National Water Sector Strategy and Investment Program, 2005-2009). Implementation of the national and regional sub-sector development and investment plan prepared in a DRA manner could tremendously increase the sub-sector capacity.

CHAPTER 6 RURAL WATER SUPPLY IMPROVEMENT PLAN

6.1 Target Sites

A screening was carried out on the 36 candidate sites using the following selection criteria to retain sites appropriate for formulation of rural water supply improvement planning.

1. Availability of water source: Reliable water source availability, sufficient capacity, good quality
2. Water supply situation: Non-existence of water supply facilities which can meet demands
3. Contribution from beneficiary: Existence of water committee or willing to form one; willingness to contribute to construction works; willingness to pay operation and maintenance fees
4. Similar projects: No overlapping of sites with other donors
5. Land use and water rights: Public water source, public land for facilities construction, no conflicts over water rights or land use
6. Accessibility: Accessibility of construction equipment and vehicles into construction areas

Then the screened sites were ranked through a point system using the following ranking parameters.

1. Difficulty to procure water: Availability of protected water source within site, water consumption rate, water fetching time
2. Water supply improvement needs: Needs ranking for water supply
3. Water source potential: Ratio of coverage population to total population
4. Capacity for payment of operation and maintenance fees: Ratio of payable amount to cost of water supply

The screened sites are listed in the next page along with their rankings. The sites are listed in order of code number and also in order of rank.

Table 6-1 Ranking of Screened Sites

In Order of Site Code		
Code	Site Name	Ranking
A-02	Jabal Al Taraf	19
A-03	Ozlat Al Jaradi	16
S-02	Jarban	20
S-03	Al Kharaba	17
S-04	Qamlan-Bait Al Najrani	10
S-05	Afesh	12
S-07	Bait Al Hadrami	9
S-09	Ruhm	21
S-11	Al Hesn-Al Abyad	13
D-01	Elow Al Mikhlaf	1
D-02	Hamal Bait Al Jabar	7
D-03	Hegrat Al A'asham	4
D-05	Mayfa'at Yaer	3
D-07	Al Asakera	6
D-08	Masneat Abdul Aziz	2
I-01	Asfal Bani Saba	5
I-02	Al Sana	11
I-04	Al Jahlah & Al Meshraq	15
T-02	Bani Al Suror	22
T-03	Sheb Humran	18
T-04	Yafoq Bani Hamad	14
T-05	Al Azaez	23
T-06	Al Khunha	8

In Order of Ranking		
Ranking	Site Name	Code
1	Elow Al Mikhlaf	D-01
2	Masneat Abdul Aziz	D-08
3	Mayfa'at Yaer	D-05
4	Hegrat Al A'asham	D-03
5	Asfal Bani Saba	I-01
6	Al Asakera	D-07
7	Hamal Bait Al Jabar	D-02
8	Al Khunha	T-06
9	Bait Al Hadrami	S-07
10	Qamlan-Bait Al Najrani	S-04
11	Al Sana	I-02
12	Afesh	S-05
13	Al Hesn-Al Abyad	S-11
14	Yafoq Bani Hamad	T-04
15	Al Jahlah & Al Meshraq	I-04
16	Ozlat Al Jaradi	A-03
17	Al Kharaba	S-03
18	Sheb Humran	T-03
19	Jabal Al Taraf	A-02
20	Jarban	S-02
21	Ruhm	S-09
22	Bani Al Suror	T-02
23	Al Azaez	T-05

6.2 Preliminary Design of Water Supply Facilities

A preliminary design of water supply facilities for the screened sites is presented to facilitate requests for project implementation from the Yemeni government to donor organizations.

6.2.1 Design Criteria

Criteria based on GARWSP customary practice for rural water supply planning were modified according to actual conditions and adopted in this study as agreed between GARWSP and JICA Study Team.

Table 6-2 Design Criteria for Water Supply Planning

Factor	Criteria
Design Period	10 years
Population Growth Rate	2.07 – 3.04 %/year
Unit Water Supply Rate	Maximum: 40 lit/capita/day Minimum : 25 lit/capita/day
Daily Average Supply	(Design Population) x (Unit Water Supply Rate)
Daily Maximum Supply	(Daily Average Supply) x (Factor:1.0)
Hourly Maximum Supply	(Daily Maximum Supply) / 24 hours x (Peak Flow Factor:2-4)
Pump Operation Hours (For ideal operation only)	Population 2,000 or less : 8 hours/day Population more than 2,000 : 12 hours/day
Successful Yield for Deep well	25-40 gal/min (1.5-2.5 lit/sec)
Water Quality Standards	Maximum value of acceptable limits of Yemeni Standards based on WHO Guidelines for Drinking Water Quality

Design Period

The period 20 years has been adopted by GARWSP, but the agreed rate for this study is 10 years as a mid-term design period.

Population Growth Rate

The rate 2.5% for all projects has been adopted by GARWSP, but the agreed rate for this study is from 2.07% to 3.04% by Governorates, based on Census 2004 data.

Unit Water Supply Rate

The rate of 40 lit/capita/day (50 l/c/d for coastal hot areas) is usually regarded as an average by GARWSP, but the rate for this study was agreed as 25 l/c/d to 40 l/c/d in accordance with the capacity of water source and pump operating hours.

Daily Average and Maximum Supply

The concept of a daily average and maximum supply has not been adopted by GARWSP. The factor of 1.0 was agreed for this study, due to the limited capacity of the water source and surplus supply is not advisable.

Hourly Maximum Supply

The peak flow factor of 2 has been adopted by GARWSP, but the factor varies from 2 for a site population of more than 5,000 residents to 4 for 500 residents for this study, in inverse proportion to the design population.

Unit Water Supply for Public Institutions

GARWSP does not have its own specific criteria, and does not have any plans to adopt this concept in the planning process because the capacity of water sources is often limited. Criteria proposed by UNICEF will be used as reference. The design for this study will consider water supply to mosques, schools and health related institutions through installation of tap stands.

Pump Operation Hours

Pump operation hours given in the table above are for reference only. Actually, the hours will be adjusted in accordance with the capacity of water source and daily supply requirements.

6.2.2 Planning Concept

The target sites can be classified into the following 2 categories for planning.

- New Construction Site: Site for construction of new water supply facilities (no water supply facilities exist or existing water supply facilities are not functioning and unfeasible to be rehabilitated)
- Rehabilitation Site: Site for rehabilitation of existing water supply facilities (existing water supply facilities are completely or partially functioning)

The concept for planning of the above 2 categories is as follows.

New Construction Sites

Since residents of these sites are not able to receive a continuous supply of clean water throughout the year, they must rely on water from other protected sources, unprotected sources or buy water from private owners. Therefore, using the targeted water sources, a complete water supply system needs to be designed from the water source to distribution (although some sites already have partial facilities such as pump house or/and storage tank). The works planned for designing are the following.

- Procurement and installation of pumping unit for water source and booster wherever necessary
- Construction of pump houses for water source and booster wherever necessary
- Construction of storage tanks for distribution and booster wherever necessary
- Procurement and laying of pipelines for pumping main and distribution lines
- Construction of public tapstands if requested by community

Rehabilitation Sites

Rehabilitation sites have existing water supply facilities in working condition and the residents are able to receive water but may be of insufficient amount. Various requests from rehabilitation sites include the replacement of existing pumping units for water source and/or booster, rehabilitation of pump houses and tanks, replacement/extension of distribution pipeline, and the construction of facilities required from newly drilled deep well to existing tank such as pumping unit, pump house, pumping main pipeline and booster station (pump house and tank) if necessary. However, at this moment, the capacities of actual water sources including newly drilled deep wells are generally insufficient to supply water to already-connected households, and also the existing distribution pipeline networks are not capable of satisfying the basic water demands of the households. In fact, it is not appropriate to extend distribution areas further in terms of water supply planning. In the meanwhile, some communities have extended or repaired distribution pipelines by themselves when necessary, although sometimes inappropriately, but most of the works have been done without properly authorized supervision by local authority or GARWSP. Also, reliable technical drawings and documents related to the constructed facilities required for facility operation and maintenance are not available. Therefore, an overall renovation of distribution facilities may be required whenever inappropriate extensions are made.

Furthermore, most of the existing pumping units for water source and booster were installed over 10 years ago, and life of these units are already past to affect their efficiencies. Since using worn-out equipment will result in wasting of fuel, replacements are necessary and will be considered depending on the extent of the deterioration.

In consideration of these factors, the principal requests from sites and also works to be prioritized are as follows.

- Procurement and installation of pumping units for water source and booster to replace deteriorated existing units
- Procurement and installation of pumping units for new deep wells with construction of pump houses, and pumping units for booster with construction of booster stations (pump houses and tanks) if necessary
- Pipeline connections from newly drilled deep wells to existing storage tanks, through booster stations if necessary

Regardless of actual contradictory differences between water source capacity and consumption, since pumping units have affect on the basic water supply system, the replacement of deteriorated existing units needs to be given priority.

Furthermore, each site can be classified into scale categories according to size of construction works based on parameters such as population, site area extent and height difference (see table below for classification of each site), and also into type categories of existing or designed water supply systems. System types are shown in Figure 6-1.

Table 6-3 Site Categorization

Code	Governorate	Name	New Construction Site		Rehabilitation Site	
			Scale	System	Scale	System
A-02	Al Mawheet	Jabal Al Taraf			Large	C
A-03		Ozlat Al Jaradi			Extra Large	C
S-02	Sana'a	Jarban	Medium	B		
S-03		Al Kharaba	Small	A		
S-04		Qamlan-Bait Al Najrani	Small	A		
S-05		Afesh			Medium	B
S-07		Bait Al Hadrami	Small	A		
S-09		Ruhm	Medium	A		
S-11		Al Hesn-Al Abyad			Small	A+B
D-01	Dahmar	Elow Al Mikhlaf	Medium	B+C		
D-02		Hamal-Bait Al Jabar	Medium	A		
D-03		Hegrat Al A'asham	Medium	B		
D-05		Mayfa'at Yaer	Medium	C		
D-07		Al Asakera	Large	C		
D-08		Masneat Abdul Aziz	Small	A		
I-01	Ibb	Asfal Bani Saba	Large	C		
I-02		Al Sana	Large	C		
I-04		Al Jahlah & Al Meshraq	Large	B		
T-02	Taiz	Bani Al Suror			Extra Large	B+C
T-03		Sheb Humran			Extra Large	C
T-04		Yafoq Bani Hamad			Extra Large	C
T-05		Al Azaez			Extra Large	A+B
T-06		Al Khunha	Large	A		
Total			S: 4 M: 6 L: 5	A: 7 B: 3 C: 4 BC:1	S: 1 M: 1 L: 1 XL:5	AB:2 B: 1 C: 4 BC:1
			15 Sites		8 Sites	

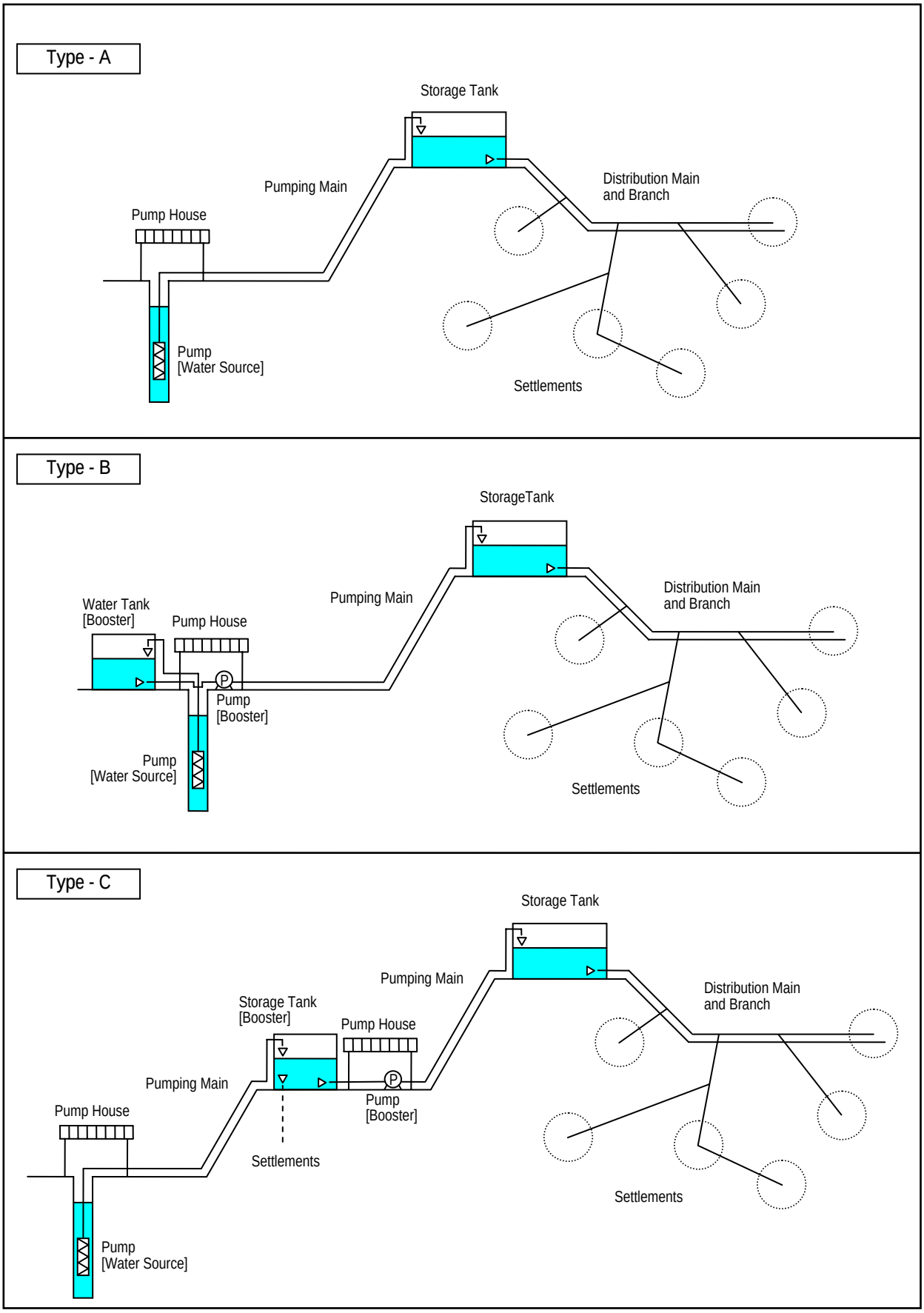


Figure 6-1 Schematic of Typical Water Supply System Types

6.2.3 Water Source

Water sources presently used by residents of the target villages include deep wells (public and private), dug wells, springs, streams, rainwater and water from vendors. Some villages separate the use of these sources for drinking and irrigation, while many are using the same source for both purposes. Sources such as dug wells, streams and rainwater are easily susceptible to contamination, and high fluctuations in flow rates can be seen throughout the year, where water becomes deficit during the dry season. Therefore, these sources are not given priority as reliable sources for water supply planning.

In accordance with the water resource survey made by the Study Team, the candidate sources for planning are public deep wells and spring sources. Some sites have more than one water source available to be used for designing. The results of pumping tests determine the extent of coverage possible with the target water source, and results of water quality analyses reveal the possibility for drinking. The water sources planned for designing are listed below.

Table 6-4 List of Water Sources for Study Plan

Governorate	Site Name	Well Code	Well depth (m)	Casing Diameter (inch)	Pumping Rate (l/s)	Static water Level (G.L.-m)	Pumping Water Level (G.L.-m)
Al Mawheet	Jabal Al taraf	A-02	165	8-5/8	4.4	26.0	33.8
	Ozlat Al Jaradi	A-03	150	10	10.4	50.8	55.9
Sana'a	Jarban	S-02	450	10	2.0	345.3	345.4
	Al Kharaba	S-03	150	8-5/8	3.5	44.9	80.8
	Qamlan-Bait Al Najrani	S-04	145	8	5.6	10.0	10.9
	Afesh	S-05	300	8	3.2	213.0	231.2
	Bait Al Hadrami	S-07	410	8	3.2	193.2	197.1
	Ruhm	S-09	470	8	3.0	192.5	227.9
	Al Hesn-Al Abyad	S-11/1	350	8	3.8	154.1	219.1
Dahmar	Elow Al Mikhlaf	D-01	273	8	2.4	184.1	185.8
	Hamal Bait Al Jabar	D-02	310	8	3.5	185.8	209.3
	Hegrat Al A'asham	D-03	320	8	5.0	163.1	184.0
	Mayfa'at Yaer	D-05	127	8	2.6	59.6	62.8
	Al Asakera	D-07	304	8	4.5	193.6	195.2
	Masneat Abdul Aziz	D-08	268	8	4.5	62.0	123.7
Ibb	Asfal Bani Saba	I-01	305	8-5/8	4.5	106.4	112.7
	Al Sana	I-02	272	8-5/8	3.9	35.6	140.5
	Al Jahlah & Al Meshraq	I-04	305	8-5/8	4.1	14.9	110.2
Taiz	Bani Al Suror	T-02/1	230	8	5.1	183.9	186.4
		T-02/3	251	8	2.6	118.6	139.7
		T-02/4	190	8	5.4	137.2	139.5
	Sheb Humran	T-03/1	400	8	4.0	22.5	44.8
		T-03/4	260	8	4.2	24.4	28.5
	Yafoq Bani Hamad	T-04	220	8	3.0	124.8	126.7
	Al Azaez	T-05/1	120	8-5/8	2.0	8.4	53.6
		T-05/2	120	8-5/8	2.0*	9.0*	50.0*
		T-05/4	Spring	-	2.4 - 5.5**	0.0	-
	Al Khunha	T-06	200	8	8.8	0.0	5.6

*Estimated from GARWSP data; **Estimated yield of dry–rainy season

6.2.4 Water Supply Facilities

(1) Pumping Units for Water Source and Booster

Units required for lifting water up from water source and boosting water to higher levels include the following.

- Vertical shaft pump for lifting groundwater up from water source
- Submersible motor pump for lifting groundwater up from water source
- Horizontal pump for boosting water up from tank to a higher point
- Diesel engine to drive vertical or horizontal pump
- Engine-generator to operate submersible motor or horizontal pump

These various types of imported pumps, diesel engines and engine-generators are available in Yemen.

Pump capacity requirements depend on the design pumping rate and total head. Diesel engine and engine-generator ratings are selected according to the pump rating. Commercial power has hardly been accepted for rural water supply projects in Yemen because of its higher operational cost as compared to diesel engine and engine-generator.

For groundwater lifting, diesel engine driven vertical shaft pumps are most popular in Yemen, but submersible motor pumps are also gaining popularity due to necessity for exploitation of deeper aquifers. Vertical shaft pumps and submersible motor pumps should be chosen through a comprehensive technical examination of parameters such as pumping rate, total head and pump installation depth.

Table 6-5 Pump Categorization

Factor	Vertical Shaft Pump	Submersible Motor Pump	Horizontal Pump
Application	Groundwater lifting	Groundwater lifting	Boosting
Pumping Rate	Wide range	Wide range	Wide range
Applicable Total Head (as reference)	less than 200m	200m and more, but less than 250m advisable	less than 250m advisable
Power Source	Diesel Engine	Engine-Generator or Commercial Power	Diesel Engine, Engine-Generator or Commercial Power
Capacity	Low to Medium	Low to High	Low to High
Feature	Mechanical	Easily affected by foreign substances such as sand in deep well	

(2) Pump House for Water Source or Booster

A pump house is needed to maintain the pumping unit for lifting up groundwater or boosting up water. Reinforced concrete structure (with wall of concrete blocks) is basic standard for GARWSP, but if the community is to construct the facility, the structure is generally masonry wall of blocks or rocks and zinc roof. The necessity for removal and installation of the pump in case of repairs or replacement needs to be considered in the design of the pump house.

(3) Water Storage Tank

The water tank has 2 functions, one as storage for distribution to settlements, and the other for temporary storage before boosting to the next height. The size of tank is standardized and the capacity is determined according to the daily maximum supply requirements. Rectangular reinforced concrete structure is GARWSP standard, so this structure will be adopted in this plan, although steel panel or stone masonry structure is used in certain projects. Commonly, ground tanks are designed to be constructed if land high enough for gravity flow can be found, but if appropriate areas are not available for sufficient flow, then elevated tanks will be considered.

Table 6-6 Water Storage Tank Categorization

Parameter		Distribution Tank	Booster Tank
Ground Tank	Standardized Size (m^3)	25, 50, 75, 100, 150, 200, 250	Basically same as Distribution Tank
Elevated Tank	Standardized Size (m^3)	25, 50, 60, 100	—
	Standardized Height (m)	3, 6, 9, 12	—
Capacity Determination		12 hours of daily maximum consumption	As reference, 2 to 3 hours of pumping as temporary storage, plus 12 hours of daily maximum consumption distributed from the tank, if necessary. The pumping hours as temporary storage should be determined for each project according to actual conditions of the site, operation and maintenance requirements, and other conditions.

(4) Pipeline

Due to the characteristic geology of the study area, trenching for underground pipe laying is very difficult. Consequently, since pipes need to be laid on the ground surface, galvanized steel pipes (SGP) are popularly selected for corrosion resistance and decay durability against external environment and high water pressure. However, wherever underground pipe laying is possible such as coastal non-rocky areas, high density polyethylene (HDPE) pipes or polyvinyl chloride (PVC) pipes can be considered. Pipe diameters are determined from requirements in flow rate, velocity and residual head.

The pipeline network will consider effective operation and maintenance as well as economy of the system. Wherever possible, pipes will be laid alongside roads or paths for easy inspection and maintenance, but pipeline may optionally require direct routing for economic reasons.

Table 6-7 Design Conditions Adopted for Pipe Hydraulic Calculations

Parameter	Condition
Applied Formula	Pipe Diameter of 2 in (50mm) or less : Weston Pipe Diameter of more than 2 in (50mm) : Hazen Williams
Roughness Coefficient	New Pipeline : 110 Old Pipeline : 100
Velocity	0.3 to 1.1 m/sec
Residual Head	3 to 100 m (0.3 to 10 bar) for distribution pipeline

Pipelines are categorized into 3 groups as explained below.

Pumping Main Pipeline

Pumping main is the pipeline from water source to the final water tank through necessary booster stations. The flow rate is calculated using daily maximum supply. Since pipelines tend to be highly pressurized by pumps for pumping water up to higher points, high-pressure resistant pipes are preferred, and larger diameters are designed (meaning, the velocity becomes slower) to reduce friction loss as much as possible.

Distribution Pipeline (Distributing Main and Branch)

The pipelines from water tanks to distributing settlements consist of distributing mains and branch pipelines. The flow rate is calculated using hourly maximum supply. A break pressure tank is necessary along the distribution pipeline if the residual head is high at the distributing point. To facilitate the connections with service pipelines, distribution pipelines are designed to be extended to a convenient point near the center of each settlement or group of households.

Service Pipeline

This type is the pipeline connected from distribution pipeline to each private property. For sites requesting house or yard connections, the service pipelines into households must be constructed by each household since these connections become private property.

Table 6-8 Pipeline Categorization

Parameter	Pumping Main	Distribution	Service
Construction Responsibility	GARWSP or Donor	GARWSP or Donor	Community
Material	SGP	SGP	SGP
Specification	BS1387 Heavy/Medium or equivalent	BS1387 Medium or equivalent	BS1387 Medium/Light or equivalent
Joint	Flange/Screw	Screw	Screw
Diameter design for this Study	2-1/2 to 4 inch (65 to 100mm)	3/4 to 4 inch (20 to 100mm)	1/2 to 1 inch (15 to 25mm)
Diameter Determination	Daily maximum supply	Hourly maximum supply	

(5) Supply Tap Facilities

For sites requesting level 2 services, public tapstands are designed essentially as 1 tap per 150 persons and to be placed in convenient locations with distances of 200 m between tapstands, so that daily water fetching by residents is not a burden. The public tapstand consists of a reinforced concrete foundation and stand with a number of taps.

Since most of the sites are requesting level 3 service, house or yard connections are needed. However, since the connections become private property, service pipeline from the nearest distribution pipeline laid as part of the project design as well as installation of water meters and taps must be carried out individually by each household.

6.2.5 Operation Control of Pumping Units

Automatic operation is not common for rural water supply facilities in Yemen, since equipment for such operation is rarely available in the local market and costs are high even if they are available, and also the pumping units for deep well and booster are usually not electric-powered (automatic operation can function only for electric-powered units). The operation system for pumping units is designed in consideration of “easy-to-handle” as well as “easy-to-understand” for operator, and therefore, manual operation is selected. However, an automatic stop function using a water level probe (sensor) to be installed in the well or booster tank will be useful in terms of water conservation and appropriate pump operation (but this function is available only for electric-powered units). Meanwhile, an automatic start function is not provided since electricity can be generated only during operation and also due to the necessity to be simplified as much as possible, this function is not necessary. For mechanical diesel engine driven units, manual operation will be chosen by necessity. Regardless of type of operation control, training for operators is needed.

6.2.6 Preliminary Design

Facilities Layout Plan

Layout of water supply facilities was planned according to the requirements of each site in view of such conditions as service level, location of water source, topography, layout of houses, extent of coverage, coverage population, needs of beneficiaries, conditions of existing facilities and rehabilitation requirements.

Facilities Plan

The water supply facilities plan for each of the screened sites is compiled and listed in Table 6-9 in the next page.

Site Plan

The site plans showing facilities layout for each screened site are attached in Annex .

Table 6-9 Facilities Plan for Screened Sites

No.	Code	Site Name	Type	Required Equipment and Facilities															Existing Equipment and Facilities														
				Pumping Unit					Pipeline			Pump House			Water Storage Tank				Pumping Unit					Pipeline		Pump House			Water Storage Tank					
				Water Source		Booster	Power		Pumping Main	Distrib. Main	Total	Water Source	Water Source & Booster	Booster	Water Tank (m^3)				Water Source		Booster	Power		Pumping Main	Distrib. Main	Water Source	Water Source & Booster	Booster	Water Tank (m^3)					
				S/M	VTL	HRZ	GNR	D/E	km	km	km	Type-A	Type-B	Type-C	25	50	75	100	S/M	VTL	HRZ	GNR	D/E	-	-	Type-A	Type-B	Type-C	25	50	75	100	150	200
AL MAHWEET GOVERNORATE																																	
1	A-02	Jabal Al Taraf	R		1	1		2												(1)	(1)		(2)	Exist.	Exist.	1		2	1			1		
2	A-03	Ozlat Al Jaradi	R	1		2	3												(1)		(2)	(3)		Exist.	Exist.	1		1		1	1			1
SANA'A GOVERNORATE																																	
3	S-02	Jarban	N	1		1	1	1	3.7	6.8	10.5		1		1	1																	
4	S-03	Al Kharaba	N		1			1	1.1	3.6	4.7	1				1																	
5	S-04	Qamlan-Bait Al Najrani	N		1			1	0.5	2.2	2.7	1			1					(1)			(1)			(1)								
6	S-05	Afesh	R	1		1	1	1	0.0	0.4	0.4													Exist.	Exist.	1		1		1		1		
7	S-07	Bait Al Hadrami	N	1			1		0.2	7.2	7.4	1					1																
8	S-09	Ruhm	N	1			1		3.3	13.0	16.3	1				2																	
9	S-11	Al Hesn-Al Abyad	R	1			1		0.5		0.5	1								1	1		2	Exist.	Exist.	1		1	1	1				
DAHMAR GOVERNORATE																																	
10	D-01	Elow Al Mikhlaf	N		1	2		3	1.7	9.1	10.8		1	1	1															2			
11	D-02	Hamal-Bait Al Jabar	N	1			1		0.8	10.7	11.5	1																			1			
12	D-03	Hegrat Al A'asham	N		1	1		2	0.4	5.2	5.7																1		1	1				
13	D-05	Mayfa'at Yaer	N		1	2		3	0.6	2.2	2.8	1		2	2	1				(1)	(1)		(2)	Exist.		(1)		(1)	(2)					
14	D-07	Al Asakera	N	1		2	1	2	2.3	10.3	12.7	1		2			1													2			
15	D-08	Masneat Al Abdul Aziz	N		1			1	1.8	1.4	3.1															1			1					
IBB GOVERNORATE																																	
16	I-01	Asfal Bani Saba	N	1		2	1	2	3.9	15.2	19.1	1		2		1	1	1															
17	I-02	Al Sana	N	1		2	1	2	3.6	15.5	19.0	1		2		1	2																
18	I-04	Al Jahlah & Al Meshraq	N		1	2		3	2.0	18.1	20.1		1			1		2															
TAIZ GOVERNORATE																																	
19	T-02	Bani Al Suror	R	2	1	3	2	4	3.0		3.0	1		1		1			(2)		(2)	(2)	(2)	Exist.	Exist.	1	1		2		1	1	2	
20	T-03	Sheb Humran	R	1	1	2	1	3	1.4		1.4	1							(1)		(2)	(1)	(2)	Exist.	Exist.	2		3	1		5			
21	T-04	Yafoq Bani Hamad	R	1		1	1	1											(1)		(1)	(1)	(1)	Exist.	Exist.	1		1	1			1		
22	T-05	Al Azaez	R	2	1	1	2	2	2.0		2.0									(2)	(1)		(3)	Exist.	Exist.	3		1		1				1
23	T-06	Al Khunha	N		1			1	1.0	15.4	16.5	1				1																	
TOTAL				16	12	25	18	35	33.8	136.4	170.1	13	3	10	5	10	5	3	0 (5)	1 (5)	1 (10)	0 (7)	2 (13)	-	-	12 (2)	2	10 (1)	8 (2)	9	8	4	2	2

N: New construction
R: Rehabilitation

S/M: Submersible GNR: Generator
VTL: Vertical D/E: Diesel engine
HRZ: Horizontal

No. in paratheses ( ) indicates existing equipment and facilities which cannot be used for the plan due to deterioration

6.3 Implementation Plan

6.3.1 Procurement

For assured sustainability of the facilities, availability of major material, equipment and spare parts in the local market is essential. Although most of them are available locally in Yemen, quality control of procurement is needed because inferior products are frequently seen.

The possibilities for procurement of materials and equipment locally or from other countries are listed below.

Table 6-10 List of Procurement Sources

Materials and Equipment	Manufacturing		Procurement	
	Local	Other Countries	Local	Other Countries
Cement, concrete blocks and aggregates	○		○	
Rebar and metallic products		○	○	
Pumping unit for water source or booster		○	○	
Pipes		○	○	
Special valves		○		○

6.3.2 Work Allocation

The screened sites should be requested for assistance to donor organizations. Requests can be made from the list of ranked sites, in accordance with the budget constraints and assistance concept of the donor organization. The works can be implemented through demarcations as proposed in Table 6-11 and work requirements demarcated between new construction sites and rehabilitation sites are shown in Table 6-12.

Table 6-11 Proposed Allocation of Work

Stakeholder		Work Allocation	
		Role	Facilitator
Yemen	GARWSP	・Procurement	・Headquarters
		・Supervision	・Branch office
		・Coordination	・Headquarters
	Local Authority	・Formation and/or strengthening of community-based water committee (CBO)	・Local council
		・Capacity building	・Local council
		・Follow-up/Monitoring	・Local council
	Beneficiary Community	・Access road construction	・Residents
		・Removal of existing pumping units wherever necessary	・Residents
		・Transport within site	・Residents
		・Pipe layout	・Residents
		・Rehabilitation works	・Residents
		・Procurement of service pipe and connections to household	・Each household
		・Operation and maintenance	・Water committee
Donor		・Procurement and installation of pumping units	・Contractor
		・Pump house construction	・Contractor
		・Storage tank construction	・Contractor
		・Procurement and installation of pipelines	・Local contractor
		・Support to social mobilization	・Local consultant
		・Overall supervision	・Donor

Table 6-12 Proposed Work Demarcation by Construction Category

Item	New Construction Sites		Rehabilitation Sites	
	Donor	Yemen	Donor	Yemen
Pumping Unit for Water Source and Booster	Procurement/ Installation	Coordination/ Supervision/ Transport	Procurement/ Installation for new deep well/ Replacement of Deteriorated Equipment	Coordination/ Supervision/ Transport
Pump House	Construction	Coordination/ Supervision	Construction for new deep well	Rehabilitation/ Coordination/ Supervision
Storage Tank	Construction	Coordination/ Supervision	—	Coordination/ Supervision
Pipeline	Procurement/ Installation	Transport/ Layout/ Coordination/ Supervision	Installation from new deep well to existing tank	Replacement/ Extension/ Transport/ Connection/ Coordination/ Supervision
Public Tapstand	Construction	Coordination/ Supervision	—	Coordination/ Supervision
House Connections	—	Connections/ Coordination/ Supervision	—	Connections/ Coordination/ Supervision
Operation/ Maintenance	Assistance	CBO Formation	Assistance	CBO Strengthening
Community Awareness	Assistance	Intervention	Assistance	Intervention

6.4 Operation and Maintenance Plan

6.4.1 Overview of Operation and Maintenance Practice in Water Sector of Yemen

During the pre-reform period from 1970 to 2000 in the history of the water sector in Yemen, the government of Japan continuously provided financial assistance to rural water supply projects. The targeted area covered most of the territory of the former North Yemen, and in 1990s in the wake of the union of North and South Yemen, Japan committed itself to a project for four districts in Abyan and Hadramout governorates in the latter.

The mode of implementation of Japanese projects at that time was to focus efforts on its technical aspects, based on the concept and principle of Japan's Grant Aid Scheme with measures for sustainable operation and maintenance of the constructed schemes to be assured by recipient countries. The main role in establishment of an operation and maintenance system, therefore, was played by counterparts from the executing agencies who used to make arrangements with village representatives, in most cases *sheikhs* or *aquils*, to formulate community water committees in order to realize sustainable operation and maintenance of facilities upon completion. National efforts to establish systematic social mobilization framework were yet to be seen.

The executing agencies for rural water supply development on the Yemeni side during the period were as follows:

(a) 1972 to 1990 — Rural Water Supply Department (RWSD) of the Ministry of Public Works, which was later transferred to the Ministry of Electricity and Water of the former North Yemen in the latter part of '90s

(b) 1991 to 2000 — General Authority for Rural Electricity and Water (GAREW), nationwide organization of the unified government for the rural water and electricity sector as a wing of the Ministry of Electricity and Water.

The latter agency, GAREW, had a department in name in its organizational setup which was to be devoted to activities for social mobilization, but no substantial work was yet launched.

Although the official policy and framework for administration of operation and maintenance remained weak, with direct contribution from stakeholders in this category in limited levels, the Japanese projects frequently witnessed through their execution that most of rural communities had their own discretion and wisdom to carry out sustainable water service among themselves. The earliest Japanese project was completed in 1984, covering 42 communities all across the former North Yemen, most of them medium to large scale communities later developed into district centers such as Jihanah in Sana'a governorate and Bait-Al Faqui in Hodeidah, and monitoring of the completed project was carried out by Japanese experts, first in 1988 and then

in 1999. The results of monitoring which covered all of 42 communities are summarized in the following table.

Table 6-13 Results of Monitoring of Early Japanese Rural Water Supply Projects

Results of Monitoring in 1888	Results of Monitoring in 1999
(1) A water users committee was organized and functional in every site upon completion except 5 communities where water production from shallow wells drilled into Precambrian rock had been extremely diminished (in Al-Baidah and Taiz governorates). Alternative sources had been planned by the RWSD, with citizens forced to switch to alternative sources or water vendors for the moment. (2) Each committee consisted of 3 to 5 members, for system management, operation, and billing/tariff collection. Each one was entirely a voluntary organization within the community with no legal status due to lack of official procedure. (3) Tariff covered cost mainly for fuel and salary of operator(s).	(1) Most of the sites were found to have been transformed into much larger communities in 15 years since the construction of the facilities. (2) Twelve (12) sites out of 42 had abandoned or ceased to use entire facilities installed under the project mainly due to depletion of sources. The situation of water supply in these sites at the time of monitoring was as follows: a. 7 sites had been offered new projects or installed alternative systems by themselves. b. 5 sites had been left without any reliable system. The residents had to rely on alternative sources such as cistern or water vendor. (3) In other 30 sites, the initial facilities were functional wholly or partly, although a part of the facilities had been replaced or rehabilitated during the same period as follows: 1) Deep Wells a. Initial wells still functional in 1999: **19** sites out of 40 where the sources were provided under this project: b. Initial wells depleted and replaced by the government or communities themselves: **11** sites (The total number of depleted wells is 23 including those in the sites mentioned in Item (2).) 2) Pumping Units a. Initial equipment still functional in 1999: **10** sites out of 30 b. Initial equipment, mainly submersible pumps, broken and replaced by the communities, etc.: **20** sites out of 30. (4) The number of communities without any water supply systems was 5 out of 42, where the residents had been left without any means other than relying upon alternative sources like cisterns, water vending, etc. In other **37** sites, each had a working water supply system under control of the water committee established by the community. The operation and maintenance of the system had been managed through the tariff system agreed in the respective communities.

The summarized results of monitoring of the earlier Japanese project reflect the following trend about the common practice of operation and maintenance of water projects in rural Yemen:

(1) Every community has a positive sense of ownership and responsibility, and is ready to have its own organization for management and operation/maintenance of completed facilities

with internal consensus on its tariff structure to ensure sustainable management. Beneficiaries willingly agree to such a system due to acute necessity of safe water, since otherwise there would be no means to ensure it in their hostile environment – scanty rainfall and rugged mountainous terrain surrounding their settlements.

(2) In a majority of the communities, the difficulty continues during the operation and maintenance period, as the monitoring results in 1999 clearly indicate --- lowering water level and eventually depletion of the wells. The crisis in the sources emerged as the communities grew with rapid increase of population. Production from the sources is suspected to have been enhanced beyond their capacities due to increasing demand in the communities. The trouble in the source is likely to have affected the operation of pumping equipment, eventually resulting in its breakdown. (The overexploiting of groundwater resource was typically manifested in the water crisis in Taiz city in the early '80s, and this situation has growingly been escalating all over the national land.)

The cause of the trouble is artificial as well as technical. Even the government has not been able to propose any effective solution as yet to contain this trend. For the rural water schemes, however, training of operators in basic knowledge of hydrogeological features of sources may have some effect to prevent earlier catastrophe of the prized system. Earlier training of operators of communities by the authorities tended to tilt to mechanical engineering for handling pumps and power units. Since the characteristics of groundwater resources in the country is unique, it is important to know the essential principle of groundwater occurrence and to learn how to preserve it.

(3) Although a larger portion of the sites in the project had encountered various breakdowns or system failures, there were those where the initial system had been intact. The best performance was shown in one site in Dahmar governorate. The operator there was in the second generation succeeding the first one who had participated in the training course by the authority. He lamented the decrease of capacities of the deteriorating pump and generator, but the facility had been able to meet the demand of residents. When the system was completed in this community with a population of 3,000 in 1984, the residents held a general assembly on how to supply water to each household, and the final conclusion was to install independent house connections with water meters and tap levers at branches of main distribution lines by the respective households. Such arrangements for house connections were in sight within the community, since they were exposed to avoid tampering by others, as shown in the photo to the right.

This is one example of beneficiaries' wisdom and voluntary efforts to protect their water systems in the era when there was no official guidance and support for operation and maintenance. This trend appears still alive in the rural communities of the country.

6.4.2 Current Operation and Maintenance Situation at Study Target Sites

The number of candidate sites for the ongoing study by JICA was initially 36, with their populations ranging from 196 at minimum to almost 24,000, although a majority of them fell within a range of 1,000 to 6,000. After the screening process for feasibility of the project, it has now been reduced to 23. The current situation of water use practice in each site of 36 was surveyed under the first stage of the study, and their characteristic features are summarized as follows:

(1) Existing Public Water Supply Systems

	Types of the existing systems	No.
1.	Sites having public supply systems now working	9
2	Sites having public systems which rely upon private sources	4
3.	Sites with supply systems not working now due to equipment breakdown, etc.	7
4.	Sites without public supply systems	16
	Total	36

Remarks:

i) In most of the sites having no public supply systems, new wells, which were mostly drilled by the government, are available for installing new systems. Until the new projects are introduced, the residents there have been forced to depend upon water vendors, private wells, springs, cisterns, etc.

ii) Those sites which now use private sources have alternative public sources for new projects. They are in need of new projects using those public sources.

iii) The sites having actively working public systems are in need of extension of systems and/or replacement of deteriorated equipment.

(2) Community-Based Management for Water Supply Schemes

It is most common in Yemen that communities are responsible for management of rural water supply schemes. There are two major community-based management models identified in the Study area. One is a traditional management model centered on village authorities (Sheikhs and Aquils) or their appointed persons, and the other is a CBO (community-based organization) management model that is represented by user community in the village. In the traditional management model, the scheme management largely relied on the leadership and capacity of village authority, while in the CBO management model, the scheme management is relatively well organized and improved. In the 16 villages having existing supply schemes, regardless of operating or not, the traditional management model is or had been adopted in 8 communities, while the CBO model is currently followed in 8 communities. It is also observed, in the Study area, that the traditional management model is widely prevalent in the Governorates located in

the north (i.e. Sana'a, Al-Mahweet, and Dahmar), while the CBO model is more common in the south (Ibb and Taiz). This may be because, in north mountainous regions of Yemen, socio-economic, cultural, and political environments are strongly governed under traditional tribe-based societies unique in the country, while tribal influences are less in southern regions.

Although the traditional management model centered on village authority is the most popular and prevalent in northern governorates of Sana'a, Al-Mahweet, and Dahmar, most of the existing supply schemes in the area are observed to be neither operational nor functioning in the candidate sites of the Study, due to mismanagement of the scheme or negligence on broken equipment/facilities. It is a fact, however, that there are some successful cases of traditional management models in the region. In management of rural water schemes, the influence of sheikhs is not always a negative factor, particularly in smaller scale communities, where the financial resources are frequently in their hands, and they can from time to time contribute to the sustainable operation and maintenance of the system, particularly in cases when troubles occur with the facility. However, their successes considerably rely on the capacity of village authorities (Sheikhs and Aquils) in scheme management, leadership, decision-making, negotiation with governmental agencies for additional funding, and financial management as well as financial procurement. In the candidate sites, capacities of village authorities are seemingly limited in the northern region, and combined with other hindering factors mentioned in the Supporting Report "Survey on Operation and Maintenance" such as in scale-merit, mode of ownership, transparency and accountability, and increased population, most of the existing supply schemes have operational problems. In those sites, introduction of the improved management model should be further considered.

In contrast to the traditional management model, it can be said that CBO models are relatively sustainable. There are several differences in the modes of scheme management by CBO models among target communities having supply schemes, of which features are described below.

1) Mode of Ownership

Except in a few cases, asset ownership for the supply facilities is legally vested to communities and protected by Civil Code and customary laws of the country. The Civil Code of Yemen, which is often referred to as a modern interpretation of Sharia'ah (Islamic Law), and along with customary law, it defines that ownership of groundwater sources and supply facilities is appendant to the land. Thus, if the sources and facilities are located on the community's commonly owned land, community ownership of the assets is legally accepted without any legal bindings. In case that those groundwater sources and facilities are located on privately owned land, then, internal arrangement in the community is made to secure community ownership.

There are some cases observed among improved CBO, which are legally registered according to the Local Administration Law and its bylaws described below, that ownership of the scheme is defined in their constitution and bylaws.

2) Mode of Management Entity

Two distinguished modes of management entity among CBOs established in the target communities are identified. Most popular mode of management entity in the governorates of Sana'a, Al-Mahweet, and Dahmar is the Water Committee, of which executive members are elected by communities or selected by village authorities. They are not legally recognized by governmental authorities, but rather identified by local communities. Less legal recognition by governmental authorities, in particular by Local Councils and GARWSP, often limits establishment of interface between communities and those authorities for provision of governmental services, such as technical and managerial guidance, follow-up, and monitoring to those CBOs. Those CBOs or Water Committees are also established without development of their organizational constitutions and bylaws based on community's consensus, which define membership of the committee, roles and responsibilities of executive members, requirements and conditions in financial management and accounting, decision making process, measures for transparency and accountability to the communities, and so forth. Negligence to develop and monitor their constitutions and bylaws for community-based management of the supply schemes also lead to mismanagement, less accountability and transparency, and also less participation of community, as it is observed in the previous section (refer to Survey on Operation and Maintenance in Supporting Report).

There is an evolving and improved mode of community-management entity, particularly in the governorates of Ibb and Taiz. Since the year 2002 when the bylaw for local administration was announced, subsequent to the promulgation of the law No. (4) for local administration in 2000, the CBOs are advocated to acquire legal status with the registration to the Ministry of Local Administration subsequent to approval of the district local council and the governor. Those CBOs formulated according to bylaws of local administration are registered as Water User Associations (WUA) and legally recognized by local administration (local councils and GARWSP branch offices). Establishment of WUA shall take the following procedures and often supported by local administrations such as local councils and GARWSP branch offices: 1) consensus building on community-based management; 2) preparation of WUA constitutions and bylaws; 3) community approval of WUA constitutions and bylaws through organizing all users' assembly; 4) approval of WUA constitutions by local administration; 5) election for executive members of WUA through organizing all users' assembly, which is monitored by local administration; and 6) registration of WUA under local administration.

Preparation of WUA constitutions based on community consensus and its monitoring by users themselves facilitates considerably community participation and ownership as well as accountability and transparency in the supply scheme management. Development of WUA requires provision of technical guidance, monitoring and supervision by local authorities such as local councils and GARWSP branch offices. Legal recognition of WUA and regular monitoring by local authorities also facilitate their expertise in the scheme operation. In the target communities where such WUAs are established, local councils are actively involved in monitoring on their account, although involvement of GARWSP branch offices in monitoring and follow-up is limited.

Among the governorates covered by the study, Taiz and Ibb have actively been pushing this legal process wherever new projects start in their territories. The number of CBOs with such legal status, however, has so far been limited to 5 out of 13, one in Al-Mahweet governorate and four in Taiz governorate. Since the sites for this study in Ibb governorate have no existing public supply systems, the CBOs are yet to be established in the candidate sites.

3) Organizational Management

a. Organizational Structure

It is observed in the target communities under the Study that basically an unregistered CBO (Water Committee) is composed of one director, one financial manager and one operator. This minimum staff structure has often been employed in systems involving up to 3,000 consumers. As the number of consumers increases with the enhanced scale of the system, the operation unit of technical staff and billing/tariff collecting personnel under the CBO is proportionally increased.

The number of the existing officially authorized CBOs (Water User Associations) for the study is five, one in Al-Mahweet and four in Taiz Governorate, among which three organizations completed the final registration with the Ministry of Local Administration, and the remaining two finalizing registration with the district local council. All of them were established basically in compliance with legal procedures as follows:

First process:	Resolution of the General Assembly of the community rallying all the beneficiaries for establishment of the CBO and its constitution
Administrative Board:	This organization is the main body of the CBO for a water scheme. An operation unit consisting of technicians and billing/tariff collection staff belongs to the board. The number of operational staff is decided, based upon respective system sizes.

Monitoring Committee: The committee members are elected by the General Assembly for monitoring the performance of the Administrative Board and carrying out auditing.

Of the existing 5 CBOs, three in Taiz governorate respectively operate schemes for more than 10,000 consumers. As this condition enhanced service range and activated works of the CBOs, their financial performance has improved to produce allowance for equipment and vehicles for their activities.

b. Organizational Constitutions and Bylaws

As mentioned earlier in this section, WUAs in the target communities under the Study have developed their constitutions and bylaws in compliance with bylaws of the Local Administration Law. Their constitutions and bylaws basically refer to the issues to be defined for organizational operation and scheme management, such as the general objectives and missions of the organization, organizational structure, functional roles and responsibilities of each sub-organization in the scheme management and operation, membership and terms of office, accounting procedures, means to assure accountability and transparency to the community members, and so forth. Community participation is significantly emphasized in the process to prepare and monitor the WUA constitution. General Assembly, which is composed of all users, is organized to facilitate community dialogue, consultation, consensus building, and final decision making and approval for their constitution. The constitution also advocates formation of a Monitoring Committee, which is representative of the user community, under the General Assembly to monitor scheme management by the administrative board of WUA according to the performance and requirements set by the constitution.

Among unregistered CBOs or conventional Water Committees established in the target communities under the Study, such constitutional arrangements are not observed. Negligence to prepare their constitution and establish community-based monitoring system often ends up in mismanagement, less accountability and transparency, and malfunction of the scheme as observed in the survey on operation and maintenance (refer to Survey on Operation and Maintenance in Supporting Report). Also worth mentioning is that, without preparing their constitutions and community-based monitoring systems, the management entity tends to be influenced by village authorities in scheme management, rather than decisions made by communities. In such management and decision making process, it is often difficult to facilitate community participation and contribution in scheme management.

c. Decision Making Process

Most of the decisions for daily scheme management and operation are made by executive members of CBOs, both conventional Water Committees and Water User Associations.

However, WUA's constitution provides that important decisions in scheme management entailed with expenses more than YR 100,000 – YR 200,000 shall be approved by the Monitoring Committee, which is representative of user communities. WUAs also organize yearly general assembly meetings, represented by all user communities, in order to report financial and operational affairs in scheme management, and receive approval of next year's budgetary and operational plans. It can be said that this decision making procedure of WUA enhances transparency and accountability in scheme management. On the other hand, conventional Water Committees have not developed such decision making procedures without preparing constitutions and bylaws. However, those Water Committees are formed in relatively smaller communities with populations of 2,000 to 3,000, so that it enables informal but closer monitoring by user communities.

d. Technical Operation and Maintenance

Capacities of CBOs in operation and maintenance of supply schemes vary between target communities. However, it was generally observed during the field survey on operation and maintenance that capacities of WUAs are relatively developed. Scheme management by WUAs is well organized in compliance with their organizational constitutions and bylaws, as well as often with manuals and guidelines developed for operation and maintenance of the scheme. Other contributing factors for improved capacities of WUAs in operation and maintenance could be location and economic scale merit of supply schemes. WUAs are formed in relatively larger communities with populations of more than 5,000 - 10,000, which are located near rural city centers. The better-off economic conditions of those communities enable appropriate tariff setting for users, often including costs for expansion and rehabilitation, and coupled with larger population as economic scale of merit, the scheme operation becomes highly profitable. Economic surplus are utilized for procurement of spare parts and equipment required both for preventive maintenance and rehabilitation. Also its profitability and location of the scheme attracts human resources with expertise in scheme operation and maintenance.

In contrast to the improved capacities of WUAs, those of conventional Water Committees are limited. Probable factors to hinder development of their capacity in operation and maintenance are: less scale merit with populations of less than 2,000; their locality with prevalence of rural poor; negligence to develop and comply with operational guideline; and less provision of technical guidance by local authorities.

e. Financial Management, and Transparency and Accountability

In most of the target communities with operational supply schemes, the metering tariff system has been employed, with tariff ranging from YR 50/m^3 to YR 130/m^3. Water tariff of YR 50/m^3 is considered as a minimum tariff for small scale water schemes, which can only cover the expenses for fuel and salary/allowance for one operator. Among tariffs set by target

communities with operational supply schemes, YR 100/m^3 is the average level. Depending on the scale merit of the supply scheme, however, this tariff setting might be far below to cover replacement costs after a certain duration of major equipment and facilities usage. Most of the target communities under the Study expect governmental support in case of major breakdowns and replacements in the supply scheme.

Several CBOs, in particular some WUAs, adopt an incremental tariff system according to the consumed volume of water. This system is primarily introduced to save scanty resources, but it also enables lower tariff settings for the poor who consume less water. Billing and collection have been carried out monthly in every community.

Monthly income of supply schemes managed by CBOs in the target communities also vary according to the tariff set and scale of the community. It ranges from YR 50,000/month at minimum with tariff set at YR 50/m3 for a served population of 3,000 persons, to YR 400,000-600,000/month at maximum with tariff set at YR 100/m3 for a served population of 20,000 persons. It is observed in the target communities with operational supply schemes that income and expenditure is nearly balanced or income exceeds expenditure. Balances are deposited in bank accounts in preparation for expenditures for repairing and rehabilitation.

It is notable that most of CBOs have experiences of system shutdown due to pump trouble and/or decrease in production of well water. Expenses for repairing or rehabilitating such troubles ranged from about YR 0.3 million to 1.5 million (the maximum case was for rehabilitation of the well), which were paid partly from the scheme account, partly from additional fund raised and in some cases contributions such as from the community's *sheikh*.

As it is mentioned earlier in the section, that transparency and accountability in financial management is relatively assured by WUAs in compliance with their constitutions and bylaws, while ones by conventional Water Committees tend to be uncertain.

f. Interface with Local Authorities (Local Councils and GARWSP Branch Offices)

It was observed in the survey on operation and maintenance under the Study that, throughout the process to establish and legally recognize Water User Associations (WUAs), technical guidance for scheme management and operation has been provided by local councils and GARWSP branch offices. The bylaws of Local Administration Law No. (4) of 2000 clearly stipulates the roles and responsibilities of local authorities in formation and monitoring of WUAs. In compliance with the bylaws of Local Administration Law, some local councils in the target area are actively involved in monitoring on community-based scheme management. Some WUAs among the target communities are obliged to report periodically their financial and operational status to local councils, which assures interface between local authorities and communities in monitoring of the scheme management. However, capacities of local councils in provision of guidance in the monitoring stages are limited to managerial and organizational

matters in community-based scheme management, but not for technical issues in scheme operation and maintenance. Provision of technical guidance in the monitoring and follow-up stages is highly required, in particular when considering problems observed in most target communities that a considerable number of wells are dried up or pumping units are broken due to overcharging of scarce groundwater resources. Provision of technical guidance continuously in the monitoring and follow-up stages, including periodical monitoring of well and pumping units, shall be undertaken, but capacities of responsible local authorities, that is GARWSP branch offices, are observed to be limited in these matters.

For the conventional Water Committee and management entity headed by village authorities in the target communities, such managerial and technical guidance are rarely provided by local authorities, without their legal recognitions. Recognition of those Water Committees and management entity shall be further facilitated, possibly with provision of legal status, as well as periodical provision of technical and managerial guidance by responsible local authorities.

g. Community Contracting-Out

As a primary form of community contracting-out, most of the CBOs, both conventional Water Committees and WUAs, employ personnel among their communities for pump operation and meter reading on contract bases. Among WUAs in the target communities, there are some Executive Boards which contract out whole scheme management to individuals or groups with managerial expertise among the communities. In this form of community contracting-out, a sort of performance contract is concluded between the Executive Board of WUA and individuals/groups, with set of performance and monitoring indicators and determination of remuneration according to achievement. It is observed in the survey on operation and maintenance in the Study that WUA introducing community contracting-out for whole scheme management guarantees relatively higher expertise in operation and maintenance, employing experts for the scheme management. However, this form of management concession contract could be replicable only to schemes with larger economic scale merit with larger number of users, and key issues for its success should be performance monitoring and regulation together with local authorities. There are no CBOs in the target communities that contract out whole scheme management or make scheme concession with private sector organizations.

Most CBOs in the target communities had experience with ad hoc contracts with private companies/agents for maintenance or replacement of pumping units, or deepening existing wells. Capacities of CBOs to manage private contracts seem to be relatively high. However, there are some communities observed in which their contracts with private companies for pump repairs were not fulfilled, due to contractors' insincere actions and possibly limited capacities. As referred earlier, provision of technical guidance in operation and maintenance of the supply scheme shall be undertaken by local authorities, especially by GARWSP branch offices in this case.

h. Pro-Poor and Gender Consideration

In most of the communities with functional supply schemes, water is currently provided free of expense for the poor households not exceeding a certain amount defined by CBOs or village authorities. Although definition of the poor varies according to socio-economic conditions of the area, and each community has well established firm criteria for the households to be provided with free water. As it is mentioned in this section, the metering tariff system and especially incremental tariff structure are also recommended as pro-poor countermeasures by introducing a minimum required provision with minimum tariff for the poor.

There are a few CBOs in which female members are represented in the executive committee, but the number of female representatives is still low particularly in north areas. However, low female participation in CBO membership does not necessarily mean low female participation in decision making for scheme management and operation. As it is observed in group focus discussions with female groups, most females feel their opinions are incorporated into and not excluded from decisions made by the CBO.

(4) Assessment of Ongoing Operation and Maintenance of Study Candidate Sites

The results of survey for the study indicate the following facts on the ongoing operation and maintenance practice of water supply schemes by the communities.

1) Mode of Community-Based Management

There are two major modes of community-based management observed in this section. One is a traditional management system in which tribal village authorities take central roles and responsibilities in scheme management, and the other is an organized management system by CBOs (Community-Based Organizations). The latter can be further distinguished by their legal recognition, namely conventional Water Committees and Water User Associations (WUAs). As it is overviewed above, the management model of WUA could relatively enhance ownership and participation of communities in scheme management, expertise and compliance in scheme operation and maintenance, transparency and accountability, interface with local authorities, and so forth, followed by the management model of traditional Water Committees.

However, it does not mean all traditional mode of management centered on village authorities always ends up in failure. In particular, in smaller and poorer communities, village authorities often contribute to the sustainable operation and maintenance of the system, especially in case of troubles and failures in facilities and equipment. Indeed, sheikhs' influence, whether positive or negative to the community-based management, cannot be ignored especially in the northern area, where traditional socio-economic and cultural structure based on 'tribalism' is well established, and it shall be deliberately incorporated into improved modes of community-based management.

2) Ownership and Participation in Management

Community ownership and participation in scheme management is well enhanced in the improved CBO model of management, in particular by WUAs. The process to prepare their organizational constitutions and bylaws through facilitating community dialogue and consensus; conduct community elections for selection of executive members; establish a community monitoring system forming a user representative committee or Monitoring Committee; and organize a General Assembly for important decision making in scheme management, will facilitate community ownership and participation.

3) Expertise in Operation and Maintenance

As the supply schemes become larger scale and more complicated, required expertise in operation and maintenance becomes higher. It is observed in the target communities that relatively large scale supply schemes tend to opt for management by WUAs with improved expertise in operation and maintenance. Its economic scale merit and profitability of the larger scheme might assure employment of competent personnel for scheme management and operation with performance based employment contracts. Economic surplus by scheme management enables timely maintenance and rehabilitation of the facilities and equipment. Also, in establishment and monitoring of WUAs, local authorities such as local councils and GARWSP branch offices are always involved, providing technical and managerial guidance to the communities. It also facilitates their competency in scheme management and operations.

Scheme operation and maintenance by traditional Water Committees and village authorities, in contrast, relies on limited human and financial resources due to its rural setting, relatively poorer socio-economic conditions, and small scale merit and less profitability in scheme management. However, there is considerable possibility for improved operation and management through provision of training and guidance by local authorities such as local councils and GARWSP branch offices.

4) Decision Making and Transparency/Accountability

Transparency and accountability is one of the key issues for community-based management of water supply schemes. Reviewing decision making processes of all community-based management entities in this section, it is observed in general that WUAs have established a shared decision making mechanism with users, which creates improved transparency and

accountability in their scheme management, while those of conventional Water Committees and traditional management bodies headed by village authorities could be more improved. Community-based monitoring systems are also well established in scheme management of WUAs, forming Monitoring Committees representing user communities that conduct periodical monitoring and auditing on scheme management. Monitoring provided by local councils for financial management of WUAs is another contributing factor for their improved transparency and accountability.

5) Interface with Local Authorities

It is also observed that, the process of formation of WUAs is legally recognized and provided with technical and managerial guidance by local authorities such as local councils and GARWSP branch offices. The WUA is also responsible for reporting periodically on its performance to the local council, although commitment of GARWSP branch office in technical and operational monitoring is lacking in the follow-up stages. It can be said in general that this interface mechanism facilitates more improved community-based management of the supply scheme as well as technical expertise in operation and maintenance, and transparency and accountability in scheme management. Such interface with local authorities are considerably lacking in community-based management by conventional Water Committees and traditional management bodies headed by village authorities.

6.4.3 Plan for Operation and Maintenance

(1) Background for Planning

The two significant principles underlying in the national policy and strategy for the sub-sector development of rural water supply and sanitation can be summarized as “decentralization” of authorities in implementation of the development project to relevant local institutions, and “participation” of user communities (beneficiaries) in implementation and management of the supply schemes. Along with these principles, current development efforts in the sub-sector has been concentrated on capacity building of relevant sub-sector institutions at local level to manage project implementations and service deliveries, as well as to facilitate community mobilization for improved community-based management of the water supply scheme.

Reviewing consistency among the national and organizational (GARWSP’s) strategies of decentralization and the currently established framework of local administration and institution

as a result of those decentralization strategies, this Study recognized Branch Offices of GARWSP as the most relevant local institution for project implementation, as well as Local Councils at Governorate and District Level as implementation partners. However, as it is observed in the Capacity Assessment of the Study, capacities of GARWSP Branch Offices and Local Councils in the target governorates of the Study, particularly in Sana'a, Al-Mahweet, and Dahmar Governorates, in provision of activities related to social mobilization, is considerably less developed, and indeed the Assessment ratings (1-5 scoring) of their capacity in provision of activities associated with social mobilization are very low (scores 1-2) with a number of weaknesses observed. Thus, the plan for operation and maintenance to be prepared under the Study has prime concern in capacity building of these institutions.

On the other hand, the modes of community-based management widespread in Sana'a, Al-Mahweet and Dahmar are observed to be rather "conventional" in contrast to the ones in other target governorates of the Study that are generally observed to be relatively "improved". A "conventional" mode of community-based management is characterized as such that: 1) management authority is confined to the traditional leaders (Sheikhs and Aquils); thus, 2) the sense of ownership is less shared among users; and 3) interface with local authorities is less developed. In other words, under the conventional mode of management, sustainability of the supply scheme depends largely on the capacity of the traditional village authorities (Sheikhs and Aquils), in scheme management, leadership, and finance in particular. The conventional mode of community-based management in most cases, although not always, ends up in failure of supply scheme, due to mismanagement, negligence on the technical requirements, and financial difficulties for operation and maintenance. Meanwhile, the "improved" mode of community-based management can be characterized as such that: 1) management entity is established through an election of executive members, legal registration and licensing, and preparation of its organizational and operational bylaws; 2) the sense of ownership in scheme management is well shared, along with collective decision making process in the general assembly of users; and 3) interface with local administration that provides technical guidance and monitoring is sustained. The plan for operation and maintenance under the Study intends to introduce an "improved" mode of community-based management, while considerations and respects on the traditional and tribal leadership are given.

(2) Strategies and Approaches

There are several strategies and approaches as follows for preparation of the operation and maintenance plan under the Study.

1) Introduction of Demand Responsive Approach (DRA)

The Demand Responsive Approach (DRA) has been a very convincing concept in planning and implementation of development projects in the country, especially in rural water supply development, of which principles are summarized as follows:

- community initiates and makes informed choices about services options based on their willingness to pay and acceptance of responsibilities for operation and maintenance;
- community contributes to investment cost relative to the level of services and has control over how funds are managed;
- adequate flow of information to the community as well as procedures for collective decision-making within the community are carried out;
- communities make choices on how water and sanitation services are managed;
- government has facilitating roles, sets clear national policies and strategies, and creates an enabling environment for all participating groups;
- community owns and is responsible for sustaining its water and sanitation facilities;
- community capacity is appropriately strengthened; and
- the approach promotes innovation and recognizes the need for flexibility.

Incorporation of these principles in DRA is a prime concern in preparation of the plan for operation and maintenance under the Study. Good practices to enhance DRA were further elaborated through implementation of the Pilot Project, which are reflected on the following strategies and approaches.

2) Responsibility Sharing among GARWSP, Local Councils, and Community

DRA calls for mutual understanding and agreement among local authorities and beneficiary communities on their shared responsibilities not only in the implementation of the project but also post-implementation stages. Commitment of the beneficiary community in operation and maintenance is one of the main concerns in project implementation and post-implementation, which should be facilitated and guaranteed by local authorities. In accordance with the principles of DRA, the functional roles and responsibilities of community and local authorities (GARWSP Branch Offices and Local Councils) are defined as shown in the next page.

Table 6-14 Responsibilities and Roles of Organizations at Each Level for Rural Water Supply Project Implementation

Stage	Activity	Determined Responsibilities and Roles			
		Community (CBO)	Local Council		GARWSP (Branch)
			District	Governorate	
Preparation and Drafting	Submitting project application	By community according to GARWSP forms to Local Council in District for approval, and submit it to Local Council in Governorate	Receiving the application, evaluate and approve it if it is appropriate and deliver it to Local Council of Governorate.	Receiving the application and place it into required project list and deliver it to GARWSP Branch Office for study and community mobilization.	Receiving the application and dealing with it.
	Community Mobilization	Provide required information to Community Mobilization Team. Responding to invitation for General Assembly meeting to elect CBO for the project.	Providing necessary supports or information to Community Mobilization Team. Adopting and supervising the General Assembly meeting to elect CBO for the project.	Securing necessary finance for Community Mobilization Team including transportation. Participating in General Assembly meeting and authorize the representative from office of Social Affairs in Governorate to supervise and prepare agreed minutes for the meeting.	Formation of Community Mobilization Team to undertake the following tasks: - confirming DRA of project - recognizing the water source if it is available. - determining project area, number of served villages and population in the served area. - estimating volume of water consumption. - preparing invitation to hold General Assembly meeting to select CBO and participating in it. - providing training for elected CBO
	Technical Study	Provide required information	Securing the cost of study, and providing necessary information of the study.		Undertaking technical and financial study for the Project. Preparing specifications and announcing tenders of important supply and implementing the project components.
Implementation	Supervision and Implementation of the Project	Contributing pump house construction. Digging trenches for pipe laying. Providing means of transport for the piping material. Paving roads to the tank sites. Transporting tank materials to the sites. Solving any other obstacles.	Intervening to solve any problems delaying the progressive works of implementing the project by community. Helping GARWSP by necessary support to assure the implementation schedule. Supervision of community work	Financing economic, technical, environmental study for the Project. Securing transportation. Constructing (paving) necessary roads to the sites of project construction or transporting the construction materials to the sites.	Providing and installing water pipes and pumping units including diesel engines or engine-generators. Constructing necessary tanks to the project and testing them to confirm their conformance to specifications and conditions of their contracts. Supervision of community-work
Receiving and Handing Over	Preparation for Handing Over	Receiving the completed project from GARWSP (Branch) and arranging to operate and maintain it.	Supervising handing over of the project for CBO from GARWSP / Branch	Approving handing over procedures of project and following up Local Councils in District.	Receiving the completed project or components, and handing over it to CBO by coordination with local council.
Operation and Maintenance	Monitoring, Follow-up and Project Evaluation	CBO of the project start managing the project according to financial, administrative and technical regulations of GARWSP to guarantee its sustainability and replacing any parts broken down.	Providing supervision, follow-up and monitoring on functional management of project and correcting any decline in its management.		Supervising and monitoring the functional process of management, operation and maintenance of the Project and providing necessary technical supports and collecting information and registering it and evaluate it periodically.

Source: GARWSP（2005）, Roles and Responsibilities of GARWSP Social Mobilization Team

In the implementation and the post-implementation stages, these defined roles and responsibilities in the table above are also allocated to each partner. Especially, roles and responsibilities of GARWSP Branch Offices and Local Councils in the post-implementation stage are emphasized in the plan for operation and maintenance under the Study. The survey on operation and maintenance in the Study revealed that the follow-up and monitoring activities by GARWSP Branch Office and Local Councils are neglected in most cases in the Study area, by not providing any technical guidance and advice for scheme management that can prevent possible malfunctions and mismanagement of the supply scheme. Thus, the routinization of follow-up and monitoring on the scheme and user committee by GARWSP Branch Offices and Local Councils needs to be enhanced.

3) Improved Community-Based Management

The survey on operation and maintenance carried out under the Study identified a number of "good practices" carried out by the user communities with provision of technical guidance and advice by the local authorities, which realize improved community-based management and sustainability of the supply scheme. These good practices are classified in the following five aspects in the community-based management for rural water supply schemes: a) mode of community-based management entity; b) technical and managerial expertise in scheme management, and operation and maintenance; c) community ownership in operation and maintenance of the supply scheme; d) collective decision making and transparency; and e) interactive channel (interface) between user communities and local authorities.

These aspects are considered in the planning strategy and shall be replicated in the plan for operation and maintenance in the following way.

a. Improved mode of community-based management entity

One of the characteristics identical in well-managed water supply schemes in terms of technical operation and maintenance, organizational operation, and financial status, can be found in the process to form the community-based management entity and the mode of its organizational operation and management for the supply scheme. These community management entities, called Water User Association (WUA), are established through the process such as: 1) community consultation and consensus building on the choice of management options, 2) formation of preparatory (working) committee, 3) preparation of bylaws and regulations in the scheme management, 4) community consultation and consensus building on the draft bylaws and regulations, 5) community election for executive members of WUA, 6) legal registration of WUA and licensing, and 7) institutionalization of executive (administrative) committee, monitoring committee, and general assembly in the WUA framework.

WUAs are entitled to legal status, provided they prepare their own bylaws and regulations for management of their supply scheme and organization. Their bylaws and regulations shall be prepared in accordance with the Executive Procedure for the Local Authority Law of 2000 prepared by the Ministry of Local Administration, in which the following subjects shall be included: membership of the association, terms of office and community election procedure/regulation; general tasks and requirements executed by the association; technical and managerial requirements necessitated for the scheme management, and operation and maintenance, and means to execute them; decision making process; regulation in water user fee and financial management; service standards and regulation in water use (domestic only, regulation in pump operation and water extraction); auditing procedures; and enforcement and penalties. These bylaws and regulations of WUA should also be developed in a participatory manner with user communities and require community approval by general assembly of users prior to the legal registration of WUA under the Ministry of Local Administration. This process to prepare bylaws and regulations facilitates their deliberation on tasks and duties required for scheme management, and operation and maintenance.

With community's deliberation on duties and tasks involved in scheme management, communities become sufficiently prepared for scheme management, by forming well structured community-based management entities (WUAs) with legal status, bylaws and regulations, and their compliance monitored by the user community. The mode of WUA's organizational structure is often elaborated by their bylaws/regulations in the way that: 1) General Assembly of WUA members, which is formed by all user households, is a forum for auditing and collective decision making for the most important issues in the scheme management, such as election of executive members, approval on excessive expenditure for operation and maintenance such as pump repair/replacement, financial auditing, and approval on any amendment on the bylaws/regulations of WUA; 2) Monitoring Committee, of which 15-20 members are nominated by the General Assembly, carries out day-to-day monitoring on scheme management, and operation and maintenance (if any undertakings by executive members of WUA against bylaws/regulations are found, the Committee reports them in General Assembly for further decision to be made on the issues): and 3) Executive Committee, of which 3-5 executive members are elected in the General Assembly for 2 to 3 years according to the bylaws/regulations of WUA, carry out day-to-day operation and maintenance, billing and fee collection, accounting, and record keeping, according to bylaws/regulations. The operation and maintenance plan prepared under the Study would facilitate this mode of community-based management entity with its effects on self-regulating scheme management, and operation and maintenance by users' monitoring system.

b. Enhanced sense of ownership and participation in management

The process to prepare bylaws/regulations of community-based management entity, as it is explained above, facilitates community understandings on their duties and tasks necessitated in the scheme management. Then, the legal registration of the community-based management entity further enhances its compliance "legally" to their bylaws/regulations, thus, "legal ownership" of their scheme management. This legal registration allows WUAs to possess and utilize the supply scheme in a legal sense, which also means that this legal ownership may be divested in incompliance of their bylaws/regulations by local authorities such as Local Councils. This "legal tension" enhances their compliance to their bylaws/regulations in scheme management, operation and maintenance, vis-à-vis improved sense of community ownership in the scheme management.

Also worth mentioning is that this legal tension in WUA can work effectively on their compliance if the local authorities carry out periodical audits in their provision of follow-up and monitoring services for the communities. It is assumed, in the current institutional arrangement along with national and GARWSP's decentralization strategies, that GARWSP provides audit for technical issues and regulations in the scheme operation and maintenance, while the Local Council provides audit for their financial accounts and regulation in WUA's management. Those issues relating to the audit by local authorities are further elaborated in the latter part of this section.

c. Increased expertise in operation and maintenance through necessary training

In the very beginning stage of project implementation and/or rehabilitation, community consultations are provided for the choice of community-based management options. Various modes of community-based management are presented and explained to the community members with consideration of advantages and disadvantages in each option and feasibility (applicability) of the options in their socio-economic and socio-cultural conditions. Those options include: 1) traditional/conventional management entity in which the scheme management is provided by village authorities; 2) unregistered water committee, by which the supply scheme is managed by elected or nominated committee members in accordance with bylaws/regulations prepared or without preparation of it; 3) Water Trust/Cooperative Committee, formed and regulated in accordance with Cooperative Society Law, in which the scheme management is entrusted to the capable individuals or group of individuals on performance contract basis with Trust Committee; 4) WUA, as explained; and 5) Public Water Utility or Water Company (by guarantee), formed and regulated in accordance with relevant sector legislation or Commercial Law Act, by which the scheme management becomes more business oriented.

Upon reviewing which WUA type of management is best suitable to and acceptable for the communities in the Study area, the community consultation also facilitates their understandings in various tasks and expertise that need to be provided by the community itself for the scheme management, and operation and maintenance in each of the above mentioned community-based management options. In this stage, gaps between current capacity of community and actual requirements of expertise for scheme management, and operation and maintenance are identified through community consultation. Then, those gaps are turned into training needs of the community, which becomes basis for the training program during the implementation periods. Those identified training needs vary in their degree and type of expertise, according to the selected community-based management option and current capacity of the community. However, emphasis is given here, from DRA point of view, to plan the package of community training program to be tailor-made according to the needs and type of required expertise identified through community consultation. It enhances community's participation and commitment in the provided trainings, as well as their eagerness and enthusiasm to absorb knowledge and skills required for the scheme management.

According to the current operation and maintenance survey, it is found that the failure of the community-based management is mostly associated with "non-provision" and discontinuation of appropriate training, or often attributed to provision of "non-appropriate" training in which the required expertise is misunderstood or limitedly identified only by training provider without creating community's commitment and eagerness. In contrast, in well organized and established community-based management, the management entity has been certainly provided with continuous series of packaged training even in the post-implementation stages according to their felt needs and realistically identified requirements in system management, and operation and maintenance, covering various types of expertise to a deferent decree required.

In project implementation and/or rehabilitation, training needs and types of expertise of requirement shall be deliberately identified through community consultation. Also, training needs and type of required expertise are often visibly exposed and realistically recognized by the communities duly after a certain period of scheme operation exceeding the one allocated to project implementation. Thus, it is emphasized that local authorities continue provision of further trainings according to the initial needs assessment or through its modification at an appropriate post-implementation stage.

d. Improved decision making (collective decision making) and transparency/ accountability

One of the features in the well established community-based management observed in the survey on current operation and maintenance under the Study is that important decisions regarding scheme management, particularly ones accrue to a considerable expenditure from the scheme account for operation and maintenance (i.e. repair/replacement of the pumping unit), are made collectively by the users. The Executive Committee of WUA, for example, encloses the scheme account anytime upon the request of the Monitoring Committee and report the financial

status in the scheme management periodically to the General Assembly of users, in accordance with their bylaws/regulations. In addition, periodical financial auditing in their scheme management is also undertaken by the Local Council. Although the Executive Committee can make ordinal decisions for financial matters in their day-to-day operation of the scheme within in an expenditure not exceeding the determined amount, it should also be subject to their accountability and transparency to the Monitoring Committee and General Assembly.

Other important managerial issues, such as changes of membership, re-election of executive members, major changes in the supply service provision that require attention and consensus of users (e.g. water rationing by time and area), other managerial issues which require amendment of their bylaws/regulations (e.g. revision of water tariff, penalties, and salary of Executive Members), and yearly budget plans, should be discussed and approved in the General Assembly. The plan for operation and maintenance under the Study also has intentions such that important managerial issues are shared and decided collectively by the user community as a whole with given accountability and transparency by management entity.

e. Established interface with relevant local authorities

As overviewed so far, an improved community-based management for rural water supply schemes is established and further elaborated only through interaction of the community with the relevant local authorities. In all the process to establish the improved community-based management entities such as WUAs, involvement of the local authorities and their provision of technical and managerial guidance to the community are quite indispensable. The survey on current operation and maintenance of the supply schemes under the Study also reviewed that most of the well established community-management entities were supported by relevant local authorities (GARWSP and Local Council) in its establishment and legal registration process, and maintain the interface with them even in the post-implementation stage. Legal recognition of WUA through registration under the local administrative framework, which defines the duties of local authorities in regulation and monitoring and responsibilities of WUA in scheme operation and maintenance, may facilitate both the local authorities and WUA to maintain such interfaces. On the other hand, it is often observed that most conventional/traditional management entities and their supply schemes are less recognized by the local authorities, and their opportunities to receive proper technical and managerial support by the local authorities are considerably limited, except that the scheme is managed by a prominent *Sheikh* (*Sheikh of Sheikhs*) who keeps various channels and powers to influence government authorities.

In preparation of the plan for operation and maintenance under the Study, emphasis is given to establish and maintain such interface of the community with GARWSP Branch Offices and Local Councils, by assuring the involvement of local authorities and their duties to provide technical and managerial guidance in the process to establish improved community-based management entities, as well as in the following post-implementation (monitoring and follow-up) stages.

Indeed, it shall be repeatedly mentioned that, currently, the significances of follow-up and monitoring activities in the post-implementation stages is ignored, and its execution and routinization of those duties is neglected by the local authorities, in particular by GARWSP Branch Offices. The negative effects of its ignorance and negligence are rather obviously found in many of the supply schemes of mismanagement and/or malfunctions elsewhere in the Study area, of which problems at an initial stage could be resolved with relatively simple and low-cost technical options.

As observed in the survey on current operation and maintenance in the Study, most of the causes for breakdown of the pumping units in the Study area is rooted in its operation exceeding its pumping capacity and/or over-abstraction of groundwater till the water level lowers below the intake depth of the installed pump in order to satisfy the increasing water demand, both of which led to overheats and gradual damages to breakdown the pumping units. Such problems in the initial stage could be prevented with technical guidance/advice from relevant local authorities for application of relatively simple and low-cost technical options as such, to regulate its operation within the limits of capacity, to determine pumping rates and hours with observations on water levels, or replace pump units to ones with more capacity to satisfy the increasing demand if the groundwater potential and recharge could meet its capacity while the replaced pump is working and saleable for purchase of a new one.

Also revealed in the Study is that less existence or decreased users' commitment and willingness to pay for operation and maintenance of the scheme is often associated with the conviction of most of the users in the community that water supply is benefaction, and/or that financial management by the management entity is unaccountable. Then, lack of collected water fee deteriorates the condition of supply facilities, ending up in entire malfunction of the scheme. In such cases, managerial guidance is essential to convince the user communities on the importance of fee collection and accountable financial management.

Thus, larger impact and cost effectiveness of simple technical options, if provided at the initial stage through periodical follow-up and monitoring activities by local authorities, have to be reconsidered in comparison to the technical complexity and cost implications for entire rehabilitation or replacement in the decadent stages.

Through the implementation of the Pilot Project, concerns of the local authorities need to be enhanced on the significance of monitoring and follow-up in the post-implementation stages. Upon reviewing the issues further, the operation and maintenance plan under the Study advocates routinization of monitoring and follow-up activities in their general undertakings in order to keep their interface with communities and sustainability of the supply scheme by providing proper guidance and advice to them. The monitoring and follow-up could be effectively carried out without duplication of undertakings among GARWSP Branch Offices and Local Councils, defining the specific subjects to be dealt with by each of the authorities as follows.

- GARWSP Branch Office monitors and regulates: the service and operation standards (supplied amount, served periods in hours and days, served area and population) in accordance with the bylaws/regulations of the supply scheme, operating capacity limits of installations (pumping amount and time etc.), water level, water quality, and any other technically relevant subjects.

- Local Council monitors and regulates: the financial accounts of the supply scheme, yearly and quarterly budget, income and total amount of water consumed, outstanding transactions and expenditures, decision making process, minutes of meetings, and any other relevant managerial subjects.

4) Enhanced Awareness on Water and Sanitation

It has been emphasised in the country that only construction of improved water supply schemes could not improve health and sanitation aspects in the rural area, unless enhanced awareness of the rural population on health and sanitation is brought into their behaviour changes. However, it is still not in practice in many rural water supply development projects. The plan for operation and maintenance also includes undertakings to improve awareness of target communities on health and sanitation, which would be further advocated in the operation and maintenance plan under the Study after due consideration on the lessons learnt obtained through the project.

In the target communities, and elsewhere in the rural areas of the country, mosques and schools are regarded as important media for social information and message "outflow". The Pilot Project also utilizes those public places such as mosques and schools, for both men and women, and boys and girls, to convey health and sanitation messages to the community.

However, it is a well known fact that only "outflow" of health messages cannot improve their awareness and behaviour. Thus, the operation and maintenance plan under the Study also takes strategy to promote personal hygiene and sanitation through participatory health and sanitation education, such as PHAST (participatory health and sanitation transformation) and KAP (knowledge, attitudes and practice on hygiene and sanitation). These health and sanitation educational tools (also each of them forms a conceptual framework of behaviour changes in relation with participation and personal hygiene improvement) are introduced and utilized in the implementation of rural water supply projects by donor communities, in particular, the former by SDF (Social Development Fund) and the latter by UNICEF. Thus, in the operation and maintenance plan under the Study suggests introduction to such concepts and participatory tools elaborated for personal hygiene promotion in social mobilizations. In practice, it is intended that female peer educators selected from the community are provided with training for these educational tools, those who are expected to facilitate female meetings in a participatory manner to promote personal hygiene.

5) Emphasis on the Monitoring Stage

The significance of establishing and sustaining the interface of communities with the local authorities are emphasised above, particularly in the post-implementation stages of monitoring and follow-up. It is also the fact that actual requirements and expertise necessary in scheme management, and operation and maintenance are clearly exposed, visible to the community after due operation periods, in which additional training and follow-up needs to be provided to deal with newly emerged or redefined requirements.

In the operation and maintenance plan under the Study, it is advocated that routinization of monitoring and follow-up services by the local authority, in particular, by GARWSP Branch Offices is further extended to the supply schemes and community management entities that are not recognized by the authority. Currently, the GARWSP Branch Office recognizes existences and conditions of rural water supply schemes located in their designated area based on either the request brought by the community or the legal registration of the scheme, but a number of other supply schemes are not. These supply schemes and operational conditions must be recognized by GARWSP Branch Offices, through preparation of the scheme inventory at governorate level. Preparation of such inventory and provision of monitoring for the currently not recognized supply schemes could be time and cost consuming undertakings. However, opportunities to prevent foreseeable breakdowns in these supply schemes needs to be maximised through the monitoring and follow-up activities to increase its sustainability. Also, cost effectiveness of monitoring in increasing sustainability of the supply schemes in comparison to the cost implication for the following should be reconsidered.

According to the financial records and budget of GARWSP, the authority solely invests more than YR 3.5 billion every year for sub-sector development only (not including its recurrent costs), which amounts to about 60% of the total investment for sub-sector development among various sector development institutions and external supporting agencies (donors, NGOs, and private entities). However, as it is analysed in the Capacity Assessment under the Study, investment of GARWSP for sub-sector development is considerably concentrated only on drilling works, without completing other surface installations (such as pipelines, reservoirs, and pumping units) required for the supply scheme to function. Along with the factors as such that drilling works are carried out in a less coordinated manner with the communities and other development partners for the other works, the deep wells constructed by GARWSP are often left alone for several years.

Rather than spending a larger amount of its capital cost to concentrating on well constructions in uncoordinated manners, some portions of the capital cost should be transferred and allocated for monitoring and follow-up work to prevent malfunctions of the supply schemes and to rehabilitate them in the earlier stages with application of low-cost and simpler technologies.

6) Formation of Social Mobilization Team (SMT) and On-the-Job Training (OJT)

In order to carry out the planned activities under the operation and maintenance plan according to the strategies above, a Social Mobilization Team (SMT) is formed as an implementation body in GARWSP Headquarters and Branch Offices. The SMT is composed of both female and male staff from GARWSP, or local consultant experienced and competent for the work can be employed where necessary.

Due to scarcity of GARWSP staff particularly in Branch Offices in the Study area who are adequately trained and experienced in the field of social mobilization, trainers for SMT need to be promoted in Headquarters through provision of "training of trainers" (TOT), who duly train SMT at Branch Office level. Training manual and guideline for social mobilization as well as personal hygiene promotion need to be developed by SMT trainers at Headquarters, and SMT at Branch Office should be provided with these manuals/guideline, theoretical training, and "on-the-job training (OJT)" during the field implementations. In the field implementation of the social mobilization, relevant staffs from Local Council are joined and carry out the field works together with SMT on the OJT basis, after proper guidance is provided by the SMT.

7) Community's Commitment to Water Resources Management

With given confined geological formations and natural conditions such as low rainfall and non-existence of permanent rivers in the country with growing populations, Yemen is facing the most severe "water crisis" in the world. In particular, Sana'a Basin and Taiz Basin which are located in the Study area, are regarded as the most critical areas of groundwater scarcity in the country. In order to cope with the groundwater scarcity and its over-abstraction in the country, the government has currently implemented various regulations in development and utilization of groundwater in accordance with the new Water Law No. (33) of 2002 and related official degrees. One of the regulations introduced by the government is registration and licensing of deep wells.

Under the regulation, all the deep wells, whether existing or planned, must be registered by the relevant state's authorities and permit for development and utilization is restricted by the licences of the state, in which conditions to be complied by users in its development/utilization, such as the purposes of use and amount of groundwater extraction, are defined. Such state's regulations introduced for groundwater management are applied only to deep wells utilized for agriculture/irrigation and industrial/commercial purposes, and not to ones for drinking and domestic use. However, scarcity and overexploitation of groundwater, and the state's undertakings for integrated water resources management is one of the concerns in the implementation of the Pilot Study and operation and maintenance plan of the Study.

In the implementation of the Pilot Study, for example, one target community, S-03 Al Kharaba located in Sana'a Governorate, has a number of deep wells for irrigation purposes, which are already registered and licensed by the state's authority (NWRA: National Water Resource

Authority). In the community, conditions in utilization of deep wells for irrigation (e.g. amount of water abstraction) and other commitments of users (e.g. water source protection) are defined by the state's licence and acknowledged by the communities. Those wells for irrigation are managed in the community by already formed and registered Water/Irrigation User Association. This WUA in Al Kharaba is established specifically for irrigation water management by the community. However, in the Pilot Project, the existing WUA for irrigation is intended to be incorporated into one for drinking and domestic uses by the social mobilization component. Regulations and conditions in utilization of the water supply scheme improved under the Pilot Project, such as amount of water abstraction and prohibition of use for other purposes, such as irrigation, would be defined together with the existing WUA for irrigation. Also other commitments of users defined in the licence of WUA for irrigation, such as water source protection and prohibition of new well constructions within 500m distance, should be extended to the supply scheme. Thus, existing bylaws/regulations of WUA for irrigation is reviewed and amended with provisions relating to water supply for drinking/domestic use, and the integrated WUA for drinking/domestic use and irrigation would be reorganized and registered. In this way, the plan for operation and maintenance advocates integration of groundwater management for irrigation and domestic water supply, where the deep wells for irrigation purpose exist.

In other communities without established WUA for irrigation, such conditions and commitments of users in use of the supply schemes would be considered and developed with local authorities, which shall be included in their bylaws/regulations. These conditions and commitments should include, at least, the amount of water abstraction, prohibition of its operation and supply not for drinking/domestic use, and commitment of the community not to construct any installations and allow any human's undertakings harmful to water source in quality and quantity within some distance (construction of houses, toilets, other deep wells, and livestock grazing, etc). These conditions and commitments defined in their bylaws/regulations are also subject to monitoring by the local authorities described above.

In such ways, the operation and maintenance plan of the Study takes approaches to increase users' commitments to water resources management.

(3) Activities

According to the strategies and approaches in preparation of the operation and maintenance plan under the Study, the following activities and expected outputs specific to the issues are set for improved scheme management, and operation and maintenance. Other related activities to enhance program/service management for improved organizational operation, which could be organizational basis for implementation of the activities specified below, are described in the Matrix for Action Plan for Capacity Development of GARWSP (refer to Chapter 8 "Action Plan for Capacity Development).

Table 6-15 Activities and Outputs for Improved Scheme Management, and Operation and Maintenance

Activity	Output
Stage-1: Pre-Planning	
Develop and adopt field implementation manual for social mobilization	☐ Field implementation manual to be utilized SMT for TOT and social mobilization are developed and adopted by GARWSP Headquarters and Branch Offices.
Prepare and accept manual and guideline for personal hygiene promotion	☐ Manual and guideline to be utilized by SMT and peer educators in the target communities are prepared and accepted by GARWSP Headquarters and Branch Offices.
Form and promote SMT (trainers) at GARWSP Headquarters	☐ SMT (trainer team) is formed and promoted at GARWSP Headquarters. ☐ Utilizing field implementation manual, capacity of SMT (trainer team) in facilitation and teaching skills is improved.
Conduct orientation for GARWSP Branch Offices and Local Councils on strategies and approaches for establishment of improved community-based management	☐ Strategies and approaches for establishment of improved community-based management in a DRA manner are fully understood by GARWSP Branch Offices and Local Councils.
Form SMT (field implementation team) at Branch Offices and select staff form Local Councils to join and coordinate works shared.	☐ SMT (field implementation team) at Branch Offices is established. ☐ Staff from Local Councils to participate and coordinate social mobilization works to be shared are selected by Local Councils.
Train SMT at Branch Offices and staff from Local Councils in DRA and facilitation skills for establishment of improved community-based management	☐ Capacity of SMT at Branch Offices and staff selected from Local Councils is developed in facilitation skills for establishment of improved community-based management in a DRA manner.
Stage-2: Participatory Planning	
Conduct community consultation to agree on possible community-based management options to run the supply scheme with identification of training needs to fulfil technical and managerial requirements in an agreed management options	☐ Most suitable, effective and efficient community-based management to run the improved water supply scheme is identified and adopted by the user communities. ☐ Capacity gaps and training needs in operation and maintenance of the improved supply schemes are identified. ☐ Identified training needs are turned into training program.
Facilitate communities to form/ select preparatory committee/task force to be committed in the following process to form and register the community-based management entity.	☐ Preparatory committee/ task force is formed from the user communities, which prepare the following draft bylaws/ regulations for management entity and the scheme operation in order to register the management entity.
Facilitate communities to prepare bylaws/regulations for technical operation and maintenance for the supply scheme, as well as one for organizational management of the community-based management entity.	☐ Bylaws/regulations of the community-based management entity (WUA: Water User Association) for technical operation and maintenance of the improved supply scheme are developed. ☐ Bylaws/regulations of WUA for organizational management are developed.

Activity	Output
Organize community consultation to discuss and finalize bylaws/ regulations for the community-based management of the supply scheme.	☐ Bylaws/regulations of the community-based management entity (WUA: Water User Association) for technical operation and maintenance of the improved supply scheme are agreed and finalized by user communities. ☐ Bylaws/regulations of WUA for organizational management are agreed and finalized by user communities.
Stage-3: Election and Registration of Water User Association (WUA)	
Facilitate communities to organize General Assembly of users for adoption of the bylaws/ regulations, and conduct community election for Executive Committee members of WUA.	☐ General Assembly of users adopts the bylaws/ regulations of WUA. ☐ General Assembly conducts election for Executive Committee members of WUA.
Support communities in the process to register WUA in accordance with the procedures defined in the Local Authority Law of 2000.	☐ WUA is legally registered in accordance to the provisions set in the Local Authority Law of 2002.
Facilitate communities to form Monitoring Committee to be institutionalized in the WUA framework.	☐ Monitoring Committee is formed and incorporated in the WUA framework. ☐ Scheme operation and management is audited by the Monitoring Committee.
Stage-4: Capacity Building of WUA in the Scheme Operation/Maintenance and Management	
Train Executive Committee and Monitoring Committee of WUA in organizational management, financial management, and technical operation and maintenance.	☐ Capacity of Executive Committee and Monitoring Committee in organizational management, financial management, and technical operation and maintenance is improved.
Train the scheme operator (i.e. pump operator, plumber, cashier/ fee collector/ billing operator) in relevant tasks and duties.	☐ Capacity and skills of scheme operators to perform their tasks and duties defined in the bylaws/ regulations of WUA is improved.
Train peer educators in the communities for improved personal hygiene practice	☐ Peer educators, both male and female, for improvement of personal hygiene practice are selected from the community. ☐ Capacity of peer educators for improvement of personal hygiene practice in the community is enhanced. ☐ Peer educators carry out activities for improvement of personal hygiene practice.
Stage-5: Monitoring and Follow-up	
Conduct follow-up training for WUA Executive and Monitoring Committee in areas identified to be weak.	☐ Capacity gap in the scheme operation and organizational management is redefined. ☐ Capacity of WUA in the scheme operation and organizational management is further developed.
Conduct monitoring and follow-up activities	☐ Problems in the scheme operation and organizational management are detected and solved in the earliest stage.

6.5 Initial Cost Estimation

6.5.1 Construction Cost

Estimation of the construction cost for 23 screened sites is as follows:

Cost Estimate = Japanese Yen (¥)784,700,000 or Yemeni Rial (YR) 1,302,603,000
(¥1 = YR1.66)

The above estimate is the local (direct) construction cost by local contractors or suppliers, and does not include consulting fees, contingencies and other such costs.

The cost estimates for new construction sites and rehabilitation sites are the following.

- Total cost for 15 new construction sites: About ¥640 million or YR1,100 million (Average about ¥43 million/site)
- Total cost for 8 rehabilitation sites: About ¥140 million or YR200 million (Average about ¥18 million/site)

Breakdown of costs for each of the screened sites is shown below.

Table 6-16 Construction Cost Estimation for Screened Sites

Governorate	Code	Site Name	Cost Estimation	
			Japanese Yen (¥)	Yemen Rial (YR)
Al Mawheet	A-02	Jabal Al Taraf	6,386,000	10,601,000
	A-03	Ozlat Al Jaradi	13,927,000	23,119,000
Sana'a	S-02	Jarban	43,672,000	72,496,000
	S-03	Al Kharaba	19,140,000	31,772,000
	S-04	Qamlan-Bait Al Najrani	12,547,000	20,828,000
	S-05	Afesh	8,351,000	13,863,000
	S-07	Bait Al Hadrami	23,127,000	38,391,000
	S-09	Ruhm	50,412,000	83,684,000
	S-11	Al Hesn-Al Abyad	9,561,000	15,871,000
Dahmar	D-01	Elow Al Mikhlaf	39,350,000	65,321,000
	D-02	Hamal Bait Al Jabar	29,125,000	48,348,000
	D-03	Hegrat Al A'asham	18,874,000	31,331,000
	D-05	Mayfa'at Yaer	40,816,000	67,755,000
	D-07	Al Asakera	50,394,000	83,654,000
	D-08	Masneat Abdul Aziz	11,887,000	19,732,000
Ibb	I-01	Asfal Bani Saba	92,514,000	153,573,000
	I-02	Al Sana	82,732,000	137,335,000
	I-04	Al Jahlah & Al Meshraq	82,878,000	137,577,000
Taiz	T-02	Bani Al Suror	53,227,000	88,357,000
	T-03	Sheb Humran	22,575,000	37,475,000
	T-04	Yafoq Bani Hamad	7,836,000	13,008,000
	T-05	Al Azaez	21,982,000	36,490,000
	T-06	Al Khunha	43,387,000	72,022,000
Total			**784,700,000**	**1,302,603,000**

6.5.2 Operation and Maintenance Cost

Costs required to operate and maintain the water supply facilities in a proper and continuous manner include fuel costs for daily operation, cost to procure spare parts when repairs are needed, salary costs for the scheme managers and operators, and replacement cost of equipment upon their life. The basis of estimation for operation and maintenance cost is shown in the following table.

Table 6-17 Basis for Operation and Maintenance Cost Estimation

Cost	Item	Estimation / Approximation
Operation Cost	Fuel	Fuel cost is estimated, based on operation hours required to satisfy the demand, fuel consumption rate/hr of specified pumping equipment, and fuel unit cost (YR 50/lit).
	Salary Costs	
	Pump Operator	100% of average monthly income in each community
	Meter Reader	50% of average monthly income in each community
Management Cost	Commission for WUA	20% of average monthly income in each community
	Management Contract	
	Scheme Manager	200% of average monthly income in each community
	Accountant	150% of average monthly income in each community
Maintenance Cost	Supply and Spare Parts	15% of capital cost for pumping equipment and pipe installation / year
	Pump Overhaul	3% of pumping equipment / year
Replacement Cost		10% of capital cost for pumping equipment and pipe installation / year
Risks and Inflation		5% of replacement cost

Estimation for fuel cost is made in a realistic manner, considering specifications of each pumping equipment and fuel consumption rate; operation hours required to satisfy the demand in each target community; and fuel unit cost. Salary for pump operator is estimated at the same level as average income in each community, which are revealed in the socio-economic survey carried out under the Study, while one for meter reader is assumed at 20 percent of average monthly income, considering their limited duties and commitment for a certain period in a month.

"Improved" mode of community-based management for the supply scheme suggested in the Study calls for competent personnel for the scheme management such as a scheme manager and accountant. Thus, 200% and 150% of average household incomes per person in each community revealed by the socio-economic survey under the Study are applied for the scheme manager and accountant, respectively. On the other hand, approximation methods are employed for estimation of maintenance cost, applying a certain ratio (10 percent) of capital

cost for pumping equipment and pipe installation (concrete structure such as water reservoir and tank are excluded from capital cost, due to its longer durability). Risks and inflation are also taken into consideration, applying 5 percent of replacement cost.

Estimations of costs for operation and maintenance of water supply facilities for each of the screened sites, assuming all the population in the target community consumes 40 liters/capita/ day (l/c/d), are listed below.

Table 6-18 Operation and Maintenance Cost for Screened Sites

Governorate	Code	Site Name	Target Population	Monthly Income/ Person	Monthly Operation and Maintenance Cost		Unit O&M Cost	% in Household Income
				YR	YR/site	YR/pers	YR/m^3	%
Al Mawheet	A-02	Jabal Al Taraf	3,619	5,093	886,804	245	204	4.8
	A-03	Ozlat Al Jaradi	27,584	6,521	10,411,088	377	315	5.8
Sana'a	S-02	Jarban	1,977	16,518	883,284	447	373	2.7
	S-03	Al Kharaba	1,670	5,268	315,249	189	157	3.6
	S-04	Qamlan-Bait Al Najrani	772	9,209	235,150	305	253	3.3
	S-05	Afesh	4,517	6,508	1,253,551	278	231	4.3
	S-07	Bait Al Hadrami	3,130	5,826	486,308	155	130	2.7
	S-09	Ruhm	5,605	7,717	1,035,487	185	154	2.4
	S-11	Al Hesn-Al Abyad	2,911	5,855	765,111	263	220	4.5
Dahmar	D-01	Elow Al Mikhlaf	1,249	3,939	671,561	538	448	13.6
	D-02	Hamal Bait Al Jabar	3,339	5,063	717,546	215	178	4.2
	D-03	Hegrat Al A'asham	2,148	3,482	453,393	211	176	6.1
	D-05	Mayfa'at Yaer	2,044	4,134	547,293	268	222	6.5
	D-07	Al Asakera	2,623	9,212	896,090	342	284	3.7
	D-08	Masneat Abdul Aziz	548	7,304	309,413	565	469	7.7
Ibb	I-01	Asfal Bani Saba	11,884	3,684	1,670,821	141	117	3.8
	I-02	Al Sana	7,691	3,541	1,398,047	182	151	5.1
	I-04	Al Jahlah & Al Meshraq	13,359	3,858	1,352,748	101	84	2.6
Taiz	T-02	Bani Al Suror	11,978	4,095	3,213,211	268	224	6.6
	T-03	Sheb Humran	30,290	5,093	5,885,463	194	162	3.8
	T-04	Yafoq Bani Hamad	8,735	4,488	2,091,807	239	200	5.3
	T-05	Al Azaez	15,040	4,126	3,492,630	232	193	5.6
	T-06	Al Khunha	2,015	3,142	678,147	337	279	10.7
Average					**1,723,922**	**273**	**227**	**4.7**

YR=Yemen Rial

The average monthly cost for operation and maintenance is about YR270/person/month, while average unit cost for operation and maintenance becomes about YR 230/m^3.

Full cost recovery for operation and maintenance is one of the most significant concerns in scheme management. Willingness-to-Pay (WTP) and Affordability-to-Pay (ATP) are carefully examined in the Study.

The survey for operation and maintenance under the Study revealed that water tariffs in existing supply schemes are set at the range of YR 50/m^3 to YR 130/m^3, while the ones in sites of the Pilot Project are set at the range of YR 50/m^3 to YR 100/m^3. Thus, it can be assessed that WTP in the target community in general ranges from YR 50/m^3 at minimum to YR 100/m^3 at maximum. Therefore, assuming the population in existing supply schemes consume 40 l/c/d (i.e. 1.2 m^3/person/ month), then WTP/person/month would be from YR 60 to YR 120.

From the viewpoint of ATP, international organizations such as World Bank and UNDP recommend that household expense for water be set not exceeding 4% of the total household income. Monthly household income in each target site was revealed in the socio-economic survey carried out under the Study. The table above also shows percentage of required monthly operation and maintenance cost in total monthly household income. It indicates that the required monthly operation and maintenance cost amounts to 4.7% of the average income of the target sites, slightly exceeding the percentage recommended by international organizations.

However, it is also observed in the table above that there are some sites where the percentage exceeds more than 7%, such as Elow Al Mikhlaf (13.6%) and Masneat Abdul Aziz (7.7%) in Dahmar Governorate, and Al Khunha (10.7%) in Taiz Governorate. This is due to their smaller population (small scale merit of economy) and/or lower income level (poverty), as it is explained in section 7.6 “Obstacles and Proposed Measures in Operation and Maintenance”. As it is suggested in the same section, in such sites where small scale merit of economy and lower income level are observed, replacement cost will be reduced or excluded from the operation and maintenance cost as a policy and strategy for poverty alleviation, bearing such cost through provision of government subsidies.

6.6 Evaluation

Evaluation of the rural water supply improvement plan will be made for the following topics.

- Economics
- Financial aspects
- Institutional aspects
- Appropriate technology
- Natural and social environment

6.6.1 Economics

Analyses were made on the project cost and benefits to evaluate their effectiveness on public investments.

Table 6-19 Evaluation on Project Cost

Item	Characteristics	Contributor	Beneficiary	Benefits	Evaluation
Initial Capital Cost for Construction	Comparatively high cost necessary to pump up water to high altitudes due to location of houses	Government	Target Community	Provision of water supply facilities normally difficult to pay by beneficiaries	Feasible for development purposes
Running Cost	Continuous fuel cost required to operate and maintain system	Target Community	Target Community	Stable supply of clean water near households	Feasible as basic human needs
Replacement Cost	Amortized costs are difficult for acceptance	Government or Target Community	Target Community	Sustainable water supply	Feasible for continued service

Table 6-20 Evaluation on Economic Benefits

Benefit	Beneficiary	Remarks	Evaluation
Cost reduction in procuring daily water	Target Community	Reduced time for fetching water resulting in more opportunities for productive activities	Feasible as positive economic activity
Willingness-to-pay for use of increased water	Target Community	Improvements in standard of living need to be balanced with affordability to pay	Feasible to raise standard of living
Improvements in public health	Target Community	Lower medical reliance for better income generating activities	Feasible to raise health standards
Water fetchers have more opportunities for productive activities	Women and children	Women are able to spend more time on income generating activities. Children will have time to go to school.	Feasible to reduce gender imbalance

6.6.2 Financial Aspects

Evaluation of financial aspects involves the financial balance related to operation and maintenance of water supply facilities as well as feasibility of the operation and maintenance cost from the viewpoint of affordability-to-pay.

Table 6-21 Evaluation of Financial Aspects

Factor	Description	Evaluation
Financial Balance of Operation and Maintenance System	Is the proposed fee sufficient to sustain the system?	Feasible since over 90% of beneficiaries are willing to pay
Feasibility of Operation and Maintenance Cost	Is the proposed amount at a level of the community's ability-to-pay and willingness-to-pay?	Feasible since fee is within 5% of average income and in the range of amount willing-to-pay

6.6.3 Institutional Aspects

The effectiveness and sustainability of the proposed operation and maintenance system were determined. Also, the compliance of this system with policies and strategies of the rural water supply sub-sector was considered.

Table 6-22 Evaluation of Institutional Aspects

Issue	Observation	Evaluation
Effectiveness of Proposed Operation and Maintenance System	Proposed system is sustainable if community is willing to participate.	Feasible through an effective program of sensibilization and education
Sustainability of Proposed Operation and Maintenance System	Over 90% of population is willing to pay the proposed amount.	Sustainable with a demand responsive approach
Compliance with Policies/ Strategies of Rural Water Supply Sub-Sector	Almost 165 thousand persons can receive benefits	Can contribute to MDGs to increase coverage of rural water supply

6.6.4 Appropriate Technology

Feasibilities of technical level of proposed water supply plans and facilities designs were studied in view of adopted local standards, local conditions and capacity of GARWSP. According to evaluation of water sources, groundwater pumped up from public deep wells and spring sources were evaluated to be feasible for this study due to their sustainability, as shown below.

Table 6-23 Comparison of Available Water Sources

Water Source	Feature	Advantage	Disadvantage	Evaluation
Public Deep Well	Machine-drilled deep well for use by community	Available to all Good quality	Pumping equipment needed Requires proper O&M	Feasible as public drinking source
Private Deep Well	Machine-drilled deep well owned privately, but in some cases, the owner sells water to public	Good quality	Often cannot be used by community If water sold to public, can be expensive	Difficult for community use
Dug Well	Shallow well usually dug by hand and is either protected (concrete-lined) or unprotected	Easy to construct	Often seasonal Easily contaminated	Often not sustainable, but appropriate for irrigation
Spring	Naturally flowing out from mountain side or in valley	Good quality if properly protected	Often seasonal	Feasible if perennial
Stream	Flowing along valley floor	Can be accessed by all	Often seasonal Easily contaminated	Often not sustainable, but appropriate for irrigation
Rainwater	Harvested through collecting systems installed on house roof	Easily collected	Available only during rainy season Improper storage can evoke contamination	Feasible if rainfall is abundant throughout year
Vendor Water	Buying water from vendors who visit village	Profitable for vendor	Tends to cost more than other sources Sometimes irregular service	Economically unviable

Water supply systems are evaluated in the following table. According to this evaluation, the booster type system with house connections, which is the most common type in Yemen, is most feasible in consideration of the geographical features and cultural characteristics of this country.

Table 6-24 Evaluation of Water Supply Systems

Service Level	Supply System	Characteristics	Adaptability		Evaluation
			Local Conditions	GARWSP Capacity	
Level 1	Handpump	Pumps operated by human power are installed in the water source, and residents must travel from their house to the water source to fetch water.	Since most houses are located on sides and top of high mountains, going down to water source is dangerous and pumping by hand is hard work.	Possible but very few experience due to non-suitability to local environment.	Inappropriate
Level 2	Point Source	Public tapstands are constructed near the water source, and residents must travel from their house to the tapstands to fetch water.	Since most houses are located on sides and top of high mountains, going down to water source is hard work and dangerous.	Possible but non-suitable for local environment and can expect opposition from community	Appropriate under certain conditions
	Direct Gravity System	Water pumped up from the water source to a distribution tank is supplied by gravity through public tapstands constructed near households.	Suitable even for residents living on mountains if tapstands are located within reasonable distances.	Many experiences in construction of this type of system	Appropriate
	Booster System	Water pumped up from the water source is boosted up (once or more times) to a distribution tank and is supplied by gravity through public tapstands constructed near households.	Suitable even for residents living on mountains if tapstands are located within reasonable distances.	Many experiences in construction of this type of system	Appropriate
Level 3	House Connections	Water pumped up from the water source is boosted up (if necessary) to a distribution tank and is supplied by gravity to each household.	Suitable for all households	Many experiences in construction of this system	Appropriate

Design criteria to be adopted for this study as agreed between GARWSP and JICA Study Team were evaluated as follows. The evaluation resulted in all factors to be feasible for application in this study.

Table 6-25 Evaluation of Adopted Design Criteria

Factor	Criteria	Remarks	Evaluation
Design Period	10 years	More realistic than 20 years, since unpredictable changes may be encountered during a long period.	Applicable
Population Growth Rate	2.07 – 3.04 %/year	Rather than applying a fixed rate for all areas, values for governorate-wise growths from the recent census were determined to be close to actual tendencies	Applicable
Unit Water Supply Rate	Maximum: 40 l/c/d	Necessary according to local demands	Applicable
	Minimum: 25 l/c/d	Necessary for areas where water resources are scarce.	Applicable
Daily Average Supply	(Design Population) x (Unit Water Supply Rate)	By necessity	Applicable
Daily Maximum Supply	(Daily Average Supply) x (Factor:1.0)	The factor should not more than 1.0 due to the unbalance between water source capacity and local demands.	Applicable
Hourly Maximum Supply	(Daily Maximum Supply) / 24hours x (Peak Flow Factor :2-4)	The peak flow factor should not be fixed at 2, but between 2 and 4 as determined by population size.	Applicable
Pump Operation Hours (For ideal operation only)	Population 2,000 or less : 8 hours/day, Population more than 2,000 : 12 hours/day	According to customary practice of GARWSP	Applicable
Success Yield for Deep Well	25-40 gal/min (1.5-2.5 lit/sec)	According to requirements and source potential	Applicable
Water Quality Standards	Yemeni Standards based on WHO Guidelines	Reasonable since some parameters are adjusted to local conditions.	Applicable

6.6.5 Natural and Social Environment

Regarding evaluation of natural and social environment, IEE was conducted as explained in the Supporting Report, and concluded that negative impacts expected due to implementation are negligible and thus proceeding to the next stage is possible.

Here, evaluation was made on both positive and negative impacts for factors that can be influenced by the project. Some factors, such as “water fetching time reduction” and “sanitary environment” were added along with the factors evaluated in the IEE to make evaluation on positive impacts as well.

Table 6-26 Evaluation on Natural and Social Impacts

Factor	Impact		Evaluation
	Positive	Negative	
Groundwater	No impact if pumping is properly controlled. No impact if other deep wells are located more than 500m away.	Groundwater lowering can occur if both project well and nearby surrounding wells are overpumped simultaneously.	No impact with proper planning of design water supply rate and conservative use for irrigation*
Water contamination	No impact if water source is properly protected.	Wastewater can enter deep well if casing is damaged or improperly maintained.	No impact with proper protection and maintenance
Water fetching time reduction	Time reduced from fetching water can be used for other productive activities	May deter water conservation practices	No impact with proper education and awareness activities
Influence on sanitary environment	Sanitary conditions can be improved through stable supply of clean water.	May generate wastewater if not properly managed	No impact with proper education on sanitation
Acceptance into society	Water is basic human needs	May cause conflicts in water rights	No impact with proper awareness and proper designing
Economic activity (on vendors)	No positive impact	Decrease in number of customers, but the impact will be minimum as demand in other areas will still be available	Minimum impact
Impact on private water supply facilities owners	Overpumping of private well can be restrained.	If private water was previously sold, then income can decrease due to availability of public water.	No impact
Impact on gender	Women and children who are water fetchers can be relieved from burden of daily water fetching	Equality between men and women can have affect on religious customs	No impact with proper awareness activities
Impact on tribal communes (water rights)	Fair water distribution can resolve tribal disputes.	Disputes can arise if tribal priority is given to water distribution.	No impact with proper management

*N.B.: To avoid depletion of water source, water supply must be carefully planned so that the design supply rate balances properly with the rate of natural recharge, in consideration of pumping rates and distances of surrounding wells as well as amount of rainfall. Also, give priority to domestic use over irrigation purposes.

CHAPTER 7 PILOT PROJECT

7.1 Concept for Pilot Project

A pilot project was implemented from April 2007. The implementation of the pilot project reflected the results of capacity assessment and considered institutional development for rural water supply improvement. The pilot project included technology transfer on supervision of construction works, and contributions by the residents, such as transport of pipes and other materials from the stock yard to the construction areas, and pipe connections to individual households. The issues for consideration included the following.

- Roles and responsibilities of GARWSP (headquarters and branch offices), governorate/district local authorities, and rural communities
- Measures for raising awareness of residents on water and sanitation
- Procedures for capacity building of water committee activities
- Proper operation and maintenance of water supply facilities
- Awareness on conservation of water resources for drinking

GARWSP branch offices located in the Governorates of Al Mawheet, Sana'a and Dahmar were targeted for capacity development through the pilot project if the following conditions are satisfied.

- A site appropriate for pilot project is available in the governorate
- The branch office is sufficiently prepared to implement a pilot project and ready to receive capacity development

7.2 Site Selection and Scope of Work

7.2.1 Selected Sites

Out of the screened sites located in the governorates of Al Mawheet, Sana'a and Dahmar, pilot project sites were selected in accordance with the following conditions.

Table 7-1 Conditions for Selection of Pilot Project Site

Parameter	Condition
Existing Water Supply Facilities	• Reliable water source such as deep well is available
Required Work	• Small scale construction or rehabilitation
Willingness of Beneficiaries	• Willing to contribute to water supply facilities construction • Willing to contribute to operation and maintenance of the completed facilities • Willing to form a community-based water committee or improve an existing water committee
Capacity of responsible GARWSP Branch Office	• Requires capacity building, and possesses staff and budget sufficient for implementation

According to the capacity assessment conducted from December 2005 to the beginning of 2006 in this study, GARWSP Al Mawheet branch office had only one permanent staff, who was the Director. Therefore, at that time, this office was determined to be not capable to implement the pilot project. However, during the beginning of this year when selection of the pilot project sites started, the number of staff has increased to 3 as shown below. Consequently, since their capacity has improved, a decision was made to include Al Mahweet in the pilot project.

Table 7-2
Transition in Permanent Staff of GARWSP Al Mawheet Branch Office

Permanent Staff	December 2005	March 2007
Number	1	3
Positions Occupied	Director	Director Geologist Mechanical Technician

As a result of selection procedures according to the above conditions, the sites selected for pilot project are as follows as agreed with GARWSP.

Table 7-3 Sites Selected for Pilot Project

No.	Code	Governorate	District	Site Name	Design Population
1	A-02	Al Mawheet	Al Mawheet	Jabal Al Taraf	3,619
2	S-03	Sana'a	Bani Matar	Al Kharaba	1,610
3	D-08	Dahmar	Mayfa'a	Masneat Abdul Aziz	548

7.2.2 Scope of Work

The work category and works required for the selected sites listed above are shown in the following table.

Table 7-4 Scope of Work for Pilot Project

No.	1	2	3
Code	A-02	S-03	D-08
Site Name	Jabal Al Taraf	Al Kharaba	Masneat Abdul Aziz
Work Category	Rehabilitation	New Construction	New Construction
Existing Water Facilities	・Deep well ・Pump house with pumping unit for deepwell ・Pump house with pumping unit for booster ・Storage and booster tanks ・Pipeline network ・House connections	・Deep well	・Deep well ・Pump house ・Storage tank
Required Works	・Procurement and installation of pumping unit for deep well ・Procurement and installation of pumping unit for booster	・Procurement and installation of pumping unit for deep well ・Construction of pump house, storage tank and public tapstands ・Procurement and installation of pipeline	・Procurement and installation of pumping unit for deep well ・Rehabilitation of existing pump house and storage tank ・Procurement and installation of pipeline ・Construction of public tapstands

7.3 Pilot Project Implementation

7.3.1 Procedures

The pilot project proceeded through the following activities.

- Short-listing of contractors registered under GARWSP
- Tendering and contracting for construction works
- Procurement of materials and equipment for construction such as pumping units, concrete structure materials and piping materials
- Construction works at the selected sites
- OJT on supervision of construction works to GARWSP staff
- Training on technical operation and maintenance of completed facilities to community's operators
- Hand-over of completed water supply facilities to the target communities
- Social mobilization
  - Briefing to community on pilot project concept
  - Formation of community-based water committee or capacity improvement of an existing water committee

- Sensibilization and education on sanitation
- Sensibilization on proper use of water, necessity for efficient operation and maintenance, importance of paying water fees and other awareness issues

➢ Follow-up and monitoring

7.3.2 Demarcation of Work

GARWSP has capacity to implement construction works on water supply facilities, but with limited staff and budget, completion within the scheduled implementation period would be difficult. Therefore, in accordance with the results of capacity assessment, the work allotted to GARWSP was supervision and coordination along with OJT on supervision procedures. Communities of the selected sites contributed by transporting materials from the on-site stockyard to the construction area, and since house connections will become private property, these connections become the responsibility of each household. Under supervision of Japanese Study Team members, the work allocated to the Japanese side was carried out by a local contractor selected through tendering as described in the next section. Work for the pilot project was allocated as shown below.

Table 7-5 Work Demarcation for Pilot Project

Stakeholder		Work Allocation	
		Role	Facilitator
Yemen	GARWSP	・Supervision	・Branch office
		・Coordination	・Headquarters
	Local Authority	・Formation/strengthening of community-based water committee	・Local council
		・Capacity building	・Local council
		・Follow-up/Monitoring	・Local council
	Beneficiary Community	・Access road construction	・Residents
		・Removal of existing pumping unit wherever necessary	・Residents
		・Internal transport	・Residents
		・Pipe layout	・Residents
		・Rehabilitation of existing pump house and storage tank wherever necessary	・Residents
		・House connections	・Each household
		・Operation and maintenance	・Water committee
Japan		・Procurement of equipment and materials	・Local subcontractor
		・Installation of pumping unit	・Local subcontractor
		・Construction of pump house	・Local subcontractor
		・Construction of Storage tank	・Local subcontractor
		・Pipeline laying/connection	・Local subcontractor
		・Rehabilitation of existing pump house and storage tank wherever necessary	・Local subcontractor
		・Support to social mobilization	・Local consultant
		・Overall supervision and OJT	・Japanese supervisor

7.3.3 Selection of Contractor for Construction Works

From the list of local contractors for construction of water supply facilities who are registered with GARWSP, and based on the ranking given by GARWSP to these contractors, twenty (20) Grade-A contractors were short-listed upon discussions with GARWSP. These 20 contractors were contacted to confirm their interests, and as a result, tender documents calling for proposals were distributed to ten (10) short-listed contractors who gave intentions of interest. At the time for submission of proposals, seven (7) prospective tenderers submitted their bids. The proposals were submitted in 2 separate envelopes (a technical proposal and a financial proposal). First the envelopes containing the technical proposals were opened for evaluation on work schedule, work experience, staff availability, equipment appropriateness and other technical requirements. Then, financial proposal envelopes of only those who qualified through the technical evaluation were opened to evaluate price proposals. The tender procedures are listed below.

- Short-listing of prospective tenderers from list of Grade-A contractors registerd under GARWSP
- Distribution of tender documents (call for proposals) to interested short-listed contractors
- Submission of tender documents
- Opening and evaluation of technical proposals
- Opening of financial proposals of technically qualified tenderers
- Financial evaluation
- Negotiations with prospective contractor
- Contracting with successful contractor

Technical evaluation was carried out by GARWSP staff and JICA Study Team members for the 7 tenderers who submitted their proposals. As a result, only one (1) qualified as fulfilling the requirements stipulated in the tender documents. Therefore, the envelope containing the financial proposal of this sole tenderer was opened and evaluation was conducted in the presence of GARWSP staff, JICA representative and JICA Study Team members. The evaluation revealed that the submitted documents were judged to be in conformity with the requirements. However, the offered price of this tenderer was above the ceiling price (budget) and therefore, negotiations were held with this tenderer to discuss possibilities for proposing another price. As a result of negotiations, the tenderer reduced the price to an amount below the ceiling price and consequently proceeded to the contracting stage. The contract for the pilot project works was finally concluded with Ahmed Ali Mahdi Office for Trading and Contracting. The attendants for the above evaluations and contracting are listed below.

Table 7-6 List of Attendants in Tender Evaluation and Contracting for Pilot Project Construction Works

Procedure	Attendant	
	Affiliation	Name and Position
Technical Evaluation	GARWSP	Fawzi Al-Khirbash, Deputy General Director of Planning and International Cooperation Rashad Al-Mekhlafi, Mechanical Engineer, Study Department
	Study Team	Shoji Fujii, Team Leader Akinori Miyoshi, Facilities Design Takafumi Ohashi, Consultant Coordination
Financial Evaluation	GARWSP	Fawzi Al-Khirbash, Deputy General Director of Planning and International Cooperation Mohammed Ali Raweh, Deputy Director of Accounting, Chief of Registration Division
	JICA	Katsuyoshi Fukai, Project Formulation Adviser, JICA Yemen Office
	Study Team	Shoji Fujii, Team Leader Akinori Miyoshi, Facilities Design Takafumi Ohashi, Consultant Coordination
Contracting	GARWSP	Fawzi Al-Khirbash, Deputy General Director of Planning and International Cooperation
	Study Team	Shoji Fujii, Team Leader Akinori Miyoshi, Facilities Design Takafumi Ohashi, Consultant Coordination
	Contractor	Ahmed Ali Mahdi Al- Yashi'ee, General Director, Ahmed Ali Mahdi Office for Trading and Contracting

7.3.4 Schedule

The pilot project construction commenced in the middle of April 2007 when tendering procedures started and completed in the middle of July 2007 when the facilities were handed-over to the target communities, for about 2.5 months. Formation of new water committees and strengthening of the existing committee, as well as social mobilization activities started during the construction stage and is scheduled to continue until the end of August 2007. Also, follow-up and monitoring activities started after completion of facilities construction, and these activities are scheduled to last until August 2007.

Table 7-7 Schedule of Pilot Project

Procedure	April	May	June	July	August
Tendering and Contracting					
Site Transfer and Preparation for Work					
Procurement of Materials and Equipment					
Briefing to Community					
Rehabilitation Work at A-02 Jabal Al Taraf					
Construction Work at S-03 Al Kharaba					
Construction Work at D-08 Masneat Abdul Aziz					
Formation/Strengthening of Water Committee					
Sensibilization Activities					
Hand-over					
Follow-Up/Monitoring					

7.4 Training on Supervision and Operation/Maintenance

7.4.1 Capacity Building on Supervision of Rural Water Supply Projects

According to the capacity assessment carried out previously in the study, supervision methods and capacity for supervision of GARWSP on project implementation need improvement. Therefore, procedures for supervision of projects were transferred through OJT to staff of GARWSP headquarters and targeted branch offices using the pilot project as training tool. Training on the following activities was conducted to strengthen capacity for supervision.

- Site transfer
- Approval of equipment and materials
- Quality management of project
- Progress management to avoid behind schedule delays
- Regular meetings with contractor and concerned parties
- Review of reports from contractor
- Inspection during construction works and before completion
- Hand-over of completed facilities

To facilitate the training procedures, a working draft of the guideline on supervision of project implementation was prepared by the Study Team. Making use of the guideline, the trainees acquired necessary experiences through the program (refer to working draft of the supervision guideline in Supporting Report Annex). This working draft was provided as a guideline to be used by GARWSP to prepare individual supervision plans for each project according to the project characteristics.

Engineers and technicians from GARWSP who would supervise project implementation in the future participated in the training activities (refer to the list of participants below). Their willingness to learn the proper procedures for effective supervision gave cause for good expectations on required improvements.

Table 7-8 List of Participants from GARWSP for Training on Project Supervision

No.	Name	Specialty	Position
1	Fawzi A. Al Khirbash	Hydrogeologist	Deputy General Director, Department of Planning and International Cooperation
2	Abdulla Abdulmalek	Hydrogeologist	Head of Technical Office
3	Ali A. Al Rabwae	Civil Engineer	General Director, Department of Planning and International Cooperation
4	Abdul Naser Al Meklafi	Civil Engineer	Deputy of Studies and Supervision Department
5	Abdulwaly Salam	Civil Engineer	Studies and Supervision Department
6	Osama Al Ozaybi	Civil Engineer	Studies and Supervision Department
7	Mohamed Al Humam	Civil Engineer	Member of Technical Office, responsible for Coordination Meetings
8	Mohamed Saleh Mayas	Civil Engineer	Studies and Supervision Department
9	Abdulrahman Al Daylami	Civil Engineer	Studies and Supervision Department
10	Nemat Al Majdoob	Civil Engineer	Head of Division in Studies and Supervision Department
11	Rabea'a Mogales	Civil Engineer	Studies and Supervision Department
12	Al A. Al Sabri	Civil Engineer	Member of Technical Office
13	Abdulsalam Al Madhaji	Civil Technician	Studies and Supervision Department
14	Abdulsalam Othman	Civil Technician	Studies and Supervision Department
15	Khaled Al Sanani	Civil Engineer	Studies and Supervision Department
16	Mohamed Saif	Civil Technician	Studies and Supervision Department
17	Abdullatif Saleh		General Director of Public Relations and Media
18	Saeed Dma'am	Drilling Technician	Studies and Supervision Department
19	Abdulkawi Salam		Studies and Supervision Department
20	Helmi M. Abdulkawi	Mechanical Engineer	Member of Technical Office
21	Amin Al Musanef	Civil Engineer	Director of Studies and Supervision Department
22	Basel Abdulrahman	Drilling Technician	Studies and Supervision Department
23	Galal Al Sabaei	Civil Technician	Studies and Supervision Department
24	Abdulwahed Al Sarori	Civil Technician	Studies and Supervision Department
25	Daood Abdulwasse	Civil Technician	Studies and Supervision Department
26	Abdulgani Al Gazali	Civil Engineer	Studies and Supervision Department
27	Tawakol A. Tawakol	Civil Engineer	Studies and Supervision Department
28	Ahmed Al Shehari	Geologist	Member of Technical Office
29	Fath Al Anisi	Geologist	Studies and Supervision Department

7.4.2 Training on Technical Operation and Maintenance of Water Supply Facilities to Operators

The operators selected by the target sites were given training by the joint efforts of GARWSP branch staff and Study Team on technical matters related to operation and maintenance of completed water supply facilities constructed or rehabilitated through the pilot project. Operation and Maintenance manuals were prepared for each pilot site in accordance with the designed equipment and facilities particular to each water supply requirements (refer to Manual for Technical Operation and Maintenance of Rural Water Supply Facilities for each of the 3 pilot sites in Supporting Report Annex). The basic mutual issues for training included the following, but the differences in water supply schemes required different training items for each individual scheme design.

- Daily operation of pumping units
- Routine inspections
- Periodic checks
- Preventive maintenance
- Measures to be taken for breakdowns and failures

The selected operators for each site showed high eagerness to learn the proper methods and precautions for effective operation and maintenance of the water supply facilities. This behaviour reveals a right sense of ownership of the facilities.

7.5 Social Mobilization and Improvement of Community-Based Management

7.5.1 Background

As it is explained in section 6.4.3 of “Plan for Operation and Maintenance”, there are two significant principles in the national policy and strategy for the sub-sector development, that are “decentralization” of authorities in implementation of the development project to relevant local institutions, and “participation” of user communities in implementation and management of the supply schemes. These principles were a prime concern in the component plan for facilitation of social mobilization under the Pilot Project.

"Decentralization" calls for capacity development of relevant local institutions in service delivery, particularly in social mobilization, through which improvement of community-based management of the supply scheme can be realized. Therefore, the component plan for social mobilization put emphasis on capacity development of GARWSP Branch Offices and Local Councils in the target governorates, as relevant local authorities in current institutional framework set in the sub-sector policy and strategy, in social mobilization and establishment of improved community-based management.

On the other hand, enhancement of "participation" in the target communities for the Pilot Project requires, as it is also reviewed in section 6.4.3, introduction of the "improved" mode of community-based management, which can be characterized as such that: 1) management entity is established through an election of executive members, legal registration and licensing, and preparation of its organizational and operational bylaws; 2) the sense of ownership in scheme management is well shared, along with collective decision making process in the general assembly of users; and 3) interface with local administration that provides technical guidance and monitoring is sustained. In the Pilot Project, where target communities are located in the governorates of Sana'a, Dahmar, and Al-Mahweet, introduction of the "improved" mode of community-based management was intended in the component plan, and its applicability and effects in scheme management in the area and communities was evaluated and findings through the implementation was consolidated in the operation and maintenance plan under the Study.

7.5.2 Strategies and Approaches

Strategies and approaches employed in the plan for operation and maintenance of the Study are basically applied and examined in implementation of the component plan for social mobilization under the Pilot Project. Applicability and effectiveness of these strategies and approaches are further assessed and findings are deliberated for finalization of the plan for operation and maintenance under the Study. Strategies and approaches for implementation of the component plan are itemized below (refer to section 6.4.3 of "Plan for Operation and Maintenance" for details).

- ☐ Introduction of Demand Responsive Approach (DRA)
- ☐ Responsibility sharing among GARWSP, Local Councils, and community
- ☐ Improved community-based management, which includes;
  - ➢ Improved mode of community-based management entity
  - ➢ Enhanced sense of ownership and participation in management
  - ➢ Increased expertise in operation and maintenance through necessary training

- Improved decision making (collective decision making) and transparency/ accountability
- Established interface with relevant local authorities

☐ Enhanced awareness on water and sanitation

☐ Emphasis on the Monitoring Stage

☐ Formation of Social Mobilization Team (SMT) and on-the-job training (OJT)

☐ Community's commitment to water resource management

7.5.3 Activities

(1) Formation and Capacity Building of Social Mobilization Team (SMT)

In order to carry out the planned activities of the social mobilization component in the Pilot Project according to the strategies above, a Social Mobilization Team (SMT) is formed as an implementation body in GARWSP Headquarters. The SMT is composed of both female and male staff from GARWSP Headquarters headed by a team leader (a local consultant experienced in this field of activities) employed by the Study team.

Due to scarcity of GARWSP staff adequately trained and experienced in the field of social mobilization, the team leader of SMT is given an assignment to provide "training of trainers (TOT)" prior to the field activities for social mobilization, and also to provide "on-the-job training (OJT)" during the field implementations. In the field implementation of the social mobilization component under the Pilot Study, relevant staffs from GARWSP Branch Office and Local Council are joined and carry out the field works together with SMT on the OJT basis, after proper guidance is provided by the SMT.

The SMT members, staffs of GARWSP Headquarters, trained through TOT and OJT in the social mobilization component of the Pilot Project is expected to be SMT trainers for other GARWSP Branch Offices. Also, GARWSP Branch Office staffs trained in the component are also expected to replicate the same strategies and activities for social mobilization in implementation of other projects in their designated governorates.

(2) Activities for Capacity Building

According the strategies and approaches in planning and implementation of the social mobilization component in the Pilot Project, the following activities are set for capacity building of staffs in GARWSP Branch Office and Local Councils in social mobilization, and improvement of community-based management for the water supply schemes in the target communities.

Stage-1: Pre-Planning

1-1. Develop and adopt field implementation manual for SMT (Social Mobilization Team)

1-2. Employ local consultant for team leader of SMT

1-3. Form SMT in GARWSP Headquarters

1-4. Conduct orientation for GARWSP Branch Offices and Local Councils on strategies, approaches, and planned activities in the social mobilization component of the Pilot Project, which is followed by selection of staff from these local authorities to join the field activities for social mobilization.

1-5. Train SMT and staff from local authorities in DRA (demand responsive approach) and facilitation skills for social mobilization activities in the rural water supply project

Stage-2: Participatory Planning

2-1. Conduct community consultation to agree on possible community-based management options to run the supply scheme with identification of training needs to fulfil technical and managerial requirements in an agreed management option

2-2. Facilitate communities to form/select preparatory committee/task force to be committed in the following process to form and register the community-based management entity

2-3. Facilitate communities to prepare bylaws/regulations for technical operation and maintenance for the supply scheme, as well as one for organizational management of the community-based management entity

2-4. Organize community consultation to discuss and finalize bylaws/regulations for the community-based management of the supply scheme

Stage-3: Election and Registration of WUA

3-1. Facilitate communities to organize General Assembly of users for adoption of the bylaws/regulations, and conduct community election for Executive Committee members of WUA

3-2. Support communities in the process to register WUA in accordance with the procedures defined in the Local Authority Law of 2000

3-3. Facilitate communities to form Monitoring Committee to be institutionalized in the WUA framework

Stage-4: Capacity Building of WUA in the Scheme Operation/Maintenance and Management

4-1. Train Executive Committee and Monitoring Committee of WUA in organizational management, financial management, and technical operation and maintenance

4-2. Train the scheme operator (i.e. pump operator, plumber, cashier/fee collector/billing operator) in relevant tasks and duties

4-3. Train peer educators in the communities for improved personal hygiene practice

Stage-5: Monitoring and Follow-up

5-1. Conduct follow-up training for WUA Executive and Monitoring Committees in areas identified to be weak

5-2. Develop monitoring and follow-up check list for GARWSP Branch Offices and Local Councils

5-3. (GARWSP Branch Offices and Local Councils) Conduct monitoring and follow-up activities

(3) Outputs of the Activities

The social mobilization component of the Pilot Project was completed at the end of August 2007. The implementation period of the component is extended over two months after basic completion of the construction and rehabilitation works of the Pilot Project in June 2007, with given emphasis on the significance and impact of its undertakings in the post-implementation stage (monitoring and follow-up stages) as described above in the strategies and approaches of the component. At the completion of the social mobilization component, the following outputs are confirmed.

a. Development and adoption of field implementation manual for SMT.

In preparation of field implementation manual for social mobilization utilized by SMT, existing manual and guidelines developed by GARWSP and other institutions involved in the sub-sector development (SFD, PWP, and UNICEF) are reviewed and modified suitable to the implementation of the social mobilization component of the Pilot Project in accordance with the strategies and approaches explained above. In addition, manual for improved personal hygiene practices utilized in the social mobilization component is developed, while also reviewing and modifying existing ones. Concepts and tools forming participatory health and sanitation education, such as PHAST (participatory health and sanitation transformation) and KAP (knowledge, attitude and practice on hygiene and sanitation), are introduced in the manual. Both of the manuals are adopted for TOT and OJT of the SMT as well as field implementation of social mobilization component under the Pilot Project.

b. Formation of a social mobilization team (SMT)

A social mobilization team (SMT) is formed and trained in mobilization skills and health education as described above. Theoretical training was provided to SMT members at GARWSP Headquarters for one week prior to implementation of the social mobilization component. Then their capacities in social mobilization and establishment of improved community-based management were further strengthened through implementation of a variety of activities planned under the component on a OJT basis.

SMT members are confirmed to be active and equipped with improved knowledge and skills through provided training and TOT in the field activities. Involvement of staffs from GARWSP Branch Offices and Local Councils in social mobilization is also fair with improved knowledge and experiences through OJT, except in GARWSP Branch of Al Mahweet, where difficulty to allocate relevant staff for the work is inevitable due to extreme scarcity of official staff (presently three permanent staffs in total).

c. Implementation of field activities

Various field activities set for social mobilization and establishment of improved community-based management were carried out by SMT and staff from Local Councils. Active participation and commitment of user communities in given tasks and duties were generally observed during implementation of the field activities.

d. Establishment of improved community-based management

Through a number of community consultation meetings, user communities in the target sites well understood their roles and responsibilities in operation and maintenance of the supply scheme, and opted for "improved" community-based management through forming and training a Water User Association (WUA). Supports to establish WUA and prepare its bylaws/regulations were provided. In all target sites, WUA was established, and its Executive Committee members are selected through community election. With formation of Monitoring Committee and General Assembly, organizational set-up of WUA was fairly established.

However, legal registrations of WUA in all the target communities (amendment of WUA registration in S-03 Al Kharaba) are not yet completed in contrast to submission of their applications and well prepared bylaws/regulations in accordance with government regulations. This is due to prolonged administrative procedures which cannot be controlled by the Study. However, it is rather important that communities' commitment to facilitate process for legal registration of WUA is observed.

e. Improvement of expertise in scheme management

Trainings for Executive and Monitoring Committee of WUA in scheme management as well as for the scheme operators in technical operation and maintenance were provided through facilitation and follow up on the WUA registration process. At present, major problems in

their scheme management, and technical operation and maintenance are not observed, and the schemes in the target sites are well managed with fair user fee setting and collection.

However, while experiencing actual management and operation of the supply scheme, their weakness in required capacity and expertise could be recognized, which would be tailored out as much as possible with follow-up trainings in due course during implementation of the component. Thus, in succession, GARWSP Branch Offices and Local Councils are expected to actively provide follow-up and monitoring activities.

7.6 Obstacles and Proposed Measures in Operation and Maintenance

Being handed over in July 2007, there are no significant visible problems exposed in the day-to-day operation and maintenance of the water supply schemes improved under the Pilot Project. However, the following are the major concerns in sustainability of the supply scheme and community-based management for the Pilot Project, which indeed will be the same for preparation of the operation and maintenance plan under the Project.

7.6.1 Lower Tariff Setting

In general, the target communities in the Pilot Project provisionally set the water tariff at minimum to meet operation costs for fuel; allowance/salary of WUA Executive members and the scheme operators; and cost for purchasing spare parts when necessary, at the range of YR 50/m^3 to YR 100/m^3, which obviously neglects the cost requirement for replacement of the installation in a long term to sustain the supply scheme. The table below shows the results of preliminary estimation of operation and maintenance cost per month necessitated in operation and maintenance of each supply scheme of the pilot project including fuel cost, salary/allowance costs for operators and WUA members, and cost to procure spare parts when needed, as well as replacement cost of equipment upon their minimum life. As it implicates, the unit price of water shall be set in a range of YR 157/m^3 to YR 469/m^3 to meet the cost required for replacement of the supply facilities.

Table 7-9 Calculated Operation and Maintenance Cost for Pilot Project Sites

Governorate	Code	Site Name	Monthly Operation and Maintenance Cost		Unit O&M Cost
			YR/site	YR/pers	YR/m^3
Al Mawheet	A-02	Jabal Al Taraf	886,804	245	204
Sana'a	S-03	Al Kharaba	315,249	189	157
Dahmar	D-08	Masneat Abdul Aziz	309,413	565	469

Considerations of the costs for replacement of facilities required in longer terms of operation and maintenance are further emphasised to the communities in the social mobilization component of the Pilot Project. However, the WUA and community refer to this as the highest setting affordable to the majority of the community. This communities' claim that the tariff set by them is at the highest affordable level is also confirmed in the socio-economic survey carried out in the Study. For the given socio-economic conditions of the target communities with lower household income at YR 30,000/month in median according to the socio-economic survey under the Study, YR 1,200/month/household could be an affordable expenditure for water, at a maximum of 4% of total household income recommended by international development organizations such as UNDP. This means YR 27/m^3 is the most affordable unit price of water at which the households in the Project area can spend, assuming a household with a family size of 6 consuming water at a minimum amount of 25 liters/person/day.

Thus, less economic affordability of the communities needs to be reconsidered, in particular for the replacement cost to be borne by themselves, which is further elaborated in the following sections.

7.6.2 Poverty in the Area

Indeed, poverty is the most rooted obstacle to apply to an improved piped water supply scheme in the area in consideration of the cost recovery for operation and maintenance including replacement cost of the supply facilities, of which technologies employed (pipeline networks, reservoir and tanks by steps, mechanized water pumping for intake and boosting) is costly due to considerable distances and often undulations (including high height differences in each undulation) from water source to storage tank and supply to the served area where the community resides, as well as decreased depths of groundwater level. For given harsh socio-environmental conditions, piped water scheme is only an applicable technology option with higher cost implications that require higher specifications in pumping for intake and boosting; longer pipelines with enough resistance to higher water pressures; and reservoirs and tanks. Wherever possible and applicable in the given natural and socio-economic conditions, cost effective technologies, such as hand pump, should be considered. However, if the piped water supply is the only acceptable option to the community in poverty with given specific socio-environmental conditions, replacement cost of the supply facilities should be borne by the government in accordance with the policy and strategy for poverty alleviation in the country, as well as capital cost which is also largely shared by the government.

Therefore, for replacement of the scheme after due duration of the supply facilities of which operation and maintenance is sustained by the community for a longer period, for example a decade, the same approaches employed in the current rural water supply development in which the government shares a larger portion in investment supplemented by community contributions for implementation of the project, will be taken, so that the pricing of water for replacement is excluded. Also worth mentioning is that pricing of water including replacement may increase poverty in the area, in particular, the poorest of the poor who cannot afford it, reducing household budget for other basic needs.

7.6.3 Scale Merit in Operation and Maintenance

The appropriation of water tariff set by the communities for operation and maintenance of the supply scheme also largely depends on the demographic conditions of the community. In the communities with larger populations (more then 2,000 persons) concentrated in the service area of the supply schemes, which are often better-off locating in the vicinity of the economic center, the shared cost for operation and maintenance becomes relatively lower due to absolute number of users in a confined service area. In contrast, for communities with smaller populations (500 to 2,000 persons) scattered over the land, which are often poverty areas located in marginalized rural areas, the shared cost for operation and maintenance becomes relatively higher due to less number of users in scattered areas in which larger and costly schemes are required.

Thus, in the implementation of improved piped water supply schemes with such smaller populations in scattered areas, deduction of the replacement costs in water pricing should be adopted, and replacement of the supply facilities should be undertaken in the same manner mentioned above in accordance with national poverty alleviation policy and strategies.

7.7 Evaluation of Pilot Project Implementation

The outputs obtained through implementation of the Pilot Project as mentioned above are further evaluated to be reflected in the operation and maintenance plan under the Study. The relevant subjects for the evaluation are divided into aspects for applied technology and its procedures and ones related to community-based management for the supply scheme. Also, an initial environmental examination (IEE) was conducted on the Pilot sites.

7.7.1 Technical Aspects

Through implementation of the Pilot Project, GARWSP headquarters and branch offices were expected to supervise and coordinate the construction works. Also, contributions from the beneficiary community were obliged as a means to express their sense of ownership of the water supply facilities, and as a result, each target site contributed fully to support the construction works. The following evaluations were made on the technical aspects of pilot project implementation.

Table 7-10 Evaluation of Pilot Project Implementation on Technical Aspects

Activity	Evaluation		
	A-02 Jabal Al Taraf	S-03 Al Kharaba	D-08 Masneat Abdul Aziz
Supervision and coordination by GARWSP	- Received OJT by Study Team, but further training required - Good coordination by GARWSP HQ staff	- Received OJT by Study Team, but further training required - Good coordination by GARWSP HQ staff	- Received OJT by Study Team, but further training required - Good coordination by GARWSP HQ staff
Contribution by GARWSP	- Drilled deep well to be used as target water source	- Drilled deep well to be used as target water source	- Drilled deep well to be used as target water source
Contribution by beneficiary community to construction works	Sufficient contribution to project through following: - Removal of existing pumping units - Assistance for installation of new pumping units	Sufficient contribution to project through following: - Construction of access road to tank - Demolition of old, deteriorated pump house - Internal transportation of piping materials - Provision of space for contractor's site camp - Assistance for installation of new pumping unit	Sufficient contribution to project through following: - (Construction of pump house before pilot project) - Rehabilitation of existing pump house - Internal transportation of piping materials - Provision of space for contractor's site camp - Assistance for installation of new pumping unit
Construction works by local contractor	- Acceptable quality of works - Works progressed on schedule - Works completed without any major accidents or problems	- Acceptable quality of works - Works progressed on schedule - Works completed without any major accidents or problems	- Acceptable quality of works - Works progressed on schedule - Works completed without any major accidents or problems

7.7.2 Community-Based Management of Supply Scheme

Results obtained through the implementation of the social mobilization component of the Pilot Project were evaluated for the following aspects in accordance with the strategies and approaches applied in the component as earlier describe above, and from viewpoints of whether or not the social mobilization component of the Pilot Project achieved the expectations described in its strategies and approaches (if, not, why and how to cope with them).

(1) Improved mode of community-based management entity

Tasks and duties of user communities are well understood in the target sites. Improved mode of community-based management entity, that is WUA, is formed through proper process such as preparation of organizational bylaws/regulation, election of executive members, formation of monitoring committee and general assembly.

(2) Improved technical and managerial expertise in scheme management, and operation and maintenance

Various trainings to improve capacity of WUA in the scheme management, and technical operation and maintenance were observed. It is observed that there are significant shortcomings in scheme management and operation at present. However, through continuous operation and maintenance of the scheme, their weakness in required capacity and expertise should be identified through periodical monitoring by GARWSP Branch Office and Local Councils, and proper technical guidance and re-trainings are expected.

(3) Enhanced community ownership in operation and maintenance of the supply scheme

Improved sense of community ownership is observed in the target sites. Although legal registration of WUA has not been completed, communities' willingness and commitment to facilitate registration process can be regarded as good sign for improved sense of community ownership.

(4) Collective decision making and improved accountability/transparency

General Assembly of user community is formed in the target site for collective decision making. Bylaws and regulations of WUA may further enhance collective decision makings for important issues in the scheme and financial management, as well as accountability and transparency through financial reporting to be given by the executive committee and monitoring committee of WUA.

(5) Established interactive channel (interface) between user communities and local authorities

GARWSP Branch Office and Local Councils were involved in all processes of social mobilization and establishment of improved community-based management. GARWSP Branch Office and Local Councils in the target areas also provided follow-up and monitoring activities for the target communities. Continuous follow-up and monitoring by these local authorities not only for the target communities under the Pilot Project, but also for other communities with improved water supply scheme are expected to enhance interactive channel with user communities for sustainability of the supply schemes.

7.7.3 Initial Environmental Examination

Pilot project implementation was permitted by the Environmental Protection Authority (EPA) of Yemen, but a simple environmental-social assessment of initial environmental examination (IEE) was carried out based on JICA guidelines. Refer to "6. IEE Assistance" in the Supporting Report for details.

Descriptions of the pilot sites are shown in the following table.

Table 7-11 Site Description of Pilot Project Sites

Code No.	Site Name	Major Crops	Presently Used Water Sources	Potential Conflict
A-02	Jabal Al Taraf	Sorghum, millet, qat	Existing water facility	None
S-03	Al Kharaba	Wheat, sorghum, qat, vegetables, fruits	Private wells, cistern	None
D-08	Masneat Abdul Aziz	Sorghum, wheat, barley	Cistern, nearby village	None

As a result of scoping, 4 parameters (economic activity, water rights, groundwater and water contamination) were judged to have impact and the possibilities of these factors having influence to each pilot site are shown in the table below. Since there are no potentially significant factors influencing the environment, all of them are evaluated as 4 (No influence).

[1: Potential for significant influence; 2: Potential for some influence; 3: Possibility for influence; 4: No influence]

Table 7-12 Evaluation of IEE Scoping Factors for Pilot Sites

Code No.	Site Name	Economic Activity	Water Rights	Groundwater	Water Contamination
A-02	Jabal Al Taraf	4	4	4	4
S-03	Al Kharaba	4	4	4	4
D-08	Masneat Abdul Aziz	4	4	4	4

Through the above IEE, it was concluded that negative impacts from implementation of the pilot project would be limited and further EIA is not required as approved by EPA. Therefore, the pilot project could be implemented without any further actions concerning environmental aspects.

CHAPTER 8 ACTION PLAN FOR CAPACITY DEVELOPMENT

8.1 General

Capacity assessment was carried out in earlier stages of Phase 1 under the Study to identify weaknesses and strengths of GARWSP's capacity in its management and functional operations. In the later stages of Phase 1 of the Study, a Draft Action Plan for Capacity Development of GARWSP was further prepared in a participatory manner with GARWSP based on the analysis made through capacity assessment. It is intended that the capacity development plan of GARWSP under the Study is developed in a comprehensive manner, so that it can be utilized as an entire blueprint or master plan for capacity development. Therefore, the plan may comprehend existing capacity development plans prepared in pieces with support of several donors, along with further deliberated action plans developed under the Study. The comprehensiveness of the plan may facilitate efficient distribution of limited development resources (human resources, financial resources, and physical resources) and increase the interest of other donors including Japanese government in further collaboration.

8.2 Approach and Methodology

Enhancing the sense of GARWSP's ownership in the process to prepare the action plan for capacity development is emphasized as a prime issue of significance, since the plan has to be further deliberated, implemented, and monitored and evaluated by GARWSP itself in the future. In order to realize development of the action plan based on the decision making by GARWSP through capacity assessment and analysis in a participatory manner, supervisory committee and working group were formed under GARWSP. Supervisory committee is consisted of a chairman and relevant general directors to manage the development process and providing decision making for the plan prepared, while appointing a working group that consists of 9 senior staff from each department/section and 3 branch office directors (Sana'a, Al-Mahweet, and Dahmar) to review current capacity of GARWSP in its management and functional operation and prepare the action plan for capacity development.

Several activities and meetings with supervisory committee and working group were held to finalize the capacity assessment and prepare the action plan of GARWSP for capacity development. The following steps and activities are undertaken for preparation of the plan.

Table 8-1 Steps/Activities for Preparation of Capacity Development Plan for GARWSP

Steps/Activities	Resource Person	Note
1. Presentation of the results in the Capacity Assessment conducted in Phase 1 of the Study for GARWSP Chairman	Chairman, Counterparts, JICA Study Team	
2. Appointment of 1) the Supervisory Committee as a decision making organ of GARWSP in the development process of Basic Action Plan for Capacity Development, and 2) the Working Group members for review of Capacity Assessment and preparation of Basic Plan for Capacity Development.	Chairman	Supervisory Committee is a decision making organ of GARWSP in the development process of the Basic Action Plan for Capacity Building, consisted of Chairman and other General Directors. On the other hand, the Working Group is, on the ground, to develop the Draft Basic Action Plan of GARWSP through review of Capacity Assessment Report, consisted of responsible and staff from each department of GARWSP HQ appointed by Chairman.
3. Distribution of 'Draft' Capacity Assessment Report to the Supervisory Committee members and Working Group members.	Leader of Working Group, Counterparts, JICA Study Team	
4. Kick-off Meeting with Working Group members to decide further steps and schedule for preparation of Draft Basic Action Plan for Capacity Development	Counterparts, JICA Study Team, Working Group	
5. Working Group meeting to review the Capacity Assessment Report.	Working Group Counterparts JICA Study Team	Comments and suggestions from Working Group members are discussed, and issues are clarified and confirmed in the review meeting
6. Finalization of the Capacity Assessment Report and Distribution to Supervisory Committee and Working Members Group	Leader of Working Group, JICA Study Team	Based on the clarification in the review meeting above (5), JICA Study Team and Leader of Working Group finalize and prepare the Draft Final of Capacity Assessment Report, which is duly distributed the concerned staff of GARWSP.
7. Presentation of the Draft Final of Capacity Assessment Report to the Supervisory Committee, and Finalization of the Report	Chairman, Supervisory Committee, Working Group, Counterparts, JICA Study Team	
8. Review of existing GARWSP plans of variety with Working Group and Preparation and Distribution of very 'First' Draft of Basic Action Plan of GARWSP for Capacity Development to the Working Group.	Working Group, Counterparts, JICA Study Team	Various existing plans are reviewed with Working Group, and very 'First' Draft of the Action Plan is prepared by Leader of Working Group and JICA Study Team as a starting point to facilitate further discussion with Working Group.
9. Working Group Meetings to develop Draft Basic Action Plan for Capacity Building.	Working Group, Counterparts, JICA Study Team	Based on the very 'First' Draft of Action Plan, discussion with Working Group members is facilitated, issues and action required for capacity development is clarified.
10. Finalization of the Draft of Basic Action Plan of GARWSP for Capacity Development and Distribution to Supervisory Committee and Working Members Group	Leader of Working Group, JICA Study Team	Based on the clarification in the Working Group meetings above (9), Leader of Working Group and JICA Study Team finalize and prepare the Draft Final of Capacity Assessment Report, which is duly distributed the concerned staff of GARWSP.
11. Presentation of the Draft Final of Capacity Assessment Report to the Supervisory Committee, and Finalization of the Report	Chairman, Supervisory Committee, Working Group, Counterparts, JICA Study Team	

As a consequence of the successive review meeting with GARWSP's supervisory committee and working group for capacity assessment, key capacity areas (major capacity development issues) required for improvement are identified as described in the following sections. Following the review meetings, a three-day participatory workshop with the working group was organized to draft a comprehensive action plan of GARWSP for organisational capacity development.

In order to develop the action plan constructively, a systematic planning framework (matrix) for capacity development is employed. The action plan for each identified capacity area is prepared in a comprehensive manner, based on the systematic SWOT (strength, weakness, opportunity, and threat) analysis through matrix building. In reviewing what capacities exist, it is actually strengths as well as weaknesses that will come forth, while opportunities and threats, which may exist on any level of system/enabling environment, organization/entity, and individual, are identified and transformed to the basis of action plans for improvement. Thus, the matrix is combined with a SWOT analysis that underpins the horizontal parameters, complemented by the narrative review of strengths and weakness that considers all three capacity layers. Bridging from assessment to strategy and programme formation, the matrix then turns to opportunities and threats as basis for capacity development actions, focusing attention on each of the levels to identify appropriate and complementary support measures. Finally, it focuses on the objectives and actions to be undertaken by GARWSP, which are served as the action plan of GARWSP for capacity development. The Action Plan was finalized with determination of human resources, financial resources, physical resources, development partners, and implementation period required for each action for capacity development. However, at the stage of Phase 1 of the Study, those required resources and periods are not decided, since its determination requires further consultation and consideration with management boards of GARWSP and MWE, as well as dialogue with various stakeholders and ESAs (External Support Agencies) at Phase 2 of the Study.

During Phase 2 of the Study, the draft action plan was duly submitted and explained to the supervisory committee for consensus building. Through implementation of the pilot project and stakeholder meetings (workshop seminar) in Phase 2 of the Study, the action plan was further improved and finalised by incorporating lessons learnt in undertakings and feedback from stakeholders.

8.3 Identification of Key Capacity Areas

Reviewing 'capacity assessment' of GARWSP in its organizational management and functional operation carried out in earlier stages of Phase one of the Study (refer to Chapter 5), ten (10) key capacity areas (major capacity development issues) are identified by GARWSP working group and supervisory committee. Those identified capacity areas are summarized as follows.

Key Capacity 1 (refer to 5.2.1)
National policies-strategies of sub-sector development and reform, and strategic plans of relevant national authority (i.e. GARWSP) are formulated in consisted manners. Legal and legislative framework for sub-sector development institutions is developed based on national sub-sector development and reform policies-strategies.

Key Capacity 2 (refer to 5.2.2)
National sector authority (i.e. MWE), and in particular, relevant sub-sector authority (i.e. GARWSP) are able to lead other national sub-sector development institutions (e.g. RWSSP, SFD, and PWP) and ESAs (External Supporting Agencies: donors, NGOs, and private sector organizations) constructively through the process of establishing, implementing, and monitoring the sub-sector development policies and strategies.

Key Capacity 3 (refer to 5.2.3)
Functional roles and responsibilities of each sub-sector development institution at national and local level are clearly defined, and appropriately shared in the decentralization framework facilitated in the sub-sector development.

Key Capacity 4 (refer to 5.3.1)
Good institutional structure and mechanism exists at GARWSP headquarters and branch offices to achieve organization's mission and goal efficiently and effectively.

Key Capacity 5 (refer to 5.3.2)
Formal and informal leadership exists at appropriate level for achievement of organizational goal of GARWSP.

Key Capacity 6 (refer to 5.3.3)
Human resource of GARWSP is strategically planned, developed, and assessed and rewarded properly.

Key Capacity 7 (refer to 5.3.4)
Financial management (financial planning, financial accountability, and financial monitoring) is properly undertaken.

Key Capacity 8 (refer to 5.3.5)
Facilities and equipment for organizational operation is adequately available.

Key Capacity 9 (refer to 5.3.6)
Program/service management for organizational operation (planning, implementation, and monitoring) is efficiently and effectively carried out.

Key Capacity 10 (refer to 5.3.7)
Effective and efficient process management is in place to facilitate proper planning, problem-solving practice, and decision making of the organization/institution.

8.4 SWOT (Strength, Weakness, Opportunity and Threat) Analysis

Followed by identification of key capacity areas, a systematic SWOT analysis was carried out through workshop with GARWSP working group. As explained earlier, currently existing capacity for each capacity area is assessed as strengths and weaknesses, while analysing opportunities and threats which turn to the bases for the capacity action plan at three different layers (system/enabling environment, organization/entity, and individual). Finally, actions to be undertaken solely by GARWSP are driven as the action plan of GARWSP for capacity development. The results of SWOT analysis for each capacity areas and action plan of GARWSP for capacity development is compiled as a matrix at the end of this section (refer to Table 8-2).

8.5 Proposed Action Plan

Opportunities and threats identified for each capacity area are turned to the objectives and various sets of activities required for improvement of capacities. Among wide variety of objectives and activity sets for capacity development, the following are considered as major focus needs for capacity development of GARWSP in its organizational management and functional operations.

8.5.1 Main Focus Needs for Capacity Development

(1) Adoption of Demand Responsive Approach

Following the lesson learnt from using a supply driven approach of water supply projects implemented in the past through the initiative of the administration which gave reason for low sense of ownership by the community, the importance of a demand responsive approach (DRA) at every stage of the project cycle is emphasized in the National Water Policy as well as the National Water Sector Strategy. Thus, DRA becomes the main approach having convincing concept for planning and implementation of water supply development projects in the country, of which principles are summarized as follows:

- community initiates and makes informed choices about service options based on their willingness to pay and acceptance of responsibilities for operation and maintenance;
- community contributes to investment cost relative to the level of services and has control over how funds are managed;
- Adequate flow of information to the community as well as procedures for collective decision-making within the community are carried out;
- Communities make choices on how water and sanitation services are managed;
- Government has facilitating roles, sets clear national policies and strategies, and creates an enabling environment for all participating groups;
- Community owns and is responsible for sustaining its water and sanitation facilities;
- Community capacity is appropriately strengthened; and
- The approach promotes innovation and recognizes the need for flexibility.

Deliberation on these principles gives clear and convincing understandings that DRA requires, in each and every stage in the project cycle, any undertakings to be initiated by the community, and carried out by the development authorities with the community in a responding manner to community's felt needs, through which the community increases considerably their sense of ownership within the entire process in development projects in planning, implementation, operation and maintenance, and monitoring.

Since DRA is a relatively new concept introduced in the country, establishment of its methodology in practice is gradually being developed. However, deliberation on the principles of DRA can be reflected for determination of some methodologies and practices at each stages of the project cycle as explained below.

Participatory Planning Stage

a. Community identification and submission of the community request

At a very initial stage in the project cycle, communities are responsible to prepare the request of the project for improved water supply, in accordance with the request format prepared by the authority. In the request, the community should identify and specify their needs with description of the current supply conditions, served population, types of work required, items to be contributed by the community, proposed means for operation and maintenance, and other relevant information, which become the basis for consideration and prioritization by development authorities (GARWSP Branch Offices and Local Councils) for implementation of the project. Thus, capacity of the community must be judged not only to identify the needs, but also to specify them in consideration of degree of demand, availability of community contribution, and preferred technology. Wherever required, the development authorities should provide support to the communities from this stage.

b. Prioritization of development need and preparation of strategic development and investment plan

With a given limitation in the development fund, GARWSP Branch Office, in collaboration with Local Council, must prioritize the various development needs identified and raised through community requests. The prioritization of the communities should be made in accordance with the improved technical and socio-economic criteria fairly developed by GARWSP and Local Council for the purposes. Moreover, this prioritization will be the basis for not only for annual development plan of GARWSP Branch Offices, but also the basis for longer term strategies such as Mid-Term Development and Investment Plan of GARWSP Branch Office. As it is observed in the Capacity Assessment of the Study, currently without such a prioritization and strategic long-term development and investment plan, GARWSP tends to scatter its financial resources to a number of partial construction works to cover communities as much as possible due to political and community pressures, but concentrating mostly on the drilling works not followed by subsequent works to complete the entire supply scheme. Thus, preparation of such mid- and long-term development and investment plan of GARWSP Branch Offices in collaboration with Local Councils could be indispensable to realize strategic implementation of the project according to the identified and prioritized development needs with deliberated allocation of the limited fund, in an integrated manner with district/governorate development and investment plan.

c. Participatory needs assessment, and survey for willingness/affordability to pay

In the target communities selected for project implementation according to the priority and strategic development and investment plan, participatory needs assessments with communities are carried out, utilizing participatory tools such as PRA (participatory rapid appraisal). PRA covers a wider range of community development issues, but is designed particularly for water and sanitation, and their cross-cutting issues such as gender and poverty. Participatory needs assessment at this stage has a major two-folded purpose: 1) that the development authority comprehends socio-economic, socio-cultural, and political conditions relating to water and sanitation, and 2) that the community identify and analyze problems pertaining to water and sanitation, as well as their available resources and capacity to cope with them. The results and observations obtained through the participatory needs assessment become the basis for further planning for improved water supply.

At this stage, the community's willingness and affordability to pay (WTP/ATP) for the improved water supply scheme is confirmed, either through the participatory needs assessment or applying "contingency valuation methods" or the well-known "willingness-to-pay survey".

d. Participatory planning, and informed choice

Participatory needs assessment is followed by planning in the same participatory manner. The results and observations obtained in the needs assessment, such as the most area affected by water and sanitation improvement shortage, determination on the served area in priority, land availability, conflicting issues in the community and/or among neighbour communities, marginalized populations in the community, current community capacity for organized management and operation of their common properties, and a kind and degree of community contribution in construction, and operation and maintenance, all shall be considered in the preparation of the water supply plan.

Importantly at this stage, a technical option for the improved water supply and management option for the supply scheme is selected by the community through consultation with development authorities.

In the community's informed choice of technologies for improved water supply, various technical supply options are brought up to the communities with implications of technical requirements and expertise necessary for operation and maintenance, as well as cost implications for the construction itself, community's contribution, and operation and maintenance. Reviewing the results and observations obtained by the participatory needs assessment and WTP/ATP survey, the community is consulted with the development authorities (GARWSP Branch Offices and Local Councils) and finally decide on the most suitable technical option for improved water supply.

Along with the informed technology choice by the community, management options for the determined supply scheme option are also consulted with local authorities. Several community management options (management entities) are presented and consulted with their advantages/disadvantages and managerial requirements, such as conventional/traditional management entities headed by traditional village authority, unregistered water committees, registered WUAs (water user associations), and so forth. Reviewing the results and observations acquired in the participatory needs assessment, as well as technical and managerial requirements in the determined supply scheme, final decision on selection of the management option is made by the community. In this process, a gap exists between the current capacity and requirements in management and operation/maintenance for the supply scheme, which shall be the basis for preparation of the training program to the community.

e. Agreed responsibility sharing

According to the basic water supply plan prepared in a participatory manner along with determined technological and managerial options for the supply scheme, duties and responsibilities among the community, GARWSP (Branch Offices and Headquarters), and Local Councils are further elaborated and agreed by them in implementation, management, and operation and maintenance, as well as in the post-implementation period of regulation and monitoring. Determination of the community's contribution in implementation (construction), management, and operation and maintenance is rather important at this stage, in order to increase their sense of ownership for the improved water supply.

Implementation Stage

a. Implementation work sharing

The implementation (construction, rehabilitation, and extension) of the improved supply scheme is carried out in a sharing manner according to the agreement between the community, GARWSP Branch Offices, and Local Councils. A mutual monitoring and supervising mechanism is developed by forming supervising committees composed of representatives from each actor.

b. Community's supervision

Whenever private contractors are employed in the implementing works for improved water supply schemes, such as construction of boreholes and water tanks, roles of communities to supervise their work may not be neglected. It is rather important to allow the community, defined in the contract with contractors, to inspect the quality of works according to the specifications prepared for the particular works contracted, so that the community further increase the sense of ownership in the supply scheme. Eventually, improvement of the community's capacity in the supervision works is also necessary.

Operation and Maintenance Stage

a. Creation of improved community-based management

DRA places a great emphasis on creation of improved community based-management for sustainability of the water supply schemes, and a number of rural water supply projects have been implemented practicing several approaches and methodologies in pursuit of it. The Study identified a number of "good practices" carried out by the user communities with provision of technical guidance and advice by local authorities and other donors for realization of improved community based-management. These good practices are classified in the following five contributing aspects for improvement of community-based management;

- Improved mode of community-based management entity
- Enhanced technical and managerial expertise in scheme management, operation and maintenance
- Increased community ownership in management, and operation and maintenance of the supply scheme
- Enhanced collective decision making and accountability/transparency
- Established channel (interface) of user communities with local authorities

The Study further elaborated methodologies recommended for the creation of improved community-based management in each of the above mentioned contributing aspects, as described in the strategies and approaches of the social mobilization component of the Pilot Project, as well as those in the Operation and Maintenance Plan under the Study (refer to Chapter 7, 7.5 Social Mobilization Component and Improved Community-Based Management).

b. Capacity building of community-based management entity

Capacity building of the community, in particular community-based organization, is one of the significant principles in DRA for realization of improved community-based management for the improved water supply schemes. Capacity gaps for required expertise in scheme management, and operation and maintenance, are identified with the target community, in the early stage of the project implementation, such as participatory needs assessment and determination of technical and management options. These identified gaps are turned into strategic training programs, which really meet their identified requirements that differ from community to community, and scheme by scheme.

c. Establishment of interface of community to the local authority

DRA is applied not only for implementation of projects, but also for the post-implementation stages of projects, such as follow-up, and regulation and monitoring stages. One of the important issues in the post-implementation stages is to establish and maintain the interface of user communities with relevant local authorities (GARWSP Branch Offices and Local Councils) to enjoy their technical and managerial guidance continuously even after the implementation of the project, which provides preventive measures against system breakdowns and/or malfunction of the community-based management entity. Strategies and approaches in this aspect is also described in the strategies and approaches of the social mobilization component of the Pilot Project, as well as those in the Operation and Maintenance Plan under the Study

During the course of the above activities, application of DRA into community assistance by the administration, especially GARWSP branch offices, is essential. Also, since these are significant factors for capacity building of these branch offices, the concepts for capacity development in the rural water supply sector were determined.

(2) Organizational Development under Decentralization

The main issue in the national strategy of Yemen for the rural water supply sub-sector as well as the sub-sector development strategy for GARWSP is the promotion of implementation of rural water supply projects organized under GARWSP branch offices and local councils. While responsibilities for project implementation are being transferred to local authorities, capacities of GARWSP branch offices and local councils for project cycle management, involving planning, implementation, supervision and monitoring, need to be strengthened. Based on responsibility allocations of each branch office and local council clearly identified through the capacity assessment made during the first fiscal year study, a plan for capacity development of the system was considered.

Indeed, most of the capacity development needs identified through the Capacity Assessment under the Study, Key Capacity Areas 4 – 10 as mentioned above, are concentrated on the issues relating to organizational development of GARWSP headquarters and particularly branch offices, while Key Capacity Areas 1 - 3 are much related to legislation and administration in sub-sector development and coordination. Appling a systematic planning matrix and SWOT analysis, methodologies and approaches (i.e. defined as objectives in each Key Capacity Area in the matrix) for each of Key Capacity Areas 4 - 10 (key issues for organizational development of GARWSP) are determined as follows.

Key Capacity (4) describes:
Good institutional structure and mechanism exists at GARWSP headquarters and branch offices to achieve organization's mission and goal efficiently and effectively.

Objectives for Key Capacity (4) are determined as:

- Improved institutional arrangements, such as well-established organizational structure, bylaws, job description, and operation manual, for GARWSP headquarters are prepared and finalized.
- GARWSP Decentralization Plan is improved with delineation of the local institutional framework for project implementation consistent with the national policy-strategy for sub-sector development and reform.
- GARWSP Decentralization Plan is further facilitated.
- Standard organizational structure of GARWSP branch office and job description for its departments and sections are developed and implemented.

Key Capacity (5) describes:
Formal and informal leadership exists at appropriate level for achievement of organizational goals of GARWSP.

Objectives for Key Capacity (5) are determined as:

- Decision making process and system with distribution of responsibilities to lowest appropriate level is designated.
- The designated process and system is reflected to the organizational structure and job description of GARWSP mentioned above.

Key Capacity (6) describes:
Human resources of GARWSP are strategically planned, developed, and assessed and rewarded properly.

Objectives for Key Capacity (6) are determined as:

- Improved institutional arrangements (organizational structure, bylaws and job descriptions) are prepared and finalized.
- Evaluation system for performance of the department/section and staff of GARWSP is developed and improved.
- Improved and strategic training program of GARWSP for mid-term is developed and implemented.

Key Capacity (7) describes:
Financial management (financial planning, financial accountability, and financial monitoring) is properly undertaken.

Objectives for Key Capacity (7) are determined as:

- GARWSP's mid-term development and investment plan, serving as a national sub-sector development and investment plan, is formulated in a strategic manner to achieve investment requirements and development indicators set in NWSSIP, based on mid-term regional sub-sector development and investment plan prepared by GARWSP branch offices through proper needs assessment, and technical and socio-economic survey.
- Development funds for GARWSP branch offices are allocated according to its decentralization plan, along with development of an accountable and transparent financial system in headquarters and branch offices.

Key Capacity (8) describe as:
Facilities and equipment for organizational operation is adequately available.

Objectives for Key Capacity (8) are determined as:

- GARWSP's decentralization plan is further facilitated, in terms of re-allocation of human, financial, and physical resources necessary for implementation of projects in a decentralized and DRA manner.

Key Capacity (9) describes:
Program/service management for organizational operation (planning, implementation, and monitoring) is efficiently and effectively carried out.

Objectives for Key Capacity (9) are determined as:

- A mid-term regional sub-sector development and investment plan is formulated by each GARWSP branch office in collaboration with local councils and other sub-sector development institutions, based on proper community prioritization through appropriate technical and socio-economic considerations.

- Sub-sector development projects are implemented strategically according to the mid-term regional sub-sector development and investment plan in terms of a project cycle of 2 years for one entire scheme to be completed and financially arranged.
- Project planning and design is prepared through proper technical and socio-economic consideration and study in a DRA manner by GARWSP branch offices, developing a guideline for project planning and design.
- GARWSP's decentralization plan is further facilitated, in terms of re-allocation of human, financial, and physical resources necessary for the implementation of project in a decentralized and DRA manner.
- Introduction of DRA in the whole project cycle of GARWSP is further enhanced with particular consideration on the following: 1) participation and mobilization skills, 2) demand responsive methodology in planning, designing, technology choice, and operation and maintenance, 3) WUA development, 4) community financing, and 5) hygiene and sanitation education and service provision, etc.
- Decentralized management of GARWSP branch offices in project implementation, including procurement of contractors and suppliers, is realized and improved to assure efficiency in the undertakings.
- Introduction of WUA in a DRA manner, through participation, consensus building for management options, community election, preparation of constitution, and registration, is facilitated by GARWSP branch offices through clearly defined and shared responsibilities with local councils.
- A guideline for WUA formation and capacity development is prepared and utilized among GARWSP branch offices and local councils.
- Capacity of WUA in scheme management is improved through provision of technical and managerial guidance by GARWSP branch offices and local councils.
- Roles and responsibilities in monitoring and follow-up of the project is clearly shared between GARWSP branch offices and local councils. Uniformed reporting system in monitoring and follow-up is developed and introduced both for GARWSP branch offices and local councils to share the information.

Key Capacity (10) describes:
Effective and efficient process management is in place to facilitate proper planning, problem-solving practice, and decision making of the organization/institution.

Objectives for Key Capacity (10) are determined as:
- Database for rural water sub-sector in the country and regions is fully developed and updated for strategic planning, and monitoring and evaluation purposes.
- Systematic and uniformed monitoring system on the organizational operation of GARWSP headquarters and branch offices by applying quantitative and qualitative performance indicators is fully developed and implemented.

Determining these objectives (methodologies and approaches) to cope with each Key Capacity Area, the Matrix of Action Plan for capacity development of GARWSP further describes activities in detail as well as in steps, in order to achieve these objectives.

(3) Community-Based Management and Capacity Building

For sustained provision of a community based rural water supply service, capacity building on operation and maintenance of the target community as well as periodic provision of administrative support in technical assistance and monitoring are required. Capacity building on participatory formation of water committees, fostering of community based operation and maintenance, and periodic monitoring are needed for GARWSP, especially their branch offices. Building of capacity for community based operation and maintenance requires a comprehensive strengthening of skills for (1) technical aspects of operation and maintenance, (2) organizational management, and (3) financial aspects including accounting, tariff setting, fee collection and funds management. Therefore, a plan for GARWSP branch offices to acquire these capacity building skills is mostly considered.

The Study further elaborated methodologies and approaches recommended for the creation of improved community-based management, as described in Chapter 7, Section 7.5 “Social Mobilization Component and Improved Community-Based Management”, as well as in the operation and maintenance plan under the Study.

(4) Increasing Awareness on Water and Sanitation

In past rural water supply projects, placement of importance on health and hygiene through construction of sanitation facilities (such as toilets) and awareness building on community sanitation was very low, and impacts of water supply improvement on health and hygiene could not be effectively conveyed. Also, construction of rural sanitation facilities was not a responsibility of GARWSP, but due to growing concern for this sector, the Ministry of Water and Environment formulated a strategy for the sanitation sector, and its implementation by GARWSP is under consideration. In this study, health and hygiene, especially measures for raising awareness of residents on water and sanitation, was considered. More definitely, participatory methods such as PHAST (participatory health and sanitation transformation), a sanitation awareness improvement method whose effectiveness has been confirmed in many developing countries, was introduced. Furthermore, measures for conservation of domestic water sources, such as protection of above ground sections of water sources by residents, were considered.

8.5.2 Matrix for Action Plan

The matrix presented in Table 8-2 forms the action plan for capacity development of GARWSP compiled from results of SWOT analysis. This matrix was finalized by specifying resources and potential partners to undertake actions for capacity development through consultation with GARWSP during the Study.

Table 8-2 Matrix for Action Plan for Capacity Development of GARWSP

Key Development Issue / Key Capacity Area	Rating 1 2 3 4 5	Weigh	Narrative Review of Capacity: Strengths and Weaknesses — System/Enabling Environment - Organization/Entity - Individual	Capacity Development Actions: Opportunities and Threats — System/Enabling Environment	Organizational/Entity	Individual	Task Description for Capacity Development of GARWSP: Objective and Activities undertaken by GARWSP	Human Resource	Financial Resource	Physical Resource	Partners	Period
Key Capacity (1) National policies-strategies of sub-sector development and reform, and strategic plans of relevant national authority (i.e. GARWSP) are formulated in consisted manners. Legal and legislative framework for sub-sector development institutions is developed based on national sub-sector development and reform policies-strategies.			【Enabling Environment】Strength Decentralization in the sub-sector development becomes one of key issues in each national policy and strategy, receiving strong political and administrative commitments (and possibly by external pressure). 【Enabling Environment - Organization】Weakness Institutional/organizational frameworks set in the national reform policy of the sub-sector and GARWSP decentralization plan/strategy for the implementation of rural water supply projects is not consistent. National Rural Water Reform Policy (Draft) and National Rural Water Supply and Sanitation Policy-Strategy advocate establishment of GRA (Governorate Rural Water Supply and Sanitation Authority) under Governorate Local Council for the implementation of rural water supply project, while GARWSP promotes capacity of its branch offices under the current institutional setting for the same purpose. 【Enabling Environment】Weakness National sub-sector development and reform policy-strategy is not finalized yet, while decentralization policy of local authority is in effect, in which responsibilities in infrastructure development including rural water supply are vested to local councils. Under the circumstances, legal and legislative framework of the sub-sector institutions at local level (i.e. GARWSP branch office and local councils) for sub-sector development is not clearly defined.	National authorities, led by MWE, may facilitate policy dialogue with central and local, internal and external stakeholders in the sub-sector development, and finalized the sub-sector development and reform policy. Institutional arrangement with GARWSP decentralization plan to delegate functional responsibilities for project implementation to branch offices can be agreed as transitional framework of local institution for the sub-sector development. Reviewing its performance and effectiveness of branch offices among stakeholders in a completion of plan (2010), final decentralized institutional arrangement will be determined.	Current Decentralization Plan of GARWSP may be revised with re-definition of local institutional framework (among GARWSP branch office, local council, and other local institutions) in transitional and final stages being consistent with the national sub-sector development and reform policy. Then the transitional and final framework may be incorporated in the finalized national sub-sector reform policy. GARWSP may actively promote consultation with Ministry concerned, in particular with MWE and MLA, and other stakeholders and actively participate in the process of sub-sector policy-strategy formulation.	Capacity of GARWSP staff to review the sub-sector development and reform policy-strategy, and to modify GARWSP decentralization accordingly may exist inside, experienced in the preparation of existing decentralization plan.	【Objective 1-1】 GARWSP Decentralization Plan is improved with delineation of local institutional framework for the project implementation in transition and final stage consistent with national policy-strategy of the sub-sector development and reform. Institutional framework in transitional and final stages delineated in GARWSP Decentralization Plan is reflected in the national sub-sector development and reform policy, or vice versa. 【Activity Set 1-1】 1 prepare scope of assignment to the unit/section/department responsible for preparation of revised GARWSP Decentralization Plan. 2 review the national policy-strategy for sub-sector development, decentralization policy-strategy of local administration, and other relevant national policy in other sectors. 3 Identify the issues to be reconsidered and incorporated into GARWSP Decentralization Plan, in particular, issues relating to transitional and finalized institutional arrangement among GARWSP branch office and local councils for the project implementation. 4 Consult with Ministry of Environment and Water, other sector development institutions (RWSSP, SFD, PWP), and Ministry of Local Authority to build consensus on the transitional and future institutional / organizational framework under GARWSP Decentralization Plan. 5 Prepare the draft of revised GARWSP Decentralization Plan with clear suggestion of local institutional framework in transition and final in the line with national sub-sector development and reform policy and other relevant decentralization policy. 6 Consult with MEW for provisional approval on draft final of GARWSP Decentralization Plan for its distribution to the stakeholders. 7 Present and build consensus on revised GARWSP Decentralization Plan among the Ministry concerned, other development institutions, and local authorities, and receive comments and feed back.. 8 Finalize the revised GARWSP Decentralization Plan and facilitate its approval and endorsement by MWE. 9 Participate and interact actively in the process of establishing national sub-sector development and reform policy-strategy, and facilitate integration of local institutional framework suggested under GARWSP Decentralization Plan into national policy-development, or vice versa.					

Table 8-2 Matrix for Action Plan for Capacity Development of GARWSP

Key Development Issue / Key Capacity Area	Rating 1 2 3 4 5	Weigh	Narrative Review of Capacity: Strengths and Weaknesses — System/Enabling Environment - Organization/Entity - Individual	Capacity Development Actions: Opportunities and Threats — System/Enabling Environment	Organizational/Entity	Individual	Task Description for Capacity Development of GARWSP: Objective and Activities undertaken by GARWSP	Human Resource	Financial Resource	Physical Resource	Partners	Period
Key Capacity (2) Extent to which national authority (MWE), and relevant sub-sector authority (GARWSP) in particular, are able to lead other national sub-sector development institutions in country and ESAs (External Support Agencies: donor, NGOs, and private sector institution) constructively through the process of establishing, implementing, and monitoring the sub-sector development policies and strategies.			【Enabling Environment】 Strength NWSSIP 2005-2009 was developed and endorsed to facilitate sector coordination sharing national vision in water sector including rural water sub-sector development among stakeholders, with development of a set of national investment program to enhance co-finance by national development agencies and External Support Agencies (ESAs; NGOs, private sector, and donors) under shared investment target.	Current sub-sector coordination mechanism of "strength", such as implementation of NWSSIP, PAWS, co-financed project/program among sub-sector development institutions, and sub-sector coordination meetings, may be further facilitated.		There are human resources available internally in GARWSP, if not externally, to review and assess current co-ordination mechanism and prepare proposal for re-organized and unified mechanism under NWSSIP initiatives for the sub-sector.	【Objective 2-1】 Current sub-sector coordination mechanism of GARWSP is further facilitated and improved. A number of current coordination mechanism are reorganized and unified under the mainstream of NWSSIP initiatives in the sub-sector development.					
			【Organization】 Strength The amount of required investment allocated to GARWSP accounts for more than 60% of the total requirement in NWSSIP investment program. With this outstanding financial capability, GARWSP is in a position to lead the sub-sector development among a number of development institutions.	There may be political will and commitments to re-organize and unify a number of national sub-sector development institutions under MWE/GARWSP, when their capacity is fully developed.	GARWSP may prepare its mid-term investment program for the sub-sector development in accordance with NWSSIP investment requirement. Its investment program may be strategic and in detail based on mid-term district/regional sub-sector development plan prepared by its branch office and local council through proper needs assessment, and technical and socio-economic study.		【Activity Set 2-1】 1 Conduct review meeting with stakeholders involved in the sub-sector development, on a number of current coordination mechanism, such as in the implementation of NWSSIP, PAWS, co-financed project/program with other sub-sector development institutions, and sub-sector coordination meetings.					
			【Enabling Environment】 Weakness The current sub-sector environment makes it difficult for the national authorities responsible for rural water supply development, MWE/GARWSP, to lead the process of establishing, implementing, and monitoring national development policies/strategies, and investment plan, where a number of national development institutions establishing PMU as decision making body independent from MWE/GARWSP exist with different modalities in decision making in planning, implementation, and financing.				2 Assess each co-ordination mechanism in; 1) leading coordinator and key stakeholders involved, 2) frequency of coordination, 3) objectives of achievement, and performance indicators set, 4) degree of achievement and its efficiency, 5) monitoring and reporting system, 6) feedback system to each institution of stakeholders involved (i.e. how the agreement made in the coordination mechanism affect undertaking of each stakeholder, and 7) impellent and hindrance					
			【Enabling Environment - Organization】 Strength Netherlands government and MWE endorse on the agreement of PAWS, which co-financing with MWE/GARWSP and other national development institutions and ESAs under shared policies and strategies.		NWSSIP Coordination and Monitoring Committee for Rural Water Supply Sub-Sector Development may be formed, led by GARWSP initiative. The Committee would be consisted of representatives from MWE, GARWSP, each national development institutions, and ESA investing for the sub-sector development, and hold quarterly progress meetings and yearly review meetings to monitor and evaluate achievement set in NWSSIP investment program for the sub-sector development.		3 Prepare review paper for the sub-sector co-ordination, and proposal for re-organized co-ordination mechanism under NWSSIP initiatives in the sub-sector development.					
			【Organization】 Strength Rural water supply component in NWSSIP is reviewed for the first time in 2006 and to be reviewed yearly, led by GARWSP with national sub-sector development agencies and ESAs.				4 Take initiatives to form NWSSIP Coordination and Monitoring Committee for the sub-sector co-ordination and development under the re-organized and unified mechanism, which consists of MWE, GARWSP, each national sub-sector development institutions, and ESAs.					
			【Organization】 Strength At the local level, co-financed project with other national development institutions (SFD, PWP) are facilitated among GARWSP (branches), Local Authority, and national development institutions (PWP and SFD). Also, implementation of co-program is planned with RWSSP.				5 Set performance objectives, expected output, performance indicators, and activities with co-investment plan for NWSSSIP Coordination and Monitoring Committee.					
			【Organization】 Weakness GARWSP has not still yet develop full leadership and ownership in the process of the sub-sector coordination through comprehensive and detail analysis in the sub-sector development, database development, and development (re-orientation) / implementation / monitoring and evaluation of strategic national policy and /strategy.				6 Conduct regular NWSSIP Coordination and Monitoring meetings under re-organized co-ordination mechanism to monitor the performance and achievement set with stakeholders.					
			【Organization】 Weakness GARWSP mid-term development and investment plan, serving as national sub-sector development and investment plan, is not fully developed in accordance with NWSSIP investment plan, which shall be a base for the sub-sector coordination and planning for co-finance among a number of national development institutions.				【Objective 2-2】 GARWSP mid-term development and investment plan, serving as national sub-sector development and investment plan, is formulated in a strategic manner to achieve investment requirement and development indicators set in NWSSIP, based on mid-term regional sub-sector development and investment plan prepared by branch office through proper needs assessment, and technical and socio-economic study.					
							【Activity Set 2-2】					
							1 Mid-Term Regional Sub-Sector Development and Investment Plan is prepared by each GARWSP BO, through proper needs assessment, and technical and socio-economic study.【Cross-apply to Activity Set of 9-1】					
							2 Review development fund allocated and achievement in each Governorate.					
							3 Review the development and investment requirements in each Governorate set in NWSSIP.					
							4 Based on the Mid-Term Regional Sub-Sector Development and Investment Plan and review results above, Draft of GARWSP Mid-Term Development and Investment Plan is prepared.					
							5 Present Draft of GARWSP Mid-Term Development and Investment Plan to Ministries concerned, other development institutions, local authorities, and NGOs.					
							6 Receiving feedback and comments from stakeholders, finalize the draft of GARWSP Mid-Term Development and Investment Plan, and facilitate its approval and endorsement by MWE					
Key Capacity (3) Extent to which functional roles and responsibilities of each institution at national and local levels are defined clearly without omissions and overlaps and appropriately shared in the decentralization framework facilitated in the sub-sector development.			【Environment】 Weakness Functional responsibilities and roles of stakeholders involved in the sub-sector development are not clearly defined in the sub-sector policies and strategies. Legislation to define the functions of central and local institutions for the sub-sector development is also not developed.	In the process to review the draft rural-water sub-sector supply policy-strategy, roles and responsibilities of stakeholders are clearly defined and agreed with stakeholders.	Current Decentralization Plan of GARWSP may be revised with re-definition of local institutional framework (among GARWSP branch office, local council, and other local institutions) in transitional and final stages being consistent with the national sub-sector development and reform policy. Then the transitional and final framework may be incorporated in the finalized national sub-sector reform policy.	Capacity of GARWSP staff to review the sub-sector development and reform policy-strategy, and to modify GARWSP decentralization accordingly may exist inside, experienced in the preparation of existing decentralization plan.	【Objective 3-1】 Cross apply【Objective 1-1】above. GARWSP Decentralization Plan is improved with delineation of local institutional framework for the project implementation in transition and final stage consistent with national policy-strategy of the sub-sector development and reform. Institutional framework in transitional and final stages delineated in GARWSP Decentralization Plan is reflected in the national sub-sector development and reform policy, or vice versa.					
			【Organization】 Weakness Functional responsibilities and roles of GARWSP headquarters and branch offices are defined, yet not well recognized in the policies and strategies of the sub-sector development.	Functional responsibilities and roles of GARWSP headquarters and branch offices are clearly defined and delineated in the national sub-sector development policy-strategy.			【Activity Set 3-1】 Cross apply【Activity Set 1-1】above.					
					GARWSP may actively promote consultation with Ministry concerned, in particular with MWE and MLA, and other stakeholders and actively participate in the process of sub-sector policy-strategy formulation							

Table 8-2 Matrix for Action Plan for Capacity Development of GARWSP

Key Development Issue / Key Capacity Area	Rating 1 2 3 4 5	Weigh	Narrative Review of Capacity: Strengths and Weaknesses — System/Enabling Environment - Organization/Entity - Individual	Capacity Development Actions: Opportunities and Threats — System/Enabling Environment	Organizational/Entity	Individual	Task Description for Capacity Development of GARWSP: Objective and Activities undertaken by GARWSP	Human Resource	Financial Resource	Physical Resource	Partners	Period
Key Capacity (4) Good institutional structure and mechanism exists at GARWSP headquarters and branch offices to achieve organization's mission and goal efficiently and effectively.			【Organization】Weakness Organizational structure, job description, and operation manual for each department of GARWSP headquarters and branch office are under preparation since its establishment in 2002, but not yet approved. The proposed organizational structure is not well designed to facilitate interactive and dynamic process in strategic planning, implementation, monitoring and regulation. The proposed organizational structure indicates top management, rather than facilitating distribution of decision making at appropriate lowest level. Department or units deal with community affairs and human resource development are missed in the organizational framework of GARWSP headquarters. 【Organization】Strength GARWSP Branch Office Decentralization Plan is formulated and implemented. 【Organization】Weakness Uniformed organizational structure, bylaw, and operation manual of branch office is not uniformly developed to facilitate strategic planning, implementation, monitoring and regulation, and coordination with other development partners at local level. Operation manuals / guidelines, bylaws, and organizational charts of departments/sections of HQ and BOs are drafted, although those are neither finalized nor approved. There are some omissions and overlaps in determination of their tasks. Moreover, those manuals and guidelines are developed independently by department concerned. As a result, those manuals and guidelines exist scattered, not integrated and compiled as a entire organizational operation and management manual/guideline. Those are also developed ignoring the important aspect in organizational operation of interaction among departments and sections. Staff requirement is not satisfied, in particular, in Al Mahweet branch office. Some delay in the implementation of decentralization plan is observed.		Current draft of organizational structure, bylaw, job description, and operation manual of GARWSP headquarters may be assessed internally and externally. Also, current interactive process among each department in organizational operation, planning, implementation, monitoring, may be examined. Through those assessment, improved institutional arrangements are identified and finalized. External consultants may be also employed to facilitate the process. Implementation of current GARWSP Decentralization Plan may further be enhanced without delay. Current organizational structure, bylaws, job description, and operation manual of GARWSP branch office may be reviewed and assessed. Standard branch organizational structure, bylaws, job description, and operation manual for sections and posts of branch offices may be developed and implemented.		【Objective 4-1】 Improved institutional arrangements (organizational structure, bylaw, job description, and operation manual for each department/section) for GARWSP headquarters are prepared and finalized. 【Activity Set 4-1】 1 Compile all the existing organizational chart, bylaws, job description, and operation manual and guideline drafted for each department/section of GARWSP HQ and BOs. 2 Review the mission statements, roles and responsibilities, decision making process, number and qualification of staff for each requirement, and in particular, interactive linkage among departments/sections of HQ and HQ and BOs. 3 Prepare the comprehensive list of bylaws, job description, and manual and guideline necessary for organizational operation and management for GARWSP HQ and BOs. 4 Identify the bylaw, job description, and manual and guideline not existing, and ones drafted already but needed to be improved. 5 Develop a comprehensive and compiled set of bylaws, job description, and manual and guideline with organizational chart for GARWSP HQ and BOs. 6 submit comprehensive set of bylaws, job description, and manual and guideline to approval. 【Objective 4-2】 GARWSP Decentralization Plan is further facilitated. 【Activity Set 4-1】 1 Review objectives and indicators of existing GARWSP Decentralization Plan 2 Study Local Administration Law of 2002, related bills, and Rural Water and Sanitation Policy-Strategy, to] identify future institutional framework for the sub-sector development under the Law. 3 Develop transitional and final institutional framework of local administration for the sub-sector development, being consistent with local administration laws, bills, and the sub-sector development policy-strategy. 4 Incorporate the transitional and final administrative framework of local administration (GARWSP Branch Offices) into GARWSP Decentralization Plan. 5 Prepare transitional plan for financial management, project implementation, human resource development in line with revised GARWSP Decentralization Plan. 6 Develop indicators for the revised GARWSP Decentralization Plan each for financial management, project implementation, and human development. 7 Implement revised Decentralization Plan and monitor the progress according to the indicators newly developed. 【Objective 4-3】 Standard organizational structure of GARWSP branch office and job description for its sections and posts are developed and implemented. 【Activity Set 4-3】 1 Review existing organizational structure, bylaws, and job description of GARWSP Branch Office. 2 Assess the requirements in operation and management of GARWSP Branch Office according to revised GARWSP Decentralization Plan. 3 Determine the required expertise, departments/sections, and number of staff, according to identified requirements of Branch Office. 4 Develop the most simple and replicable organizational structure of GARWSP Branch Office. 5 Prepare job description and bylaws for each department/section of Branch Office to meet requirements for Branch Office in its operation and management.					
Key Capacity (5) Formal and informal leadership exists at appropriate level for achievement of organizational goal of GARWSP.			【Organization】Strength Robust commitment of GARWSP Chairman in formal leadership is observed in organization's operational and management towards organizational goals. 【Organization】Weakness Responsibilities of formal decision making is not distributed to lowest appropriate level, which cause inefficiency in organization's operation and management. Top dominant decision making process has possibility to neglect opportunities of interaction by personnel possessing analytical background and knowledge valued for the issues of concerns. Organizational structure is not in favor to develop the systematic web of formal leadership and decision making. 【Organization】Weakness Informal leadership is merely emerged and facilitated in GARWSP, due to less opportunities to improve their capacities, and neglecting circumstances, and limited incentives and motivations.		Decision making analysis on GARWSP may be carried out, to identify current key decision makers at different levels, types of decisions made, and decision making processes. Based on the decision making analysis, improved decision making process with re-distribution of responsibilities in various types of decision making to appropriate lowest levels are identified, which would be reflected in the preparation of organizational structure, bylaw, and job description of the Authority.		【Objective 5-1】 【Activity Set 5-1】 Decision making process and system with distribution of responsibilities to lowest appropriate level is designed. The designed process and system is reflected to the organizational structure and job description of GARWSP mentioned above. 1 Conduct decision-making analysis to identify types of decision made and decision-making process employed in GARWSP headquarters and branch offices. 2 Carry out leadership assessment to identify the characteristics of current leadership at deferent level and preciseness of decision made or to be made in improved decision-making system. 3 Determine the type of decision to be transferred to the appropriate lower level. 4 Revise job descriptions and bylaws according to determination above.					

Table 8-2 Matrix for Action Plan for Capacity Development of GARWSP

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Key Capacity (6) Human resource of GARWSP is strategically planned, developed, and assessed and rewarded properly.			【Organization】Strength				【Objective 6-1】					
			There are 525 personnel in GARWSP, among which one third are degree holders.	Staff salary structure may be revised.	Organizational structure and job description of GARWSP may be developed and finalized.		Improved institutional arrangements (organizational structure, bylaw, and job description) are prepared and finalized.					
			【Organization】Weakness				【Activity Set 6-1】 Cross apply【Activity Set 4-1】above.					
			Capacity of organization staff of GARWSP is not fully utilized fully due to undecided organizational structure and by-law (job description)									
							【Objective 6-2】					
			Evaluation system for staff performance is not developed in GARWSP, which hampers proper allocation of staff and less motivations and incentives of staff.		Evaluation system for performance of department/section and staff may be developed and implemented in GARWSP.		Evaluation system for performance of department/sections and staff of GARWSP is developed and implemented.					
			【Enabling Environment】Weakness				【Activity Set 6-2】					
			Current staff salary structure of GARWSP gives less incentives and motivation for its employee, often which causes outflow of competent human resources.				1 Review the current evaluation and promotion system and indicators for performance of department/section and staff of GARWSP.					
			【Organization】Weakness				2 Study national laws and regulation for evaluation and promotion of government employee.					
			Provision of training for human resource development is limited to the basic training such as for computer skills and language (English), and training program to improve technical skills are few.		Training needs for GARWSP staff in headquarters and branch offices may be carried out, and improved and strategic training program in mid-term will be developed and implemented.		3 Determine performance indicators and prepare evaluation format.					
							4 Develop guideline for staff evaluation and provide guidance to the staff.					
							5 Adopt the guideline developed and carry out evaluation on regular bases.					
							【Objective 6-3】					
							Improved and strategic training program in mid-term is developed and implemented.					
							【Activity Set 6-3】					
							1 Conduct training needs assessment, and identify capacity gaps for requirements in organizational operation and management determined by newly developed job description.					
							2 Prioritize the training needs identified, and determine target groups for training.					
							3 Identify and consult with training providers for development of the program.					
							4 Prepare mid-term training program and curriculum in strategic manners.					
							5 Determine indicators for monitoring and evaluation of training program.					
							6 Carry out monitoring and evaluation of the training program.					
Key Capacity (7) Financial management (financial planning, financial accountability, and financial monitoring) is properly undertaken.			【Organization】Strength				【Objective 7-1】					
			Amount of budget allocated to GARWSP is stably increased, 90% of which is allocated as development fund.	Amount of governmental budget allocated to GARWSP may be stable or increased, through development of GARWSP Mid-Term Investment Program for the sub-sector development in accordance with NWSSIP investment requirements.	GARWSP may prepare its mid-term investment program for the sub-sector development in accordance with NWSSIP investment requirement. Its investment program may be strategic and in detail based on mid-term district/regional sub-sector development plan prepared by its branch office and local council through proper needs assessment, and technical and socio-economic study.		GARWSP mid-term development and investment plan, serving as national sub-sector development and investment plan, is formulated in a strategic manner to achieve investment requirement and development indicators set in NWSSIP, based on mid-term regional sub-sector development and investment plan prepared by branch office through proper needs assessment, and technical and socio-economic study.					
			【Organization】Weakness				【Activity Set 7-1】Cross apply【Activity Set 2-2】above.					
			Strategic and mid-term sub-sector investment program at governorate level, based on the regional mid-term development plan to be formulated through proper prioritization of communities, technical study, and socio-economic assessment, is not prepared by GARWSP branch offices in cooperation with local council. It hampers not only preparation of investment program and budget plan by headquarter in a strategic manner, but also strategic investment at local level, which often ends up 'spotted' implementation of project or a part of project component.				【Objective 7-2】					
			【Organization】Weakness				Development fund for GARWSP branch office is allocated according to its Decentralization Plan, with development of accountable and transparent financial system in headquarters and branch offices.					
			Absence of strategic investment plan at central and local level discourage other national development institutions and ESAs (donors, NGOs, private sector organizations) to cooperate in investment.				【Activity Set 7-2】					
			【Organization】Strength		Development fund for GARWSP branch office may be allocated according to its Decentralization Plan, with development of accountable and transparent financial system in headquarters and branch offices.		1 Develop Mid-Term Regional Sub-Sector Development and Investment Plan【Cross-apply to Activity Set of 9-1】.					
			The amount of development expenditure by GARWSP accounts for more than 60% of the total spent for the sub-sector development in the country. With this outstanding financial capability, GARWSP is in a position to lead the sub-sector development among a number of development institutions.				2 Based on the Mid-Term Regional Sub-Sector Development and Investment Plan, determine allocation of development fund for each GARWSP Branch Office.					
			【Organization】Weakness				3 Develop financial flow system from headquarters to branch offices.					
			Allocation of development fund to GARWSP branch offices are not yet provided, instead of its decentralization strategy.				4 Develop accounting and auditing system both for headquarters and branch office.					
							5 Allocate development fund for branch office which satisfy the requirements.					
			【Organization】Weakness				6 Conduct regular auditing.					
			Recurrent budget allocated to the branch office is not adequate to carry out undertakings relating to DRA (Demand Responsive Approach) in the sub-sector									
Key Capacity (8) Facilities and Equipment for organizational operation is adequately available.			Evaluation of facilities and equipment of GARWSP headquarters and branch offices are carried out under the Study. In general, the facilities and equipment of branch offices are insufficient for project implementation in the decentralized framework. The study results will be reflected in the equipment procurement plan.									

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Key Capacity (9) Program/Service Management for organizational operation (planning, implementation, and monitoring) is efficiently and effectively carried out.			【Organization】Strength				【Objective 9-1】					
			Functional roles and responsibilities of GARWSP headquarters, branch offices, local council, and community in the implementation of project is defined in GARWSP guideline.		Mid-Term Regional Sub-Sector Development and Investment Plan may be developed in each governorate and GARWSP BO in collaboration with local council, based on proper community prioritization through appropriate technical and socio-economic considerations.		Mid-Term Regional Sub-Sector Development and Investment Plan is formulated by each GARWSP BO in collaboration with local council and other sub-sector development institutions, based on proper community prioritization through appropriate technical and socio-economic considerations. Sub-sector development projects are implemented strategically according to the Mid-Term Regional Plan in terms of project duration (within 2 years) and financial arrangement.					
			Strengths and weaknesses of GARWSP (both headquarters and branch office), local council, and community in the implementation of the program/project are analyzed in detail, in the Capacity Assessment Matrix for Program / Service Management with scoring of project (Refer to the Matrix attached). The followings are significant organizational strength and weakness of each institution involved in the project implementation, dividing the stages into 1) planning-study, 2) implementation - service delivery, 3) service delivery - operation and maintenance, and 4) monitoring and evaluation.				【Activity Set 9-1】					
							1 List up all the uncompleted project sites and give a first priority.					
							2 Complete all the unfinished project.					
							3 Develop technical and socio-economic criteria for prioritize the target communities.					
					Project duration of GARWSP may be shorten to 2 years, implementing strategic development and investment plan of the regions and decentralized procurement system.		4 Develop field implementation manuals/guidelines for technical and socio-economic survey.					
			【Organization】【Planning - Study Stage】Strength and Weakness				5 Form SMT (Social Mobilization Team) and provide training for capacity building in DRA (Demand Responsive Approach) and socio-economic survey, or conclude contract with local consultant/NGO capable to carry out same activities.					
			Mid-Term Regional Sub-Sector Development and Investment Plan is not strategically prepared in collaboration with local council.									
			Community-request format is developed, but not fully recognized and utilized.									
			Technical and Socio-Economic Criteria for prioritization of requested communities are not adequately developed, nor fully utilized.				6 Carry out technical and socio-economic survey.					
					Uniformed guideline of project planning and design may be fully developed, and project design may be prepared through proper technical and socio-economic study in a DRA (Demand Responsive Approach) manner.		7 Prioritize target communities according to the technical and socio-economic criteria.					
			Prioritization of requested communities are often decided without proper application of criteria, and under strong community and political pressure.				8 Estimate project cost for each prioritized community.					
			GARWSP project cycle is often prolonged (3-5 years) due to 'spotted' financial arrangement without prioritization of requested communities.				9 Prepare Mid-Term Regional Sub-Sector Development and Investment Plan for each branch office in collaboration with Local Councils and other sub-sector development institutions (e.g. Public Works Project and Social Fund for Development).					
			Introduction of DRA (Demand Responsive Approach) in the project planning (village planning, demand responsive design and technology, willingness-to-pay survey, etc) is not realized yet in some governorate.									
							10 Submit the draft plan to GARWSP headquarters and finalize the plan incorporating feed back from HQ.					
			Internal procedure and communication system to receive, assess, accept, forward to further study is not well established nor recognized among GARWSP HQ, BO, and local council.		Capacity of BOs in human, financial, and physical resources for the project implementation may be further facilitated under the current Branch Decentralization Plan.							
			Proper community dialogue is often not facilitated to determine tasks and responsibilities among GARWSP and communities.				【Objective 9-2】					
			Uniformed guideline for project planning and designing is not fully developed, nor utilized. The draft guideline is missing some important socio-economic consideration in the design.				Project planning and design is prepared through proper technical and socio-economic consideration and study in a DRA (Demand Responsive Approach) manner by BOs, developing uniformed guideline for project planning and design.					
							【Activity Set 9-2】					
			Project design is often prepared without proper technical survey and socio-economic study.				1 Develop project planning and design manual.					
							2 Develop field implementation manual/guideline for technical and socio-economic survey【cross-apply to Activity Set of 9-1】.					
			Limited capacity (human resource, physical resource and financial resource) is allocated to branch office to carry out proper technical and socio-economic design and planning work.				3 Identify training needs of GARWSP branch office and local council for proper project planning and design.					
							4 Develop and provide training program for necessary capacity area.					
			SMT (or fund to employ SMT) is not available for most of BOs to carry out socio-economic survey.		Introduction of DRA (Demand Responsive Approach) in a whole project cycle of GARWSP may be further enhanced, with particular consideration in the following; 1) participation and mobilization technique, 2) demand responsive methodology in planning, designing, technology choice, and operation and maintenance, 3) WUA development, 4) community financing, 5) hygiene and sanitation education and service provision, etc.		5 Project planning and design employing the manual/guideline developed above.					
							【Objective 9-3】					
			【Organization】【Implementation - Service Delivery Stage】Strength and Weakness				GARWSP Decentralization Plan is further facilitated, in terms of re-allocation of human financial, and physical resources necessary for the implementation of projects in a decentralized and DRA manner.					
			Decentralized fund management of GARWSP BO, including fund flow system, accounting, auditing, and fund operation manual, is not established for capital investment (i.e. development cost).				【Activity Set 9-3】Cross-Apply【Activity Set of 4-1, 4-2, and 7-2】					
			Decentralized procurement-implementation of BOs is not in place.									
			Uniformed guideline of BOs for procurement of contractor and supplier (standard tender document, tender procedure, evaluation, contracting) is not developed, nor utilized.				【Objective 9-4】					
							Introduction of DRA in a whole project cycle of GARWSP is further enhanced, with particular consideration in the following; 1) participation and mobilization technique, 2) demand responsive methodology in planning, designing, technology choice, and operation and maintenance, 3) WUA (Water User Association) development, 4) community financing, 5) hygiene and sanitation education and service provision, etc.					
			GARWSP project cycle is often prolonged (3-5 years) due to delay in central management of procurement.									
			Delay of community work, such as pump house construction and pipe transportation and laying, causes other delay in project implementation.		Project implementation, including procurement of contractors and suppliers, may be managed by BOs in an efficient manner, under decentralized funding mechanism.		【Activity Set 9-4】					
			GARWSP BO is able to provide supervision work in construction and installation.				1 Study good practice for introduction of DRA into rural water supply projects, which are implemented by other sub-sector development institutions such as RWSSP, SFD, and PWP.					
			Introduction of DRA (Demand Responsive Approach) in the implementation stage (community dialogue and election, WUA development, community participation and mobilization techniques, sanitation service options, etc.) is not well carried out.				2 Examine existing manuals and guidelines developed by other sub-sector development institutions for introduction of DRA, as well as similar ones developed in other countries.					
							3 Study current approaches/methodologies of DRA and alternatives in the field of 1) participation and mobilization technique, 2) demand responsive methodology in project cycle, 3) WUA development, 4) community financing, and 5) hygiene and sanitation education and service provision.					
			【Organization】【Service Delivery - Operation and Maintenance Stage】Strength and Weakness		Introduction of WUA in a DRA manner, through participation, consensus building for management options, community election, preparation of constitution, and legislation, may be facilitated by BOs in clearly defined and shared responsibilities with local council.		4 Develop DRA manuals and guideline suitable for GARWSP's project implementation.					
			Processes to formulate WUA (Water User Association) in the communities through DRA such as community dialogue, consensus building, community choice for technical and managerial options, community election, preparation of constitutions, registration of organization under society law, is not facilitated by GARWSP branch office in collaboration with local council.				5 Identify training needs for introduction of DRA, and develop training program.					
							6 Form SMT (Social Mobilization Team) in branch offices or contract with local consultant/NGO for implementation of DRA in the projects.					
			Guideline for WUA in its operation and management is not prepared in the project area (Dahmar, Sana'a, Al-Mahweet).				7 Provide training package for capacity building of GARWSP branch offices in DRA.					
			Roles and responsibilities in formation and capacity building of WUA between GARWSP BOs and local council is not well defined and recognized in some governorates.		Capacity of BOs in human, financial, and physical resources for monitoring and evaluation may be further facilitated under the current Branch Decentralization Plan.		8 Introduce DRA in the project implementation.					
							【Objective 9-5】					
			Manual for technical training for communities is developed, although ones for financial management and organizational management are not fully developed.				Decentralized management of GARWSP BOs in project implementations, including procurement of contractors and suppliers, is realized and improved to assure efficiency in the undertakings.					
			Less capacity (human, financial, and physical resources) are available for community mobilization and capacity development at BOs									

Table 8-2 Matrix for Action Plan for Capacity Development of GARWSP

Key Development Issue / Key Capacity Area	Rating 1 2 3 4 5	Weigh	Narrative Review of Capacity Strengths and Weaknesses: System/Enabling Environment - Organization/Entity - Individual	Capacity Development Actions Opportunities and Threats: System/Enabling Environment	Organizational/Entity	Individual	Task Description for Capacity Development of GARWSP: Objective and Activities undertaken by GARWSP	Human Resource	Financial Resource	Physical Resource	Partners	Period
			Provision of hygiene and sanitation education and services are not undertaken by GARWSP in the implementation of project, due to current jurisdictional law and degree.		Guideline for WUA formation and capacity building may be prepared and utilized among BOs and local council. . Legal ownership arrangement may be also made for WUA.		【Activity Set 9-5】					
			Guideline and manual for hygiene and sanitation education and service provision is not prepared.				1 Allocate development fund for GARWSP branch offices【Cross-Apply Activity Set of 7-2 above】.					
			Less capacity (human, financial, and physical resources) are available for provision of hygiene and sanitation education and services at BOs				2 Develop project management manual and guideline including procurement and tender process.					
			Legal ownership arrangement of supply scheme for WUA, with preparation of its constitutions and memorandum of understandings with local council and GARWSP, are not introduced in the project area (Dhmar, Sana'a, Al-Mhweet).		WUA assure transparency and accountability in the scheme (financial) management, through provision of technical and managerial guidance with local council.		3 Conduct audit for financial management.					
			Transparency and accountability in the scheme (financial) management by some CBOs (community-based organizations) are not well assured.				4 Develop and apply uniformed reporting system for headquarters and Local Council.					
			Most of CBOs are established, without community dialogue and election, preparation of constitutions, legal registration.				【Objective 9-6】 Introduction of WUA in a DRA manner, through participation, consensus building for management options, community election, preparation of constitution, and legislation, is facilitated by BOs in clearly defined and shared responsibilities with local council. Guideline for WUA formation and capacity development is also prepared and utilized among BOs and local council.					
			Communities are less trained for the scheme management (technical and organizational management).				【Activity Set 9-6】					
			【Organization】【Monitoring and Evaluation Stage】Strength and Weakness		Roles and responsibilities of GARWSP branch office and local council in provision of technical guidance and monitoring on community-management for the project may be clearly defined and mutually understood, and technical guidance and monitoring for community-management may be carried out by branch office and local council, respectively.		1 Study Local Administration Law of 2002 and related bills defining requirements and procedure for community-based management of social infrastructure including water supply schemes.					
			It is suggested, in the implementation and monitoring stage in the decentralization framework of GARWSP, that technical guidance and follow-up to the communities shall be provided by GARWSP branch office, while follow-up and monitoring on organizational management of CBO (community-based organization), including auditing for their accounts, shall be given by local councils. However, GARWSP branch offices and local council are not adequately and periodically conducting technical guidance and monitoring, which often causes misuse, malfunctioning / break-down of supply facilities and equipment, and mismanagement of CBOs.				2 Assess the efficiency of WUA in operation and management of the supply schemes.					
							3 Examine existing manuals and guidelines developed by other sub-sector development institutions for introduction of WUA.					
							4 Develop WUA formation and management manuals/guidelines for GARWSP branch offices and Local Councils.					
							5 Develop operation and management manual for WUA, and define the roles and responsibilities between GARWSP branch offices and Local Councils in formation and capacity development of WUA.					
			Roles and responsibilities of monitoring and follow-up is not fully recognized by local council.				6 Provide training for SMT (Social Mobilization Team), GARWSP branch offices, and Local Councils to improve capacity in formation and capacity development of WUA.					
			There is no standard reporting system in planning, implementation, operation and maintenance of the supply scheme.				7 Facilitate WUA formation and provide training package for WUA to enhance community-based management of the supply scheme.					
							8 Provide monitoring and follow-up activities for WUA in collaboration with Local Councils.					
							【Objective 9-7】 Capacity of WUA in the scheme management is improved through provision of technical and managerial guidance by BOs and local councils.					
							【Activity Set 9-7】Cross-Apply【Activity Set of 9-6】above.					
							【Objective 9-8】 Roles and responsibilities in the monitoring and follow-up of the project is clearly shared between GARWSP BOs and local council. Uniformed report system in monitoring and follow-up is developed and introduced both to BO and local council to share the information.					
							【Activity Set 9-8】Cross-Apply【Activity Set of 9-6】above.					
Key Capacity (10) Effective and efficient process management is in place to facilitate proper planning, problem-solving practice, and decision making of the organization / institution			【Enabling Environment】Weakness				【Objective and Activity Set 10-1】					
			Water resource management, such as projection of groundwater potential and regulation and monitoring for resource development, is not adequately undertaken. Thus, a number of rural water supply development projects are planned and implemented with less consideration on resource management.	MWE and NWRA may establish water resource management system in the country and regions, which may be incorporated in planning rural water supply development.	Database for rural water sub-sector in the country and regions may be fully developed and updated for strategic planning, and monitoring and evaluation purposes.		Database for rural water sub-sector in the country and regions is fully developed and updated for strategic planning, and monitoring and evaluation purposes.					
			【Organization】Weakness									
			Database for rural water sub-sector in the country and regions is not fully developed nor updated for decision-making, planning and monitoring / follow-up				【Objective and Activity Set 10-2】					
			Systematic and uniformed monitoring system on the organizational operation of GARWSP HQ and BOs with applying quantitative and qualitative performance indicators is not fully developed and implemented.		Systematic and uniformed monitoring system on the organizational operation of GARWSP HQ and BOs with applying quantitative and qualitative performance indicators may be fully developed and implemented.		Systematic and uniformed monitoring system on the organizational operation of GARWSP HQ and BOs with applying quantitative and qualitative performance indicators is fully developed and implemented.					

CHAPTER 9 CONCLUSION AND RECOMMENDATIONS

9.1 Lessons Learnt

As a result of conducting this Study through Phase I and Phase II, the following lessons and experiences were identified for enhancing future studies and projects.

(1) An inventory of all existing water supply facilities, whether functioning or not, around the country with information including construction year, funding source, specifications of all equipment and facilities, record of breakages and repairs, water committee data, operation and maintenance records and other particulars is needed to determine appropriateness of water systems and to properly support formulation of future plans. As part of this inventory, all available water sources, especially groundwater sources, should be identified along with information such as drilled year, depth, water levels, pumping rate and water quality for proper water supply planning and conservation of limited water sources.

(2) Since pumping tests carried out by GARWSP are only partially conducted, in order to prevent aquifer depletion and to properly determine the potential of boreholes, pumping tests should include step drawdown test, constant discharge test and recovery test.

(3) If additional drillings are necessary, groundwater should not be exploited from the same catchment, but another larger catchment nearby should be developed in order to preserve the sustainability of precious aquifers.

(4) Development of technology for handling of boreholes having extreme characteristics, such as high water temperatures (above 40℃) and deep water levels (below 500 m), is essential for development of water resources for drinking purposes due to shortages in water sources.

(5) Most of the study sites are located along ridges and on tops of very high and rugged mountains ranges. Therefore, elaborate topographic surveying becomes difficult and advanced surveying equipment is not always useful for designing of rural water supply facilities in these kind characteristic locations, but a summary surveying (including route surveying and plane surveying) is sufficient for planning pipeline routes for water delivery from source to distribution tank.

(6) Effective planning of booster facilities is important to conform to the special characters of low groundwater tables as well as dwellings situated on mountain tops to give large height differences (resulting in large total head for pumping) which were encountered at the study sites.

(7) Generally in Yemen, constructed rural water supply facilities have not been adjusted properly nor operated quantitatively, which may often result in improper operation and excessive pumping. Therefore, water flow adjustments should be made by controlling revolution speed of diesel engines or gate valves, and some equipment such as water meters and pressure gauges should be included in the design by GARWSP.

(8) Use of Demand Responsive Approach (DRA) can encourage ownership of water supply facilities in hopes of sustainable proper operation of these facilities.

(9) Experiences accumulated through on-the-job training (OJT) and training of trainers (TOT) are considered to be effective for capacity building of GARWSP, and therefore these acquired experiences should be transferred on to other staff members.

(10) Equipment used during the capacity development activities in the study as hands-on training tools were provided to GARWSP in hopes of contributing to strengthen their organizational capacity.

(11) Capacity development needs to be a continuous effort by all stakeholders.

(12) The local subcontractor for the pilot project provided construction work quality in conformity to specifications and completed the works within the contract period without any major accidents. This indicates that capable contractors are available in Yemen.

(13) Local contractors of Yemen have sufficient skills and capability to implement work according to methods traditionally used in Yemen, but do not have experience with international standards of work procedures. Therefore, they should work more with donors to acquire experience and learn about international practices.

9.2 Recommendations

In consideration of the above mentioned lessons learnt as well as other affairs and problems encountered during the Study, the following recommendations and suggestions are made.

(1) The procedures used in this Study for the target 5 governorates as well as lessons learnt through study activities can be applied to other governorates having similar socio-economic and environmental conditions, or adapted to conform to any other conditions.

(2) After excluding the pilot project sites (3 sites) from the screened sites (23 sites) leaves 20 sites which are feasible for implementation, and these 20 sites are recommended to be requested to donor organizations and countries for implementation of the rural water supply improvement plans for early realization of projects.

(3) Due to the screening procedures, 13 sites were screened out as not feasible for implementation. Since the main reasons for screening out were due to problems in quality, quantity and potential of water sources, exploitation of alternative sources becomes essential. However, if appropriate alternatives cannot be found, then the following solutions are recommended for consideration.

- Handpump system or a point-source scheme for low quantity sources
- Installation of small-scale water treatment units for poor quality sources (however, maintenance requirements need to be carefully considered)
- Rainwater harvester as complementary supply

(4) The following factors (5As) are most important for appropriate planning and effective implementation of rural water supply projects.

- ✓ Affordability — Payable by beneficiaries
- ✓ Appropriateness — Technically simple to operate and maintain
- ✓ Accessibility — Easily approached and serviceable
- ✓ Adaptability — Responsive to gender and tribal culture
- ✓ Appreciative — Satisfied by all beneficiaries

(5) Exchange and coordination activities with other donors and NGOs implementing similar support are needed to share information and experiences, and to avoid possible overlapping or repeated negative experiences.

(6) Financial and human resources are needed to sustain capacity for project implementation by GARWSP branch offices and other relevant organizations.

(7) Since overpumping can lead to depletion of precious groundwater sources, stricter control over limiting the number of drillings within the same catchment is essential for groundwater conservation, especially to private drillings.

(8) Most of the water used for irrigation is consumed for Qat cultivation to limit water supply for drinking purposes. Therefore, government enforcement is needed to preserve the water balance in areas with high activities of Qat cultivation.

(9) For sites which were ranked low due to low yield of targeted water sources, other water sources such as dug wells, springs, rainwater and streams need to be developed as supplementary sources.

(10) Periodical measuring of borehole water levels by GARWSP is significant to monitor groundwater in terms of water resource conservation.

(11) Small-scale rehabilitation works on water supply facilities such as replacement and extension of distribution pipelines should be initiated by the communities with support from GARWSP branch offices and local councils. Also, large-scale rehabilitation works such as replacement of pumping units and newly extended facilities should be handled through the planning and coordination of GARWSP branch offices and local councils.

(12) Continuous monitoring and evaluation of administrative activities at all levels is necessary to strengthen and develop their capacities.

(13) In pursuit of satisfactory capacity development, a long-term advisor is required to provide managerial and technical support to GARWSP branch offices and local authorities.

(14) If Yemeni local contractors are given the opportunities to experience and accumulate internationally accepted methods and standards, their work can be accepted more widely and their work results can contribute to quality development of Yemen's infrastructures.

(15) EPA has approved IEE of screened sites with no need for further procedures under the condition that project implementation takes into consideration the following points. Therefore, these points should be given full consideration at the stage of implementation. (Refer to 6.2.2 in Supporting Report for description of these issues and recommended measures to be taken.)

- Effects on surrounding wells
- Effects from settlements' waste
- Scarcity of water issue
- Water storage barriers and small dams
- Air, soil and noise pollution
- Potential of conflicts

(16) Through this study, groundwater in Yemen was confirmed to be a very precious resource for water supply to the Yemeni population, and therefore, effective and conservative development of this resource has great significance. Presently, while the crisis due to depletion of groundwater sources in Yemen is being warned, the Water Law (2002) and other laws and institutional regulations on integrated water resources management are being prepared. Consequently, conservation of water sources such as introduction of licensed use of all deep wells for agricultural and irrigation purposes and prohibition of new drillings for agricultural and irrigation use is being promoted. Furthermore, a characteristic of integrated water resources management of Yemen is the participatory and self-control method of water resources management by the users of wells for agriculture and irrigation. However, the target wells of this Study to be used for drinking and

domestic purposes also need to be conserved and managed at the user level. Concrete actions such as formation of water users associations (WUAs); formulation of WUA agreement on resources management and conservation of groundwater; prohibition on use for agricultural and irrigation purposes; and monitoring by local authorities and GARWSP branches need to be considered.

(17) For the 23 target sites, the required average monthly operation and maintenance cost including facilities replacement cost was calculated to be 4.7% of the average income of the target sites. However, for 3 sites where income is low due to concentration of poor households and per household operation and maintenance costs are high due to small population, the percentage becomes 8 to 14%. For these sites, the burden of the operation and maintenance cost which includes facilities replacement cost can evoke further poverty. Therefore, for these sites, as a poverty reduction policy of the government, only routine operational costs and costs for maintenance and small repairs should be borne by the users to assure low-cost supply of domestic water to the poor, and future renewal costs should be funded by GARWSP branch offices or local authorities.

(18) Presently in Yemen, sector reform and decentralization of rural water supply services is being promoted as national policy and strategy. However, promotion on decentralization of GARWSP and strengthening of powers of branch offices is needed, but through conformity and coordination with the national policy and strategy.

(19) Although GARWSP is the responsible organization for development of this sub-sector on the national level, it was established recently in 2002, and restructured into present status under the Ministry of Water and Environment (MWE) in 2004. This organization was established through support mainly from World Bank. On the other hand, other organizations such as RWSSP (Rural Water Supply and Sanitation Project) and SFD (Social Fund for Development) are also taking responsibilities for development of this sub-sector independently and in parallel to GARWSP. However, for realization of sector coordination by MWE and GARWSP as clearly defined in the National Water Sector Strategy and Investment Program (NWSSIP), a display of development initiative and strategic action of development investments by these 2 organizations are required. For this realization, comprehensive capacity development of GARWSP headquarters and branch offices is needed.

(20) One of the key issues for capacity development of GARWSP is organizational development. In the capacity assessment carried out in this Study, development issues were identified from the viewpoints of 1) institutional organization, 2) leadership, 3) human resources, 4) financial aspects, 5) facilities and equipment, 6) program and service management, 7) process management and 8) organizational culture, style and mission. The results were compiled as the action plan for capacity development and promotion of this plan is anticipated.

(21) In order for GARWSP to indicate development initiative for this sub-sector, formulation of a strategic mid-term plan for project investment is urgently needed. Although the development budget of GARWSP is over 60% of the overall investment cost for this sub-sector, from the lack of a strategic project investment plan and existence of incomplete projects, formulation of a project investment plan for GARWSP branch offices based on DRA and plan coordination by GARWSP headquarters need to be promoted in a concrete manner. Since this is also one of the key capacity development issues, the objectives set for GARWSP in NWSSIP need to be achieved. Under good sector coordination by GARWSP, effective development investments can be promoted.

(22) Through social mobilization carried out in this Study and during the pilot project, the following strategies and approaches are recommended for formulation of the operation and maintenance plan of this Study.

A) At all stages of the project cycle, DRA intervention is further promoted. At each stage of this Study, good practices of DRA are identified and analyzed from similar projects and the pilot project, and these are summarized below. In the future, activities for project implementation by GARWSP branches and local authorities are anticipated.

Stage 1: Participatory Planning Stage

- Needs identification of target communities and submission of requests by communities
- Prioritization of community development needs by GARWSP branch offices and formulation of strategic development and investment plan
- Participatory development needs assessment and survey on amount willing-to-pay and able-to-pay
- Formulation of participatory community development plan and informed choice of technology by communities
- Clarification of roles between GARWSP branch offices, local authorities and communities

Stage 2: Implementation Stage

- Project implementation according to allocated roles
- Supervision of works by communities

Stage 3: Operation and Maintenance Stage

- Improvement of community-based management system
- Capacity building on operation and maintenance to community organization
- Establishment of an interface with GARWSP branch offices and local authorities, and creation of a monitoring system

B) Following the flow of decentralization being promoted by Yemen, clarification of roles between GARWSP branches, local authorities and communities is necessary for implementation of rural water supply projects. In the pilot project of this Study, an agreement between the 3 stakeholders was concluded, and the project was implemented upon clarifying each role. Concerning roles after completion of works, technical monitoring was carried out by GARWSP branch offices, and training and supervision on managerial and financial aspects of community organization were conducted by local authorities. For sustainability of rural water supply facilities through community initiatives, administrative support is essential and therefore, performance of allotted roles by both stakeholders is anticipated.

C) Rural water supply facilities in the target area are generally operated and maintained by Sheikhs (traditional tribal heads) or Aquils (village leaders). However, this traditional system for operation and maintenance is greatly influenced by the capability and financial power of the Sheikh or Aquil. Further, since the community thinks the facilities are owned by the Sheikh or Aquil, this creates an obstacle for fostering sense of ownership. In this Study, the formation of WUA was recommended to be carried out through selection of executives, preparation of management agreement and legal registration by the users to improve institutional organization and enhance sense of ownership. Also, in the WUA formation process, collaboration of GARWSP branches and local authorities is required.

D) Establishment of a community-based operation and maintenance system requires technical training on operation and maintenance to the target community as well as training and monitoring on institutional and financial management. The former training should by handled by GARWSP branch offices and the latter activities by local authorities.

E) By forming a WUA as a community organization and making important decisions on management of facilities and funds collectively by all users at general meetings can further improve sense of ownership. Moreover, if local authorities conduct periodic auditing and WUA releases the results to users, then accountability of funds can be enhanced.

F) Most of the development budget of GARWSP is spent on new well drillings and construction of storage tanks, but if it is used for monitoring of existing water facilities and strengthening of operator training, then break downs due to overload on facilities and equipment as well as to improper operation can be prevented as an effective use of the development budget. Establishment of interface between users, GARWSP branch office and local authorities, and periodic execution of monitoring are important activities.

9.3 Conclusion

The Yemeni government is requesting assistance for the 20 screened sites excluding sites implemented as pilot project. The Yemeni side is anticipating early implementation of all 20 sites which are listed below.

Table 9-1 Site List for Implementation Request

No.	Governorate	Code	Site Name	District	Priority Ranking	Design Population
1	Al Mawheet	A-03	Ozlat Al Jaradi	Al Rujum	15	27,584
2	Sana'a	S-02	Jarban	Hamdan	17	1,977
3		S-04	Qamlan-Bait Al Najrani	Bani Matar	9	772
4		S-05	Afesh	Belad Al Rous	11	4,517
5		S-07	Bait Al Hadrami	Sanhan & Bani Bahlowl	8	3,130
6		S-09	Ruhm		18	5,605
7		S-11	Al Hesn-Al Abyad	Jehana	12	2,911
8	Dahmar	D-01	Elow Al Mikhlaf	Jabal Al Sharq	1	1,249
9		D-02	Hamal Bait Al Jabar		6	3,339
10		D-03	Hegrat Al A'asham		3	2,148
11		D-05	Mayfa'at Yaer	Ans	2	2,044
12		D-07	Al Asakera	Mayfa'a	5	2,623
13	Ibb	I-01	Asfal Bani Saba	Al Qafr	4	11,884
14		I-02	Al Sana	Al Makhader	10	7,691
15		I-04	Al Jahlah & Al Meshraq	Ibb	14	13,359
16	Taiz	T-02	Bani Al Suror	Al Ma'afer	19	11,978
17		T-03	Sheb Humran		16	30,290
18		T-04	Yafoq Bani Hamad	Al Mawaset	13	8,735
19		T-05	Al Azaez	Al Shamayaten	20	15,040
20		T-06	Al Khunha	Al Wazieyah	7	2,015
					Total	**158,891**

Conclusions made through the execution of this Study are as follows.

(1) An objective of this Study was the formulation of a rural water supply improvement plan of piped water schemes for 36 sites in 5 governorates. At all of the target sites, since GARWSP prepared deep wells to be used as water sources, pumping tests were conducted for all of the target water sources, and results from these tests as well as those from socio-economic and other surveys were used as information for the screening procedure. Excluding the 13 sites which had problems with their water sources (problems with water quality, pumping rate or groundwater potential), water supply facilities plan and operation and maintenance plan were formulated for the remaining 23 sites in 5 governorates, and feasibility of the plans was confirmed.

(2) Development of alternative water sources for the 13 sites which were screened out is necessary. However, if appropriate alternatives cannot be found, then other solutions such as 1) a handpump system or a point-source scheme for low quantity sources; 2) installation of small-scale water treatment units for poor quality sources; and 3) installation of rainwater harvesters as complementary supply are recommended for consideration.

(3) From the 23 sites targeted for water supply facilities plan and operation and maintenance plan in this Study, 3 sites were selected for implementation as a pilot project. For the remaining 20 sites, early realization of projects is anticipated through support from the Yemeni government or donors.

(4) Assessment on present capacities for project implementation and institutional management was made together with the executing agency, GARWSP, using a participatory approach to formulate a capacity development plan. GARWSP is adopting this plan to prepare for future project activities, but cooperation and support by the donor community is needed to realize these activities.

(5) A key issue for capacity development of GARWSP is strengthening the capacity for project implementation based on DRA (Demand Responsive Approach). Although GARWSP places project implementation using DRA as a basic concept, practical applications are not being followed. In this Study, concrete activities such as social mobilization needed for DRA interventions were introduced at each stage of the project cycle, and these were actually carried out during the pilot project. As a result of DRA interventions, ownership of residents was enhanced, community-based management system was strengthened and effectiveness on sustainability of water supply facilities was reconfirmed. Experiences accumulated through DRA interventions, on-the-job training (OJT) and training of trainers (TOT) conducted in this Study were effective for strengthening the capacity for project implementation of GARWSP, and therefore these acquired experiences should be continuously applied and transferred on to other staff members.

(6) For GARWSP, enhancement of sanitation awareness to target communities was not part of their project implementation process. In this Study, importance was placed on the synergistic effect of community sanitation awareness on the living environment for water supply projects. Therefore, concrete activities such as training of community facilitators focused on women and adoption of the participatory sanitation education method PHAST (Participatory Health and Sanitation Transformation) were planned and applied in the pilot project. The realization of activities aimed at enhancement of sanitation awareness of target communities will have an effective influence on water supply projects.

(7) In the sector reform and decentralization policy being promoted for this sub-sector, roles and responsibilities of GARWSP branch offices and local authorities on water supply project implementation were not clear. In this Study, each policy and strategy for sector reform and decentralization were reviewed, and roles and responsibilities of GARWSP branches and local authorities were clarified and a coordination role focused on GARWSP branch offices is recommended.

This concludes the "Rural Water Supply Component of the Study for Water Resources Management and Rural Water Supply Improvement in the Republic of Yemen" in hopes of contributing to the improvement of rural water supply conditions and development of capacity in GARWSP organization.