MINISTRY OF WATER & ENERGY (MoWE)
THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA
SOMALI REGIONAL WATER RESOURCES DEVELOPMENT BUREAU

THE STUDY ON JARAR VALLEY AND SHEBELE SUB-BASIN WATER SUPPLY DEVELOPMENT PLAN, AND EMERGENCY WATER SUPPLY IN THE FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

FINAL REPORT (4/7)

VOLUME 3

EMERGENCY WATER SUPPLY,

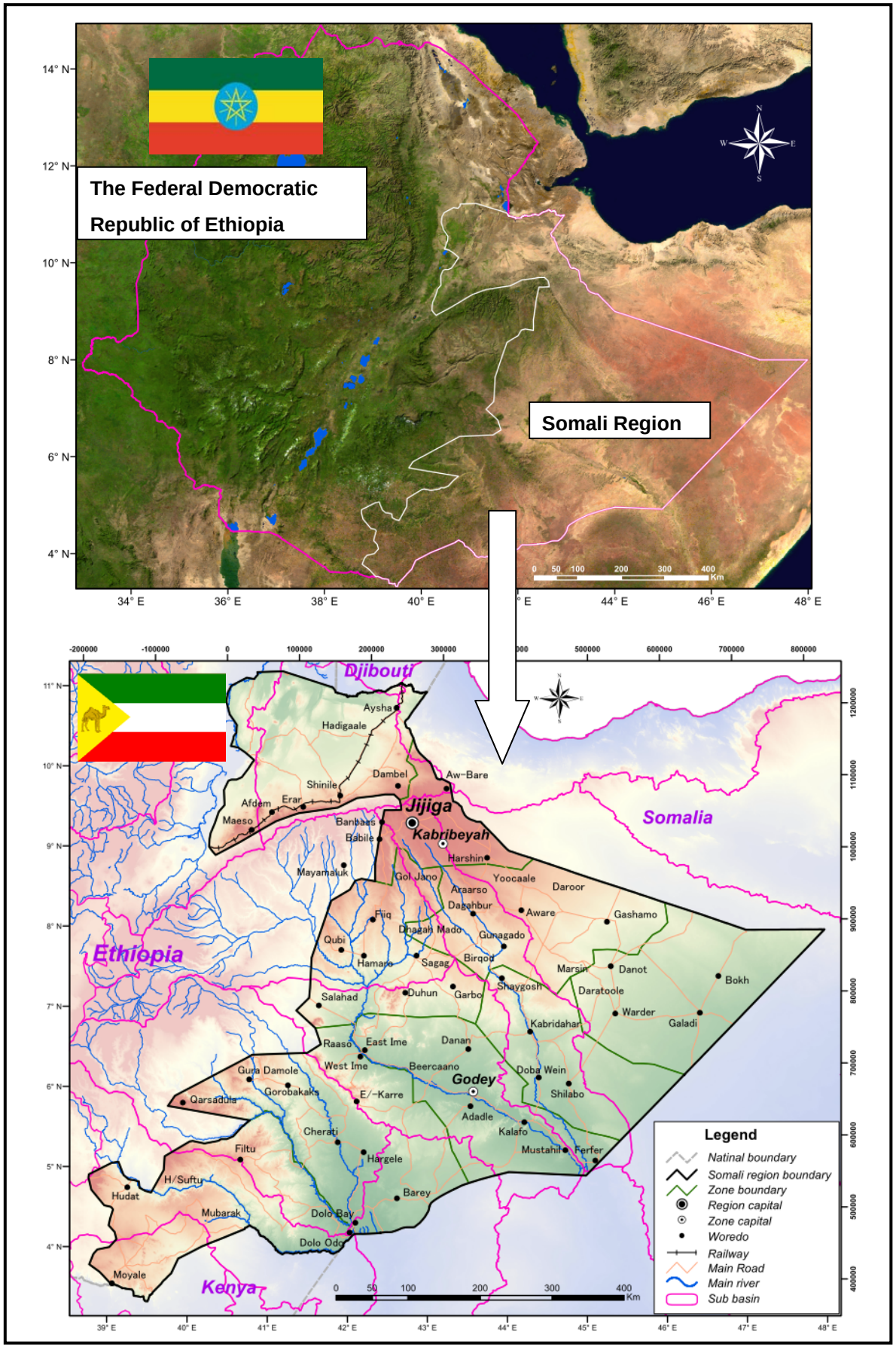
OPERATION AND MAINTENANCE

OF WATER SUPPLY FACILITIES

August 2013

Japan International Cooperation Agency (JICA)

Kokusai Kogyo Co., Ltd.



Location Map of Study Area

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Abbreviations

ABE	Alternative Basic Education
ARRA	Administration for Refugee and Returnee Affairs
BoFED	Bureau of Finance and Economic Development
BPR	Business Process Reengineering
CGIAR	Consultative Group on International Agricultural Research
CSA	Central Statistical Agency
CSE	The Conservation Strategy of Ethiopia
COD	Chemical Oxygen Demand
C/P	Counterpart (organization or personnel)
DFID	Department for International Development
DF/R	Draft Final Report
DTH	Down the Hole Hammer
DPPB	Disaster Prevention and Preparedness Bureau
EC	Electric Conductivity
EIA	Environmental Impact Assessment
EPA	The Environmental Protection Authority
EPC	The Environmental Protection Council
ESA	European Space Agency
ESIA	Environmental and Social Impact Assessment Unit
EU	European Union
EU-WATCH	Water and Global Change (WATCH) program funded by the European Union
EWTEC	Ethiopia Water Technology Center
FAO	Food and Agriculture Organization of the United Nations
F/R	Final Report
F/S	Feasibility Study
GEM	Global Environment Monitoring
GIS	Geographical Information System
GLCF	Global Land Cover Facility
GLG	Grass Land GIS
GMT	Greenwich Mean Time
GSE	Geological Survey of Ethiopia
GPS	Global Positioning System
GUPE map	Groundwater Utilization Potential Evaluation map
IC/R	Inception Report
IEE	Initial Environmental Examination
IRC	International Rescue Committee
ISCGM	International Steering Committee for Global Mapping
IT/R	Interim Report
JICA	Japan International Cooperation Agency
JSS	JAXA Supercomputer System
JWSO	Jijiga Water Supply Office
MODIS	MODIS Land Cover Product by using Moderate resolution Imaging Spector radiometer of Earth-Observing-System EOS
MoFED	Ministry of Finance and Economic Development
MoWR	Ministry of Water Resources
MoWE	Ministry of Water and Energy
MrSID	Multi-resolution Seamless Image Database
NFE	Non Formal Education
NGO	Non-Governmental Organization
NMA	(Addis Ababa) National Meteorology Agency
NOAA	National Oceanic and Atmospheric Administration

NRCS	Natural Resources Conservation Service, United States Department of Agriculture
O&M	Operation and Maintenance
OJT	On the Job Training
P/R	Progress Report
PA	Preliminary environmental assessment study
PALSAR	Phased Arrayed L-type Synthetic Aperture Radar
R/D	Record of Discussion
REA	Regional Environmental Agencies
RGSR	Regional Government of Somali Region
RWBs	Regional Water Bureaus
SAGE	Center for Sustainability And the Global Environment at the University of Wisconsin Madison
SEDAC	Socioeconomic Data and Applications Center
SEPMEDA	Somali Regional State Environmental Protection, Mine and Energy Development Agency
SHAAC	Shaac Consulting Engineers
SRTM	Shuttle Radar Topography Mission
SRWDB	Somali Regional Water Resources Development Bureau
SWWCE	Somali Water Works and Construction Enterprise
TDM	Time Domain Method
TEM	Transient (or Time-domain）Electromagnetic Method
TOT	Training of Trainers
TVETC	Technical and Vocational Education and Training College
UAP	Universal Access Program
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
USDA	United States Department of Agriculture
USAID	United States Agency for International Development
USGS	United States Geological Survey
UTM	Universal Transversal Mercator
VES	Vertical Electrical Sounding
WASH	Water Supply, Sanitation and Hygiene Programme
WASHCO	Water Supply and Health Committee
WATSANCO	Water, Sanitation & Hygiene Committee
WFP	World Food Programme
WLR	Water Level Recorder
WMO	World Meteorological Organization
WRI	World Resources Institute
WRIM	Water Resources Information Map
WSDP	Water Sector Development Program
WTP	Willingness to Pay

Chapter 1

Introduction

1 Introduction

1.1 The project

This report was prepared to present the results as of the end of July 2013 of the Study of "Jarar Valley and Shebele Sub-basin Water Supply Development Plan, and Emergency Water Supply in the Federal Democratic Republic of Ethiopia (hereafter, the Study)" based on the results of the record of discussions (R/D) agreed and signed by the Federal Democratic Republic of Ethiopia and Japan International Cooperation Agency (JICA) on 23 December 2011. JICA organized a team of consultants (the Study Team) made up of 14 members (one member was added later) to conduct the Study. The Study started in March 2012 and is confirmed to end in August 2013. The work schedule is shown in Figure 1.1 below.

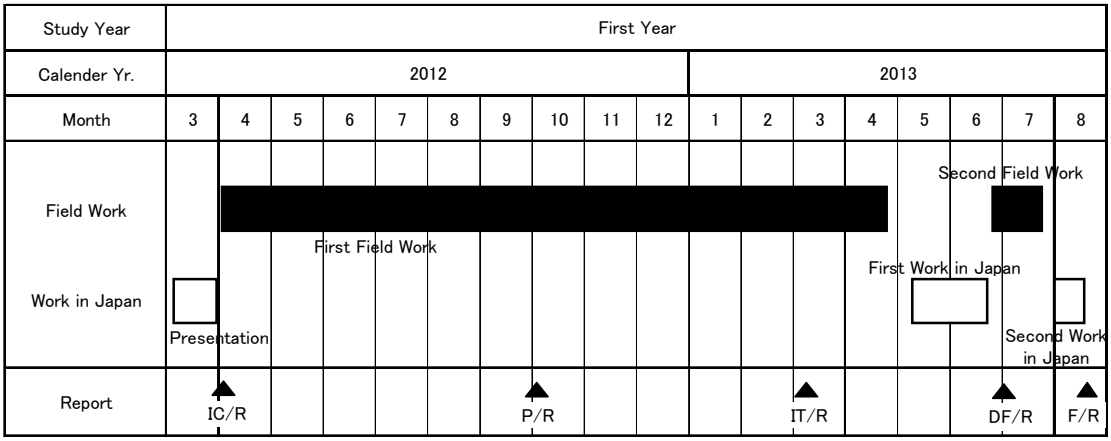


Figure 1.1: Outline of the Study Schedule

The first field work was carried out from April 2012 to April 2013, before starting the field work, the Study Team submitted the inception report (IC/R) and discussed its contents with Ethiopian side. After that, Minutes of Meeting (M/M) was exchanged between JICA and MoWE in consideration of the request of modification from the Ethiopian side (April 2012). The results of the Study were reported in the Progress Report (P/R) after seven months and the reporting in the stage of interim results was executed in the Interim Report (IT/R) five months after submitting the P/R. The contents of both reports were discussed with Ethiopian side at the steering committee, and M/M of P/R and IT/R was exchanged among JICA, Somali Regional State Water Resources Development Bureau (SRWDB) and Ministry of Water and Energy (MoWE) taking in the correction from the Ethiopian side (M/M of P/R: November 2012, M/N of IT/R: April 2013). After the first work in Japan, Draft Final Report (DF/R) was submitted to Ethiopian side at the end of June 2013 during the second field work, and M/M was exchanged between JICA and Ethiopian side after discussion of contents at the steering committee. After that, Ethiopian side carried out the final modifications, and finally JICA will submit the Final Report (F/R) to Ethiopian side by the middle of September 2013.

The study objectives are mainly to prepare a water supply plan based on the collection and analysis of the existing data, and the information of natural conditions and socio-economic situation data in the Jarar valley and Shebele sub-basin. Other important tasks are: the arrangement of a hydrogeological information system, construction works for emergency water supply focused on Kabribeyah and Godey towns and the rest of Somali region, and training to strengthen the ability of SRWDB and other relevant organizations.

The expected output and the activities of the Study are as follows;

(1) Expected outcome of the implementation of the Study

1) The potential of utilization of water resources in Jarar Valley and Shebele River watersheds will be evaluated.
2) The water supply plan for the Jarar Valley and Shebele River watersheds will be prepared.
3) The technical and organizational capacity of C/P personnel in water supply planning will be improved.
4) Water supply situation in Kabribeyah Town will be improved
5) Feasibility study for the planned water supply facilities (system) will be conducted.
6) Situation of emergency water supply in Somali Region will be improved through the use of the water supply equipment and materials donated.

(2) Activities in the Study

In order to realize the outcomes stated above, the following activities will be conducted in this Study.

1) Confirmation of potential of water resources development through “water resources utilization potential survey,”
2) Proposition of concrete improvement plans for water supply systems by water supply planning, and
3) Improvement of current water supply condition by implementing emergency water supply projects
4) Capacity development of relevant staff through short-term technical training.

To sum up the above, the following Figure 1.2 illustrates the outline of this Study: the activities under (2) above were first conducted to realize the outcomes under (1) above by the end of the Study. The Ethiopian C/P organizations, then, were expected to realize the formulated water supply plan making the best of what they have learnt through short- to long-term training in order to achieve the future long-term goals in the Study that are stated under the outcomes.

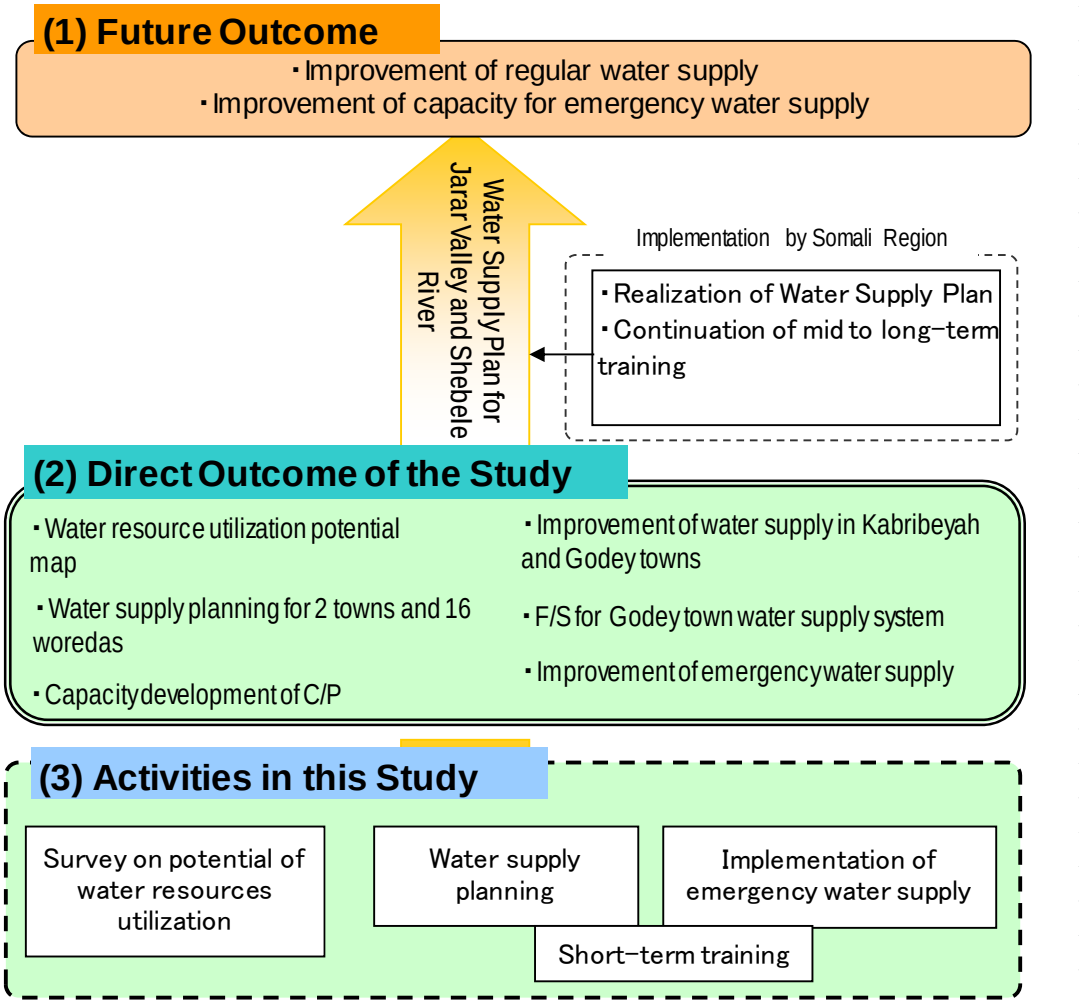


Figure 1.2: Flow of the Study (Project)

The target area differs depending on the work components of the Study: Emergency water supply works covered the whole region, water supply plan and water resources potential study target the sub-basins of Jarar Valley and Shebele River. Also pilot projects were conducted in Kabribeyah and Godey towns. These areas of project components and locations of the towns are indicated in Figure 1.3 below. The sixteen woredas and two main towns (Kabribeyah and Godey towns) were selected as the final target.

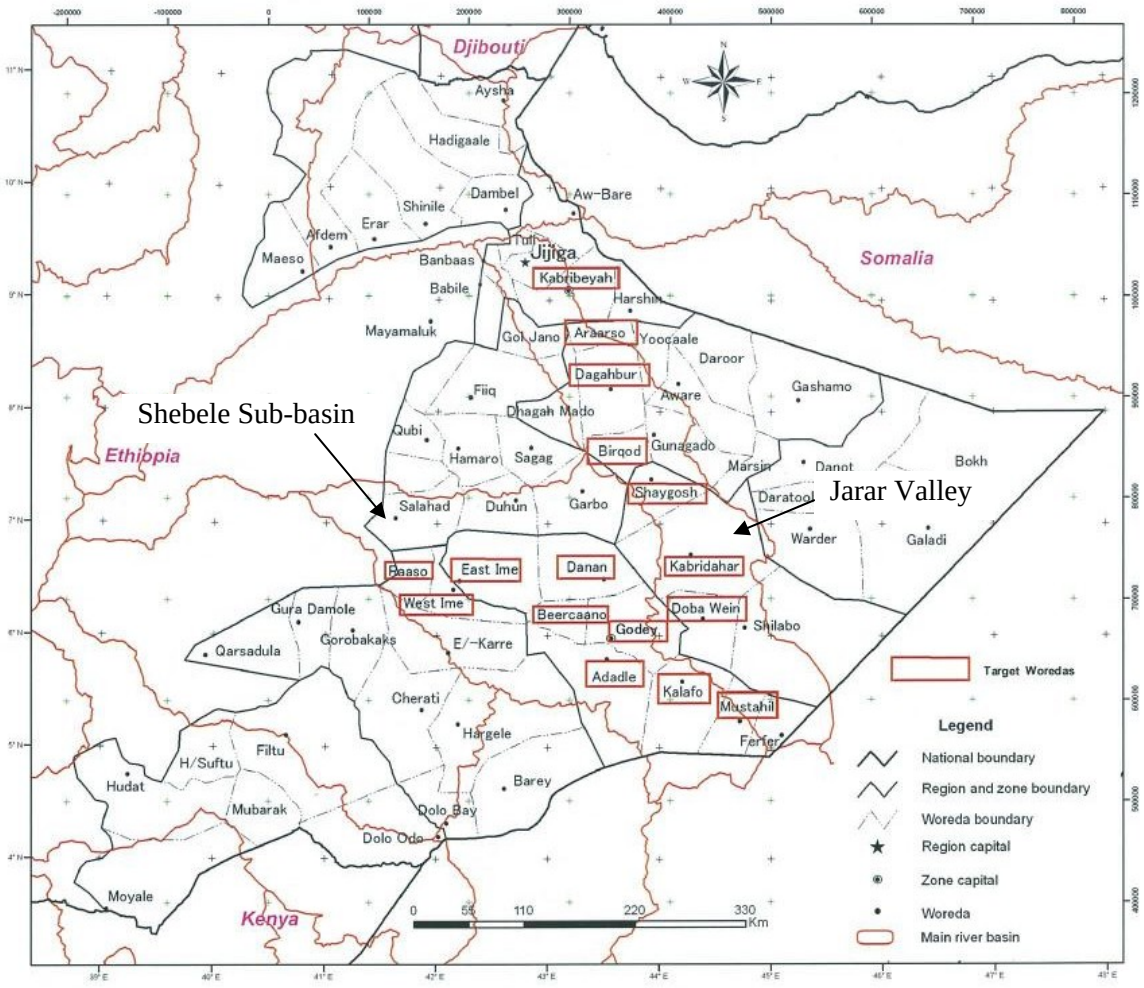


Figure 1.3: Study Area Map

The JICA Study Team was composed of fifteen (15) experts and each C/P was assigned to work exclusively with one of the Study Team members in this Study. The Study was executed through close collaboration between the Study Team and counterpart personnel (C/P) and others of Ethiopia. The R/D stipulated that a steering committee was to be established for the Study. There were many organizations concerned with this Study. Therefore, as a measure to assure good communication and information sharing with these organizations, a steering committee needed to be organized. The Study Team interacted with the Steering Committee when there were any important issues to discuss; making important decisions, sharing the progress of the Study, acceptance of various reports to be prepared in the course of the Study etc. in order to realize smooth implementation of the Study. The Steering Committee members were as follows;

<Chairman>

Director of Water Sector and Capacity Building Directorate, MoWE

<Members>

1) Representative of Ministry of Finance and Economic Development (MoFED)
2) Staff of Water Supply and Capacity Building Directorate, MoWE
3) Representative of ARRA
4) Head of SRWDB
5) Deputy Head of SRWDB in charge of Water Supply Core Process
6) Deputy Head of SRWDB in charge of Water Supply Management Core Process
7) Representative of Kabribeyah town water supply utility office
8) Representative of Godey town water supply utility office
9) Representative of DPPB
10) Representative of Jijiga sub office of UNHCR
11) Representative of Somali Regional State Environmental Protection, Mine and Energy Development Agency (SEPMEDA)
12) Representative of Bureau of Finance and Economic Development (BoFED)
13) Study Team
14) JICA Ethiopia Office

1.2 Report structure

The report structure in this time has been composed by the four activities in principal. However the results of the feasibility study in Godey town have been reported for one volume. The main items are as follows;

<Main Report>

Chapter 1 Study Summary

Chapter 2 In Relation to the Emergency and Long-Term Water Demand in Somali Region

Chapter 3 Operation and Maintenance of Water Supply Facilities

Chapter 4 Feasibility Study on Water Supply Plan

Chapter 5 Conclusions and Recommendations

<Volume 1 Survey on the Potential of Water Resources (Groundwater) Utilization>

Chapter 1 Introduction

Chapter 2 Meteorology and Hydrology

Chapter 3 Geology

Chapter 4 Hydrogeology

Chapter 5 Water Quality Analysis

Chapter 6 Groundwater Utilization Potential Evaluation Map

Chapter 7 Water Resources Information Map for Somali Region

Chapter 8 Conclusions

<Volume 2 Water Supply Plan>

Chapter 1 Introduction

Chapter 2 Basic date of Water Supply Plan

Chapter 3 Water Resources and Existing Water Supply Facilities

Chapter 4 Water Supply Plan, Cost Estimation and Implementation Plan of Each Woreda

Chapter 5 Water Supply Plan and General Design, Cost Estimation and Implementation Plan of Kabribeyah Town

Chapter 6 Water Supply Plan and General Design, Cost Estimation and Implementation Plan of Godey Town

Chapter 7 Conclusions

<Volume 3 Emergency Water Supply, Operation and Maintenance of Water Supply Facilities>

Chapter 1 Introduction

Chapter 2 Emergency Water Supply

Chapter 3 Operation and Maintenance of Water Supply Facilities

Chapter 4 Conclusions

<Feasibility Study on Water Supply Plan in Godey Town>

Chapter 1 Summary of Feasibility Study

Chapter 2 The Project Area

Chapter 3 Socio-Economic Survey

Chapter 4 Water Resources Study

Chapter 5 Population and Water Demand

Chapter 6 Existing Water Supply

Chapter 7 Water Supply Plan

Chapter 8 Cost Estimates

Chapter 9 Operation and Maintenance

Chapter 10 Environmental and Social Consideration

Chapter 11 Financial and Economical Evaluation

Chapter 12 Conclusions

1.3 Summary of Volume 3

In this volume, the results of the study on 1) the present condition of O&M of water supply facilities, 2) the personnel, O&M activities for the facilities planned in the master plan, and the cost and training to realize the O&M activities, are presented. Also, the details of the equipment and materials that were procured in this study as part of measures against emergency water supply in the case of disaster are described and expected benefit from this intervention is briefly mentioned.

In chapter 2, emergency water supply, first, the details of specifications and procurement results of the vehicles, water tanks, and water treatment chemicals that were procured to help Somali Region in emergency water supply were presented. Then, the roles, activities and relationship of the organizations involved in emergency water supply in Somali Region were reviewed and the result is presented. Finally, the expected uses of these equipment and materials are explained from the viewpoint of effect of the procurement, together with propositions in their uses by the study team.

In chapter 3, operation and maintenance of water supply facilities, the roles of the organizations involved in water supply in Somali Region is reviewed and their inter-relation is clarified. Then, the result is presented. Next, the details of the short-term training sessions the study team conducted for WASHCO members and for technical staff of workshop of SRWDB are described. Then the issues on O&M identified through the training are discussed and corrective measures for the identified problems are briefly suggested. Finally, based on the study of all these results, an O&M plan including the personnel plan and activity plan for the designed water supply facilities for the 16 woredas and 2 towns is presented along with the estimated cost of the O&M plan. Furthermore, a series of mid- to long-term training for the organizations concerned, required to realize this O&M plan of the water supply projects, is presented in brief summary.

In addition, in chapter 4, some suggestions are made for Somali Region to follow from the viewpoint of ensuring O&M so that the region can properly implement the proposed water supply projects in future.

Chapter 2

Emergency Water Supply

2 Emergency Water Supply

2.1 Introduction

Somali Region is located in arid lowland of Ethiopia and has experienced a number of droughts in the past. Especially, the recent droughts in 2010 and 2011 have reportedly been severe. Many shallow wells and surface water sources dried up during droughts and it affects not only agricultural and livestock production but also water supply in the areas where no deep borehole wells were available, causing serious water shortages.

In this study, in order to assist the Somali regional government to cope with the situation, the study team procured a set of equipment and handed it over to SRWDB. Also, in connection with the drought fighting, the situation of emergency water supply and involvement of relevant aid organizations were investigated. Then, based on the findings, the study team assisted the bureau to prepare a delivery and utilization plan of the equipment. In addition, the study team gave instructions on the utilization of the donated items. The following sections present the results of such activities.

2.2 Procurement of emergency water supply equipment and related materials

In this study, the following equipment listed in Table 2.1 was provided and instructions on their use were made.

Table 2.1: Emergency Water Supply Equipment and Relevant Instructions

Equipment to be supplied	- Water truck (5 trucks) - Water tank for supply point (150 pcs) - Chlorine disinfectant (for 3600m^3 water) - Vehicle for mobile workshop (3 vehicles)
Demonstration on operation and use	- Training on water supply equipment (pump & generator) - Effective use and operation of mobile workshop

As training on the O&M of water supply equipment, a short training was provided for the workshop staff of SRWDB in December 2012. The planned demonstration of the water truck and related training on emergency water supply were not conducted due to the delay in the procurement of the vehicles. As for the demonstration on operation and use of mobile maintenance workshops, a training session was organized for the relevant staff of the SRWDB in March 2013. The details of the training sessions conducted are presented in chapter 3 of this volume.

2.2.1 Specifications of emergency water supply equipment and related materials

The specifications of the emergency water supply equipment and other associated items were determined though discussion with SRWDB. The following Table 2.2 lists the specifications of the procured equipment and materials and their status as of July 2013.

Table 2.2: List of Emergency Water Supply Machineries and Specifications

Equipment	Q'ty	Status	Delivery Route	Spec, Model
1.Supplied machineries and materials				
a)Water truck	5	Delivered	MoWE→SRWDB (4 for Jijiga, 1 for Godey)	ISUZU With a pump and tank capacity 10m^3
b)Water tank for water point	150	Delivered	MoWE→SRWDB	Fiber Glass Water Tank (10,000L)
c)Chlorination chemical	For 3,600 m^3	Delivered	MoWE→SRWDB	Powder (Bishan Gari) 70% Tablets (Aqua tab) 15% liquid (Waterguard) 15%
2.Operation and maintenance equipment				
a)Mobile workshop vehicle (Single cabin)	3	Delivered	MoWE→SRWDB	NISSAN (Single cabin pickup truck with canvas top)
b)Equipment for mobile workshop (tool kits)	3	Delivered	MoWE→SRWDB	Refer to Data book

Note: "Delivered" signifies the items have been officially received by the MoWE

The proportion of different types of chlorination chemicals was determined based on the discussion with SRWDB as shown in the table. SRWDB received support from UNICEF for delivery of 150 water tanks on the list and started distributing them based on its delivery plan. The bureau delivered 76 water tanks up until the beginning of April 2013.

2.2.2 Specification of other related equipment

The specifications of the other sets of related equipment and their procurement status as of the beginning of April 2013 are shown in the list in Table 2.3 below.

Table 2.3: List of Other Related Equipment and Specification

Equipment	Q'ty	Status	Delivery Route	Specification, Model
Project car 1	2	Delivered	MoWE→SRWDB	TOYOTA (4WD, Station wagon)
Project car 2	2	Delivered	MoWE→SRWDB	TOYOTA (4WD, Pickup truck double cabin)
Surface water pump	3	Delivered	MoWE→SRWDB	ROVATTI ME100K80-90/4A 75kw,100HP
Submersible pump and Generator	2 sets	Delivered	MoWE→SRWDB	Submersible pump WILO(made in Germany) TWI 6.18-20-8-SD-R / Generator PRAMAC(made in Spain) GBW45p

Note: "Delivered" signifies the items have been officially received by the MoWE

Accordingly, the installation of surface water pumps and generators has been completed at the site in Kabribeyah Town, as of December 2012. The four project vehicles have also been officially delivered to MoWE.

2.2.3 Equipment for mobile workshop

JICA study team and SRWDB discussed equipment and materials to be loaded on the three mobile workshop vehicles based on the list the workshop staff prepared. A concise list of the items procured is shown in Table 2.4 and the detailed list is presented in Data Book.

Table 2.4: Outline of Equipment and Tools for Mobile Workshop

Lot name	Contents	No. of items /set	No. of set
1. General tools	Spanners, drivers, hammers, files etc.	30	3
2. Equipment and tools for welding	Generator & welder and its accessories	11	3
3. Equipment and tools for electrical work	Drill, grinder, pliers, miltimeter, etc.	13	3
4. Tools for plumbing	Pipe wrenches, pipe cutter, threading tools	14	3
5. Consumable parts for above	Grinder disks, drill bits, terminal clips, gas cylinders, masks for welding etc.	18	3

The equipment and tools that have been procured are all made in Japan and metal tools have anti-rust finish. The electrical apparatus work with 220V power supply.

2.3 Actual condition of emergency water supply in Somali Region

2.3.1 Administrative responsibilities for emergency water supply of organizations concerned

In Somali Region, many organizations are engaged in emergency water supply activities. One of the major activities is so called “water trucking” where water from perennial rivers and deep borehole wells is transferred to areas in need by water trucks. The following organizations listed in Table 2.5 are the major players of emergency water supply.

Table 2.5: Organizations Concerned with Emergency Water Supply and Their Roles

	Type	Roles and activities in emergency water supply
SRWDB	Gov’t	Information collection from woredas, Water trucking, Coordination of & giving instructions to relevant government offices, Securing budget and materials, Guard against drought problems by reinforcing ordinary water supply systems
Woreda water office	Gov’t	Reporting of the situation within woreda to SRWDB, water supply at sites, distribution of disinfectant chemicals at site
DPPB	Gov’t	Water trucking, Dealing with emergency cases in the region, coordination of all the organizations concerned
DPPO	Gov’t	Execution of emergency water supply measures and information collection at woreda level
UNHCR	UN	Support and coordinate partner organizations (mainly NGOs) to supply water to refugee population together with ARRA
UNICEF	UN	Financially assist NGOs that conduct water supply and other intervention in affected areas
NGOs	NPO	Performing water trucking at woreda and Kebele levels, IRC and Oxfam are actively involved.

In emergency situations, DPPB is the organization that is in the position of coordinating all the other organizations concerned to cope with the situation effectively and they work in the following way.

- A joint field assessment mission with agricultural bureau is organized twice a year with the intention of mainly securing food supply. It is called “Food Security Assessment”

and is a multi-sector assessment covering many areas that concern the regional security. DPPB analyzes the collected data and prepares a list of priority woredas/areas for emergency water supply.

- In the case of emergency (outbreak of a drought), DPPB mobilizes the water trucks of the regional administration. In addition, they have contract with private companies to augment the water trucking service and make the payment to the private company according to the contract.
- When their own budget runs out, DPPB asks NGOs to mobilize water trucks (usually at the cost of NGOs).

The emergency water supply activity using water trucks usually requires swift response to the situation. On the other hand, many organizations such as NGOs are involved in the activity and it was necessary to have a coordinating group composed of the players of emergency water supply. For this reason, DPPB and UNICEF together with voluntary NGOs established a workgroup called “Emergency Task Force” to conduct water trucking and other interventions more efficiently through sharing of information among the members. However, the group points out insufficient involvement of SRWDB.

Meanwhile, the members now recognize the high cost of water trucking and that the water trucking can not be continued at the current scale if droughts continue to occur at this pace. Thus, they started discussing the shift in their intervention policy, from emergency water trucking to construction of permanent water supply facilities.

DPPO is the subordinate body of DPPB and established in each woreda. The office works with DPPB and is engaged in activities of protection of the woreda population against various security threats. It is a part of woreda administration and responsible for information collection and emergency responses. Urban areas such as towns in woredas are also under their jurisdiction. The number of staff is usually around 10 (both field and office staffs) and the staff tends to be larger in woredas that are prone to disasters. Their actual tasks are as follows:

- Execution of early warning (collection of security information except for tribal and military conflicts and attempts to give warning 2 months in advance)
- Coordination of organizations that respond to emergency situations
- Transportation of food, water, medicine at the time of emergency
- Monitoring of activities by NGOs and UN agencies
- Survey of general situation of woreda (prices, population etc.)

DPPOs do not have their own trucks. Thus, they rent commercial trucks and the trucks owned by NGOs and other organizations to conduct water trucking.

SRWDB, a responsible agency for water supply in the region, coordinates with DPPB and contributes to emergency water supply by providing some materials, equipment, and technical support to those that need them at the time of emergency. SRWDB supplies chlorination chemicals to the residents of drought areas through woreda water offices. It also provides water tanks to woredas so they are prepared for emergency water supply.

Although DPPB, which is responsible for coordinating all organizations concerned, should give instructions to SRWDB, the main implementation agencies in water supply in the region. Moreover, sufficient coordination between the two government agencies has not been realized as mentioned above. The situation is, however, being improved.

DPPB received from the regional administration a total of 20 water trucks in 2004 and 2005 (with finance by UNICEF) and deployed 17 of them at woreda level and 3 at the region level. However, it is reported that many of the trucks are not functioning due to insufficient maintenance.

2.3.2 Target areas of emergency water supply and activities of relevant organizations

a. Target area

In Somali Region, many organizations are involved in emergency water supply activities in order to cope with the repeated droughts these days. The region has established a system of emergency water supply by water trucking and the emergency water supply is conducted jointly by relevant organizations. In concrete, as briefly explained earlier, DPPB, as the coordinator of the operation, takes the initiative in selection of target areas of emergency water supply, fund procurement and also in arrangement of water trucks. According to DPPB, the current target areas (for year 2013) of emergency water supply in Somali Region are as shown in Table 2.6 below.

Table 2.6: Emergency Water Supply Area in Somali Region

	Zone	Woreda
1	Fafan	Harshin, Babile
2	Jarar	Dagahbur, Aware, Gashamo, Gunagado, Daror, Ararrso, Yo'ale
3	Dollo	Galadi, Bokh, Danot
4	Nogob	Sagag, Salahad, Lagahida, Kubi
5	Liben	Hudat, Mubarak, Dekasuttu
6	Korahe	Shilabo, Dobawein, Marsin
7	Shebele	Danan, Ceelwein, Kelafo
8	Afder	Dolo bay, Barey, Raso, Gura damol, Karsadula
9	Sitti	Hadogalo, Afdem, Aysha

Source: interview with DPPB

Specific target kebeles have not yet been identified but these woredas are drought prone areas where emergency water trucking is frequently needed.

b. Activities of organizations in emergency water supply

There is a workgroup called "Emergency Task Force (ETF)" that consists of representatives from DPPB and of NGOs. The workgroup was organized to coordinate activities by relevant organizations for the time of emergency water supply. An example of recent activities of ETF is the operation of 15 water trucks in Barey, Dolo bay and Harshin woredas as emergency

water supply from August to September 2012. The group did not only supply water but also delivered water tanks and plastic sheets to line the water ponds (used to keep out dirt and keep the ponds or birkas water tight).

SRWDB also conducts activities associated with emergency water supply where they dispatch mobile maintenance teams to target areas, distribute chlorination chemicals, and drill boreholes. However, due to inadequate sharing of information and cooperation with the ETF team, it is difficult for the two parties to perform emergency responses effectively and efficiently.

The organizations concerned with emergency water supply in Somali Region were already described in the section 2.3.1 of this chapter. In addition to the activities by ETF, involving SRWDB and DPPB as a measure of emergency water supply, DPPO works at the site level and especially NGOs working on WASH activities also conduct water and sanitation education activities, deliver goods and conduct water supply mainly for the same target areas.

c. Activities of SRWDB for emergency water supply

The equipment and materials for emergency water supply provided to SRWDB are listed in Table 2.2. In emergency water supply target areas, in dry season some households find it difficult to get even 5 liter/day/person of water, which is the minimum requirement. The situation is caused by increased price of drinking water, shortage of water tanks and reservoir facilities, shortage of water trucks, and unsanitary conditions of water storage facilities.

In this context, SRWDB selects the sites for intervention and prepares a plan on deployment of chlorine chemicals, water trucks, water tanks and mobile workshop vehicles that have been donated. The planning and distribution are now underway. It was assumed at the start of this study that four (4) water trucks were to be used in Jijiga Town and one (1) in Godey Town to contribute to emergency water supply activities. The 150 water tanks can help community peoples to get water supply after they are delivered to each woreda. However, the SRWDB does not have enough budget to transport the water tanks. For this reason, SRWDB made a request for assistance from UNICEF to distribute the water tanks. As a result, 76 tanks out of the 150 the study team donated to SRWDB in September 2012, have been delivered to and installed in target areas as of April 2013.

d. Problems and future tasks

The results of the study revealed that actual operation of emergency water supply accompanied some problems as listed below.

- It is reported that the majority of the 20 water trucks owned by the regional government can not be used for emergency water supply because of poor maintenance etc.
- SRWDB does not have enough budget for their activities related to emergency water supply operation. Thus, the bureau is obliged to depend on NGOs for various support.
- Collaboration and information sharing between DPPB, as the organization responsible for emergency water supply, and SRWDB, as an implementation organization, are not adequately exercised.
- It is difficult to access target areas of emergency water supply due to poor road conditions in the region. In addition, it is also difficult for water trucks to find a good

alternative source of water in an emergency (alternative water sources are far and it takes time to reach the water resource. Waiting time at the water source is also long)

- In the areas where there are no large water reservoirs, the people have to get their small tanks filled directly by the water truck. This keeps the truck at one site for a long time, leading to inefficient truck operation.
- In some areas, only high turbidity and salty water are available and used for emergency water supply.
- People need to wait much longer time to get water due to limited water availability and limited number of water supply points in emergency water supply.
- Water supply by water truck costs much higher than water supply by ordinary water supply facilities in the long run.

In order to solve these problems and issues mentioned above, it is necessary for SRWDB to ensure a certain amount of budget for emergency water supply as a short-term measure. Meanwhile, for the areas where water sources are available, it is necessary to do water supply planning for each woreda by taking advantage of the water resources potential map and woreda water supply plans prepared in this study as mid-term measures. On the other hand, for areas where water sources are difficult to find, it will be required to continue emergency water supply through planning for advance budgeting.

2.3.3 WASH program

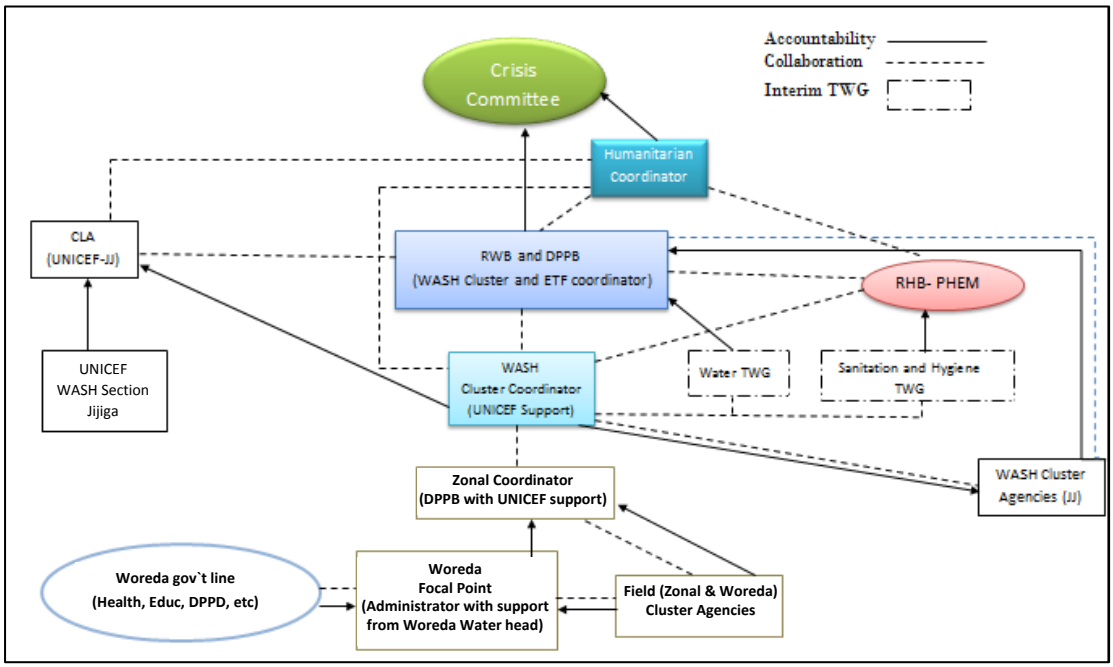
a. Summary of activities

In the study area, a series of serious droughts has occurred and water trucking is being employed to satisfy the emergency need of water. Meanwhile, the donors and NGOs have been discussing the importance of expansion and new installation of water supply facilities and also of education of the residents in water and sanitation in the affected areas as a permanent solution.

In this study, the procurement of materials and equipment for emergency water supply took into account the activities of WASH (Water Supply, Sanitation and Hygiene Programme) that UNICEF has been conducting since 2006. Also, other activities of this study such as water supply planning and mapping of water resources were done while sharing a common philosophy of WASH of providing safe water and improvement of sanitation and also in cooperation with other donor agencies. According to UNICEF, the main objectives of WASH are:

- To increase the proportion of people with sustainable access to safe drinking water and basic sanitation by 2015,
- Ensure that all schools have adequate and safe water supply and sanitation facilities for the children and establish hygiene education programs.

In Somali Region, there are various activities and projects conducted according to these basic principles of WASH. The organizations involved in the WASH programs (called WASH clusters) share information on their activities and realize smooth execution of their activities. The structure of the WASH related organizations is illustrated in Figure 2.1.



Source: Somali Regional State WASH Cluster TOR, 2012, UNICEF

Figure 2.1: WASH Inter-Organizational Relationship

WASH clusters perform their activities in the target areas and report the results to DPPB and SRWDB to share information on the present situation of their target areas. In this way, they are prepared for emergency water supply activities in Somali Region. Table 2.7 below shows the programs and activities that WASH clusters are performing recently.

Table 2.7: List of WASH Program by Organization

S/N	Partner	Project	Details	Status
01	ACF	Kabridahar water supply	2 Birkas, 3 BH equipping and storage	
02	Ad-Horn	Ferfer and Dollo-bay HDW	4 HDW in Ferfer and 4 in Dollo-bay	Concept to be re-submitted
03	ADRA	Kelafo and Bare HRF project	2 birkas and 2 SW in Kelafo 5 Birkas in Bare	Fund available from HRF
04	IRE	Hergeele water project	Birka rehab	Secured fund
05	COOPI/IRE	Filtu water project	To be assessed	Merge funding
06	Oxfam GB	Shinile water supply	2BH drilling in Hadagahala 1BH +equip in Ayisha	Funds available for Ayisha, include Hadagahala in HRF proposal
07	OWDA	Danot, Danan and Adadle water supply	4 Birkas, 4HDW in Danan; 2BH complete in Danot; 9Birkas, 2 HDW in Adadle	Project ongoing for Adadle; concept to be submitted to TWG.
08	Oxfam Intermon	Dollo-Ado Host community water supply	To be assessed	To discuss with partners when I visit Dollo
09	RWB (SRWDB)	Various water supply projects	17HDW; 2 river intake; 10 drilling complete; 7 Haffir dam construction; 1 water scheme	Ongoing and planned
	RWB (SRWDB)	Town Water Supply	4 town water supply	Ongoing
10	IRE/SAAD	Water supply Cheratit	4 Birka Construction and 4 Birka rehab in Charati	Concept note to be submitted
11	ScUK	EC Water Supply project	5 Birkas; 8 Shallow wells; 1 BH complete	Ongoing
12	Woreda Water Office	DRS water supply project	6 river intake; 24 HDW; 6 HDW rehab; 9 Birkas; 8 Birka rehab; 2 water schemes; 1 scheme rehab all in six woredas	Part of funds transferred by UNICEF
13	ZOA	Fik water supply	3 BH complete; 1 Haffir dam rehab	Ongoing
13	DPPB	Vulnerability assessment		Proposal submitted
14	Various	Ground water potential study	Over 20 planned	Ongoing and planned

Source: WASH JAP presentation document 01 June 2012

Among the listed above, in the “Water trucking program” conducted by Oxfam GB (part of 06 in the table), the project successfully collected water fee from communities at the time of water supply by issuing water vouchers in advance. The money collected is then going to be used to continue the same program.

In addition, WASH members formed the Technical Work Group (TWG) that works in two different sectors of sanitation–related technical cluster (Sanitation and Hygiene TWG) and water-related technical community (Water TWG). Especially the Water TWG is analyzing

problems, resolving concerns and formalizing principles and responsibilities, as well as sharing the results with the members at regular meetings.

As explained above, the short-term water supply problems in the region can be somehow handled if the organizations concerned all clarify their target areas and activities. Meanwhile, it is necessary to consider use of river water and well drilling based on the water resources maps produced in this study.

b. Budget of annual activities

WASH activities budget is allocated by the activities of each organization. In the case of SRWDB, the 2013 annual budget for the 27-woredas WASH program in Somali Region (part of No-09 in Table 2.7) is 296,853,868 Birr. This budget came from the World Bank and the African Development Bank (ADB).

In closer look above, a budget of 232,294,489 Birr from the World Bank is for various WASH projects in 18 woredas. Also, the remaining 64,559,379 Birr budget from the African Development Bank is to finance the WASH program activities of small and large scales in 9 woredas.

2.4 Operation plan and expected effect of emergency water supply machineries and materials donated by JICA

2.4.1 Operational plan and expected benefit

Based on the operational and deployment plan of materials and equipment procured in this study, SRWDB, has been preparing a deployment plan of the items. Although the bureau has not made clear its operational and deployment plans of water trucks and mobile workshop vehicles, the operational and utilization plans initially assumed by the study team for each item are as follows.

a. Water trucks

According to the initially assumed plan presented in the inception report, SRWDB is to deploy four (4) trucks in Jijiga Town and one (1) truck in Godey Town. Operation of these additional water trucks is expected to increase availability of water trucks more than in the past. In the past, the government had to rent commercial water trucks to use in emergency water supply.

b. Water tanks

SRWDB is currently distributing the tanks to woredas based on the delivery plan of their own (see Table 2.8). This intervention is expected to enable the people in the communities to get clean water supply even in the areas where there are not sufficient water storage facilities. It will also help reduce the time needed for the residents to get water and the time taken by water trucks to supply water to the residents. The list of distributed tanks as of Feb 2013 made by SRWDB is as shown below.

Table 2.8: List of Woredas for Water Tank Distribution by SRWDB and Distribution Record

LIST OF WOREDAS IDENTIFIED/SELECTED TO SUPPLY WATER TANKS (STORAGES)

27 Feb.2013

S/n	Regional/Zone	Woreda	Required Qty	Level of Categorizing (hotspots woredas)	Transportation method	Timeframe of supply			Remark	Qty Delivered
						M1	M2	M3		
	Regional Water Bureau *(for standby)*	RWB (SRWDB)	21						For quick emergency responses and for newly drilled BH and also for replacement of old water tanks	
1	Jarar (D/bour zone formerly)	Aware	3	1	By Road through trucks					
2		Gunagado	3	1						
3		D/madow	2	1						
4		Daror	2	1						2
5		Yocale	3	1						3
6		Ararso	2	1						2
7		Birkod	2	1						
8		Gashamo	3	1						2
9	Nogob (Fikh zone formerly)	Duhun	2	1						
10		Fikh	2	1						2
11		Garbo	2	1						
12		Goljano	2	1						2
13		Hamero	2	1						2
14		Legehida	3	1						3
15		M/Muluka	3	1						3
16		Qubi	3	1						3
17		Segeg	2	1						
18		Salahad	3	1						3
19	Doolo (Warder zone formerly)	Danod	3	1						3
20		Daratole	3	1						3
21		Warder	2	1						
22		Bokh	2	1						2

23		Galadi	2	1						2
24	Siti (Shinile zone formerly)	Afdem	3	1						3
25		Adigale	2	1						2
26		Mulu	2	1						2
27		Ayshia	2	1						
28		Denbel	2	1						
29	Korahe zone	Dhoboweyn	2	1						
30		Shilabo	2	1						
31		Mersin	3	1						
32		Sheygosh	2	1						2
33		Kebridahar	2	1						
34	Afder zone	Karsadule	3	1						3
35		Dollo-bay	2	2						
36		Raso	3	1						3
37		Barey	2	2						
38		G/dhamole	3	1						3
39		G/boqosa	3	1						
40		West imey	2	1						
41		El-kari	2	1						2
42	Shabele (Gode zone formerly)	Danan	3	1						
43		Ceel-weyne	3	1						
44		Adadley	2	2						
45		Mustahil	2	1						
46		Bercano	2	2						
47	Liban	Filtu	3	2						3
48		Mubarak	3	1						3
49		Hudet	2	2						
50		Dakasuftu	2	1						2
51	Fafen (Jigjiga zone formerly)	Harshin	4	1						4
52		Babile	2	2						2
53		k/bayah	3	2						3
	Grand Total		**150**						**75**	

Source: SRWDB Planning, M&E and NGO coordination department

c. Chlorination agent

The ratio of different types of chlorination agents for procurement was determined as 70% powder, 15% tablets and 15% liquid as discussed between JICA study team and SRWDB. The chlorination agents were supposed to be used by the residents of drought-stricken areas in order to disinfect dirty water in birkas etc. Based on the operation plan of SRWDB, the agents were delivered to each woreda water office on the list. The chorination agents were distributed to the communities in each woreda and to hospitals to keep the water clean. This is expected to reduce health problems caused by contaminated water. The distribution of chlorination agents to the target woredas donated to SRWDB have already been completed and the list of the target woredas prepared by SRWDB is shown in Table 2.9 below.

Table 2.9: Distribution List for Chorine Tablet by SRWDB

(JICA) WATER PURIFICATION CHEMICALs FOR EMERGENCY

s/n	Zone	Woredas	Unit	Qty	Type of purifier	Date of received	Remark
1	Jarar	Araarso	box	8	Bishangari	4/10/2004 Ec 11/06/2012 Gc	
2	Jarar	Araarso	box	8	Bishangari	19/10/2004 Ec 26/06/2012 Gc	
3	Qorahey	Dhobowayn	box	7	Bishangari	20/11/2004 Ec 27/07/2012 Gc	
4	Jarar	Aware	box	7	Bishangari	24/11/2004 Ec 31/07/2012 Gc	
5	Dolo	Daratole	box	3	Bishangari	9/1/2005 Ec 19/09/2012 Gc	
6	Jarar	Gaashamo	box	4	Bishangari	5/2/2005 Ec 15/10/2012 Gc	
7	Fafan	Goljano	box	3	Bishangari	20/2/2005 Ec 30/10/2012 Gc	
8	Nogob	Hamaro	box	30	Bishangari	22/5/2005 Ec 30/1/2013 Gc	
9	Jarar	Dhagahmadow	Box	20	Bishangari	24/5/2005 Ec 1/2/2013 Gc	
10	Nogob	Duhun	box	20	Bishangari	27/5/2005 Ec 4/2/2013 Gc	
11	Fafan	Karmara hospital	box	20	Bishangari	27/5/2005 Ec 4/2/2013 Gc	
12	Jarar	Daror	box	15	Bishangari	5/06/2005 Ec 12/2/2013 Gc	
13	Doolo	Warder	box	10	Bishangari	30/11/2004 Ec 06/08/2012 Gc	
14	Nogob	Lagahida	box	8	Bishangari	19/4/2005 Ec 28/12/2012 Gc	
15	Fafan	Awbarre	box	7	Bishangari	—	
16	Qoraxay	Marsin	box	3	Bishangari	24/10/2004 Ec 01/07/2012 Gc	
17	Jarar	Araarso	box	1	Aquitable	19/10/2004 Ec 26/06/2012 Gc	
18	Nogob	Fik	box	2	Wuhagar	17/11/2004 Ec 24/07/2012 Gc	
19	Fafan	Karamera hospital	Box	1	Aquatable	27/05/2005 Ec 04/02/2013 Gc	
20	Fafan	Karamara hospital	box	2	Wuhagar	17/11/2004 Ec 24/07/2012 Gc	

Note: Ec: Ethiopian calendar, Gc: Gregorian (European) Calendar
Source: SRWDB Planning, M&E and NGO coordination department

d. Mobile workshop vehicles

Based on the preliminary plan of deployment of the procured three (3) mobile workshop vehicles, SRWDB is planning to keep all three vehicles at the bureau and send them to sites when it is necessary. But it is necessary to consider whether the vehicles should be based in SRWDB and be used at sites outside Jijiga Town when required within the patrol program, or the vehicles should be deployed at three major towns in the region as initially assumed. If they are based in SRWDB, the scheme has advantage in O&M of the vehicles but it will take time to send them to sites. On the other hand, if the vehicles are based at major towns, realization of proper O&M will be the key issue.

Equipment for mobile workshop that was described earlier will be loaded onto each mobile workshop vehicle. The management and O&M of the vehicles and the equipment are expected to be the responsibility of the relevant staff of SRWDB. Initial training was provided to the staff of the workshop by the study team in April 2013. In the future, the trained staff will be able to repair non-functional machines and facilities at various sites, which will contribute to the O&M capacity of SRWDB. In this sense, if the vehicles are deployed in some towns outside SRWDB, it will be highly necessary to send trained technical staff to the town along with the vehicle so as to realize effective operation of the mobile workshop vehicles.

e. Project vehicle 1 (Station wagons)

The two (2) procured project vehicles (station wagons) were used by the JICA study team during the study period in the short time, under the ultimate management of SRWDB. After the end of this study, SRWDB will bear responsibility of operation and management of the vehicles. These vehicles are mainly designed to transport people but they are also suitable for transporting small spare parts or field water test kits that can be easily lost or contaminated otherwise.

f. Project vehicle 2 (Double cabin pickup trucks)

The two (2) procured double-cabin pickup trucks were mainly be used for the field survey during the study period in the short time. After the end of this study, SRWDB will bear responsibility of operation and management of the vehicles and then they will help the technical staff to quickly go visit sites and also transport small to medium size items to sites.

g. Surface water pumps

Three (3) of the surface water pumps in Jarar Valley water supply system failed and installation of one (1) pump at conveyance pump station and booster pump station respectively were completed in February 2013 (refer to “results of pilot project” in chapter 2 of volume 2). Replacement installation of these pumps will enable stable water delivery to the service areas in the town. These pumps will be placed under the management of town water supply utility office and the office, together with JWSO (or another operational partner of UNHCR), will handle the operation and maintenance in the near future.

h. Submersible water pumps and generators

The two (2) submersible water pumps and generators were installed at the two JICA borehole wells in Jarar Valley. The installed submersible pumps will pump up groundwater from the

wells and deliver the water to the reservoir adjacent to the pump station. With the completed deep wells having submersible pumps, an additional 36m^3 per hour of water will be provided to the system. These sets of submersible pump and generator will also be operated and managed by the water supply utility office of Kabribeyah town and JWSO (or another operational partner of UNHCR).

2.5 Conclusions

As explained above, all the equipment and materials were procured and supplied to the Ethiopian side by July 2013. The delivery of the vehicles to SRWDB was delayed due to the required formalities on the Ethiopian side. However, the study team gave all possible training and instructions with regard to future operation and maintenance of the equipment and materials. Thus, these items especially vehicles are expected to be effectively used for O&M and water supply activities in the region, once the operational budget is secured.

Chapter 3

Operation and Maintenance of Water Supply Facilities

3 Operation and Maintenance of Water Supply Facilities

3.1 General

3.1.1 Background and objectives

Proper maintenance and management of water supply facilities and associated equipment is one of the crucial factors in realizing sustainable and efficient water supply. Proper management of a water supply system enables the water supply operator to earn stable income from its operation and this, in turn, will make it possible for the operator to implement planned expansion and maintenance of its facilities in future, which will maximize the operational rate of the facilities. Also, performing regular and planned maintenance will realize preventive maintenance of the facilities and equipment, and this will help extend the operational life of the facilities and will eventually make it possible to gain higher benefit versus the investment made to the facilities and equipment.

In Somali Region, the study area, a series of serious droughts has occurred and water trucking is being employed to satisfy the emergency need of water. Meanwhile, the donors and NGOs have been discussing the importance of expansion and new installation of water supply facilities in the affected areas as a permanent solution. In this context, this JICA study prepared a water supply master plan for the 16 target woredas and two large towns of Kabribeyah and Godey. Also, within the study, a small-scale pilot project of improvement and expansion of water supply facilities in the two towns (refer to Chapter 2 in volume 2 for details) was planned and implemented. This section of the study aimed to prepare a viable and effective O&M plan for the facilities to be planned in the master plan. This was done through monitoring of the pilot project construction and subsequent operation of the installed facilities. The outcome of the study is presented in this report as the O&M plans, and their cost. Also, a plan for technical training, that is required for the implementation bodies of the project, has been proposed. In addition, in this study, procurement and donation of vehicles to be used as mobile workshops, and equipment and tools to be used in the mobile workshops were planned and procured. This set of equipment is intended to improve the technical capacity of the maintenance workshop of Somali Regional Water Development Bureau (SRWDB) that is the major counterpart organization and main target for technical transfer in the study. Therefore, in this study, effort was made to prepare plans or guidelines for how to effectively use the donated equipment in order to realize efficient maintenance activities of water supply facilities by the government staffs concerned. This is to be realized through planned training to the technical staff concerned within this study. In this area of the study, “O&M of the Water Supply Facilities”, the following three tasks were performed and the results were presented as the final output.

- Preparation of O&M plans (staffing, activities, budget) for the water supply facilities for the 16 woredas and two (2) towns that take shape as a result of master planning.
- Preparation of mid- to long-term training plan to realize the above master plan
- Provision of short-term training and demonstration intended for effective use of the donated equipment for the workshop and emergency water supply

3.1.2 Approach and methodology

In this study, the author first reviewed present condition of operation and maintenance of water supply facilities of the target areas, especially of Godey and Kabribeyah towns and

reviewed the organizations concerned to clarify the problems. Also, special focus was placed on the staff of SWRDB that performs maintenance of water supply facilities, since SRWDB is the counterpart organization and a major target of technology transfer. In order to obtain the data, since the study team members were allowed to access only Godey and Kabribeyah towns, teams of local consultants were sent to collect the data for the study team.

In preparing the O&M plan and the training plan mentioned above, the outcome of the government organizational change (Business Process Reengineering: BPR) and the plans and policy of the donor agencies concerned, especially that of UNHCR, was taken into account in order to draw up realistic plans.

3.2 Present condition of O&M of water supply facilities

3.2.1 Policies on O&M at national to woreda levels

a. Rules and regulations at woreda, zone, region, and federal level

In Ethiopia, no manuals or guidelines that exclusively deal with O&M issues of water supply facilities has been prepared at the federal level. Some limited descriptions can be found in the federal-level documents such as “Water Resources Management Policy, 2010” and in “Water Sector Development Program”. Each region prepares its own manuals and guidelines in accordance with these documents. In many cases, preparation of O&M manuals and guidelines at the regional level or lower is realized with support from NGOs and donors.

The upstream government policies concerning O&M of water supply facilities found in such documents indicate the following policies for the purpose of improved sustainability and reliability of water supply facilities.

- Decentralization
- Self-financing for all future planning of water supply
- Promotion of community participation
- Preparation of manuals and guidelines

b. Policy, guidelines and manuals for O&M of water supply facilities in Somali Region

SRWDB is the organization that deals with issues of water resources and water supply in Somali Region. In SRWDB, each Core Process (highest level of operational unit within the organization) prepared the “Operational Manual” of its own in line with the upstream federal policies in the process of BPR. As will be mentioned in another section, the Water Supply Scheme Management Core Process that is responsible for O&M issues of water supply facilities in the region, made the manual (Water supply scheme management core process, Operational Manual, 2010) and clarified the general tasks and purposes of the activities of its staff. However, the overall contents of the manual rather focus on the principles and purposes and the document is not specific to the O&M work of water supply facilities. Even though, the following items of O&M related issues have been specifically described in this document.

- General contents of O&M work and Construction activities assigned for different levels of government offices.
- The standard duration of the work item of the O&M and construction services performed

by the offices above.

- Proposed staff list of different levels of government offices (woreda, town, zone, region)

The manuals specific to technical training of maintenance of water supply facilities and equipment were prepared by SRWDB as it became necessary, especially at the time of construction of new facilities and establishment of new management organizations. Such manuals have been, therefore, created sporadically just for a certain woreda or a certain group of people. Thus, no regular and comprehensive manuals have ever been made. In SRWDB, some individual staff members unofficially use manuals and guidelines that have been developed by NGOs or by another region but even such practices are rare at the zonal and woreda levels. An interview with SRWDB staff revealed that the bureau did not have any plan to prepare such manuals. This was found mainly because most technicians at the sites cannot understand written manuals and also because they do not have a custom of using manuals. The manuals are simply wasted even when they are prepared.

3.2.2 Category of water supply facilities for O&M

The water supply facilities (systems) in Somali Region, the detail of which is described in Chapter 3 of volume 2, can be classified into two types by their size and the level of technologies employed as shown in Table 3.1 below. The town water supply systems are managed by town water supply utility offices whereas the rural water supply systems are managed by woreda water offices. For each and every water supply system such as wells with a hand pump and public water taps, there is a group of users or a caretaker who are assigned to perform daily management of the system.

Table 3.1: Comparison between Town and Rural Water Supply System

Type of System	Town type	Rural type
Example of facilities	・ Piped distribution system with deep borehole wells or river water as its source, accompanying reservoir tanks, public fountains, individual taps as terminal supply points. Note: Applies only to Kabribeyah, Dagahbur, Godey, and Kabridahar towns	・ Small scale piped system with small diameter borehole well as water source, accompanying reservoir tanks and public taps as terminal supply points. ・ A hand pump installed over small diameter shallow borehole wells. ・ Small scale and shallow dam to harvest rainwater such as birka and haffir dam.
Water source	Deep groundwater, river water	Shallow groundwater, rainwater, river water
Size (target population)	10,000 to 50,000	A few tens to a few thousands
Managed by	Town water supply utility office	Woreda water office
WASHCO	Responsible for management of public water supply points. Collect water fee from end users and pay the water bill to town water supply utility office. The maintenance of the facilities is done by the water supply utility office.	Responsible for management of independent water supply facilities such as hand pumps, shallow wells. Collect money from end users and accumulate the money for future maintenance. Conduct fundamental maintenance by itself using the raised money.

3.2.3 Organizations concerned with water supply and their relations

SRWDB is mainly in charge of issues of water supply and water resources and under it are subordinate government branch offices and woreda water offices dealing with actual

maintenance of water supply facilities. Other than these government water offices, there are other organizations involved in water supply to refugee population and in emergency water supply. This makes the situation of water supply in Somali Region a bit complicated compared with the situation in other regions. The organizations concerned with water supply in Somali Region can be summarized as follows (refer to Table 3.2).

Table 3.2: Organizations Engaged in Water Supply in Somali Region

	Type	Duty/Activity	O&M aspect
Regional water bureau	Govt.	Drawing up the water supply plan for the entire region, implementation of large scale water supply construction works, Technical and managerial support to subordinate government offices, Emergency water supply, O&M of water supply facilities	Repair and change of the equipment and device of water supply in woredas (including towns)
Zonal water office	Govt.	Improvement planning, O&M, construction works of small scale water supply facilities in rural areas in the zone	Technical and managerial support to woreda offices
Woreda water development office	Govt.	Improvement planning, O&M, construction works of small scale water supply facilities in rural areas in the woreda	Simple repair and improvement of small scale water supply facilities in rural areas
Town water supply utility office	Govt.	Management and O&M of town water supply system of the area in charge	Basic light maintenance of the facilities
Woreda administration	Govt.	Discussion and advising on water supply issues in woreda through the water board	None
WASHCO	Users	Management and operation of individual water supply points	Daily management of water supply point
UNHCR	UN	Dealing with refugee issues (including water supply), instruction and monitoring of JWSO	Provision of operational fund to JWSO
JWSO	Govt.(UN)	Maintenance, expansion and protection of water supply facilities in Jijiga and Kabribeyah towns,	Repair of facilities in Jijiga and Kabribeyah towns
ARRA	Govt. (UN)	Provision of various support to refugee population in the camp	Repair of public taps within refugee camps
NGO	NPO	Implementation of water supply and hygiene projects in the areas of interest	Mainly rehabilitation and construction of small scale water supply facilities, fund provision to woreda offices

The following chart (Figure 3.1) illustrates the interrelationship among the organizations engaged in the management and O&M of water supply facilities in Somali Region. As can be seen in the chart, the situation is different in Kabribeyah woreda where UNHCR is involved in water supply due to the existence of large scale refugee camps. In Kabribeyah town, Jijiga Water Supply Office (JWSO) plays an important role in the O&M of water supply facilities. JWSO is, as will be explained later, a government organization but works under a contract with UNHCR and it is nearly solely responsible for the O&M and expansion of the town's water supply system.

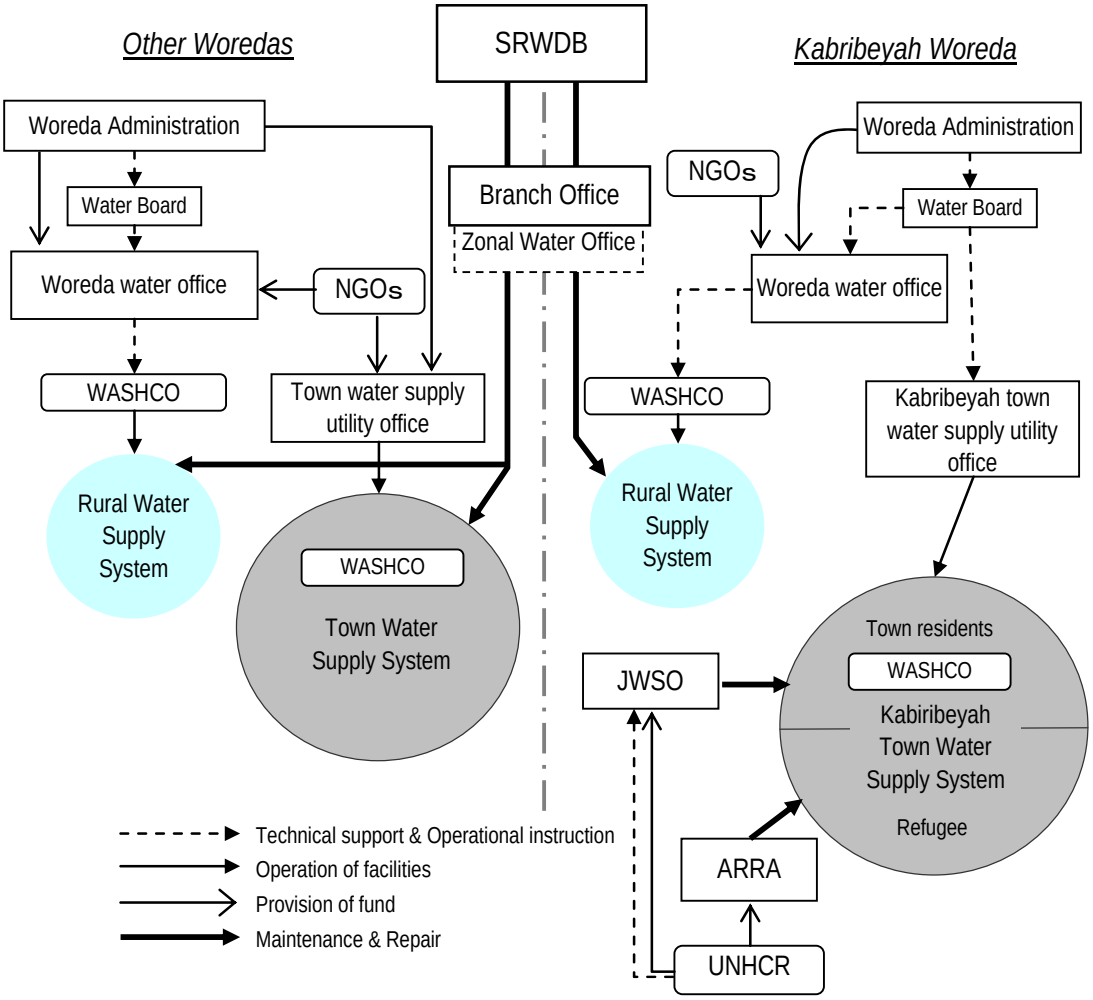


Figure 3.1: Inter-relationship among the Organizations Concerned with Water Supply

The following sections present the explanation of each of the organizations shown in the chart.

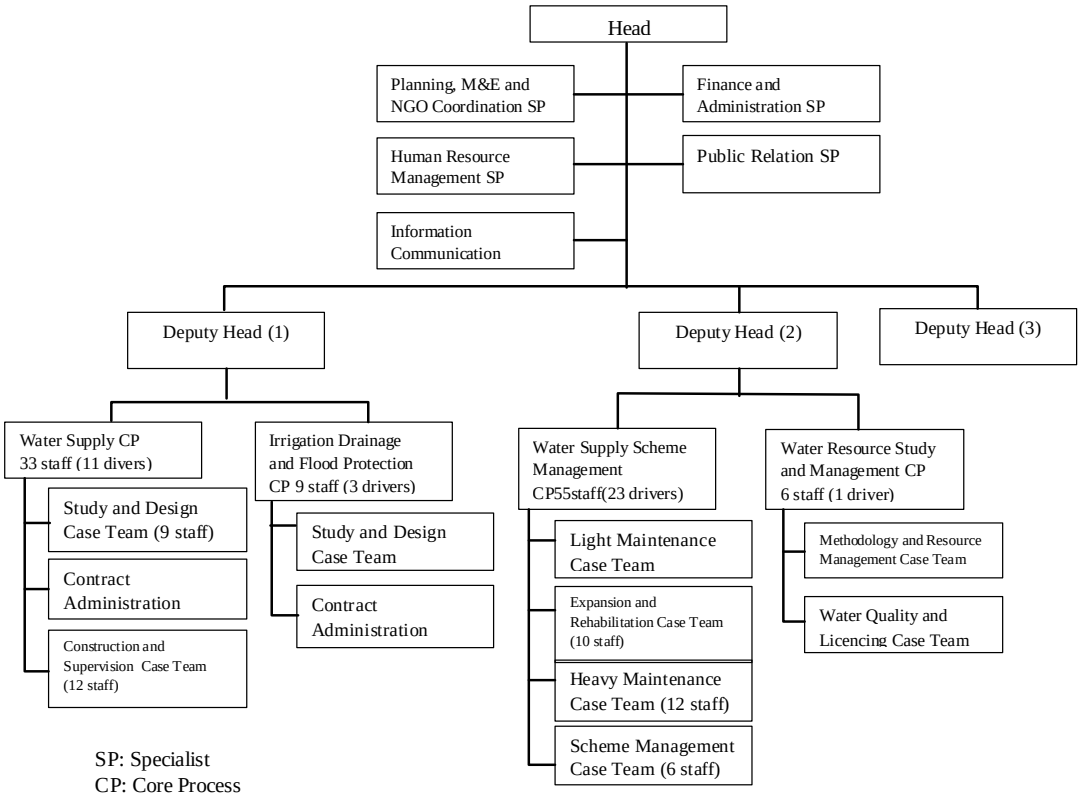
3.2.4 General conditions of organizations concerned with water supply

a. Somali Regional Water Development Bureau (SRWDB)

a.1 Organization of SRWDB

SRWDB is the subordinate organization at the regional level of Ministry of Water and Energy. It is responsible for preparation of plans/policies and execution of projects in water resources, water supply, energy, and irrigation. It is also responsible for providing technical instructions to its subordinating government offices such as woreda water offices, town water supply utility offices and for conducting monitoring of their activities (refer to Figure 3.2). SRWDB is especially responsible for maintenance of water supply facilities in rural areas. The maintenance work is classified into three levels: 1) light maintenance, 2) medium maintenance, and 3) heavy maintenance depending on the equipment involved. SRWDB was solely in charge of the maintenance work of all the levels before the BPR. However, after this restructuring, woreda offices have been given the responsibility of conducting light

maintenance.



Note : the third deputy head (one on the right) is currently being planned

Figure 3.2: Organization Structure of SRWDB

a.2 O&M work by SRWDB

The section that is in charge of the management of water supply facilities after construction is the Water Supply Scheme Management Core Process. This section carries out monitoring of the existing water supply facilities in the region and conducts repair and rehabilitation of the facilities based on the results of the monitoring and by working together with water offices. In addition, the section provides information, materials, and technical support to organizations concerned when there is an emergency. One part of this section is the maintenance workshop of SRWDB (corresponding to the light maintenance case team and heavy maintenance case team in the chart above)

a.3 Rules and manuals within SRWDB

SRWDB does not prepare or possess any comprehensive and standardized manuals on management and O&M of water supply facilities. According to the interview with the staff, this is because of the following reasons:

- There have been no major issues in O&M of rural water supply facilities. Sufficient technical training is given at the time of establishing a new organization and of employment of new staff members. Thus, necessity of preparing a comprehensive technical manual for daily activities is considered low.
- The operators and technicians who actually take on the O&M work of water supply

facilities do not have enough technical knowledge and educational background to read and understand manuals. Furthermore, they do not have a custom of using manuals at work.

The financial source of SRWDB is in principle the budget from the regional government. For ordinary activities, SRWDB forms the budget in the end of every fiscal year that starts from July and submits it to the regional government for approval. This ordinary budget does not include emergency/contingency spending items. Such emergency spending is covered by the special contingency budget of the regional government, or sometimes by the financial assistance from donors such as UNICEF.

b. Woreda administration and water board

Woreda administration is the government organization that deals with financial and administration issues of the woreda. One of its subordinate organizations is the woreda water office and woreda administration provides budget to the woreda water office. Woreda administration also has the water board that is made up of representatives of several organizations and groups concerned with water supply in the woreda. The water board functions as a decision making and advisory body to water offices. The members of water board are the following 10 people in general.

- Woreda council (1)
- Woreda water office head (1)
- Town council chairman (1)
- Town water supply utility office (1)
- Woreda health center (1)
- Representative of private sector (1)
- Representative of water user in town (1)
- Representative of water user in rural area (1)
- Representative of village seniors (1)
- Woreda financial office head (1)

In addition to the members shown above, the head of town water supply utility office is required to join the board's meeting as an observer.

According to the latest system of operation, the water board has the following rights and duties with regard to the activities of town water supply utility office.

- following up the activities of the office
- facilitating the budget procurement from NGOs and donors
- providing technical support and subsidies to improve conditions of water supply facilities

The water board, on the other hand, has a great influence over the function of the town water supply utility office, possessing the power of deciding its head, evaluating and approving their annual activity plan and budget. The water tariff, the major income source of town water supply utility office, also has to be approved through the water board by the regional water bureau, the woreda water office, and the woreda administration.

c. Town water supply utility office

Town water supply utility office is the government organization that is in charge of management and O&M of urban water supply system with piped distribution network and public and individual supply points. It is positioned below woreda water office or municipality government. In Somali Region, the following four towns have a town water supply system managed by the town water supply utility office (refer to Table 3.3).

Table 3.3: Town Water Supply Offices in Somali Region

Town		Kabribeyah	Dagahbur	Godey	Kabridahar
Supply population	Dry season	28,685	40,863	No data	51,000
	Wet season	11,360	28,637	No data	48,000
Water source		Groundwater	Groundwater	Surface water	Groundwater
Staff member		35	5	20	9

Data source: the socio-economic survey

Their usual activities are limited to the management and simple maintenance of the water supply facilities (including bill collection). The offices are, in principle, financed by the income from the sales of water collected from end users. However, the office sometimes receives some financial or materialistic support from regional water bureau, woreda water office, and NGOs. Out of the four listed in the table above, Kabribeyah has not yet been officially recognized as a town.

c.1 Kabribeyah Town Water Supply Utility Office

Kabribeyah water supply utility office is the government office that is in charge of the O&M of the water supply system in Kabribeyah town (Jarar water supply system) and it is unofficially often called “the water desk”. It is one of the subordinating organizations of the woreda administration and was established in 2006 at the time the town’s water supply system was completed. In the beginning of 2012, its organizational structure went through a major reform due to the BPR (Business Process Reengineering). The current organizational structure is supposed to be as follows (refer to Figure 3.3):

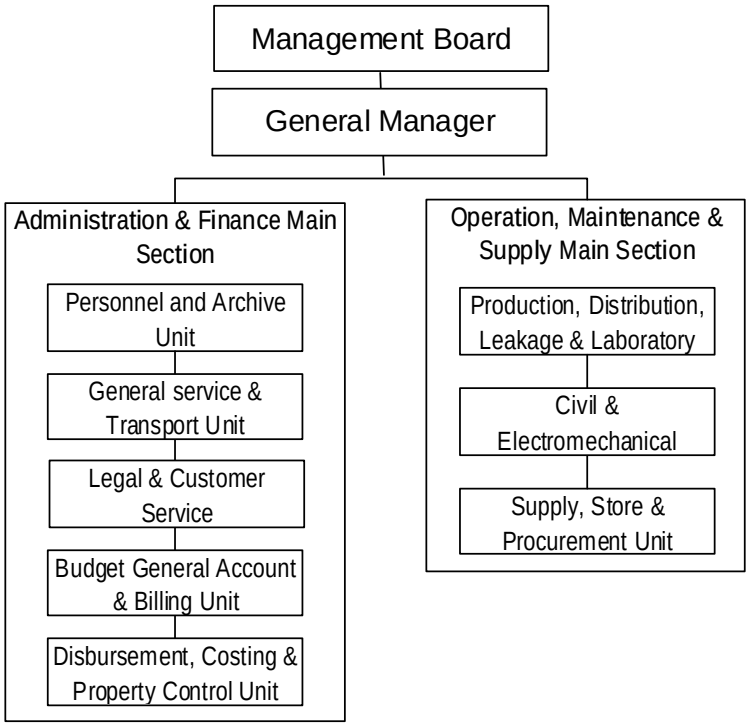


Figure 3.3: Organization Structure of Kabribeyah Water Supply Utility Office (after BPR)

The renewed organization is divided into many functional groups and the complete structure

requires more than 90 staff members according to SRWDB. However, the current number of employees is only 35 including the head, which is less than a half of the required number.

In general, the town water supply utility offices in Ethiopia are responsible for both O&M and management of urban water supply systems in their jurisdiction. However, in Kabribeyah town, where the system was introduced by the initiative of UNHCR, the O&M of the major part of the town's water supply system has been undertaken by JWSO since the establishment of the system* . The town water supply utility office is only engaged in its operation and maintenance within the host community area, although the office, from time to time, performs simple maintenance and extension work with some financial and materials support from NGOs. In such cases, it is the Civil and Electromechanical Maintenance Unit in the office that deals with the maintenance activity.

The detail of the staff assignment of the office at present is summarized in the table below. The total number of the staff is 34: office indoor staff including, the head, accountant, meter readers has 14 members and additional 20 staff members are employed to maintain and operate the large water supply facilities as field staff (refer to Table 3.4). The field staff works in daily shifts.

Table 3.4: Staff of Kabribeyah Town Water Supply Office

	Office staff	Field staff			
Site	Main office	Source well	Pump station & Treatment plant	Booster station	All area
Staff	Head (1) Office staff (6) Technical staff (7)	Operator (2) Security guard (1)	Operator (4) Security guard (4)	Operator (2) Security guard (3)	Plumber (4)

* The numbers in brackets signify the total number of employees for the work

The operators daily switch on and off the pumps depending on the level of water in the reservoir tank. They also check the operational condition of the equipment and if they notice any problems, they are supposed to notify the main office.

Kabribeyah town water supply utility office has 280 registered small individual customers (17 of which are public water supply points) and 8 large consumers such as public institutions subscribing to its service. All these customers have water meters. The water fee is collected as follows: two meter readers go around inspecting the water meters of subscribers at the end of every month. Then, the subscribers are given the bill. They either pay at the site or pay later at the office. The money is collected temporarily in the office and eventually deposited in a bank account. All the regular activities other than emergency measures are financed by this money they collect from the users. The site survey by the study team confirmed that the accounting book is properly kept with monthly income and water amount recorded. The accounting, however, is only checked internally, not by an external body. The water tariff is officially set at 10 Birr/m^3 for both small and large individual customers. However, the actual price of water sold at each public water point is set at a much higher rate of 0.5 Birr/20L (= 25 Birr/m^3) and the caretaker of the water point gets the difference. Also, many people buy water from house connection water points in their neighborhood.

Kabribeyah water supply utility office together with ARRA is supplying water to also 2,200

* Note : JWSO retreated from Jarar Valley water supply system in April 2013.

households (about 16,000 people) in the refugee camp in Kabribeyah town but no money is collected from the refugee population. The water supply points within the camp are without water meters and the office only checks the flow diverted to the refugee camp at the junction of the distribution pipeline.

c.2 Godey Town Water Supply Utility Office

c.2.1 Outline and background of the office

Godey town is a new administration that was spun off from Godey Woreda around the middle of 2011. The water supply utility office was created at the same time as part of the town administration. The office is in charge of the management and O&M of Godey town water supply system. A water board made up of seven representatives from stakeholders was established as a consultation body on water supply issues in the town about eight months after the establishment of the office but it was inactive after a while. Thus the office is temporarily fully in charge of any decision making on the town's water issues. Decisions made by the office have to be ultimately approved by the town council. The head of the office was replaced in January 2013 and the members of the water board were also changed to be the following 10 members.

1. Chairperson: Godey town Mayor
2. Deputy Chairperson: Godey town manager
3. Secretary: Godey town water supply utility office
4. Member: Godey town administration finance office
5. Member: Godey town administration women's affairs
6. Member: Godey town administration health office
7. Member: Godey town administration Education & Capacity Building office
8. Member: Godey town electric power cooperation authority
9. Member: Community elders
10. Member: Women's association

This change of the office head helped improve the environment of the office and the water supply condition as well.

c.2.2 Water supply facilities in its jurisdiction

There are six public water supply points in the (one is non-functional). There are also 350 private connection points (yard taps). The water is distributed free of charge at public water points as a measure to help low-income households. For the subscribers of yard taps, the office charges a uniform rate of 15 Birr per $1m^3$ of water. The water meters are checked normally at the end of every month and bills are prepared based on the reading but this is not done regularly on a monthly basis. The office has registered customers of 350 individuals. Besides these individual customers, there are also six large consumers such as schools and hospitals that subscribe to the service of the office. The rate for these large subscribers is also 15 Birr per $1m^3$. In addition to these, the office sells water to water trucks for road and other construction works.

c.2.3 System of tariff collection

A meter reader goes around checking the meters at the end of every month. They bring the data back to office and the bills are prepared in the office. The customers, after receiving the bill, pay the bill at the office. The money collected is recorded and taken to the bank. The

average monthly amount of money collected is generally 70,000 Birr. The rate is fixed at 15 Birr per 1 m^3 regardless of the total amount used or the type of customers. If the water meter is rented, the user is charged a rent of 8 Birr per month. At the public water supply points, water is provided totally free or as low as 2 Birr per 1 m^3. However, at one public site which is located in a private yard, the household owner controlled the price for her own sake and refused to give water to those who could not afford the rate. As a result, only 10 households were able to get water from that point. This problem was solved by the water office after the study team pointed it out.

Collection of money depends on the voluntary conduct of the customers and thus, many people pay late or default on their payments. As a result, usually only 60% of bills are paid on time. In general, when the users default more than 2 months, the office will stop the water supply. However, this rule does not apply to some government workers who have regular incomes.

c.2.4 Budget for the office

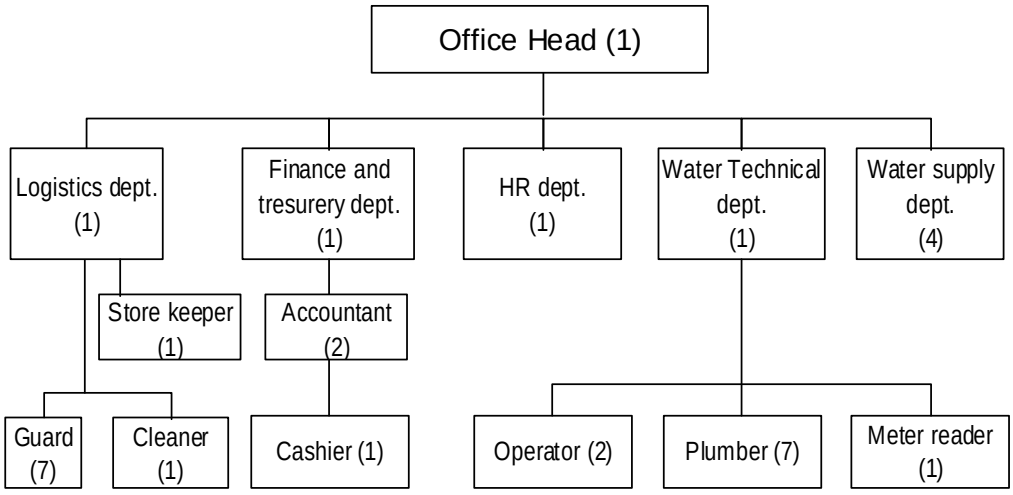
All the expenses of the office are paid from the money collected as water bills and the average monthly amount is about 70,000 Birr. A special budget from the town administration for O&M and repair of facilities is to be released from July 2012. However, the budget has not yet been release at this point (November 2012) and the continuation of the budget is not promised either. The office did not have its own financial function before March 2012, and all the budget was managed by the woreda water office. At present, with its own financial function, the office keeps the data on water supplied to the customers and the collected bills in the book. As for expenses, the office compiles the items and prepares an expense report to the town administration.

c.2.5 O&M activities

As the daily O&M activities, the following tasks are conducted: 1) operation of intake pumps, 2) repair of leakage in pipelines, 3) input of chlorine. In addition, they regularly conduct cleaning of reservoir tanks (once a year), sludge removal in the sedimentation pond (twice a month), replacement of damaged distribution pipes (as required). The regular activities at each of the component facilities of the system are listed in the table at the end of this chapter.

c.2.6 Organizational structure

The office has 31 members and 12 out of them are clerical staff members who work inside the office. The other staff members work outside the office as field staff. The office structure is as shown in Figure 3.4. The office shares the building with woreda water office and occupies four rooms including a storage room.



Note: numbers in parenthesis indicate the number of staff members

Figure 3.4: Organizational Structure of Godey Town Water Supply Utility Office

c.2.7 WASHCO in Godey Town

There are no resident groups that are in charge of operation and management of water supply facilities in the town yet. The office has an intention to establish such organizations (WASHCO), at the six existing public water supply points in future. To do so, the office is going to get technical support from SRWDB but budget allocation is the duty of the office. Thus, no specific plans have been made at this point. Most of the existing water points are located within a private yard and the owner of the plot temporarily acts as the operator of the facilities. Since the price of water is determined by the owner, as presented earlier, that creates problems of water distribution.

c.2.8 Educational and technical levels of the staff

About a half of the members have TVETC level education but actual experience is limited, especially for the young employees. The staff members are not doing what they are supposed to do daily and their morale is not high. However, the situation seems to be gradually improving after a new head took office at the beginning of 2013.

d. UNHCR

UNHCR, Jijiga sub-office, one of the agencies of United Nations is the founder of the water supply system in Kabribeyah town (Jarar water supply system) and still is the legal owner of the system. UNHCR has a remote office in Kabribeyah town and provides various supports to the refugee population working together with the Agency for Refugee and Returnee Affairs (ARRA). Their support to the refugees covers food security, water supply, health and hygiene, education, and general security. Kabribeyah town has a large refugee camp and the Jarar water supply system was originally constructed to serve this population. The O&M of the whole water supply system except for the host community area is conducted in collaboration with Jijiga Water Supply Office (JWSO) and ARRA, and they do maintenance, improvement and expansion of the system. The contract between UNHCR and JWSO, however, has recently terminated. Both ARRA and JWSO are the government agencies created mainly to

facilitate the activities of UNHCR in the region and thus, they are both financed by UNHCR. For this reason, UNHCR closely monitors their activities by requiring the two agencies to regularly report their activities and financial status and also to attend regular meetings with UNHCR.

e. JWSO

Jijiga Water Supply Office (JWSO) is a government agency founded by the Ethiopian government and is in charge of O&M of the water supply system in Kabribeyah town as well as the management and O&M of the water supply system in Jijiga city. As for the activities concerning Kabribeyah town water supply, the office depends on UNHCR for its contractual budget. The office is strictly monitored and supervised by UNHCR under the contract and has an obligation of reporting annual activity plan and quarterly performance reports and accounting record. Its organizational structure is shown in Figure 3.5 below.

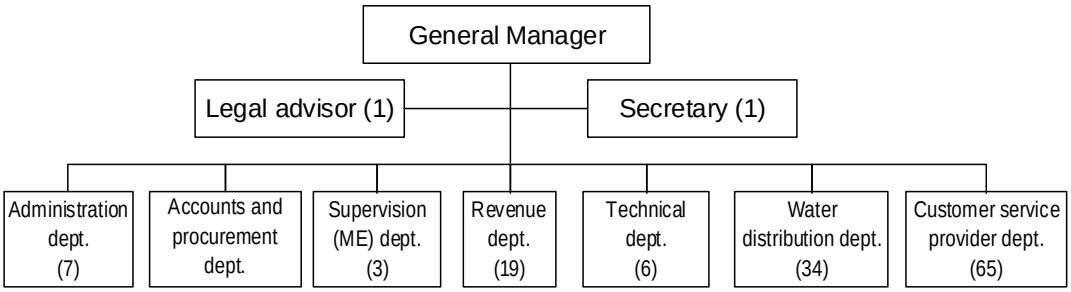


Figure 3.5: Organization Structure of JWSO

In addition to the organization in the chart above, in Kabribeyah town, JWSO has a local operation office named (Jarar Valley Water Supply Organization) that used to share an office with Kabribeyah town water supply utility office. Now it is moving to a new office within the refugee camp. Usually, 13 technical members in the office deal with large-scale extension of the system or repair works. If the scale of the work is too large for JWSO to handle, it subcontracts the works to a local contractor, which it then supervises throughout the works. Their field inspectors regularly go around in the assigned sectors of the camp to check the conditions of water supply facilities. Repair work is done by its technical staff in response to the report from these inspectors. When a new water supply point is constructed, it is also their duty to organize a WASHCO for the water point. The department that is engaged in the construction, works supervision, and O&M is the technical and water distribution department that has a lot of technicians.

Due to the termination of the contract with UNHCR in April 2013, JWSO withdrew from the O&M activities of Jarar Valley water supply system.

f. Agency for Refugee and Returnee Affairs (ARRA)

ARRA is a government organization designed to provide support to the refugees within Ethiopia. It has the head office in Addis Ababa and four sub-offices to manage 17 refugee camps of about 353,935 people in the country (ARRA update Vol. VI, June 2012). It provides various types of support in the areas of food, health and hygiene, education etc. In the area of water supply in Somali Region, ARRA is a coordinating agency on the government side. In water supply in Kabribeyah town, it is in the position of monitoring and

coordinating the activities of many other organizations concerned with water supply such as UNHCR, JWSO, Kabribeyah water supply utility office, NGOs to adjust their interventions in the area.

One of the sub-offices (coordination office) is located in Jijiga city and it also has a small operation office in Kabribeyah town where a large refugee camp is located. As for its activities in refugee camp in Kabribeyah town, one water supply engineer and three assistant technicians together work to repair broken facilities (of 48 water supply points) within the refugee camp. ARRA financially depends solely on UNHCR.

g. Woreda water development office

Woreda water development offices are subordinating offices of woreda administrations and they deal with the water supply issues in the entire woreda. The office is in charge of all the water supply facilities in its woreda except for large scale urban water supply systems that are looked after by town water supply utility offices. Their target water supply systems are, thus, those in rural areas and they are usually hand pumps and small scale traditional dams. The following table summarizes the condition of the 15 woreda water offices (excluding Doba wein woreda) that are the targets of this study (refer to Table 3.5). The data was collected in the socio-economic survey in this study.

Table 3.5: Condition of Woreda Water Development Offices in the Target Woredas

Woreda	No. of Office staff	Office & Technical equipment	Functional water supply system (Functional/all)	Status of fee collection
Araarso*	6	Desktop PC x 1	3/3	No data
Adadle	3	None	0/1	Not enough
Beercaano*	1	None	NA	Not enough
Birqod*	7	None	3/3	Not enough
Danan	5	Desktop PC x 1, Phone x 1	(0/2)	Not enough
Dagahbur	8	Desktop PC x1 , Phone x 1	6/6	Not enough
East Ime	3	None	0/1	Not enough
Godey	7	Desktop PC x 1	2/2	Not enough
Kabribeyah	8	None	4/11	Not enough
Kalafo	7	Generator x 1	1/1	Not enough
Kabridahar	7	Desktop PC x 1	5/8	Not enough
Mustahil	7	None	1/1	No data
Rasso*	2	None	1/1	No data
Shaygosh	6	Printer x 1	3/3	Not enough
West Ime	3	None	1/2	Not enough

Note: Data source is the socio-economic survey in this study.
The woredas with "*" are newly created ones
The number of functional system is the system excluding dams,
The systems in Danan have been reported abandoned due to problem with source water

As shown in the table above, many offices are under-staffed the general capacity of woreda water offices are low and less than a half of these offices have decent office space. Especially technical equipment to facilitate their daily work is totally lacking. The ratio of functional water supply systems (borehole wells, river intake) excluding crude earth structures such as

traditional dams is not very high with about 70% working out of 43 systems overall. The main activities of woreda water offices before BPR were limited to very minor and simple repair work. All the major repair work of the water supply facilities in the woredas that required some skills was conducted by SRWDB. Thus, these water supply systems have been maintained practically by SRWDB until now. However, BPR shifted some responsibilities of SRWDB to woreda water offices and they now have to do the maintenance of the basic level (light maintenance) on their own. None of the woredas are collecting the water fees properly.

g.1 Kabribeyah woreda water office

The organizational structure of Kabribeyah woreda water office has been changed as a result of BPR in the beginning of 2012. However, the new structure has not been announced yet. The old structure is as follows (refer to Figure 3.6).

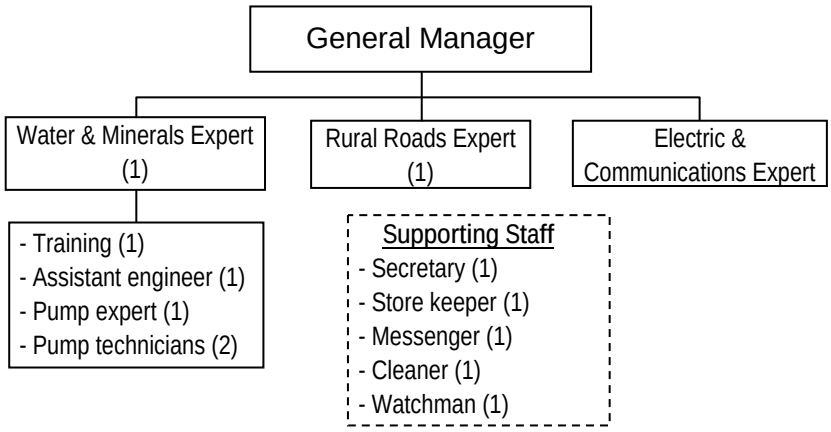


Figure 3.6: Organization Structure of Kabribeyah Woreda Water Office (before BPR)

In the case of Kabribeyah woreda, woreda offices have been recently doing the following work targeting 29 kebeles within the woreda.

- Construction of Birkas (small traditional dams)
- Water supply by water truck
- Distribution of chlorine disinfectant
- Monitoring of borehole sites
- Simple maintenance of water supply points

The activities of the woreda water office are financed mainly by the woreda administration. Supplementary financial support also comes from SRWDB, NGOs especially in the case of emergency water supply. Before BPR, the budget was evaluated and executed at the regional level and such budget was not appropriate considering the change in situation in woredas during the time of budget evaluation and execution. After BPR, however, the budget is executed directly from the woreda administration office that knows the situation of the woreda better and the problem is expected to improve.

g.2 Godey woreda water office

g.2.1 Organization

This office is a part of Godey woreda administration and has 15 staff members as indicated in

Figure 3.7. All are technical members and there are no clerical staff who deals with financial matters. Its organizational structure is as shown below.

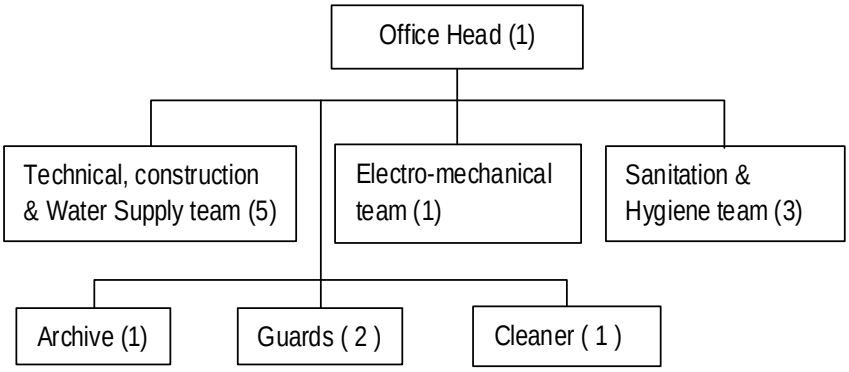


Figure 3.7: Organizational Structure of Godey Water Supply Utility Office

g.2.2 Activities

The office is in charge of 16 kebeles within the woreda and mainly conducts the following activities.

- Planning, designing and construction of birka (many are covered)
- Planning, designing and construction of Hand-dug wells (max 15 m)
- Formation of WASHCOs
- Distribution of water treatment agents

The office trained 4 WASHCOs in 2012 and 9 WASHCOs in 2011. As for the water treatment agent, the office distributed 12 cartons of agents to four kebeles in 2012. As a result of BPR, the office is now also in charge of minor maintenance of water supply facilities. The office already has a budget allocated for this purpose and anticipates no specific problems in this regard.

g.2.3 Budget

The budget for its activities is provided by the woreda administration. For the fiscal year of 2011 (July 2011 to June 2012), the total annual expense was about 370,000 Birr. This accounted for ordinary office expenses and O&M cost of the water supply facilities but does not include salary of the office staff.

g.2.4 Status of O&M of water supply facilities

In order to conduct O&M of the constructed and existing rural water supply facilities, WASHCOs were established. The members were instructed to collect at least 0.5 Birr per 20L of water to raise funds for O&M of the facilities from 2011. So far, WASHCOs collected about 500 Birr on average and the maximum is 2,000 Birr. They are reportedly doing well.

h. Zonal water office

The zonal water office is the government agency hierarchically positioned between the regional water bureau and woreda water offices and they deal with issues of water resources, water supply, energy, and irrigation in the zone. However, in Somali Region, there are no more active zonal water offices at present. Instead, there are three branches of SRWDB as local coordination offices of SRWDB. These three branch offices coordinate three zones respectively as shown in the table below, and perform the tasks that had been previously done by zonal water offices. This change is a result of decentralization where more duties and power were given to woreda water offices in the process of BPR (refer to Table 3.6).

Table 3.6: Branches of SRWDB and Zones under the Branch

Dollo branch	Kabridahar branch	Shinile branch
↓	↓	↓
Godey Zone	Korahe Zone	Jijiga Zone
Afder Zone	Dagahbur Zone	Shinile Zone
Liben Zone	Warder Zone	Fik Zone

According to SRWDB, the bureau has a plan to revitalize zonal water offices in the near future.

i. Water user's management committee (WASHCO)

i.1 Outline of WASHCO

The Ethiopian water sector policy and WASH guideline dictate that a group of users (WASHCO) be assigned in order to properly manage and operate each and every water supply point. A WASHCO normally consists of 5 to 7 members and is in charge of operation of public water supply points (water delivery), collection of water fees from the users and minor maintenance of the facilities. The following members (refer to Figure 3.8) make up a WASHCO and it employs guards and operators (caretakers) when necessary.

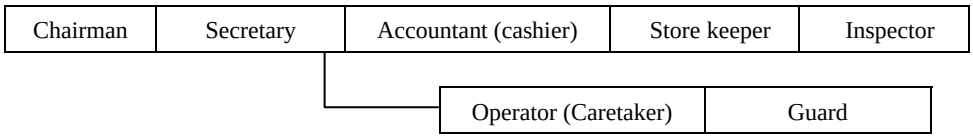


Figure 3.8: Organization Structure of WASHCO

The members are generally selected from the expected users of the water supply point at the time of its construction and the members receive organized training before they take on their tasks. The members work without salary but at existing sites where WASHCOs have not been formed, the current caretakers have advantages of obtaining a part of the sale of water.

The duties and tasks of WASHCO are different depending on the setting of the water supply points. Their tasks in rural areas, urban areas, and in refugee camps are summarized in the table below. In rural areas, the water supply points such as hand pumps and dams are usually independent facilities that are constructed by the government, donors, and NGOs. The facilities are handed over to the WASHCO after the construction and become the property of the population (water users). In this sense, WASHCO is required to maintain the facility on its own (except for heavy maintenance) by collecting water fee from the users and keeping the money for future O&M needs. On the other hand, in the case of urban water supply where

WASHCOs look after mainly public taps and boreholes with a motorized pump, WASHCOs only collect water fee from the users and hand over the money to the water offices in charge (town or woreda water offices) that have responsibility to maintain the system. In the refugee camps, since the O&M of the facilities is conducted by JWSO and ARRA, WASHCOs only engage in daily operation of the water supply points (refer to Table 3.7).

Table 3.7: Comparison of WASHCO Tasks and Duties in Different Settings

	Facilities	Duties and Tasks	Maintenance
Rural area	・Public tap ・Small dams ・Well with hand pump ・Borehole with public taps	WASHCO is responsible for all the operation and most of the maintaining the facilities on its own by collecting water fee. In the case of heavy maintenance, they receive technical assistance from woreda water office or SRWDB.	All the facilities except for Birka and Hafir dams are practically maintained by SRWDB
Urban area	・Public tap	Conduct daily operation of the facility. Collect water fee from the users to give to the water offices in charge of maintenance. Maintenance is done by water office.	Water offices (town or woreda) conduct the maintenance of the facilities
Refugee camp	・Public tap	Daily operation only. No water fee collection	JWSO and ARRA does the maintenance

3.2.5 Ability and actual performance of workshop in the SRWDB

In order to grasp ability and performance of the staff concerned with O&M in Somali Region Water Development Bureau (SRWDB), interview surveys with the staff and document collection were conducted in this study. Especially an investigation by a member of the study team who specializes in machinery issues was done, through interviews with all the staff members and observation of their behavior at work in July and August 2012. The confirmation of the machine parts owned by SRWDB was conducted based on the equipment list provided by the workshop with the help from some selected staff members.

The maintenance of the water supply equipment in the region are conducted by the maintenance workshop (hereafter called “the workshop”) of SRWDB. The workshop has a designated workspace of about 40m x 60m in the SRWDB compound and have small work areas with a roof designed for different kinds of maintenance work in addition to an auto-garage and a pump test pit.

a. Staff of the maintenance workshop of SRWDB

The composition of the staff of the workshop is as follows.

Group	Number	Education level
Electric maintenance staff	8	TVETC graduates or experienced worker.
Machine maintenance staff	6	TVETC graduates or experienced worker.
Welding staff	3	Maybe educated in welding technique.
Plumbing staff	2	Experienced worker
Assistant	3	Include a service driver

The staff consists of above-mentioned 22 members, but a half of the staff regularly work in the field for field patrol duties and the rest remains in the SRWDB compound. The age structure of the staff is as follows: it ranges from the youngest (25 years old) to the eldest (58

years old). The average age of the staff is 36.4 years old. The employment period of the staff ranges from one year to 24 years (2 persons) with its average being 8.5 years. Judging from the years of experience of the staff, they are considered fairly experienced.

b. Technical level of the workshop staff

There are several ways to evaluate the technical level of the staff including some simple methods, but none of them could not be used due to the condition of the day of the visit and also to lack of apparatus. Therefore their technical level was estimated through visual observation of their behavior in addition to observation of tidiness of the workshop (proper arrangement of equipment and materials) and how the machines and apparatus are stored.

The result is far from satisfactory for the staff of SRWDB. It is, thus, necessary for the staff to make more effort to improve their skills and foster the morale as an engineer. Even if the work environment and other conditions are not favorable, with appropriate morale and aspiration as engineers, they would be able to keep their work environment tidy and more organized.

c. Present conditions of materials and equipment owned by maintenance workshop

The list of machines, tools, and apparatus owned by the maintenance workshop was reviewed and confirmed and is shown in Table 3.8. The tools and equipment owned by the workshop is far from sufficient and the study team selected tools and equipment to be used with the mobile workshop vehicles based on this list. The details are presented in chapter 2 of this volume. After the arrangement of the tools and equipment was complete, the study team also procured some consumables necessary for the use of the tools and equipment.

Table 3.8: Machine Parts and Apparatus owned by the Workshop

No	Name	Condition
1	Bench Vice	Reportedly there should be three in number but only one was confirmed and it is out of order. (small size)
2	Drilling Machine	Left unattended; it is not wired and is out of order.
3	Bench Grinder Machine	Three in total. One is left not-wired. (large size)
4	Hydraulic Press Machine	Hydraulic-press machine is not working. (large size, the size not match the workshop)
5	Compressor (Electric drive)	Both have missing parts, damage to two baby compressors.
6	Nozzle Tester	Impossible to use. There is damage and missing parts
7	Sheet rolling machine.	Unattended in mint condition.
8	Shearing Machine	Not confirmed
9	Metal Cutter Machine	Not confirmed
10	Valve grinder Machine	Kept in the indoor warehouse in mint condition.
11	Lathe Machine	There are large and small ones. Old models. The large one has missing parts.
12	Welding machine	Kept in the warehouse. No match for repair work
13	Pipe Bender	Not confirmed
14	Pipe threading Machine (manual)	They are not systematically available.
15	Welding Machine (electric)	220V AC type. No match for repair work. An error of the model choice.
16	Cutting Machine	One is available.
17	Battery Charger	There are two but one is completely dismantled

* They have fair amount of hand tools though they are not systematically chosen.
* The stock keeping method of the electric apparatus is inappropriate, but the stock covers a general selection of equipment (not clear if they are all in a functional state)

d. Actual activities of the maintenance workshop

The actual maintenance work performed by the staff is mainly what can be called as “reactive exchange of the corresponding parts”. This is not the proper “planned maintenance work” performed in accordance with schedule. The main activities of the staff are limited to such reactive maintenance work due to the unavailability of equipment, facilities, and budget to perform the work in a more organized way.

As mentioned above, a half of the staff of 22 members is engaged in site patrols. Therefore, their duties can be classified into the following two types: Normal inspection and field patrol using the mobile workshop.

d.1 Normal inspection

It is usually performed every three months by visiting existing borehole wells for inspection. The inspection aims to replace common consumable or wearable parts and to check if there is any leakage of water or damage in the pipelines. It is thus, quite different from the large-scale maintenance and repair work that are usually conducted in regular maintenance work in other countries. Cases of trouble with electric control panels caused by sand dust are reported, but in many cases, the problem is suspected to have been caused by another factor other than sand dust.

d.2 Field patrol by mobile workshop

Every year, the patrol team visits three zones using the only one existing mobile workshop (pickup truck loaded with equipment in the cargo space). It is reported that it takes 40-60 days for the team to visit all the facilities in one zone and this leaves little time to visit other zones. In the new system after BPR, the team is supposed to conduct maintenance centered in the three branches of SRWDB mentioned earlier.

The maintenance of the vehicle performed between field patrols is nothing more than the reactive repair work to fix problems that have happened. Their work covers many facilities and equipment though the required level of maintenance is not high. This is considered a combined result of aging of the facilities and reactive maintenance work that have been performed. In addition, duties of the staff also include changing oil and the expendable supplies for vehicles and machines. With all these activities, the staff is considered fairly busy.

3.2.6 Present condition of O&M of Kabribeyah and Godey towns

The following sections present the results of the survey on the present status of operation of the water supply systems in Kabribeyah and Godey towns, the two important towns in the study area. The survey clarified, through interviews and site observations, what type of tasks and which and how many staff members were involved in the operation of each component facilities of the systems. The tasks discussed here are all those necessary for regular operation of the facilities and do not include irregular and accidental ones.

a. Kabribeyah Town

In Kabribeyah town, the town’s water supply system is operated mainly by the field staff of town water supply utility office. As explained earlier, JWSO is also involved in the

maintenance of the system. However, the survey focused only on the daily and regular activities of system operation and cleaning, and thus, this section does not discuss the major maintenance activities by JWSO that are conducted on an irregular basis. The results of the survey in Kabribeyah town are summarized in Table 3.30 to Table 3.31 at the end of this chapter. The table shows the tasks and their frequency, and the number of staff members assigned to the tasks.

The component water supply facilities in the Jarar Valley water supply systems are located in clusters and four clusters can be recognized as compiled in Table 3.9 below. The staff members are assigned to each facility and the table summarizes the total numbers of staff members for each cluster of facilities and the pipeline system.

Table 3.9: Staff Assigned to Operation of Kabribeyah Town Water Supply System

Cluster of facilities	Stationed field staff			Temporary staff
	Technician	Operator	Guard	
Water source wells	0	2	2	0
Treatment plant, Reservoir, Conveyance pump station	0	3	2	2 plumbers 1 technician
Reservoir, Booster pump station	0	2	2	2 technicians
Distribution reservoir	0	0	2	1 technician
Pipeline system	0	0	0	3 plumbers 2 technicians
Sub-total of each staff	0	7	8	
Total	15			

Note) Temporary staff: unspecified technical staff from Water Desk (town water supply utility office) to assist the main staff
Shaded column is the non-field staff that is not stationed at these facilities

As can be seen from the table above, the total number of staff members who are engaged in operation and maintenance of the water supply system is 15 and all are the field staff of Kabribeyah town water supply utility office. Out of this, the essential technical staff is only 7 in number. When they do cleaning of water tanks, valves, and pipes, the office sends two plumbers and one or two technical staff members to supervise the work. The operation of pumps and generators are done by two or three operators but some at both conveyance and booster pump stations are those who have been just promoted from a guard. It is common that a guard, after having worked frequently as an assistant to an operator and having acquired experience, becomes an operator. Since commercial power supply is available at most facilities, the tasks of the operators are simply to turn on and turn off the pumps except at one source well site where a generator needs to be run. Other than this pump operation, the operators need to check the operational condition of the pumps and generators and associated facilities. When they find any problems, they will report them to the office.

Another work regularly done is the input of chlorination agent at the reservoir adjacent to the conveyance pump station. This is done only twice a week and one kilogram of agent is dosed each time regardless of the pumping amount. The operator, without supervision of technicians, mixes the agent (including powder) with water to prepare a concentrated solution, and dumps it into the reservoir.

The tasks regularly performed and related to maintenance of the system are cleaning of pipes, valves, and reservoir. Since the hardness of the source water is very high, a thick layer of scale is produced on the inner walls of pipes and valves and on the walls of reservoir etc. in a

short period of time. In order to remove the scale within pipes and valves, these parts must be detached from the main system. Two (2) plumbers from the office are sent to the site and they work with the operators. Likewise, one technician from the office is sent to the site of reservoir cleaning to supervise the work. The work of scale removal in reservoir is manually done by mechanically scraping off the scale. The work will require up to 45 daily workers. As for the pipeline system, there is no regular inspection of the pipelines conducted. The office organizes a comprehensive pipeline repair work once every 8 months, covering both conveyance and distribution pipes based on the information the staff has come across or on the information that has been reported.

Most of the operators working in the field do not have sufficient educational background and many of the guards have no official educational record. Some guards become operators after they have learned skills and gained experience and consequently, some of the operators cannot read or write. The three operators in the table above are not the exceptions but they have more than 10 years of field experience. Two of them even have a total of four months training experience in the field of electro-mechanical equipment. The technician from the water supply utility office who comes to the site to supervise the reservoir tank cleaning work also has insufficient education but has over 15 years of work experience and equivalent training experience to the above.

The pump operation at the pump stations is not a difficult or time-consuming work in itself but the work starts early in the morning and continues until late in the night, involving switching on and off of the pumps 10 times a day. One person takes charge of this operation for an entire day and three people work in a shift. The pump stations and water sources are more than 10 to 20 km away from the town center and mobile phone network is not reliable. In this sense, the work environment of the operators is not very favorable.

b. Godey Town

In Godey town, the town's water supply system is operated mainly by the field staff of town water supply utility office. The results of the survey in Godey town are summarized in Table 3.10 below. The table shows the tasks and their frequency and the number of staff members assigned to the tasks. The component water supply facilities in the systems in the town exist in clusters and thus can be divided into three clusters as in the table below. The total number of staff members assigned to all the component facilities is 15.

Table 3.10: Staff Assigned to Operation of Godey Town Water Supply System

Cluster of facilities	Stationed field staff				Temporary staff
	Technician	Operator	Guard	Plumber	
Intake, Pump house, Treated reservoir	2	2	4	0	0
Treatment plant			2	0	0
Distribution reservoir	0	0	1	0	1 technician
Pipeline system	0	0	0	4	0
Sub-total of each staff	2	2	7	4	
Total	15				

Note) Temporary staff: unspecified technical staff from Water Desk (town water supply utility office) to assist the main staff
Shaded column is the non-field staff that is not stationed at these facilities

All the component facilities are operated by the specially assigned field staff of town water

supply utility office except for the distribution reservoir in the town which is operated by an available non-field technical staff member of the office. The main staffs who are in charge of operation of pumps and generators are the two technicians and the two operators in the table above. They work as a pair (one technician and one operator) in an alternative-day shift. Their tasks involve, as shown in Table 3.32 and Table 3.33 at the end of this chapter, operation of pump and generators, regular cleaning and sludge removal in tanks and repair of intake pipes. The suction end of intake pipe is currently placed directly into the natural river stream. Thus, regular cleaning of clogged intake filter will be necessary. Also the intake pipe is damaged due to torrential river flow and floating objects in the rainy season. This makes it necessary to regularly repair and replace the intake pipe especially in the rainy season. There is only one set of pump and generator at the water intake facility and there are no backups. They do not conduct regular maintenance of these pumps and generators either. When they clean reservoir or remove sludge from the treatment plant chambers, they hire a few to 20 daily workers and the work is done manually under the supervision of the technician and the operator. As for the maintenance of pipeline system, the office does not conduct regular inspection work but performs comprehensive repair work covering both conveyance and distribution pipelines based on the information obtained during their regular course of work.

Both operators and technicians have insufficient education but the technicians have much longer work experience with the system. Furthermore, one of the technicians has had a total of a few months of training in the relevant field. The work is done mainly by the operators under the supervision of the technician. At the site of the distribution water reservoirs (3 tanks) in the town center, other than regular cleaning of the reservoir, one technician from the water supply utility office checks, every day, the water levels in the reservoir and operates the valves accordingly. Many of the staff members of the office have TVETC level educational background but they have little work experience especially in practical work.

At present, the operation work of the majority of the component facilities of the water supply system is conducted only by the four members of the staff as explained above. They need to work from early in the morning to late in the night to operate pumps and in addition, they are also obliged to respond to emergency situations.

3.2.7 Condition of water fee collection and WASHCO activities

a. Present status of WASHCO in study area

The system of management of water supply facilities by the users through establishment of WASHCO is still a new idea in Somali Region. In Kabribeyah town, there are 15 public water supply points but no WASHCOs have been officially formed at any sites. The persons who operate these water points at present are called “caretakers”. Since the caretakers have no technical skills, they only conduct most rudimentary maintenance of the public taps and report all the other problems to the water supply utility office and ask for their maintenance service. Each water supply point is equipped with a water meter to show the amount of water used at the point. Caretakers collect water fees from the water users and pay the bill that is calculated based on the amount of water used and on the pre-determined water tariff to the town water supply utility office.

A survey on the nine functional water points in Kabribeyah town revealed that the caretakers had never received training on water point management. They were simply nominated as caretaker because the water point was constructed in their yards. For this reason of having the

water points in their own plot, they have been in that position for a long time of three to seven years and they are rarely replaced. The caretakers understand that their duties are to distribute (sell) water to end users and to keep the water points clean. They do not keep record of income and spending concerning the water. Within the refugee camps, similar systems have been organized for every water supply point but they do not collect water fee. The members simply do the daily water supply operation for the users and report to ARRA in the case of any problems.

In Godey town, there were no WASHCOs at the time of the study but the town water supply utility office is planning to establish WASHCOs at the six public water supply points. The office is supposed to conduct WASHCO organization with technical assistance from SRWDB. However, it is the duty of the water supply utility office to prepare budget for the training and the budget has not been secured yet. Currently, all the existing public water supply points are located in privately owned plots and the owners of the plots are temporarily put in charge of the operation of the water points as caretakers. Some caretakers decide their own water prices and that in some cases causes problems. A survey by the study team revealed that the existing two public water points were located in private yards and the owners of the plots were assigned as caretakers by the town water supply utility office for that reason. These caretakers have not received any training on the management of the water point and the other conditions are the same as in Kabribeyah town.

In rural areas, WASHCOs are organized to look after some of the hand pump wells and small dams like birkas and haffir dams. The collected money is deposited and later spent for repair of the facilities. However, in reality, not much money is collected or even if it is collected, few keep the book to record the income and spending. This is due to the lack of sufficient water in these facilities in most seasons, especially in the dams and also due to distant location of such facilities (prevents effective money collection by caretakers). As the study team confirmed in this study, missing WASHCO members led to inactivity of the group and the broken facilities are left unreported to the water office in charge. Money for water may be collected but the record is rarely kept.

b. Condition of fee collection

Collection of money for water by WASHCO or caretakers is, in most cases, made at the time of water fetching. In Kabribeyah town, the going rate is 0.5 Birr per 20L water tank and the rate was determined by the town water supply utility office. The meter readers of the water office hand out the bill monthly to WASHCOs or to caretakers and they make the payment at the water office

The caretakers, current manager in charge of public water points, pay a monthly water rate of 15 Birr / m^3 while they are collecting 0.5 Birr for 20L water. Thus, they put the difference (about 60% of the money they collect from the users) in their pocket. A survey in Kabribeyah town indicates that in many cases, the caretakers collect around 300 Birr every month and they keep about 180 Birr out of it. This difference seems to be recognized as the benefit of being a caretaker, which goes against the system of WASHCO where the members are expected to be volunteers without remuneration.

Meanwhile, private households in urban areas that have their own yard taps and those that own private birkas in rural areas sell water to the surrounding residents. In such cases, the prices of water are higher than in the case of public water supply points. The rates are usually

1 to 2 Birr/20L tank or a monthly rate of 15 Birr. Different rates are applied for dry and rainy seasons because other sources of water become available in the rainy season and the demand for the piped water decreases.

3.3 Results of O&M training

In this study, the following two trainings for capacity development were conducted within the framework of the study.

1) O&M training in relation to utilization of equipment and materials procured in the study

2) WASHCO training for the water supply facilities constructed in the pilot projects

The following sections describe the outcome of the two training sessions.

3.3.1 Outcome of Training in SRWDB

a. Summary of training on installation of electro-mechanical equipment

As part of the capacity development measures that were conducted within this study, a technical training was conducted in December 2012. The training was designed to take advantage of the installation work of the pumps and generators procured in the pilot project in Kabribeyah town and intended for technical staffs of the organizations concerned. The outline of the training is shown in Table 3.11 below.

Table 3.11: Outline of Training on Equipment Installation

Date (duration)	Early - Mid December, 2012 (8 days)
Location	Workshop of SRWDB and deep well sites in Jarar Valley
Target (number)	SRWDB (9), JWSO (5), Kabribeyah town water supply utility office (10)
Trainer	- Member of study team in charge of equipment - Ethiopian national, EWTEC regular trainer
Training contents	Observation plus lecture at site and ordinary lecture
Purposes	As the pumps and generators are installed in Jarar Valley, the technicians of relevant organizations had the chance to observe the installation to obtain the skills and knowledge. They also learnt basic theories behind the operation of pumps and generators.

b. The outcome of the training on installation of electro-mechanical equipment

The training was conducted as planned until the second week. When the party went to the installation sites in Jarar Valley at the beginning of the second week, they found the pump that was to be installed that day had a problem and the installation was postponed. Since installation of the other equipment could not be scheduled for the week, the site visits were cancelled. Instead, the study team organized a make-shift training in the third week to make up for the site observation. In this practical training, the participants were asked to repair broken generators that had been left unattended in the workshop of SRWDB. The originally planned schedule was, thus, modified and the actual activities of the training conducted in three weeks were as shown in Table 3.12.

Table 3.12: Details of the Training

Date	Detailed training activities	Participants
1st Week 4 to 7 December	Lecture on the starting theory of generators and basic principle of engines was given in the workshop of SRWDB	SRWDB,JWSO, Kabribeyah Water Supply Utility Office
2nd Week 10 December	Due to the problem with the submersible pump, a lecture on the daily checking of equipment was given at the site.	SRWDB,JWSO, Kabribeyah Water Supply Utility Office
3rd Week 18 to 20 December	2 generators and 1 compressor that had been left unrepaired in the yard of SRWDB were used for practice of repair. The repair was done at the initiative of the participants.	SRWDB,JWSO, Kabribeyah Water Supply Utility Office

While waiting for the transportation of the equipment to Jarar Valley, a series of lectures on the basic principles of electricity and mechanics of the generators was given mainly by the Japanese member of the JICA study team in charge of electro-mechanical equipment. The lecture made use of drawings and basic formula on a whiteboard. At some points of the lectures, an EWTEC lecturer (who in the past had been trained by the Japanese lecturer) gave lectures in place of the Japanese member. A Somali language interpreter also attended the lecture all the time to facilitate understanding of the lecture. The participants were also found helping each other by re-phrasing the explanation by the lecturer to the other members.

Lecture by EWTEC trainer at the equipment installation training

Since the site observation in Jarar Valley could not be continued due to the problem of the submersible pump that was to be installed that week, the study team organized another opportunity to do some practical training in the third week to make up for the site observation. In this practical training session, the participants were asked to repair several generators (especially those that SRWDB staff had been trying to restore) under the advice of the trainers. The trainers guided the participants to think about how to repair the equipment as they gave clues to the participants piece by piece at each stage. As a result, the participants were able to repair two generators and one compressor without replacing any major parts.

Although the planned site observation could not be conducted, the participants appreciated the training as a whole. Especially for the members of SRWDB and JWSO who already had some technical backgrounds, the training helped them to associate their practical experience to essential theories.

The following issues were extracted from the execution of the training as future challenges.

- In each organization, the technical staff are usually busy with their daily duties and it made it difficult to give training for all the members at one time. This affects the efficiency of training.
- The educational level of the staff is low on the whole and it is difficult to make them understand even the basic principles that even operators who work at site should learn.

- The organizations to which the participants belong do not appreciate the importance of O&M activities.

c. Outline of training related to mobile workshop

After the training on the installation of equipment explained above, another training on the use of mobile workshop (MWS) vehicles and associated equipment was conducted after the equipment was delivered to SRWDB as an initial introduction to the equipment. The training was conducted in the workshop of SRWDB in April 2013 and targeted the technical staff of the maintenance workshop. The outline of the training is summarized in Table 3.13 below.

Table 3.13: Outline of Training on Mobile Workshop Vehicle

Date (duration)	Late March - Mid April, 2013 (10 days)
Location	Workshop of SRWDB
Target (number)	SRWDB (6)
Trainer	- Member of study team in charge of equipment
Training contents	Practical training using the equipment and some lectures
Purposes	The participants will have knowledge of and experience with the mobile workshop vehicles and the machinery that are to be loaded on the vehicles. They will learn how to do maintenance and how to use the machinery especially those that are new to them so they can apply the skills in future O&M activities in the region.

d. Outcome of MWS related training

The training was at first planned to be conducted after the vehicles were delivered to SRWDB so the training could include loading and set up of the equipment on the vehicles. However, due to the unexpectedly prolonged delay in delivery of the vehicles, the training had to be conducted with only the equipment that had arrived earlier. The training was conducted for three weeks as summarized below:

Table 3.14: Details of MWS Training

Date	Detailed training activities
1st Week 27 to 29 March	- Instruction on the use of basic tools during the time of opening the crates - Preparation of necessary consumables for the training - Setting up of new equipment and demonstration of the use
2nd Week 1 to 5 April	- Explanation and practice (arc welding) of how to use the generator combined with electric welding machine - Explanation and practice of gas welding machine (cutting and welding) - Explanation and practice of battery recharger and engine starter - Explanation and practice of terminal connectors
3rd Week 8 to 10 April	- Continuation of practice of use of gas welding machine (cutting and welding) - Explanation of setting up of the machines on the mobile workshop vehicles (handouts given)

The training aimed at teaching the participants how to use the following four machines that they were not familiar with. A short explanation of the working principles of the machines was followed by a quick demonstration. Then, the participants practiced how to use the machines in order to familiarize themselves with the machines.

- Generator & welder (dual purpose)
- Gas welder and cutter
- Starter & battery charger
- Terminal kits (connecting electric wires)

Practice of gas cutting (trainer is directly teaching a trainee)

The first week was dedicated to opening the two large crates that had been delivered. The trainer taught the participants how to use the basic tools used to open the crates. Then the participants together checked the contents of the crates and properly arranged and stored the items in the workshop. Finally the trainer gave demonstration of the four actual machineries above and explained how they were used. At the same time, the participants were involved in procurement of consumables for the gas cutter and welding machine (oxygen and acetylene gases).

The second week was started with practice of using actual machines. The selection of the trainees for this practice considered the limitation in time and materials. Thus, relatively small numbers of trainees with sufficient experience were selectively chosen. The trainer intended to teach a small number of good and fast leaner's as much as he could so that these trainees would be able to teach the others in future. Finally six members (four electricians and 2 mechanics) were chosen as the trainees. Even within those six trainees, some of the members were selectively trained depending on the machine they used. Since the use of gas welding machine was new to the trainees, and handling of the machine accompanied potential risks, the training was conducted with due prudence. As a result, the trainees overcame the fear of using the gas welding machine and started to do the practice on their own, which accelerated the learning process. The use of terminal connectors, though it looks easy, actually required craftsmanship and the participants were found to need more practice.

In the third week, the participants continued on their own the practice of what they had learned in the previous weeks. In addition, the trainer gave detailed explanation and tips on how to set up the machines on the mobile workshop vehicles after they arrive. The lecture also covered how to effectively and efficiently use the vehicles loaded with the machines and handouts on these topics were given to the participants.

Although the practical training of loading the equipment onto the mobile workshop vehicles and practice of maintenance using the vehicles could not be conducted, the participants as a whole appreciated the training. Especially, they appreciated the use of gas cutting and welding machine that they had never used in their work. It is also one of the major outcomes of this training that the trainees realized that their conventional maintenance work was a reactive one and that they came to know that there are many tools that are useful in the market.

The following additional issues were recognized after the completion of this training.

- The training given this time is an introductory one and not sufficient. Therefore, the staff members will have to continue practicing to improve their skills on their own

- SRWDB should create a system and an environment where those staff members who learned the skills can disseminate their knowledge and skills to the other members.
- It is required to regularly procure consumables such as welding gases and keep them always in stock in order to realize continuous use of the machines. Thus, such system needs to be established.

e. Technical capacity of the participant organizations

During the training, the technical capacity of the staff in O&M work of the participating three organizations was evaluated. The evaluation was carried out by observing and casually interviewing key persons of the organizations but was not based on examination of knowledge and skills of individual members. However, through the practical training of repairing of generators, general capacity of each staff of the organizations was confirmed to some extent. The following is the essential issues extracted from the evaluation.

Shortage of budget for operation: this is a universal problem that applies to any developing country and it greatly affects the availability of equipment and materials and securing and upgrading of human resources. In this regard, SRWDB and Kabribeyah water supply utility office specially have a serious problem in procurement of necessary materials and education of the staff members (JWSO receives essential support from UNHCR as far as the Jarar Valley water supply system is concerned). However, this is in principle an issue between these organizations and the regional administration, and furthermore concerns the budget allocation at the federal government level. Therefore, this issue is not handled in this study.

Educational capacity of staff: as pointed out earlier in this report, the technical level of the staffs of these organizations in maintenance work is not very high. Specifically the staffs lack systematic and comprehensive knowledge on O&M activities. In the workshop of SRWDB, about a half of the staff members only have secondary or lower level of education and those with TVETC level are eight in number. For the town water supply utility office, most of the staff members (total 30 members, 25 of whom are primary school graduates) have only secondary or lower education. Lack of fundamental mathematical and scientific knowledge prevents them from appreciating each maintenance skill and from acquiring new knowledge and skills on their own. As a result, their maintenance work only repeats what they have been doing in the past without understanding the theories behind it. Also it makes it difficult for them to find solutions to the new problems they will face.

Organizational issues: current O&M activities conducted by the staffs are responsive ones in nature, partly because of the shortage of various resources. No systematic O&M work based on proper planning that is a norm in developed countries is done. As a matter of fact, no regular maintenance of generators or pumps is conducted in either Kabribeyah or Godey town. It is the responsibility of the top management of each organization to initiate this planned O&M work but it seems that they do not well understand this issue or do not intend to put it into practice. In addition, in the O&M of Kabribeyah water supply system, the organizations concerned are not always collaborating well with each other or not sufficiently sharing information to effectively work together.

3.3.2 WASHCO training

a. General system of training

As mentioned above, WASHCO, a group of community members who are assigned to

operate and manage constructed facilities need to be formed for each site. In Somali Region, the government water offices at woreda level have insufficient technical capacity to conduct WASHCO training. Thus, the training has been conducted by trainers from SRWDB at newly constructed sites. According to SRWDB, WASHCO training is categorized into two types: rural water supply and urban water supply and the training are separately conducted for each category. Among the facilities constructed in the pilot project of this study, the two deep wells in Jarar valley are categorized as rural water supply facilities and the other facilities are all under urban water supply.

There is a manual intended for the trainers and facilitators of WASHCO training titled “Rural Water Supply and Sanitation and Hygiene Program, Community Facilitator’s Manual 2010”. This is available as a booklet. This manual was produced a few years ago at the federal level and it is compiled based on the policy of de-centralization and beneficiary-pays principle. The manual used in the region has been partly modified to adapt to the local condition and translated into Somali language. However, the modification of the contents is limited and it remains nearly original. This manual recommends that WASHCO training should be conducted from the stage of planning of new facilities and that the members should be encouraged to discuss the level of service they need and the location of the water supply points. In the manual, WASHCO formation is treated as part of comprehensive activities to fight against poverty and to improve hygiene situation in the target community. In reality, however, WASHCO training, so far, has been conducted during the time of or after the construction of new facilities. The members are in many cases chosen by the discretion of water offices concerned.

It is the responsibility of the government water offices concerned to conduct WASHCO training. However, in many cases, NGOs and donors bear the cost of the training because these government offices do not have sufficient budget. In such cases, SRWDB only provides technical assistance (dispatch of trainers, provision of manuals) and does not share the cost. Therefore coordination among the organizations concerned and budget preparation take too long to conduct training at appropriate timings during the course of planning and construction and especially after construction (follow-up training).

Another manual used in WASHCO training is designed for WASHCO members. It was developed in English by MoWE. This manual has been modified to adapt to the local conditions and has been translated into Somali language. However, some of the important sections have been omitted in this Somali language version. Especially the fact that the section on the financial management by WASHCO members is omitted suggests that this aspect of WASHCO management is not given much importance. Woreda water offices do not have this manual since they do not conduct training by themselves.

b. Training provision and monitoring in the pilot project

In this study, WASHCO training was provided for pilot project sites in Kabribeyah town and Godey town and the activities of formed WASHCO have been monitored. This section presents the outcome of the training and monitoring.

b.1 WASHCO training in Godey Town

In Godey town, five water supply points were constructed in the pilot project of this study. They were all located in the outskirts of the town’s urban area where no water supply points had been available. These water points were, from the start of the study, designed as isolated

facilities without connection to the existing water supply system of the town. These were instead equipped with a water tank and were planned to be used mainly as emergency water supply points. Godey town water supply utility office confirmed that the town did not have any plans to use these water points on a regular basis. In addition, the study team noticed that the people in the communities had started using the facilities as toilets and that some of the pipes had been clogged with trash at some sites. In this context, the study team considered provision of a short training and of the financial support for this. As a result of the discussions with the water supply utility office, a short training was scheduled as summarized in Table 3.15 below.

Table 3.15: Outline of WASHCO Training in Godey Town

Date (duration)	29 to 30 January 2013 (2 days)
Site	Godey city hall
Target (number)	35 people representing 5 sites (7 men and 28 women)
Trainer	WASH Coordinator of a Godey based NGO and two moderators
Purpose	Fostering sense of ownership, preparation for WASHCO formation

In this training, the study team explained the purpose and background of the pilot project and the training to the organizer (water supply utility office) and gave material and financial support. The rest was left to the discretion of the organizer. The target of the training (trainees) were selected from each community surrounding each of the water supply points by the water supply utility office. As a result, seven people for each site (one person from one household) were selected simply by one criterion, that of living close to the water points. The selected trainees were 7 men and 28 women and only four of them are literate. The organizer told the study team that, in their opinion, proximity to the water supply points is more important than being literate.


WASHCO training in Godey town (group discussion)

Since the organizer knew that the facilities would not be used on a regular basis for some time after construction, a training that is shorter than ordinary WASHCO training was planned. The training aimed at establishing the system to protect the facilities until they are regularly used. The topics of the training are as follows.

1) Background of the pilot project
2) Importance of community water supply facilities (with reservoir tank), especially in emergency
3) Discussion among the trainees to raise awareness of ownership of the facilities
4) How to keep the facilities hygienic and in good condition
5) About formation of WASHCO and outline of its roles and tasks

The training started with explanation of the background of the pilot project and the constructed facilities by the trainer. For each topic, short introductory lecture was given at the beginning and the trainees discussed the topics and exchanged their opinions. No manuals were handed to the trainees. The following decisions were made uniformly.

1) Trainees selected five major members of WASHCO (head, deputy head, secretary, cashier, storekeeper)
2) Members will hold meetings with the community members to raise the sense of ownership of the facilities.
3) Members will communicate with town water supply utility office whenever there is a problem
4) Members will keep the environment of the facilities clean
5) Members will make sure that the facilities are properly protected by hiring a guard etc.

b.2 Monitoring of WASHCO activities

In Godey town, the first monitoring of WASHCO activities was conducted about two weeks after the training at the five water points and the second monitoring was conducted 1.5 months after the training at the same sites. The following sections describe the outcome of the monitoring and the outline of the monitoring is shown in below.

Table 3.16: Outline of WASHCO monitoring in Godey Town

	First monitoring	Second monitoring
Date (duration)	14 and 15 February 2013 (2 days)	14 and 16 March 2013 (3 days)
Site	5 water supply points in Godey town	5 water supply points in Godey town
Target and number	3 members of WASHCO at 5 water supply points, a few residents in the neighborhood of each site	5 members of WASHCO at 5 water supply points, Residents of 10 households in the neighborhood of each site
Method	Interview with the targets with the use of prepared monitoring sheet. Evaluation of understanding of the training contents and evaluation of activities record	Interview with the targets with the use of prepared monitoring sheet. Evaluation of especially their motivation and activities record

In the first monitoring, the following items were evaluated on a 1 to 5 scale based on the results of the interview. The numbers in parenthesis signifies the weight of evaluation. In Godey town, the WASHCO members cannot start their regular activities soon. Therefore, the sense of ownership of the facilities and related activities were the main focus of evaluation.

1) Understanding of the background of pilot project and constructed facilities (10%)
2) Degree of sense of ownership (40%)
3) Activities record (40%)
4) Influence on the non-members in the community (10%)

The results are compiled in Table 3.17 below.

Table 3.17: Outcome of the 1st Monitoring of WASHCO Activities in Godey Town

	Site 1	Site 2	Site 3	Site 4	Site 5
Comprehensive evaluation	3.2	3.7	3.3	2.7	4.1
1) Understanding of background	0.2	0.3	0.2	0.2	.0.2
2) Ownership	1.6	2.0	1.6	0.8	1.6
3) Activities record	1.2	1.2	1.2	1.6	2.0
4) Influence on neighboring community	0.2	0.2	0.3	0.1	0.3
Remarks				Twice for each activity	3 times for each activity

Note: Comprehensive Evaluation scale: Poor 1 < 2 < 3 < 4 < 5 Excellent

The results show that the scores for each site are all above the mid value (2.5) of the evaluation scale and the training was confirmed to be highly effective. In concrete, the members at all the sites planned and already conducted some of the activities they had discussed during the training. Also at every site, the facilities and the surrounding environment were cleaned and guards were employed at some sites. The motivation of the members is especially high at site No-4 and 5 and they conducted the activities two to three times already. The activities the members conducted, however, are limited to what they discussed during the training and no developmental activities were done.

The second monitoring was conducted the same way as the first one. However, more importance was given to the conducted activities and their influence over the surrounding residents in the communities. For this reason, the distribution of weights was changed as follows.

1) Understanding of the background of pilot project and constructed facilities (10%)
2) Degree of sense of ownership (20%)
3) Activities record (50%)
4) Influence on the non-members in the community (20%)

For item No. 4 above, 10 households surrounding each water point were interviewed to obtain the data. The results are summarized in Table 3.18 below.

Table 3.18: Outcome of the 2nd Monitoring of WASHCO Activities in Godey Town

	Site 1	Site 2	Site 3	Site 4	Site 5
Comprehensive evaluation	3.2	3.6	2.7	3.3	3.4
1) Understanding of background	0.2	0.2	0.3	0.2	0.2
2) Ownership	0.6	0.6	0.6	0.8	0.6
3) Activities record	2.0	2.0	1.5	1.5	2.0
4) Influence on neighboring community	0.4	0.8	0.3	0.8	0.6
No. of activities and households involved	6 times 70 HH	4 times 50 HH	3 times 30 HH	3 times 80 HH	4 times 200 HH

Note: Comprehensive Evaluation scale: Poor 1 < 2 < 3 < 4 < 5 Excellent, HH: household

The result shows that the comprehensive scores for the five sites are all above the middle score (2.5), which indicates that all the WASHCOs are continuing the work as expected. As a matter of fact, they had conducted activities (mostly meeting with the local community) more than several times and the activities involved up to 200 households. They have not done any creative activities of their own but the objective of this training is satisfied. On the other hand, two WASHCOs voiced their anxiety about the status of the water points and asked for realization of regular water supply at an early stage. From this reaction of WASHCOs, it is assumed that some kind of measures will have to be taken to keep the WASHCOs motivated in the future.

b.3 WASHCO training in Kabribeyah Town

In Kabribeyah town water supply system, SRWDB planned to conduct a short training for three sites including the two JICA deep wells in December 2012. However the staff of SRWDB found no major communities around the two deep wells and could not conduct the training. Normally in Somali Region, source water production facilities such as deep wells

are coupled with community water supply facilities and communities are located close to such water supply facilities. WASHCOs are formed from some members of the community to operate and manage the source water production facilities together with the community water supply facilities. On the other hand, in Jarar Valley area, the deep wells of the water source and the water supply area (town area) is over 20km away, which is a special case. There are several water supply facilities along the conveyance line in-between the well field and water supply area but none of them are operational. SRWDB was not aware of the situation at the time of planning the training. As a result, the two deep wells will be operated and managed only by the staff of JWSO and Kabribeyah water supply utility office. However, the study team constructed two additional water points near the JICA water source wells later.

For the five public water supply points constructed in Kabribeyah town, SRWDB had a vague plan to conduct training but either SRWDB or Kabribeyah water supply utility office was not likely to obtain any budget to conduct the training as of January 2013. In this context, the study team discussed the issue with SRWDB and decided to conduct the training with the financial support of the Study. The training was planned based on the conventional program of SRWDB as shown in Table 3.19 and was conducted in March 2013 in consideration of the progress of the construction work.

Table 3.19: Outline of Planned WASHCO Training in Kabribeyah Town

Date (duration)	From March 5, 2013 (10 days)
Site	A meeting hall in Kabribeyah town
Target (number)	Representatives of community at 5 sites (35 people)
Trainer	Staff in charge of WASHCO from SRWDB
Purpose	Fostering sense of ownership, WASHCO formation, WASHCO member training

In the same way as the training in Godey town, the study team asked the trainer to follow the standard training program and methods of SRWDB to conduct the training. The training was conducted as summarized in the table below.

Table 3.20: Record of WASHCO Training in Kabribeyah Town

Date	Contents of training
5 and 10 March	Contact with water supply utility office in Kabribeyah town and selection of trainees (WASHCO members) at each site
18 March	Explanation of the federal and regional government policies on rural and urban water supply
19 March	Explanation of general idea about water supply system
20 March	Explanation of roles of communities in rural and urban water supply. Especially explanation of sustainable O&M activities to promote awareness.
21 March	Explanation of participation of community, cost sharing, and roles of women in water supply to promote awareness.
22 March	Explanation of operation of town water supply utility office (bill collection and operational cost)
23 March	Explanation on the activities to improve environment and individual hygiene. Causes of water-borne diseases that cause child mortality.
24 March	Explanation of roles and tasks of WASHCO members. Responsibilities of other government organizations and relationship between the organizations and

	WASHCO. Determination of roles of WASHCO members.
25 March	Questions and answers session. Site training about the name and functions of the parts of the constructed public water points. Completion ceremony.

The training started on 5 March but the two existing boreholes in Jarar Valley suddenly broke down and the water supply to the town was interrupted. Due to this accident, the training was also suspended for some time and finally resumed on 18 March. All the training except for the site training was conducted in the meeting hall of Kabribeyah town. WASHCO manuals prepared in Somali language were provided to all the participants. Seven people from each site were chosen as participants (WASHCO members) through a Kebele meeting based on the following selection requirements prepared by the trainer.

- Members live close to the water supply points
- Each WASHCO should have at least three women members
- Try to include literate members as much as possible

As a result of the first selection of members, one WASHCO turned out to be made up of the members of the same family. Thus, the WASHCO members had to be re-selected. A few members also resigned at this time after they realized that WASHCO activities were voluntary and no remuneration was paid. The same problem also occurred again in the middle of the training and 10 members left the training. The organizers had to re-select 10 people to fill their positions. Out of the 35 members finally selected, 23 were literate and 23 were also women.

Group discussion in WASHCO training in Kabribeyah town

The training was conducted as shown in Table 3.20 above. The trainer first explained the general concept or system as training topics and then the participants were encouraged to have group discussions to exchange ideas. On the last day, the participants spent a few hours at one site to learn about the name and functions of various parts of the constructed water supply point. They also learned how to do maintenance at the site. Since the target of this training was the WASHCOs in charge of urban water supply facilities, not much time was spent explaining how to collect money from users and how to handle the collected money. However, the water supply utility office assigned one staff member to each WASHCO as its member to make sure the money is properly collected at each site.

Besides the trainer, involvement of two facilitators was stated in the program and it was found that these two facilities were conventionally chosen from water offices of the woreda or the town in charge of the training. However, in the training in Kabribeyah town, nearly all the training was conducted by the trainer from SRWDB alone and the two facilitators were not even present at the training. The situation was more or less similar in Godey town.

As a result of the training, in each WASHCO, three core members of chairman, deputy chairman, and a secretary were selected. As for the aspect of community participation in

water supply activities, the participants recognized that the awareness of water supply by the community members was still low and that some measures would have taken to raise awareness. Then they discussed among the members and decided to conduct activities to sensitize the residents in their communities.

b.4 Monitoring of WASHCO activities

In Kabribeyah town, a monitoring of WASHCO activities was conducted at the five water points about two weeks after the training. The following sections describe the outcome of the monitoring and the outline of the monitoring is shown in Table 3.21 below.

Table 3.21: Outline of WASHCO monitoring in Kabribeyah Town

Date (duration)	10, 11, and 15 April 2013 (3 days)
Site	5 public water supply points in Kabribeyah town
Target and number	3 members (assigned) of WASHCO at 5 water supply points, a few residents in the neighborhood of each site
Method	Interview with the targets with the use of prepared monitoring sheet. Evaluation of understanding of the training contents and evaluation of activities record

In the monitoring, the following items were evaluated on a 1 to 5 scale, based on the results of the interview in the same way as in the monitoring in Godey town. The numbers in parenthesis signify the weight of evaluation. The training was conducted in late March, later than planned due to the delay in completion of the pilot project. Therefore, at the time of monitoring (two weeks after the training), the water supply points had not been handed over to the community yet and thus they were not operating. The situation did not allow sufficient monitoring period, which was taken into account in the evaluation.

1) Understanding of the background of pilot project and constructed facilities (30%)
2) Degree of sense of ownership (30%)
3) Activities record (30%)
4) Influence on the non-members in the community (10%)

The results are compiled in Table 3.22 below.

Table 3.22: Outcome of the Monitoring of WASHCO Activities in Kabribeyah Town

	Site 1	Site 2	Site 3	Site 4	Site 5
Comprehensive evaluation	2.3	2.3	2.3	2.3	2.3
1) Understanding of background	0.6	0.6	0.6	0.6	0.6
2) Ownership	0.9	0.9	0.9	0.9	0.9
3) Activities record	0.6	0.6	0.6	0.6	0.6
4) Influence on neighboring community	0.2	0.2	0.2	0.2	0.2
Remarks	None	None	None	None	None

Note: Comprehensive Evaluation scale: Poor 1 < 2 < 3 < 4 < 5 Excellent

The results are the same for all the sites above and the scores are a little below the mid value (2.5) of the evaluation scale. However, the training was confirmed effective to some extent even though no activities have been done yet since all the WASHCOs were found to have understood what was taught in the training. In consideration of the fact that the WASHCOs

had started some activities two weeks after the training in Godey town, the motivation of the members may be comparatively lower. This can be illustrated by the fact that many members resigned during the training. All five WASHCOs have similar level of understanding of and motivation towards their duties. At the time of the monitoring, all WASHCOs had already planned a meeting.

The most serious problem concerning WASHCO activities in Kabribeyah town is then considered to be, as mentioned above, the mentality of the people in the community. There are many people who are negative about working as volunteers (without payment) to operate and take care of public water supply points.

c. Issues concerning execution of WASHCO training

Through execution of WASHCO training and its monitoring, the issues concerning planning and execution of WASHCO training have been identified for both Kabribeyah town and Godey town as shown in Table 3.23 below.

Table 3.23: Issues Concerning Execution of WASHCO training

Common issues	・ Necessary to set aside quick and continuing budget for WASHCO training to conduct the training when it is needed. ・ Training for trainers (TOT) of staff at woreda level and manuals (Somali language) should be provided. ・ Should take advantage of the presence of the two “facilitators” who participate in the training on the trainer’s side (the two are usually selected from the government offices in charge). ・ Involvement of community from the early stage of facilities renovation or construction should be encouraged. ・ Provision of fence around water supply points is recommended to be included in the construction project and ask the residents to provide labor. ・ Necessity for improvement of mentality and attitude toward water supply
Issues for Godey town	・ Should select at least two literate members for WASHCO members in consideration of literacy level of members and expected future activities ・ Better to use more pictures to explain ideas in consideration of low literacy rate. ・ Need to devise measures to sustain WASHCO activities in the case that the facilities are not used (do not produce water) for a long time
Issues for Kabribeyah town	・ Many people have negative ideas about working as volunteers and many resigned during the training and an improvement measure is required. ・ Training on money collection and on how to handle the money is insufficient. It should be given more importance.

3.4 Issues and approach for improvement of O&M

In this section, major issues concerning water supply operation and maintenance of water supply facilities identified based on the results of the study that are presented so far in this chapter are discussed one by one. Corrective measures are also briefly suggested.

3.4.1 Specific issues and approaches for improvement

Some issues of O&M of water supply facilities mainly recognized at the site level are pointed out in some documents and also by the study team. Table 3.24 and Table 3.25 below list some of the important issues together with potential solutions or measures for improvement.

Table 3.24: Specific Issues of O&M by WASHCO (1)

Issues	Detail	Measures
1. Standardization of the equipment and materials to procure		
	Pumps and generators etc. of various manufactures are currently procured. The situation makes it difficult to accumulate knowledge in O&M work and to obtain spare parts. This is undermining the efficiency of O&M work.	A guideline for procurement of equipment designed to standardize specifications or manufacturers should be produced by the initiative of SRWDB. The bureau should ask NGOs and donor to follow the guidelines.
2. Procurement plan for O&M equipment and spare parts		
	In SRWDB where the condition was confirmed by the study team and also in other water offices in the study area, procurement of spare parts is a difficult task. In the workshop of SRWDB, this is the major reason that the workshop is only conducting the responsive maintenance. In rural areas, this problem contributes to prolonged non-functionality of water points.	SRWDB should take a lead to establish a system of procurement and distribution of spare parts and necessary consumables. For small parts such as hand pump spare parts, one possibility is to open up spare parts outlets at woreda level. WASHCOs should be trained to pay for the spare parts with the money they accumulate.
3. Highly turbid river water in Godey town		
	As mentioned in the chapter of water supply plan, the source water from Shebele river in Godey town has very high turbidity. The situation requires the system to use large amount of coagulant and as a result, large amount of sludge will be produced.	In consideration of the technical level of the operation staff and power supply condition at the site, sludge removal should be done manually. To minimize the interruption to the water supply, sufficient number of workers should be gathered and sufficient number of tools should be ready for the work. Also, sufficient land space will be required to keep the disposed sludge.
4. Scale problems in Kabribeyah town		
	The groundwater from the wells in Jarar Valley has high hardness and causes scaling problem in pumps and associated pipes. Also it is said to be the cause of damage to the riser pipes due to corrosion although it is not really substantiated. However, stainless steel riser pipes that are more resistant to corrosion are not available in the Ethiopian market and it is difficult to import them from abroad.	In consideration of the technical level of the staff, the use of chemicals is not recommended. The scale has to be regularly removed manually. Before procurement of stainless pipes, the operators should conduct proper monitoring of the two JICA wells and two UNHCR wells to confirm how quickly and how the corrosion occurs to GI riser pipes. This should be done regularly (ie. every 3 month) by pulling up the pipe and the pump to check the condition. The use of stainless steel pipes should be considered after it is found really necessary. If it is, a reliable procurement route will have to be explored.
5. High turnover of water office staff		
	Staff members of water offices in rural areas tend to leave the job frequently. The situation prevents accumulation of skills and experience and capable staff are in short supply.	Provide incentives to water office staff members who need to work in rural areas. Also conduct more technical training targeting the technical staff in rural woredas.
6. Maintenance work by WASHCO at woreda level		
	Under the new O&M system, the duties of WASHCO increased but their duties in O&M work are not clear. Furthermore, the members do not have the technical capacity to perform the duties.	Include staff of water offices in a part of WASHCO training in order to facilitate communication between the WASHCO and water office to discuss their roles in O&M. Provide technical maintenance training to both parties.

Table 3.25: Specific Issues of O&M by WASHCO (2)

Issues	Detail	Measures
7. Financial management in organizations		
	The money is not properly handled neither by WASHCOs nor by water offices. The situation is making it difficult for other parties to verify their financial performance in detail.	Provide training on financial management to both WASHCO and water office staff members.
8. Implementation of WASHCO training at existing water supply points		
	In many woredas, WASHCOs have not been officially established. As a result, water fee is not properly collected especially in rural areas. The source of the problem is that there is only one person who is officially allowed to conduct WASHCO training in Somali Region.	Conducting WASHCO training at many placed within a limited time requires more numbers of qualified trainers through TOT, let alone the budget for the training. Conducting WASHCO training as a trainer will require similar training experience but the contents of the training itself is no especially complicated. Thus, provision of short and specific training to the NGO staff who have similar training experience can help improve the situation. Meanwhile, woreda water office staff members should be included in the training to foster them as future trainers.

3.4.2 Issues for relevant organizations and approach of improvement

a. Issues of maintenance workshop in SRWDB

The present condition of the technical staff and the facilities in the maintenance workshop are as mentioned above. The issue is that even if the staffs is aware of the problems, they do not have power to improve and either the power to make any decisions for improvement. An interview with SRWDB revealed that the workshop relies heavily on external financial support from donors for its operation. Unless this situation is improved, the development of the future O&M plan will be difficult.

a.1 Issues of the staff education

The improvement of technical ability of the staff can be achieved through “recurrent training of repair work” and “remedial education of technical knowledge”. Both can only be realized by establishing an improvement plan by the initiative of SRWDB. The plan by the organization enables it to improve the present condition of the maintenance workshop. The machines of advanced technology are deployed, in many cases, in technical cooperation projects for water supply. Therefore, it is necessary to make the staff understand how such machines can be maintained properly to achieve designed life. It is also important to realize the magnitude of the amount of spare parts necessary for maintenance work for the entire life of a machine. For example, the staff should be made to realize how much money will be required to perform the maintenance work of all the machines and equipment for the next several decades.

The materials for technical improvement training (non-functional machines) are already readily available in the compound. And also, there is sufficient space that enables the improvement of the maintenance workshop. The improvement training plan should make the most of this favorable environment.

a.2 Issues of materials and equipment

One of the problems is the choice of unsuitable equipment in addition to the volume and

diversity of the machines and apparatus to be taken care of by the workshop staff. Especially, introduction of overly sophisticated devices regardless of the power supply condition and technical levels of the staff at the site and also inappropriate deployment of machines and apparatus resulted in the diversity of replacement and expendable parts both in its number and brands (countries of origin). This, in turn, will add to already-long procurement period of necessary parts and will eventually lead to the practice of "reactive maintenance work". From now on, SRWDB should take a lead to improve the situation by carefully selecting the specifications of the devices in consideration of the site condition and staff's technical capacity. At the same time, SRWDB should make an effort to establish a system of standardization of basic water supply equipment.

b. Issues of organizations concerned with water supply

b.1 SRWDB

SRWDB is the agency that is ultimately responsible for the water supply activities in the region. In this sense, the knowledge and ability of the staff, and the facilities and equipment of the bureau should be superior to the other sub-ordinate government offices. In order to realize this, it will be necessary for SRWDB to make its maximum effort to improve the workshop, and also to thoroughly check the details of new projects for which SRWDB asks for assistance from external aid organizations. The items to consider in future capacity development are as follows.

1) Discuss means to enable repair experiences as much as possible for the workshop staff in order to reinforce their technical capacity
2) Discuss the establishment of the procurement routes (domestic and overseas) of parts, machines to realize effective repair experience for the staff
3) Plan development of specific annual maintenance programs once the materials procurement routes are established
4) Discuss the organizational system where it is possible to perform maintenance work without the distinction of electricity and machinery
5) Keep the workshop clean and in order and conduct regular maintenance of the facilities and apparatus

SRWDB, as the control center of the water supply activities in the region, is expected to make its own effort to seek ways of improvement and also to establish its position and responsibilities in the water supply of the region. In addition, the bureau should be able to drastically change the conventional way of doing the work when necessary to redefine its organization and activities. Before implementing projects, SRWDB should scrutinize the contents of the projects to determine the list of items necessary so that the bureau can present appropriate and convincing project implementation documents to external aid organizations for assistance.

Specific activities necessary for capacity development are as follows.

1) Steady supply of parts and the machines for repair experiences/training.
2) Establishment of procurement routes of machines and parts
3) Securing budget necessary for execution of maintenance programs every year
4) Education system to foster versatile engineers
5) Establishment of a well-equipped maintenance and repair workshop to realize skill training for the staff

For the capacity development of SRWDB staff, it is mandatory to have appropriate sets of maintenance facilities including an education system on electricity and machinery maintenance in addition to establishment of the materials procurement routes which will be permanently required. Therefore SRWDB should examine necessary measures thoroughly to prepare improvement plan. On the other hand, the aid organizations should check the viability of the plan and procure necessary materials and equipment.

b.2 Kabribeyah Town Water Supply Utility Office

There are in general two types of maintenance work: patrol maintenance for major repair work and in-house heavy repair work. In consideration of the current capacity of staff and equipment of the town water supply utility office, the office should concentrate on patrol maintenance. The staffs are expected to conduct regular patrol maintenance. When they identify problems, the staff should report to appropriate external organizations for assistance depending on the level of maintenance required.

If the identified problems are minor, the staff itself will repair the problems. Otherwise it should consider asking for help from the workshop of SRWDB that can do heavy maintenance. At this point, SRWDB and JWSO that mainly works in the field, should coordinate each other's interventions in order to conduct scheduled repair work of facilities and equipment. One of the key staffs to successful operation of the water supply system is the operators. Thus, it is important to train them for proper operation of equipment, and identification of problems through constant observation of the system operation based on the correct theoretical knowledge.

Since Kabribeyah town water supply utility office is the only government body largely involved in O&M of Jarar Valley water supply system, SRWDB recently reviewed its existing structure and work to propose a new system for the office for the future (Organizational Structure for Kabribayah Town Water Supply Utility Office, January 2012 GC, Jijiga). This report discusses the future organizational structure, tasks and duties, and annual budget among other things, assuming that the office will continue to depend on both financial and materialistic external assistance in order to operate and maintain the existing water supply system on its own. The office is supposed to have a total of 90 staff members and work under the supervision and technical assistance of SRWDB. The major maintenance work of the system is currently undertaken by JWSO (or its successor) and the office is mainly engaged in operation of the system. Thus, it is not likely that the office will suddenly be given a large extra burden in both financial and technical terms. However, at least its field staff such as operators of the system will have to be augmented to be able to properly conduct the operation of the proposed water supply facilities in the master plan even with the presence of JWSO (or its successor). This is explained in more detail in the following sections.

b.3 JWSO

The staff is expected to be capable of handling field maintenance work of both electricity and machinery. It is also important to coordinate well with the operators of the water supply utility office.

b.4 Other organizations

As has been described so far, the capacity of all the government organizations involved in

water supply is similarly low. Especially the woreda water offices do not practically have any OA and technical equipment. Thus, they are expected to have difficulty in conducting the minor maintenance work they will be required to do under the new system. For these woreda water offices, basic tools and equipment necessary to conduct maintenance of the water supply facilities under their jurisdiction should be carefully selected and supplied. As for Godey water supply utility office, the technical level of staff was not directly confirmed but is assumed to be similar to that of Kabribeyah water supply utility office. Thus, they will need technical training for improvement as well. As the study team confirmed, its operators do not use coagulant and the dose of chlorination agent is always the same regardless of the treatment amount. The regular cleaning of sedimentation pond is often neglected. In order to improve the situation, it will be necessary to raise the level of the operation staff: specifically increase of the work force and provision of sufficient technical training. Plans of technical training provision for Godey and Kabribeyah Town Water Supply Utility Offices and for the 16 woreda water offices were discussed and proposed in this study. The results are presented in the following section.

c. Issues concerning WASHCO

The issues about conducting actual WASHCO training are already briefed in the previous section. Here, as a result of the training, monitoring, and field investigation, some of the important issues together with other relevant significant issues on the O&M of water supply facilities by WASHCO are discussed in detail.

c.1 Urgent need to establish the system of management by WASHCO

The management of water supply facilities by WASHCO is still a new system. As a matter of fact, WASHCOs were first formed in both Kabribeyah town and Godey town as a result of the training conducted by the study team. Although no specific figures about the number of official WASHCOs was obtained in the study, it is assumed that the number is still small in the study area. Therefore, it is necessary to conduct WASHCO training at existing water supply points as quickly as possible and at the same time, provide follow-up training to existing WASHCOs. The training should take into account the feedback from the monitoring. Provision of WASHCO training at this scale will only be possible if there are some trainers at woreda levels and also if they are provided with necessary manuals.

c.2 Low literacy rate of WASHCO members

As observed in the WASHCO training in Godey town conducted in this study. The literary rate of the residents in communities that take care of the water supply facilities is very low. It is important to record income from money collection and expenses for maintenance in WASHCO activities. Also, it is important to keep a WASHCO operation manual at hand so that the members can refer to it whenever necessary. None of these are done by WASHCO members at present and their accounting (income and expense record) is in most cases unclear. From now on, trainees (to-be WASHCO members) should be selected in consideration of the low literacy rate and their future tasks in order to include at least a few literate members.

c.3 Lack of staff for WASHCO training at woreda level

At present, WASHCO training is conducted only by one experienced trainer of SRWDB by visiting each site because there are no other capable trainers available. The situation makes it

difficult to conduct training when it is needed. Especially it is the major factor that prevents follow up trainings after organization of WASHCO from being done in many woredas. From now on, it is recommended in future that some staff members from woreda water offices should be involved in the training as assistants to the trainer from the viewpoint of training of trainers (TOT) in order to give them experience. Meanwhile, in order to fill the gap until the time such trainers are available, it is better to employ experienced trainers from NGOs and assign them to conduct training themselves after giving them a short training on WASHCO. Some NGO members have sufficient experience in provision of similar training and the idea of WASHCO training itself is not necessarily complicated. Also it is recommended to provide such staff from woreda water offices with training materials prepared in Somali language to foster their ability.

c.4 Awareness of residents and staff of relevant offices about water supply

As explained in the case of the pilot project, in a previous section, the awareness about public services of the people in communities, especially in rural areas, is very low. The residents tend to neglect things that do not directly benefit their own lives, even if these things benefit the entire community or the town as a whole. On top of that, the staffs of the government offices in charge seem to overlook the situation or neglect takeing measures. Under the present government policy of de-centralization, the O&M work of water supply facilities by communities through the organization of WASHCO is becoming more and more important. Therefore, the government should make every effort to actively sensitize the people in communities about the importance of water supply systems to change their mentality through WASHCOs and publicity campaigns.

c.5 The system of working as volunteer:

According to the policy of SRWDB, the WASHCO members are required to work on a volunteer basis without any payment. However, as already mentioned, many people in the community in Kabribeyah town are not willing to accept this idea. At present, in Kabribeyah and Godey towns, the caretakers who were appointed by the town water supply utility offices are operating the public water supply points and collecting money from water users. These caretakers are selling water at a higher rate to the end users and the caretakers can keep the difference. In other words, they get benefit from doing the task. This system seems to be working well at the moment. In this context, introduction and establishment of the new management system by WASHCO that is in line with the new government policy, is expected to require a large scale intervention in changing the mentality of the people in the community. Such interventions will involve education and publicity campaigns to change the attitude of the residents, and even replacement of existing caretakers.

3.5 Comprehensive evaluation for O&M capacity of relevant organizations

a. Adaptation to the new system

As explained earlier, according to the interview with the staff of SRWDB, the staff regards that there are not major problems in water supply. However, the operational rate of the water supply facilities (excluding dams) found in this study indicates that 70% of the facilities are functioning. This is not very high in consideration of the importance of each one of water supply points in arid rural areas. The capacity of staff and equipment of woreda water offices are very weak, and WASHCOs, the user groups responsible for O&M of the facilities, are not

efficiently performing their major task of collecting water fees. With future shift in some of the maintenance responsibilities to woreda water offices and to WASHCOs, it is obvious that they will not be able to handle the new tasks both in terms of workforce and equipment. The situation is no different in the case of town water supply utility offices. For Kabribeyah town water supply utility office, SRWDB has proposed a new structure and operational duties in line with the new work system after BPR (refer to Organization Structure for Kabribeyah town water supply utility office, 2012, Jijiga). This document proposes a work force of 90 members to cope with the new system and also roughly estimates the operational cost of the proposed new office based on the self-financing principle. The result indicates that the new office will have to inevitably depend on external financial and material assistance from donors and NGOs in order to perform all the tasks required. Therefore, it is one of the very important issues to seek for a way for the government water offices to adapt to the new system in order to realize appropriate O&M of water supply systems.

b. Necessity of realization of the importance of O&M

As explained earlier, in order to realize appropriate O&M activities by the organizations concerned, it is highly important that the executive officers as well as technicians at the site level of all organizations concerned come to realize the principles and basic ideas of O&M activities as follows: the fact that machines break or have trouble sooner or later, and to avoid the problems, preventive measures are taken by planning appropriate future O&M activities and securing the budget is required. Appropriate O&M plans are created based on the past operation record of a machine or a system and on its future operational schedule. The amount of work, materials for maintenance, and all the cost concerned should be clearly recognized and the regular maintenance work should be conducted according to the schedule. The cost of such maintenance incurred in the long run is much larger than it is conventionally recognized by the staff of government offices concerned. In many countries, for the purpose of realizing efficient operation of machines, O&M of machines is institutionalized and performed under the legal framework. The staffs of the government offices concerned should come to appreciate such facts through the training.

c. Issue of staff capacity for efficient operation of organizations

The educational level of the staff of organizations does not only affect the acquisition of skills and knowledge by the staff, but also greatly affects how the organizations perform their tasks. Especially the head of organizations is important, which was exemplified when a new head took office in Godey town water supply utility office. The environment of the office improved and the daily water supply hours were extended in a few months. Leaders of organizations should give appropriate instructions to make sure the staff carries out their assigned tasks efficiently and effectively. The heads also need to acquire sufficient budget for the operation of the organization. His/her tasks cover various things. They also need to negotiate for budget and assistance for their projects with NGOs and donors since the budget from the government is usually not sufficient. They need to deal with foreign aid organizations, international organizations, in addition to the government to win budget approval. This task will require a high level of skills. The fact that the majority of staff members, especially at the lower level of government water offices have lower capacity, should be changed through active provision of training and also replacement of staff members should be considered in the long run. The head or deputy head of organizations should have work experience in other aid organizations such as international agencies and foreign NGOs and they should be able to write proper letters or reports in English. It is in

principle the woreda or town administration office who has the power to assign the heads of water offices. However, in order to choose an appropriate person, they are expected to consult with all relevant organizations, especially SRWDB when selecting a head for water offices.

d. Future operation of Jarar Valley water supply system

As a long-term issue of O&M of Jarar Valley water supply system, the issue of divided operation by JWSO and Kabribeyah water supply utility office carries utmost importance. According to a report by Karamara Engineering (Technical and Institutional Capacity Study of Jerer Valley Water Supply Scheme, Sep. 2007), the water supply system in Kabribeyah town was first constructed by UNHCR. From the beginning of the construction of the system, the system was to be handed over to the Somali region. Then the system was once handed over to SRWDB after an agreement was signed between SRWDB and UNHCR in 2001. However, for some reason, the system was returned in the hands of UNHCR a few months later. In response to this unexpected situation, UNHCR was forced to sign a contract with JWSO on the technical maintenance of the system and also UNHCR requested Kabribeyah woreda administration to establish a town water supply utility office in order to manage the system. In this context, the O&M work of the Jarar Valley water supply system is undertaken by two different parties: JWSO under the contract with UNHCR for major maintenance and repair of the main components of the system, and Kabribeyah water supply utility office in charge of general operation of the system [*] .

For UNHCR, which is supporting JWSO operation, the operation cost of the system is a financial burden. However, the fact that the town water supply utility office that would normally be in charge of the entire operation and maintenance of the system does not have the slightest capability to take on the task, has prevented the actual handover of the system so far.

UNHCR is primarily responsible for water supply to the refugee population in Kabribeyah town. Thus, it is concerned about possible negative consequences after the handover where the town water supply utility office with insufficient capability cannot operate the system properly and water supply to the refugee camp area will be ceased. On the other hand, SRWDB is expressing its attitude towards the refugee camp saying that the bureau cannot be responsible for the water supply to the refugee population after the handover. This conflict of interest is also making the handover difficult. Since the ultimate responsibility of UNHCR in Kabribeyah town is to provide daily basic needs, including water supply, to the refugee population in the camp, the organization will most probably withdraw from Kabribeyah town sooner or later. Although considering the existing refugee population of about 16,000, withdrawal of UNHCR is not likely to happen in the next few years or so, the Somali Region side should still be well prepared for the event. Therefore, the core of the preparation effort should be the capacity development of Kabribeyah Town Water Supply Utility Office.

Both UNHCR and SRWDB are aware of this issue to some extent. UNHCR is contemplating active provision of training to augment capacity of the water supply utility office and SRWDB produced a report on restructuring and upgrading of the office titled “Organizational structure for Kabribeyah town water supply utility office, January 2012 GC” in 2012. In this sense, capacity upgrading of the town water supply utility office to make the office self-sufficient in terms of the operation of the water supply system will be of merit to both

[*] Note: JWSO withdrew from this system in April 2013.

UNHCR and SRWDB. At this moment, no specific activities about the capacity development of the office have been conducted. It is, thus, proposed that the Somali Regional administration represented by SRWDB, UNHCR, and other partners concerned should get together to discuss step-wise capacity development plans for the town water supply utility office. Once the plan is prepared, the parties should implement it in collaboration.

e. Issue of collaboration of organizations concerned with regard to Jarar Valley water supply system

Until the handover of the system described above is realized, the Jarar Valley water supply system will have to be separately operated. Broadly speaking, the operation of the system involves UNHCR, JWSO, ARRA, Kabribeyah town water supply utility office, woreda administration, and SRWDB. Their relations are also complex. JWSO and UNHCR somehow work based on a contract and their responsibilities and jurisdictions are relatively clear. However, this is not really the case with the other organizations. For example, UNHCR as an international organization is not allowed to directly instruct town water supply utility offices and is required to do so through ARRA, a government organization. Under such circumstances, in the operation of the water supply system, and furthermore in the case of project implementation by external aid organizations, misunderstandings and confusion tend to occur. Such situation, in turn, will hinder effective operation of the water supply system and smooth project implementation. In order to improve the situation, it is recommended that all parties concerned should have a meeting to discuss the measures to ameliorate the situation. They are expected to unify the contact from outside, decide on the decision making and information sharing system, clarify the responsibilities and duties of each party in water supply system operation and expansion, and share all these rules agreed with by the parties concerned. Also, in taking this measure, attention should be paid to the increased tasks of the town water supply utility offices so that their duties would be increased gradually.

3.6 O&M plan of water supply systems

In this section, the results of the study of operation and maintenance work and personnel required for each of the proposed water supply systems of the master plan are presented based on the examination of the proposed facilities in the systems. The proposal is the result of the study at the master plan level. In addition, the costs of the proposed O&M plan of the water supply systems based on the details of the facilities and the implementation plan have been estimated. The detailed data used to calculate the cost is attached in Data Book in a separate volume.

3.6.1 Proposed systems and required O&M work and cost

a. Conditions of planning and cost estimation

The operation and maintenance plan for the proposed water supply systems has been prepared in consideration of the following conditions.

- Specific O&M work corresponding to the specifications, size, and level of technology employed of the proposed facilities was proposed.

- To realize appropriate O&M work in future, it is a prerequisite to improve the existing organizations and staff concerned with operation and maintenance of water supply facilities. Thus, in every type of work the operators do, they were designed to work as a group and a leader was assigned and provision of appropriate training was planned, especially for the leader. Such member with sufficient qualification should probably be newly recruited from outside and their employment condition should also be improved.

- In order to supply necessary materials and equipments prepared in operation and maintenance work, SRWDB is expected to procure such items according to the schedule and deliver them to site on time. Especially, the master plan requires the use of a large amount of chlorination chemicals to disinfect water for all the target woredas. Therefore, SRWDB should buy a large amount of the chemical in Addis Ababa and distribute them to each woreda.

The cost of implementation of the proposed operation and maintenance plan was calculated in consideration of the following conditions.

- The O&M cost covers both the newly planned facilities and the existing facilities for all woredas and towns.
- The cost of O&M of the terminal water supply facilities such as public water supply points that are conventionally operated and maintained by WASHCO was not included because WASHCO is solely responsible for it.
- Staff assignment at each facility is in principle based on the existing operation of the same facility to propose realistic number of members required.
- The annual O&M cost is calculated as an annual average of 10 year operation. Thus, the cost that occurs every few years was distributed over the 10 years.
- The cost of replacing over-used equipment is separately calculated for corresponding years.
- The cost does not consider accidental expenses but only regular expenses.

b. Target of O&M plan and details of the plan and cost

The targets of O&M planning and O&M cost estimation are the 16 woredas and the two towns of Kabribeyah and Godey. The basic approaches of determining the type of work required and assignment of staff for the 16 woredas and the two towns is concisely described in Table 3.34 to Table 3.39. For the two towns, the type of work and number of staff members required for the work are shown in more detail for each and all facilities of the proposed systems of the towns (refer to Table 3.40 to Table 3.45). The costs of O&M for these woredas and towns were calculated based on the result following the cost items below.

1) Personnel (stationed field staff directly involved in O&M of the facilities and day workers)
2) Materials (tools, materials and equipment necessary for O&M)
3) Fuel and electricity (Fuel for generators and electricity bill for pumps)
4) Chemicals (chlorine agents for household use, and treatment chemicals for the plant)
5) Spare parts (consumables and spare parts for generators and pumps)

In the cost estimation, actual price data was used as much as possible to make the values realistic. However, the amount of chemicals that has a great impact in the total O&M cost should be verified at the time of the training after the detailed design. Then the O&M cost should be reviewed along with the other costs and revised accordingly. As for the costs of fuel and electricity, the use of commercial electric supply was either unconfirmed or instable except in Kabribeyah town. Thus, the power supply was planned with generators in all areas other than Kabribeyah town.

c. Woredas (rural areas of 16 woredas)

c.1 Work required and staff assignment

The water supply systems of the woredas were categorized into the five types as in Table 3.26 below based on their water source and distribution method. Since no detailed survey was conducted on the existing water supply systems in the target woredas in this study due to the problem of the security, the estimation of O&M cost for each woreda was conducted as follows: First, the basic O&M cost was calculated for the typical system of the following four types. Then the total cost of O&M of each woreda was calculated based on the combination of the basic four types of the systems.

Table 3.26: Classification of Water Supply Systems in Woredas

System classification	Outline of system and O&M work
1. Birka/ Haffir dam	Facilities of the specifications proposed in the master plan are designed to collect and store surface water. The "no information" entries in the table of the existing systems were taken to be under this category.
	Regular removal of silt and debris in the facilities, and also repair of roof are necessary. They are managed by WASHCO members or caretakers. Chlorination chemical for household use is required to use the water for drinking.
2. Hand-dug well	A hole of about 1m in diameter and 10 m in depth. It is manually dug in the ground to get water in the bottom by a bucket and rope. Serves from 50 to 300 people.
	Regular removal of silt and debris on the bottom of the well as well as repair of the well wall are required. Since it is a small facility, it is managed by WASHCO members or by a caretaker. Chlorination chemicals for household use are required to use the water for drinking.
3. Shallow well and hand pump	Water is drawn by a hand-pump that is installed over a borehole. The borehole is usually no deeper than 80m.
	Since it is a small and simple system, WASHCO members or caretakers manage the system. Regular replacement of worn hand pump parts is necessary. Regular disinfection of the inside of the well is necessary.
4. Borehole well and submersible motor pump (S, M, L depending on size)	A borehole well drilled by a machine is equipped with a submersible motor pump. The pump is driven by a generator to pump water to the service area. It can be a smaller version of town water supply system. "Shallow well" in the existing system was categorized under this system.
	The size of the system is much bigger than the above systems. Thus, the system should be managed and operated by one to three operators with a sufficient technical level of woreda water office staff as well as WASHCO members. Procurement of diesel fuel and spare parts for generators will be necessary. Also chlorination chemicals to disinfect borehole will be needed. To do the maintenance of generators, input of daily workers and technical staff from woreda water supply utility office will be necessary. The system was classified into small (S), Medium (M), and Large (L) based on its size (generator capacity).
5. River intake system (S, M, L depending on size)	The water from a river is pumped up and turbidity is removed through sedimentation and filtration. Then the water is disinfected and pumped to service areas by ground pumps driven by generators. Smaller version of Godey town water supply system. Commercial electric power was assumed to be unavailable in every woreda.
	The system is bigger and more complex than borehole system. Thus, 2 to 4 operators with sufficient technical level from the woreda water supply utility office will be necessary. Also, in order to do the maintenance of equipment, input of some daily workers and technical staff of woreda water office will be necessary. Other items that will be necessary are diesel fuel for generators, spare parts for pumps and generators, and water treatment chemicals. Also, they will be necessary to regularly remove sludge from the sedimentation pond. The system was classified into small (S), Medium (M), and Large (L) based on its size (water supply amount).

The categorization of the water supply facilities presented above is principally based on the information of the existing water supply facilities (List of existing water supply systems) discussed in the section of present condition of water supply in volume 2. However, since the information on the source and associated facilities is not sufficient for each woreda, the items labeled “shallow well” was taken to be a shallow borehole well with a submersible pump, and the items labeled “no information” was taken to be Birkas or Haffir dams. Other existing systems (facilities) were also assumed to be similar to the ones in the table above. The relatively large and complex systems of No. 4 and 5 above were classified into small, medium and large based on the magnitude of the system.

c.2 General cost

The cost of O&M was calculated for both the newly planned and existing water supply facilities together for each woreda. All the existing systems recognized in the study were treated as those described in Table 3.26 and all the systems were assumed to be functional in 2020. The “borehole with motor pump system” and “river intake system” were further divided into three based on the size of the system. However, the details about the existing corresponding systems are not clear. Thus, it was assumed that the numbers of existing systems are proportional to those that were planned in the master plan which was prepared in consideration of the water source condition of each woreda. As for Kabribeyah and Godey woredas in the target 16 woredas, the urban water supply system of the two towns of Kabribeyah and Godey were excluded and separately treated under town water supply system in this study. On the other hand, the remaining 14 woredas were handled together with their urban water supply systems.

The O&M costs of the target 16 woredas were calculated accordingly using the price of 2013 and are presented in Table 3.46. The cost for Kabribeyah woreda is comparatively large. This is because there are many large scale borehole systems in the woreda. Energy cost takes up a large part of the total O&M cost. In the case of large scale borehole with submersible pump system and of river intake system, the energy cost amounts to as much as 80%.

d. Kabribeyah Town

d.1 Work required and staff assignment

The staffs engaged in the operation and maintenance of the water supply system are divided into stationed field staff and non-stationed temporary staff. The former regularly operates the facilities in charge and the latter is mainly involved in maintenance work when it is necessary. For the operators, as a stationed filed staff, who are the major players of O&M work, the study team has proposed to newly assigned leaders of operators to supervise them at each facility. These leaders are named “technicians”. Such members can be recruited from outside and should have educational background with at least TVETC level. Also, once employed, appropriate technical training should be given from the stage of construction of the facilities. Also, comparatively low salary scale for the staff may discourage the newly recruited employees. Thus, the staff salary should be raised by 50 to 100% to raise morale of the staff members. In the planning and cost estimation work, all the regular O&M work were assumed to be conducted by Kabribeyah town water supply utility office for convenience, although most of the maintenance work of the major part of the system is being conducted by UNHCR and by JWSO as a contractor.

As a representation of O&M plan of the water supply system, the tasks required, frequency of

the tasks, and assigned staff for each of the facilities constituting the water supply system that will be managed by the town water supply utility office from 2020 are presented in Table 3.40 to Table 3.42. The conditions of preparation of work plan are shown in Table 3.36 and Table 3.37. Based on this detailed O&M plan, the total number of staff required to operate the water supply system in Kabribeyah town can be determined as in Table 3.27 below. The numbers of current staff members assigned are also shown in brackets as a reference.

Table 3.27: Total Number of Staff Required for Operation of Planned System in Kabribeyah Town

Facility cluster	Stationed field staff			Temporary staff	
	Technician	Operator	Guard	Day worker (man-day /year)	WD staff (man-day /year)
Borehole wells（Fac.1）	5 [0]	4 [2]	6 [2]	18 [0]	6
Treatment plant, Reservoir, Pump st.（Fac. 2, 3, 4）		4 [3]	3 [2]	671 [640]	36
Reservoir, Pump st.（Fac. 5, 6）		2 [2]	3 [2]	105 [96]	24
Distribution reservoir（Fac. 7,8）	0 [0]	2 [0]	3 [2]	170 [180]	0
Pipeline system（Fac. 9）	0 [0]	0 [0]	0 [0]	160 [67]	0
Sub-total	5 [0]	12 [7]	15 [8]	1124 [983]	66
Total	32 [15]				

Note: the numbers under the header “Facility cluster” signify the facility number in Table 3.40 to Table 3.42.
The numbers shown signify the total number of field staff to be employed under the system of working in shift.
The shaded entries are temporary staff members from Water Desk (WD) and not calculated in the O&M cost.
The numbers in brackets “[ ]” signify the total number of current staff employed.

In addition to the numbers of the staff members shown in Table 3.27, input of 66 person-day equivalent of technical staff from the town water supply utility office is required as technical support. Although, the basic composition of the facilities in the system will not change after the completion of the project, the number of wells to operate will increase. In addition, the task of adding water treatment chemicals and removal of scale from the pipes and valves should be properly conducted. For this reason, mainly the technicians and operators have been augmented.

d.2 Estimated cost

In Kabribeyah town, as explained in the section of water supply planning, major part of the existing water supply system will be used to supply water but the newly constructed facilities and this existing portion of the system were handled together to conduct the cost estimation. It was assumed that the existing system will be properly managed and maintained until the year 2020 and that the old equipment will be all replaced at the beginning of 2020, the target year of the master plan. Namely, the system was assumed all functional at the start of the year 2020. As for the personnel cost, only the stationed field staffs and day workers shown in Table 3.27 were calculated as cost but not the temporary staff members from the woreda water utility office (shaded entries in the table). The calculated annual O&M cost is 3,915,960 Birr in 2013 price and it is equivalent to about US$ 211,000.

The O&M cost of the system was calculated accordingly using the price of 2013 and is presented in Table 3.46. The fuel cost accounts for as much as 80% of the total cost.

e. Godey Town

e.1 Work required and staff assignment

The staffs engaged in the operation and maintenance of the water supply system are divided into stationed field staff and non-stationed temporary staff. The former regularly operates the facilities in charge and the latter is involved mainly in maintenance work when it is necessary. For the operators, as stationed filed staff, who mainly deals with O&M work, the study team has proposed to newly assign a leader of operators to supervise them at each facility. These leaders are named technicians. Such members can be recruited from outside and should have educational background with at least TVETC level. Also, once employed, appropriate technical training should be given from the stage of construction of the facilities. The operation of the new system in Godey town involves input of water treatment chemicals such as coagulant and pH adjusting agent that the staff is not familiar with. The daily dose of these chemicals should be determined based on a simple lab test and the dose should be adjusted according to the flow conditions. One of the main tasks for the technician is to supervise this work. The treatment of turbid water involves a large amount of chemicals and thus, some assistant should assist the operators. Also, one laboratory technician is assigned to engage in daily checking of water quality and lab testing of water to determine the dosage of the chemicals.

As the O&M plan, the tasks required, frequency of the tasks, and assigned staff for the set of facilities constituting the water supply system that will be managed by the town water supply utility office are presented in Table 3.43 to Table 3.45. The conditions of the work planning at each facility are presented in Table 3.38 and Table 3.39. Based on this detailed O&M plan, the total number of staff required to operate the water supply system in Godey town was determined as in Table 3.28 below. The numbers of current staff members assigned are also shown as a reference.

Table 3.28: Total Number of Staff Required for Operation of Planned System in Godey Town

Facility cluster	Stationed field staff					Temporary staff	
	Technician	Operator	Assistant. Operator	Lab. Technician	Guard	Day worker (man-day /year)	WD staff (man-day /year)
Intake, Pump st., Generator house, Sedimentation pond, Rough filter, Slow filter (Fac. 1-6)	5 [2]	6 [2]	3 [0]	0 [0]	18 [6]	4950 [4580]	8
Treated water reservoir (Fac. 7)		2 [0]	2 [0]	2 [0]	3 [1]	20 [216]	0
Distribution reservoir (Fac.8,9)		3 [0]	0 [0]	0 [0]	6 [0]	21 [96]	0
Back up distribution reservoir (Fac. 10)	0 [0]	0 [0]	0 [0]	0 [0]	[NA]	0 [NA]	0
Transmission and distribution pipeline system (Fac. 11)	0 [0]	0 [0]	0 [0]	0 [0]	[NA]	200 [NA]	60
Sub-total	5 [2]	11 [2]	5 [0]	2 [0]	27 [7]	5191 [4892]	68
Total	50 [15]						

Note: the numbers under the header "Facility cluster" signify the facility number in Table 3.43 to Table 3.45.
The numbers shown signify the total number of field staff to be employed under the system of working in shift.
The shaded entries are temporary staff members from Water Desk (WD) and not calculated in the O&M cost.
The numbers in brackets "[ ]" signify the total number of current staff employed.

Although, the basic procedure of water treatment and distribution in the system will be similar to the existing one after the completion of the project, the operation is not currently properly done and the size of the system will increase. In the O&M plan, the task of input of water treatment chemicals and removal of sludge from the sedimentation pond should be properly conducted. For this reason, the numbers of technicians and operators have been increased. Also, new positions of assistant operator and lab technician have been created to support the operator's work that is expected to be more complex and labor intensive at the same time. On the other hand, the number of day workers required increased only a little due to improved efficiency of the proposed system. The technical staff (engineers and plumbers) of Water Desk (town water supply utility office) as temporary staff mainly engages in the maintenance of distribution pipelines for 68 man-day.

e.2 Estimated cost

In Godey town, as explained in the section of water supply planning, almost the entire system will be newly constructed. However, the small existing facilities that will be continued to be used were also considered together to conduct the cost estimation. It was assumed that the existing system will be properly managed and maintained until 2020 and that the old equipment will be all replaced at the beginning of 2020, the target year of the master plan. Namely, the system was assumed all functional at the start of the year 2020. As for the personnel cost, only the stationed field staff and day workers in Table 3.28 were calculated but not the temporary staff from water desk (town water supply utility office) of the shaded

columns in the table. The O&M cost of the system was calculated accordingly using the current price and is presented in Table 3.46. The calculated annual O&M cost is 3,929,000 Birr in 2013 price and it is equivalent to about US$ 212,000. Approximately 60% of the total O&M cost is the fuel cost, which is followed by chemical cost and personnel cost of about 20%.

f. Long-term O&M cost of water supply systems in master plan

The estimated annual expenditures for O&M of the water supply systems of the master plan for the 16 target woredas and 2 towns are shown in Table 3.47 and Table 3.48 at the end of the chapter. The calculation considered future price increase rate of 11.3% and the cost of replacing major equipment. The annual cost was determined as an average over 10-year operation. The price increase was assumed to apply up to the year 2020 and to be 0 % after that. The calculation of the replacement of the equipment is based on the assumed life of pumps of five years and that of generators of seven years. In Kabribeyah town, the replacement cost exceeds the annual O&M cost in 2025 and 2030 because many pumps will be replaced at the same time.

3.6.2 Points of consideration in project implementation

It is highly important that all the organizations concerned with water supply play their roles properly in order to realize appropriate O&M of the water supply facilities that are completed. In the previous section of O&M planning and cost estimation, only the work and cost that are directly required to operate and maintain the facilities planned in the master plan were considered. However, the organizations and work that are indirectly involved in the O&M of the facilities are important as well and should also be considered.

In this sense, SRWDB plays a special and significant role in managing the water supply in the region as a responsible agency in water supply issues. The bureau should take care of the issues that woreda water office or town water supply utility office cannot cope with. SRWDB should also deal with tasks that the government offices at woreda or town level cannot handle or those that would be highly inefficient if handled by these offices. For example, procurement of a large amount of water treatment chemicals or spare parts for equipment from Addis Ababa and their distribution to woredas should be their duty. It was assumed that the cost of the water treatment chemicals itself should be recovered form the water offices of woreda or town level and eventually through WASHCO. The money is naturally raised by running the system in the woredas and towns. However, the other associated costs should be shouldered by SRWDB.

Also, at woreda level, when materials have to be transported to sites or when there is an issue that the operators at the site cannot handle, technical staff members of woreda water office are expected to attend to the site immediately. In such cases, it is necessary for woreda water offices to have a means of transportation such as a motorcycle.

On the other hand, WASHCO, the terminal group of residents that was not considered in O&M planning and cost estimation, plays an important role in the O&M of water supply systems. In that respect, the group should be responsible for proper management of the terminal water supply facilities and should make sure that the money is duly collected from the users. The money so collected should be, then, used for O&M activities or be handed over to the water supply utility office in charge. These are the main duties of WASHCO in O&M

of water supply facilities. However, the current WASHCOs are not yet existent and even where they exist, their capacity is far from satisfactory. Therefore, appropriate technical training should be provided to raise their motivation and work skills.

As will be described in the following sections, various training will be required for the organizations mentioned above in order to realize proper operation of maintenance of the water supply systems/facilities after their completion. Since the cost of the training is not included in the O&M cost calculated earlier, the government of Somali Region should secure the budget for the training at any cost and conduct the training. SRWDB is the organization that should take on this responsibility to conduct the training in a timely manner. It is expected to allocate its own budget to implement the training or to win assistance from external aid organizations such as NGOs to make it possible.

<Reduction of O&M cost>

Although the calculated O&M cost shown in the previous section is based on several assumptions, the determined figures are reasonable in consideration of the magnitude of served populations and types of the water supply system. However, the implementation of the master plan is scheduled for 2015 to 2020 and there is a possibility that the assumed conditions may change to some extent. Especially the fuel cost that takes up a major portion of the O&M cost can be reduced to a large extent. This is because the O&M plan is now based on the use of generators to operate pumps except for Kabribeyah town and thus, the cost is inevitably high. However, in areas such as Godey town where commercial electricity supply may soon be available, the energy cost can be reduced by operating the pumps with cheap commercial electric supply. A calculation conducted by the Study Team indicates that the energy cost can be reduced to about one-third of the current figure if commercial electric supply is available. The personnel cost is an essential spending item and cannot be cut down. On the other hand, the chemicals cost may be reduced to some extent after achieving appropriate water treatment and reduction of leakage in future because sufficient amount is planned in the O&M plan.

3.7 Capacity development plan for the relevant organizations

In this section, training program that will be necessary and has to be conducted from the construction stage in order to realize proper O&M of the proposed systems in the master plan was proposed along with its details. Also, the outline and approaches of long-term capacity development measures to enable sustainable future O&M is described.

3.7.1 Outline of mid-term capacity development plan

a. Conditions of planning for training

As explained in the first half of this chapter, at present, all the organizations involved in water supply, from resident to regional level, lack sufficient capacity to execute their work properly in terms of materials and equipment, skills, budget, and human resources. In order to realize proper O&M of the proposed water supply facilities in the master plan, it is mandatory to establish a system where these organizations can fulfill their duties and perform the tasks that have been proposed in the previous section. To help realize this, a series of short to long-term training sessions should be provided to the staff of the organizations concerned with water supply. The training sessions should start from the year 2015 when the construction of the proposed facilities is to start and be conducted in accordance with the proposed construction

plan. Furthermore, sufficient additional follow up training as OJT will be necessary even after the start of the operation of the completed systems in 2020. In this context, the training was planned in consideration of the following.

- There are many entities as targets of the training and same training needs to be frequently repeated. Thus, the training courses in each field are taken as modules and training programs were prepared by combining necessary modules associated to the target organization.

- The contents of the training will be compiled in a table format and only the outline will be presented. The format was designed to serve as an initial TOR to be used when the programs are to be implemented. It should be noted, however, the TOR should be revised to include the details of the facilities at the time.

- Since there are too many associated training items and implementation of all of them is not realistic, minimum required training was selected for implementation as the programs. Especially the items of training that concern the issues identified in the study were given higher priority in the attempt to improve the situation.

- Water treatment is a new task that the current staffs are not familiar with. Thus, it is difficult to learn all the necessary techniques and knowledge during the implementation of the training programs. Therefore, OJT training was planned as a follow up measure after the completion of training program to be implemented during actual operation of the systems.

- The contents of the technical training were specifically designed to fit to the specifications of the proposed facilities and aim at enabling the staff to acquire skills to operate the facilities. Appropriate timing of implementation of the training was examined and planned in accordance with the project implementation plan of the master plan so that the training can be started at proper timing after the start of facilities construction.

- It was assumed to be prerequisite that the minimum-required tools and small equipment that will be necessary to conduct the actual O&M work would be all provided as part of the training program implementation. Proper use of the tools and equipment provided should be taught within the training.

The following are the outline of the training programs proposed for each organization concerned. The schedule of the implementation of the training programs is also presented at the end of the chapter (Figure 3.9). Also, the proposed training modules are presented at the end of the chapter as Table 3.49 to Table 3.65.

b. SRWDB

b.1 Training for supporting woredas

Since SRWDB is responsible for general assistance to the target woredas water offices and town water supply utility offices regarding the O&M of the constructed facilities of the master plan, the staff should be aware of the outline of the facilities to be planned in each woreda and town and the type of work required for each type of facility. For this purpose, a short-term training session was planned for the workshop staff members and its supervisor and also to raise their morale.

b.2 Training for technical staff

The training focuses on the technical aspect of the workshop. It involves effective use of the mobile workshop vehicles provided to SRWDB to conduct patrol maintenance work in the region and capacity building to enable repair of the generators and pumps that have been brought to the workshop due to malfunctioning. For the technical training of O&M of the system with generators and motor pumps in woredas and towns, assistance from technical staff of SRWDB is considered inevitable to realize proper O&M of the facilities in the long run. One technical member of SRWDB should join the training to learn the relevant techniques and also to clarify the roles and duties of both parties in O&M work, and further to promote mutual communication.

c. Kabribeyah Town Water Supply Utility Office

c.1 Training for management

The study has pointed out that the financial management of the office is weak. Thus, a short-term training designed to raise the capacity in financial management was planned. Since the office is financially autonomous, the training should include the topic of how to properly determine the water tariff.

c.2 Training for technical staff

In the technical aspect of the water supply system, the problem of excessive scaling has long been the issue although no realistic solution has been found. This made it necessary to deal with this problem somehow during the O&M work and a training to enable these measures effectively and efficiently was planned. In the daily O&M work, the roles of the operators who conduct the daily O&M work and that of the technicians, a newly proposed position to supervise the operators, are very important. Especially the introduction of the new position should be first well explained to the concerned members and their duties and tasks should be well defined in the training.

d. Godey Town Water Supply Utility Office

d.1 Training for management

Like in Kabribeyah town, the study has pointed out that the financial management of the office is weak. Thus, a short-term training designed to raise the capacity in financial management was planned. Since the office is financially autonomous, the training should include the topic of how to properly determine the water tariff.

d.2 Training for technical staff

In the technical aspect of the water supply system, the problem of highly turbid river water has long been the issue, although no realistic solution has been found. This made it inevitable to deal with this problem during the O&M work and a training to enable removal of suspended solids in water with the use of water treatment chemicals was planned. Especially the dosage of chemicals needs to be carefully adjusted every day based on the result of laboratory test of the water. Since this is a totally new area of work and knowledge for most staff members, a mid-term training focusing on this technique should be provided to the operators and the technicians. In the daily O&M work, the roles of the operators who conduct the daily O&M work and that of the technicians, a newly proposed position to supervise the

operators, are very important. Especially the introduction of the new position should be first well explained to the concerned members and their duties and tasks should be well defined in the training.

e. Woreda water office

e.1 Training for management

Similar to the town water supply utility offices, the study has found that the financial management of these offices is weak. Thus, a short-term training designed to raise the capacity in financial management was planned. However, the contents of the training will be much simpler because these offices are not financially responsible unlike the town water supply utility offices.

e.2 Training for technical staff

The technical level of woreda water offices are expected to be very low. Thus, short-term training to teach the basic knowledge and skills required for their jobs should be provided first. If it is possible, it is better first to employ staff members of higher educational levels and provide training to these people.

f. WASHCO

f.1 Training for management

As mentioned in the first half of this chapter, no official WASHCOs have been formed at many of the existing facilities. These water supply systems and facilities are currently managed by conventional caretakers or without anyone to manage them. Therefore, ordinary training to form a WASHCO should be provided first in such areas. In the training, the aspect of training of future trainer of WASHCO training should be considered. Financial management and accounting is included in the original WASHCO training curriculum and no separate training in this field will be given. WASHCOs need to be formed before the other technical training is conducted at each site. Thus, WASHCO training should be conducted at an early stage as possible.

f.2 Training for technical staff

Although the level of skills required for WASHCO members is not necessarily high, most members lack basic technical knowledge and skills. Thus, appropriate technical training should be provided to WASHCO members. The training should focus especially on the maintenance of birkas, hafir dams, hand-dug wells, and hand pumps that WASHCO members will have to look after on their own. A member of woreda water office should also be included in the training so that both parties can clearly understand their duties and responsibilities and that their mutual cooperation will be promoted.

g. Residents

The study has revealed that the awareness level of the general residents is low as a whole and the situation is making it difficult to obtain their cooperation in construction and O&M work. Therefore, a publicity campaign targeting the 16 woredas in the master plan, especially the sites where construction of new facilities are planned, should be conducted.

h. Cost of training

The cost of implementing the series of training is not included in the O&M cost discussed in the previous section, the cost of implementing the training program shown in Figure 3.9 was roughly calculated based on the prepared tables of training modules. Since the mode of provision of training and their details are not yet certain, the cost can be also different depending on the type of organizations that will undertake the training. Thus, the cost estimation included the case where foreign trainers are involved when the training is technically advanced. The results for the 16 woredas and two towns are as follows. The details of the calculation are shown in the Data Book.

Table 3.29: Estimated Cost of Proposed Training Program for Capacity Development

	Training Cost (Birr)	
	Local resource case	Foreign resource case
SRWDB	337,000	450,000
7 woredas in Jarar Valley basin	61,623,000	NA
9 woredas in Shebele River basin	101,490,000	NA
Kabribeyah town	1,716,000	1,967,000
Godey town	2,918,000	3,285,000

Note: NA: No answer.
The cost is based on 2013 price and only the cost directly needed is included

In comparison with the O&M cost, in woredas where the targets of the training are scattered, the training cost is 1.8 to 2.5 times of the annual O&M cost. On the other hand, in towns where the training targets are concentrated, the training cost is from 50% to 80% of the annual O&M cost. The details of the training needed for major organizations concerned with water supply are described in the following.

i. Expected training provider and method of training

The expected training providers of the training modules are shown in the tables. The local level training targeting WASHCOs can be handled by local NGOs or by the staff of SRWDB. However, it is only one person who has experience in WASHCO training in Somali Region and fostering of other trainers is urgently needed. For those training modules that involve rather complex systems such as hand-pumps can be handles by Addis Ababa-based NGOs and consultants as well as by SRWDB. For more complex and large systems of borehole with submersible pumps or river intake system, one of the most experienced NGOs or seasoned consultants in Ethiopia should be employed. For the water treatment techniques, employment of AAWSA (Addis Ababa Water Supply Authority) staff or water treatment specialists from abroad needs to employed. The study team confirmed that EWTEC invites some people for its electro-mechanical training course every year and it dispatches trainers to TVETC in major towns across the country in order to organize training at local levels. AAWSA says that it is ready to either dispatch its technical staff for short period or receive some people from outside as part of mutual cooperation within the public sector. In addition, some consulting firms in Addis Ababa have experience and offer training on financial management for government or private institutions. Meanwhile, foreign resources can be utilized for almost all the above training. The cost of the training, however, will be higher if foreign resources are employed. Also the cost will be different depending on how the training is organized: by employing individual consultants or it is done as an integrated capacity development project by donors or NGOs. In any case, it is necessary that an organization or group of people who have sufficient knowledge of Somali situation and of technologies to be applied to prepare for

and organize the training.

3.7.2 Prospect of long-term capacity development plan

In addition to the short and mid-term training programs proposed in the previous section, the outline and approaches of the activities for capacity development that are necessary to ensure long-term improvement of water supply situation in Somali Region is presented in the following section.

a. Continuation of WASHCO training

According to SRWDB, there were 228 water supply systems in 2008 and if the associated public water points and other facilities are included, nearly 300 facilities and systems are in operation. For all these systems and facilities, WASHCOs have to be formed. As mentioned in the first part of this chapter, it is one of the main issues. Training that focuses on training of the to-be trainers of WASHCOs is, therefore, expected to be regularly conducted. Table 3.66 at the end of this chapter presents the summary of the points to consider in future implementation of training related to WASHCOs.

b. Improvement of issues of SRWDB workshop

Several improvement measures based on the identified problems were proposed for the workshop of SRWDB, the major counterpart, in this study. It is appropriate to attempt to improve the workshop that is a large organization at the regional level, through long-term training and improvement measures. From the experience of the study team in Ethiopia, a period of 10 years may be appropriate for this purpose. Also, as indicated from the result of this study, it is considered necessary to provide intensive training for several selected staff members who are to play core roles in future dissemination of skills and knowledge on their own. Table 3.67 at the end of this chapter presents the summary of the points to consider in future implementation of training related to the workshop of SRWDB.

Table 3.30: Regular Operation and Maintenance Activities for Each set of Existing Facilities in Kabribeyah Town (1)

Facility (operation)	Capacity (dimension)	Activity details	Frequency (duration)	No. and level of staff assigned (work shift)	Remarks
1. Borehole wells (pump operation)	4 wells with a total 17.6L/s	1) Pump switch on and off	2 times / day (5 min x 4) Morning – on Evening - off	2 operator	They keep running the pump all day from time to time.
		2) General guarding	Every day (24 hrs)	1 guard (2 take turns)	
2. Treatment plant (Iron removal)	(V=415m^3)	1) Minor cleaning (scale removal in pipe and valve)	2 times / month (1 day)	2 operators and 2 plumbers	The 2 plumbers come from Kebribayah Water Desk
		2) Major cleaning (scale removal in reservoir)	1 time /3 month (5 days)	1 technician and 28 daily labors	The 1 technician comes form Kebribayah Water Desk
		3) General guarding	Every day (24 hrs)	1 guard (3 take turns)	
3. Reservoir	(V=200m^3)	1) Cleaning (scale removal)	1 time / 3 month (1 day)	1 technician and 20 daily labors	The 1 technician comes from Kebribayah Water Desk
4. Pump station (pump operation , chlorination)	2 pumps with a total 140 m^3/h (One out of order)	1) Pump switch on and off	5 times / day (5 min x 5 time) • 6:00 – on 8:00 – off • 10:00 – on 12:00 – off • 14:00 – on 16:00 – off • 18:00 – on 20:00 – off • 22:00 – on 0:00 – off	1 operator (3 take turns)	One guard has recently been promoted to an operator
		2) Valve open and closing	2 times / day (10 min)	2 operators	Same operator as 2-1)
		3) Chlorine dosing	2 times/ week (10 min- 15 min)	2 operators	Same operators as 2-1) 1 kg of chlorine
		4) General guarding	Every day (24 hrs)	1 guard (3 take turn)	Same guard as 2-3)

Table 3.31: Regular Operation and Maintenance Activities for Each set of Existing Facilities in Kabribeyah Town (2)

Facility (operation)	Capacity (dimension)	Activity details	Frequency (duration)	No. and level of staff assigned (work shift)	Remarks
5. Reservoir	(V=200m^3)	1) Cleaning (scale removal)	1 time / 3 month (1 day)	1 technician and 20 daily labors	The 1 technician comes from Kebribayah Water Desk
6. Booster Pump St. (pump operation)	1 pump with a total 75m^3/h * 2 out of order	1) Pump switch on and off	3 times / day (5 min) • 7:00 – on 12:00 – off • 15:00 – on 17:00 – off • 9:00 – on 1:00 – off	1 operator (2 take turns)	A guard and an operator work in shifts
		2) Valve and pipe scale removal	2 times / year (1-2 day)	2 technician & 4 daily labors	The 2 technicians come from Kabribeyah Water Desk
		3) General guarding	Every day (24 hr)	1 guard (2 take turns)	
7. Reservoir (Cleaning)	(V=500m^3)	1) Cleaning	1 time / 3 month (1 day)	1 technician and 45 daily labor	The 1 technician comes from Kabribeyah Water Desk.
8. Pipeline system (repair)	Conveyance and distribution	1) repair by welding, replacement, scale removal	1 time / 8 month (4 - 6 day)	2 technician 3 plumber 20 daily worker	Scale removal is done only in the pipe between the treatment plant and the reservoir immediately down stream

Note: The status above describes that of before intervention by JICA pilot project, Water Desk = Town water supply utility office
*In the treatment Plant – there are 3 operators and 2 guards.

Table 3.32: Regular Operation and Maintenance Activities for Each set of Existing Facilities in Godey Town (1)

Facility (operation)	Capacity (dimension)	Activity details	Frequency (duration)	No. of Staff assigned (level of staff)	Remarks
1. River water Intake (water intake & pump operation)	1 pump operating 25 to 30KW 3000 rpm	1) Pump switch on and off	2 times/day, 6:00-on, 21:00-off (5 min)	1 Technician and 1 operator at Intake	The intake pipe in the river is sometimes damaged due to river flow
		2) Intake filter cleaning	1 time/month, (0.5 – 1 hr)	1 technician + 2 daily workers	
		3) Intake pipe repair	1 time/ 3 – 4 months, (3 – 7 days)	1 technician + 10 daily workers	
		4) General guarding	Every day (24hrs)	1 person (guard, 2 take turns)	
2. Treatment plant (sediment removal)	Sedimentation pond V= 540m^3	1) Sediment removal	1 time/ 1 – 3 months, (12hrs)	1 technician + 6 - 10 daily workers	Coagulant was never used. Trained person quit a few years ago Sludge removal system not used due to ineffectiveness
		2) Input of coagulant	Never	NA	
		3) General guarding	Every day (24hrs)	1 person (guard, two take turns)	
	Sand Filter 1 V= 250m^3 (4 chamber)	1) Sediment removal	Dry: 1 time/month Rainy 1 time/week (16 – 21days)	1 technician + 10 daily workers	Sediment removal is done all manually
		2) General guarding	Every day (24 hrs)	1 person (guard, 2 take turns)	
	Sand Filter 2 V= 310m^3 (2 chamber)	1) Sediment removal	Dry: 1 time/month Rainy 1 time/week (16 – 21days)	1 technician + 10 daily workers	
		2) General guarding	Every day (24 hrs)	The same person as Sand filter 1	
3.Terated reservoir (chlorination)	V= 106m^3 V= 209m^3	1) Chlorine dosing	1 time/day (10min)	1 technician and 1 operator	Chlorine solution is made and put into the smaller chamber Always 80g of Chlorine
		2) cleaning of tank	Dry: 1 time per month Rainy: 1 time per week (1 day)	1 technician + 8 to 10 daily workers with help from WD sometimes	

Table 3.33: Regular Operation and Maintenance Activities for Each set of Existing Facilities in Godey Town (2)

Facility (operation)	Capacity (dimension)	Activity details	Frequency (duration)	No. of Staff assigned (level of staff)	Remarks
4. Pump station (pump operation and management)	1 pump with total a total 2 generators of 50 to 60kVA capacity	1) Pump and generator switch on and off	2 time/day 6:00- on, 21:00-off (5min)	1 technician + 1 operator	The generators supply power to intake and conveyance pumps respectively 2 guards watch 3 and 4 No regular maintenance of pump and generators
		2) Store keeping	Every day (12 hrs)	1 store keeper	
		3) General guarding	Every day (24 hrs)	2 guards (take turns)	
5. Reservoir 1 (Cleaning)	V= 60m^3, round	1) Cleaning	1 time/ 4 months (3 – 5 hrs)	1 person from WD + 4 daily workers	One from WD always differs
		2) Level check and valve operation	1 time/day (15 min)	1 person from WD	
		3) General guarding	Every day (24hrs)	1 person only	
6. Reservoir 2 (Cleaning)	V= 150m^3, rectangle	1) Cleaning	1 time/ 4 months (8 hrs)	1 person from WD + 8 daily workers	
		2) Level check and valve operation	1 time/day (15 min)	1 person from WD	
		3) General guarding	Same as 5	Same as 5	
7. Reservoir 3 (Cleaning)	V= 1000m^3, round	1) Cleaning	1 time/ 4 months (12 hrs)	1 person from WD + 20 daily workers	
		2) Level check and valve operation	1 time/day (15 min)	1 person from WD	
		3) General guarding	Same as 5	Same as 5	
8. Pipeline system (repair)	Conveyance and distribution	1) repair, replace	1 time/ 5 month (2 - 5 day)	2 technician 4 plumber 20 daily worker	

Intake Staff: Technician and operator at intake: 2 technicians and 2 operators take turns every other day. Operator works under the supervision of the technician. Technician and operator both have primary education but technicians have more experience and training.

Table 3.34: Policy of O&M of the Facilities in16 Target Woredas (1)

Item	Details
1. Hand-dug well	
1) Management	One member (not paid) of WASHCO is in charge of one system (well) who collects money and checks well condition
2) Well bottom dredging	3 daily workers employed to clean the bottom of the well. The cleaning is done twice a year in dry season
3) Distribution of chlorination agent	Chlorination agent for drinking and washing water for the community is distributed Water guard is used for its low-cost The agent is distributed from woreda water desk through WASHCO
2. Birka	
1) Management	One member (not paid) of WASHCO is in charge of one system (birka) who collects money and checks condition of the system
2) Birka cleaning	5 daily workers are employed to clean the silt trap and repair the roof The work is done once a year in dry season (2 days)
3) Pump maintenance	WASHCO members and woreda water office together do the maintenance of the hand-pump attached to the birka. WASHCO pays the per diem of the woreda water office staff and the replaced spare parts if necessary. The work is done in one day and is conducted in dry season. Hand-pump is assumed to last for 10 years.
4) Distribution of chlorination agent	Chlorination agent of household use will be distributed for each 300 people who depend on Birka. The treatment targets only water for drinking and washing. Chlorination agents will be distributed from woreda water desk to the residents through WASHCO.
3. .Hafir dam	
1) Management	One member (not paid) of WASHCO is in charge of one system (dam) who collects money and checks condition of the system
2) Dam cleaning	5 daily workers are employed to clean the “silt trap” The work is done every year in dry season. Each time it takes 2 hours.
3) Distribution of chlorination agent	Chlorination agent is distributed for the drinking and washing water for 2,500 people. The chlorination agent will be delivered from woreda water office through WAHSCO
4. Shallow well with hand-pump	
1) Management	One member (not paid) of WASHCO is in charge of one system (well) who collects money and checks condition of the system
2) Pump maintenance	WASHCO and woreda water office will conduct maintenance of the hand-pump The work is conducted once a year. The work will take 20 min. The spare parts may be replaced if necessary.
3) Chlorination of the well	WASHCO and woreda water office will conduct disinfection of well by chlorine. The work is conducted twice a year.

Table 3.35: Policy of O&M of the Facilities in16 Target Woredas (2)

Item	Details
5. Deep borehole well and motor pump	
1) Management	Two members of WASHCO are in charge of one system (not paid) involving management of public water points and money collection.
2) Operator	WASHCO employs 1 to 3 operators to depending on the size of the facility The operator will conduct operation of the generator, fuel refilling and maintenance.
3) Fuel for generator	The system is run for 8 hours per day with one 35kVA generator
4) Maintenance of generator	Operator and staff of woreda (town water supply utility) water office will conduct regular maintenance of generators (engine oil and filters).
5) Chlorination	Chlorination is conducted in the borehole once a year
6. River intake system	
1) Management	Two members of WASHCO are in charge of the system (not paid) They attend mainly public water supply points and collect money.
2) Operator	2 to 4 operators will be employed by WASHCO depending the size of the system Operators will mainly conduct operation of the generator, fuel refill, instruction of the cleaning of the facilities. They also do the input of water treatment chemicals. Guards sometimes help operators to do the work.
3) Fuel for generator	Generator will drive intake and distribution pump Generator is operated for 8 hours. 1 or 2 generators of 20kVA～120kVA
4) Maintenance of generator	Operator and woreda water office (town water supply utility office) staff conduct regular maintenance of the generators (refill of engine oil, replacement of filters etc.) WASHCO will shoulder the per-diem of woreda water office staff and spare parts cost. The maintenance work is done twice a year.
5) Cleaning of sedimentation pond	All work is done manually. Employed workers will work under the instruction of operators. 3 to 12 workers are employed at a time depending on the size of the system and the work is conducted in one day.
6) Spare parts of equipment Other materials	Spare parts of intake pumps and distribution pumps (gland packing, mechanical seal, bearings) are replaced Basic tools such as shovels and scrapers for cleaning of sedimentation ponds are necessary.
7) Maintenance of equipment	The maintenance of equipment is done by operator and workers under the supervision of technician of woreda water office.
8) Water treatment chemical	Aluminum sulphate is used as coagulant because the price is reasonable and easily available in Ethiopia. Same dosage as Godey town 100mg/L is used. Calcium hydroxide powder is used to adjust pH Chlorination is done after sedimentation and filtering. Calcium hypochlorite is easily available and its price is relatively reasonable in Ethiopia. The same dose as in Godey town of 3mg/L will be used. The chemicals will be first mixed with water to prepare high concentration solution and this solution is dripped from the chemical tank

Table 3.36: Policy of O&M of the Facilities in Kabribeyah (1)

1 Basic conditions	Water supply amount: 2,699 m^3/day (maximum value including 30% leakage loss) Pump operation: 11 hours/day at intake wells, 12 hours/day at pump stations Facilities and equipment: ・8 borehole deep wells (5 are driven by generator) ・6 surface pumps (3 in pump house, 3 in booster pump house) ・Sedimentation pond, reservoir tanks, elevated reservoir tanks
2 Staff assignment	The assignment of staff was proposed based on the staff assignment at existing facilities and their work status. It also took into account the size and required work at the planned facilities as follows. Some operators should have some basic theoretical knowledge on their work and leadership skills. One person who has at least TVETC level education as a leader (technician) of operator is assigned. Technically more intricate work such as determination of chemical dosage and high level maintenance of work will be assisted by an engineer from the town water supply utility office as required. The staff should avoid excessive over work and their assignment was proposed to realize average 8 hour/day work by working in shifts. The staff assignment was proposed to minimize interruption of water supply even when maintenance such as tank cleaning is conducted.
3 Generator fuel and commercial electricity	The fuel efficiency of the existing generators is reported to be 5 to 6 L/h and that of the new ones procured in the pilot project was measured to be 4 to 5L/h. Thus the value of 5L/h was adopted for the generator of same size. For others, figures from product catalogues were used. 2 JICA wells, 2 UNHCR wells and one newly planned well (total 5 wells) will be driven by generators. The other 3 wells will be powered by commercial electric supply. The electricity bill of “General (Active Reactive)” of Ethiopian Electric Power Corporation was applied. The operation of the wells are continuous 10 to 12 hours Diesel fuel is available in Jijiga town.
4 Chemicals for water treatment and input of the chemicals	In Kabribeyah town, only chlorine is used to disinfect water. Calcium hypochlorite is easy to handle and relatively safe and also it lasts longer in storage. Thus, calcium hypochlorite powder is used as disinfectant. First the powder is mixed with water to prepare a high concentration solution. Then it is poured into a chemical tank to be released (drip) at a constant rate. This chlorine chemical is available in Addis Ababa. Dosage will have to be determined based on the test at site but it is assumed to be 2mg/L

Table 3.37: Policy of O&M of the Facilities in Kabribeyah Town (2)

5 Spare parts of equipment	In consideration of the fact that the existing equipment mostly breaks down in around 3 years, and the maintenance capacity will also be improved, the realistic life of equipment was set as follows: Submersible pump: 5 years, Ground pump: 5 years, Generator: 7 years The following spare parts for generator were assumed Engine oil（every 6 months） Fuel filter（every 6 months） Oil filter（every 6 months） Air cleaner（every 6 months） Fan belt（once every 2 years） Assumed spare parts for ground pump are as follows: Gland packing (once a year) Mechanical seal (once a year) Bearing (once every 3 years)
6 Large equipment	They are replaced right after their life years are reached starting from 2020. These large equipment will be procured with assistance from donors and thus free from customs tax. This cost is not included in the regular O&M but separately handled
7 Cleaning of reservoir tanks	In consideration of power supply conditions at site and difficulty in maintenance of the associated small equipment, the cleaning work should be conducted all manually. The assignment of works was determined based on the existing condition and the size of the planned facilities. Daily workers are employed to work under the supervision of the operator. Actual facilities to be cleaned are shown in another table and the following tools may be used. Shovel, deck brush, scraper (made from iron pipe), dewatering pump, bucket,
8 Other maintenance work (scale removal)	The short pipes and valves attached to the ground pumps are taken apart and the accumulated scale is removed carefully. The work is all done manually. The assignment of works was determined based on the existing condition and the size of the planned facilities. Daily workers are employed to the work of cleaning the pipes and valves under the supervision of the operator. The engineer and plumber from the water supply utility office will detach the pipes and valves. Scale inside the pipes is physically removed with the use of a scraper.

Table 3.38: Policy of O&M of the Facilities in Godey Town (1)

1 Basic conditions	Water supply amount: 2,212 m^3/day (maximum value including 30% leakage loss) Pump operation: 24 hours/day Facilities and equipment: Intake pump x 2 (driven by two 120kVA generators) Distribution pump x 2 (driven by two 120kVA generators) Sedimentation pond, Rough filter, Slow sand filter, Clear water reservoir, Elevated water tanks
2 Staff assignment	The assignment of staff was proposed based on the staff assignment at existing facilities and their work status. It also took into account the size and required work at the planned facilities as follows. Some operators should have some basic theoretical knowledge on their work and leadership skills. One person who has at least TVETC level education as a leader (technician) of operator is assigned. Technically more intricate work such as determination of chemical dosage and high level maintenance of work will be assisted by an engineer from the town water supply utility office as required. One lab technician is assigned to conduct water tests to determine appropriate dose of water treatment chemicals. The staff should avoid excessive over work and their assignment was proposed to realize average 8 hour/day work by working in shifts. The staff assignment was proposed to minimize interruption of water supply even when maintenance such as tank cleaning is conducted.
3 Generator fuel and commercial electricity	The fuel efficiency of the existing generators is reported to be 5 to 6 L/h and that of the new ones procured in the pilot project was measured to be 4 to 5L/h. Thus the value of 5L/h was adopted for the generator of same size. For others, figures (70% load) from product catalogues were used. - The operation of one intake pump is continuous 10 hours and second 24 hours - Diesel fuel is available in Godey town
4 Water treatment chemicals	In Godey town water supply system, coagulant, pH adjuster, and chlorination disinfectant are used. Calcium hypochlorite is easy to handle and relatively safe and also it lasts longer in storage. Thus, calcium hypochlorite powder is used as a disinfectant. It is available in Addis Ababa. The dosage will have to be determined based on the test at site but it is assumed to be 3mg/L Aluminum sulfate powder, easy to procure in Ethiopia, is used as coagulant. The dosage will have to be determined based on the jar test at the site every day. It was however, assumed to be 100mg/L based on data from several water treatment plants including AAWSA, Ethiopia. In order to adjust pH of water after input of aluminum sulfate, lime (Calcium hydroxide) will be added. The dosage is assumed to be 40mg/L Note that sufficient training should be given to the staff who deals with the chemicals.

Table 3.39: Policy of O&M of the Facilities in Godey Town (2)

5 Spare parts for equipment	In consideration of the fact that the existing equipment mostly breaks down in around 3 years, and the maintenance capacity will also be improved, the realistic life of equipment and frequency of parts replacement was set as follows: Ground pump: 5 years, Generator: 7 years The following spare parts for generator were assumed Engine oil（every 6 months） Fuel filter（every 6 months） Oil filter（every 6 months） Air cleaner（every 6 months） Fan belt（once every 2 years） Assumed spare parts for ground pump are as follows: Gland packing (once a year) Mechanical seal (once a year) Bearing (once every 3 years)
6 Large equipment	They are replaced right after their estimated life years are reached starting from 2020. The large equipment will be procured with assistance from donors and thus free from customs tax. This cost is not included in the regular O&M but separately handled
7 Cleaning of reservoir tanks	In consideration of power supply conditions at site and difficulty in maintenance of the associated small equipment, the cleaning work should be conducted all manually. The assignment of works was determined based on the existing conditions and the size of the planned facilities. Daily workers are employed to work under the supervision of the operator. Actual facilities to be cleaned are shown in another table and the following tools may be used. Shovel, deck brush, scraper (made from iron pipe), dewatering pump, bucket, soil carrier
8 Sludge removal in slow sand filtration pond	The condition of the filter layer in the slow sand filtration pond should be maintained through adjusting in response to the surrounding environment in order to assure the best performance. Since the work is highly technical and requires experience, the work will be done under the supervision of 2 technicians who have received necessary training. The technicians will instruct the operators and day workers. The work is done all manually.
9 Other maintenance work	The short pipes and valves attached to the ground pumps are taken apart and the accumulated scale is removed carefully.

Table 3.40: Regular Operation and Maintenance Activities for Each Set of Planned Facilities in Kabribeyah Town (1)

Facility	Spec/Capacity (Dimension)	Detailed O&M tasks	Frequency (duration)	No. of staff assigned (work shift)	Remark
1. Borehole wells	8 wells total 67.7 L/s *5 with generators	1) Pump switch on and off	2 time / day (10 min each) x 8 pumps Morning – on Evening - off	3 operator (4 in shifts)	-Design supply amount is 2,699m^3/day. -11 to 12 hour operation - 5 driven by generator - 3 clusters of wells (UN, JICA, existing)
		2) Generator maintenance	2 time / year 1 time / year (3 days)	1 engineer 1 technician 1 operator 3 workers	Oil, Air and Oil filters (2 time/year) Belt replacement (1 time/year) 1 engineer from Kebribayah Water Desk
		3) General guarding	Every day (24 hrs)	3 guard (6 in shift)	- 3 clusters of wells
2. Sedimentation pond	(V=415m^3)	1) Minor cleaning (scale removal in pipes and valves)	2 times / month (1 day)	1 technician 2 operators 2 plumbers 2 workers	The plumbers come from Kebribayah Water Desk
		2) Major cleaning (scale/sludge removal in reservoir)	1 time /3 month (3 days)	1 technician 2 operators 45 daily workers	
		3) General guarding	Every day (24 hrs)	1 guard (3 in shift)	Together with facilities 3 & 4
3. Reservoir	(V=200m^3)	1) Cleaning (scale removal)	1 time / 3 month (1 day)	2 operators 1 technician 20 daily workers	
		2) Chlorine dosing	1 time / day (30 min)	2 operators (4 in shifts)	

Table 3.41: Regular Operation and Maintenance Activities for Each Set of Planned Facilities in Kabribeyah Town (2)

Facility	Spec/Capacity (Dimension)	Detailed O&M tasks	Frequency (duration)	No. of staff assigned (work shift)	Remark
4. Pump station	3 pumps total 225 m^3/h 75kW x 3 pumps	1) Pump switch on and off	2 time / day (20 min) 8:00 – on 18:00 - off	2 operators (4 in shifts)	12 hour continuous operation
		2) Valve open and closing	2 time / day (10 min)	2 operators (4 in shifts)	
		3) Pump packing replacement	1 time /year (3 days)	1 engineer 1 technician 1 plumber 1 daily worker	3 pumps, one after another 1 engineer come from Kabribeyah Water Desk
		4) Removal of scale in pipes and valves	2 time / year (3 day)	1 technician 1 operator 1 plumber 4 daily workers	The plumber come from Kabribeyah Water Desk
		5) General guarding	Every day (24 hrs)	1 guard (3 in shifts)	Same guard as 2-3)
5. Reservoir	(V=200m^3)	1) Cleaning (scale/sludge removal)	1 time / 3 month (1 day)	1 technician 1 operator 20 daily workers	The 1 technician comes from Kebribayah Water Desk
6. Booster Pump St.	3 pump total 225m^3/h 75kW	1) Pump switch on and off	2 times / day (5 min) 9:00–on,19:00– off	1 operator (2 in shifts)	
		2) Valve and pipe scale removal	2 time / year (3 day)	1 technician 1 operator 1 plumber 4 daily workers	The plumber comes from Kabribeyah Water Desk
		3) Pump maintenance	1 time / year (1 day)	1 engineer 1 technician 1 plumber 1 daily worker	Gland packing replacement 1 engineer from Kabribeyah Water Desk
		4) General guarding	Every day (24hr)	1 guard (3 in shifts)	

Note: Water Desk = Town water supply utility office. The same members for a facility may work at other facilities.

Table 3.42: Regular Operation and Maintenance Activities for Each Set of Planned Facilities in Kabribeyah Town (3)

Facility	Spec/Capacity (Dimension)	Detailed O&M tasks	Frequency (duration)	No. of staff assigned (work shift)	Remark
7. Reservoir 1	(V=500m^3)	1) Cleaning (Scale/sludge removal)	1 time / 6 months (1 day)	1 operator 45 day labors	
8. Reservoir 2	Elevated tank (V=400m^3)	1) Cleaning (Scale/sludge removal)	1 time / 6 months (1 day)	1 operator 40 day labors	
		2) General guarding	Every day (24hr)	1 guard (3 in shifts)	Together with tank 1
9. Pipeline system	Transmission and distribution	1) repair by welding, replacement, scale removal	1 time / 6 month (4 day)	1 engineer 2 technician 3 plumber 20 daily worker	Scale removal is done only in the pipe between the purification plan and the reservoir immediately down stream

Table 3.43: Regular Operation and Maintenance Activities for Each Set of Planned Facilities in Godey Town (1)

Facility	Spec/Capacity (Dimension)	Detailed O&M tasks	Frequency (duration)	No. of Staff assigned (Work shift)	Remark
1. Intake canal	Concrete channel with 2 screens (W: 2 m, Depth: 5.5 m) L = 20 m)	1) Sludge removal	1 time / year (6 hours)	1 technician 1 operator 20 daily workers	Cleaning of the channel is only done at the peak of dry season.
		2) Screen cleaning	4 times / month (2 hours each)	1 technician 1 operator 2 daily workers	Large debris stuck in the screen is removed
Settling basin	V = 46m^3 1.5m x5.7m x 5.4m Including the receiving well	3) Sludge and garbage removal	4 times/year (4 hours each)	1 technician 1 operator 4 daily workers	The bottom of the chamber is roughly cleaned Intake filter cleaning
2. Pump house	2 intake pumps (Q =66 m^3 /h, H = 15m) x 2 pumps 2 distribution pumps (Q =114 m^3/h, H = 59)x 2 pumps	1) Pump switch on and off	2 times/day 8:00 - on 18:00 - off (15 min each)	2 Operators (4 in shift)	1) Design supply amount is 1,418m^3/day. 24 hour continuous operation 2) Gland packing, mechanical seal, and bearing will be replaced.
		2) Pump spare parts replacement	1 time / year (1 day) x 4 pump 1 time / 3 years (1 day) x 4 pump	1 technician (5 in shift) 1 operator 2 plumbers 2 daily workers	
		3) General guarding	Every day (24 hrs)	1 guard (3 in shifts)	
3. Generator house	2 generators 120kVA x 2 generator 1 back-up generator	1) Generator operation	2 times/day 8:00 - on 18:00 - off (15 min each)	2 Operators (3 in shift)	One generator is standing by as a backup
		2) Spare parts replacement	2 times / year 1 time / year (2 hour) x 2 generators	1 technician 1 operator 1 daily workers	Engine oil, Oil filter, Air filter, Belt,
		3) General guarding	Every day (24 hrs)	1 guard (3 in shifts)	

Table 3.44: Regular Operation and Maintenance Activities for Each Set of Planned Facilities in Godey Town (2)

Facility	Spec/Capacity (Dimension)	Detailed O&M tasks	Frequency (duration)	No. of Staff assigned (Work shift)	Remark
4. Sedimentation pond	Sedimentation pond 2 ponds in parallel (21 x 7 x 1.5m) x 2 V= 220m^3 x 2 One pond for backup	1) Sludge removal	Dry: 1 time/ 6 months (2 days each) x 3 pond	1 technician (5 in shift) 1 operator (2 in shift) 15 daily workers	1 out of 2 ponds are regularly used Sludge removal is done for one pond at a time
			Rainy: 1 time/ 2 months (5 days each) x 3 ponds		
		2) Coagulant and lime dosing	1 time / day (60 min)	1 technician (5 in shift) 1 operator 2 assistant operator (3 in shift) 1 lab-technician (2 in shift)	
		3) Store room management	Every day	2 assistant operators	Handling of chemicals
		4) General guarding	Every day (24hrs)	1 guard (3 in shifts)	Same as 3 – 3)
5. Rough filter	Q = 132 m^3/h (6 x 5 x 1 m) x 6 chambers with 1 for backup	1) Surface sludge removal	1 time / year (2 days) x 5 time	1 technician 1 operator 5 daily workers	5 out of 6 chambers are used regularly 1), 2) Cleaning is done for 1 chambers at a time
		2) Filter cleaning	1 time / 2 years (5 days) x 5 times		
		3) General guarding	Every day (24hrs)	2 guards (3 in shifts)	
6. Slow sand filtration pond	One sand filter system Q = 132 m^3/h (20 x 10 x 1 m) x 5 chambers with 1 for backup	1) Surface sludge removal, conditioning of the filter layer	6 time / year (2 days) x 5 time	2 technician 2 operator 20 daily workers	Out of 5 chambers, 4 will be regularly used. One is for backup. 1), 2) the cleaning is done for 1 chamber as a unit. This is probably the most technically difficult work in this system
		2) Filter cleaning	1 time / year (5 days) x 5 times		
		3) General guarding	Every day (24hrs)	2 guards (6 in shifts)	

Table 3.45: Regular Operation and Maintenance Activities for Each Set of Planned Facilities in Godey Town (3)

Facility	Spec/Capacity (Dimension)	Detailed O&M tasks	Frequency (duration)	No. of Staff assigned (Work shift)	Remark
7. Treated reservoir	1 reservoir (24 x 24 x 1.8 m) V= 1,000m^3	1) Cleaning	1 time / year (6 hours)	1 technician (5 in shift) 1 operator 20 daily workers	
		2) Chlorine dosing	1 time/day (30 min)	1 operator 1 assistant operator	
		3) General guarding	Every day (24hrs)	1 guard (3 in shifts)	
8. Reservoir 1	V= 400 m^3 11.8 x 11.8 x 3 m Elevated 10 m	1) Tank cleaning	1 time / year (4 hrs)	1 operator 6 daily workers	
		2) Level check and valve operation	2 times/day (20 min each)	1 operator	
		3) General guarding	Every day (24hrs)	1 guard (3 in shift)	
9. Reservoir 2 (Existing)	V= 1,000 m^3	1) Tank cleaning	1 time/ year (4 hrs) x 1 tank	1 operator 12 daily workers	
		2) Level check and valve operation	1 time/day (15 min)	1 operator	
		3) General guarding	Every day (24hrs)	1 guard (3 in shift same as 8-3))	
10. Reservoir 3 & 4 (Existing)	2 tanks for backup V = 60m^3 V = 150m^3	1) Tank cleaning	1 time/ year (4 hrs) x 2 tank	1 operator 12 daily workers	These 2 tanks are used as backups
11. Pipeline system	Transmission pipe D300 (L= 4,998m) Distribution pipe D 300: 2,797m D 200: 1,384m D 160 less (L = 37km)	1) repair and replacement of pipes	1 time/ 6 months (5 day)	1 operator 2 Engineers from WD 4 plumbers from WD 20 daily worker	Repair is done based on observation and reports Engineers and plumbers from WD

Note: WD : Water Desk = Town water supply utility office,
* The number of assigned staff members indicated signifies the number required for each facility and thus the same members may work at other facilities.
* Assigned staff and shift: the number after the staff title signifies the number of persons who work at the facility on a given day while the number in “shift” is the total number of the staff members who work in shift.

Table 3.46: O&M Cost of the Water Supply Systems of the Target 16 Woredas and 2 Towns

16 woredas (rural)		
Woreda	Amount (Birr/year)	Remarks
Kabribeyah	14,137,322	excluding facilitiies in urban area of Kabribeyah town
Araarso	3,751,608	
Dagahbur	6,417,767	
Birqod	1,971,192	
Shaygosh	2,710,123	
Kabridahar	6,486,672	
Doba wein	3,961,764	
East Ime	7,674,432	
Danan	1,595,124	
Beercaano	3,477,084	
Godey	5,037,504	excluding facilitiies in urban area of Godey town
Adadle	3,203,184	
Kalafo	7,413,996	
Mustahil	6,487,116	
Rasso	1,227,300	
West Ime	4,597,200	
Kabribeyah Town		
Cost item	Amount (Birr/year)	Remarks
Spare parts	41,796	spare parts for generators and ground pumps
Power supply	3,258,540	fuel and electricity bill for generators and pumps
Personnel	456,000	salary of stationed field staff and daily workers
Chemical	116,592	cost of water treatment chemicals (chlorination agent)
Consumable	43,032	tools for cleaning of facilities and engine oil for generators
Others	0	
Total	3,915,960	Equivalent to approx. US$ 211,000
Godey Town		
Cost item	Amount (Birr/year)	Remarks
Spare parts	22,272	spare parts for generators and ground pumps
Power supply	2,211,840	fuel for generators and pumps
Personnel	954,096	salary of stationed field staff and daily workers
Chemical	707,724	cost of water treatment chemicals (coagulant, pH adjuster, Chlorination)
Consumable	33,372	tools for cleaning of facilities and engine oil for generators
Others	0	
Total	3,929,304	Equivalent to approx. US$ 212,000

Conditions of estimation

- Cost includes VAT and based on 2013 prices
- Cost was calculated as annual average over 10 year
- Cost covers all the facilities in Jarar valley includig those constructed by UNHCR until April 2013
- Cost is for the regular operation of the system and does not include major facilities/equipment replacement

Table 3.47: O&M Cost and Replacement Cost for the Master Plan Water Supply Systems of 16 Woredas from 2020 to 2030

(Unit: Birr/year)

Woreda	2013	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2,030
Kabribeyah O&M cost	14,137,322	29,911,164	29,911,164	29,911,164	29,911,164	29,911,164	29,911,164	29,911,164	29,911,164	29,911,164	29,911,164	29,911,164
Equipment replacement							19,676,940		27,268,430			19,676,940
Araarso O&M cost	3,751,608	7,937,498	7,937,498	7,937,498	7,937,498	7,937,498	7,937,498	7,937,498	7,937,498	7,937,498	7,937,498	7,937,498
Equipment replacement							4,231,600		7,024,456			4,231,600
Dagahbur O&M cost	6,417,767	13,578,446	13,578,446	13,578,446	13,578,446	13,578,446	13,578,446	13,578,446	13,578,446	13,578,446	13,578,446	13,578,446
Equipment replacement							7,193,720		11,941,575			7,193,720
Birqod O&M cost	1,971,192	4,170,567	4,170,567	4,170,567	4,170,567	4,170,567	4,170,567	4,170,567	4,170,567	4,170,567	4,170,567	4,170,567
Equipment replacement							3,977,704		5,154,089			3,977,704
Shaygosh O&M cost	2,710,123	5,733,967	5,733,967	5,733,967	5,733,967	5,733,967	5,733,967	5,733,967	5,733,967	5,733,967	5,733,967	5,733,967
Equipment replacement							2,962,120		4,917,119			2,962,120
Kabridahar O&M cost	6,486,672	13,724,233	13,724,233	13,724,233	13,724,233	13,724,233	13,724,233	13,724,233	13,724,233	13,724,233	13,724,233	13,724,233
Equipment replacement							7,193,720		11,941,575			7,193,720
Doba wein O&M cost	3,961,764	8,382,137	8,382,137	8,382,137	8,382,137	8,382,137	8,382,137	8,382,137	8,382,137	8,382,137	8,382,137	8,382,137
Equipment replacement							12,187,008		13,710,384			12,187,008
East Ime O&M cost	7,674,432	16,237,247	16,237,247	16,237,247	16,237,247	16,237,247	16,237,247	16,237,247	16,237,247	16,237,247	16,237,247	16,237,247
Equipment replacement							4,426,254		7,561,869			4,426,254
Danan O&M cost	1,595,124	3,374,898	3,374,898	3,374,898	3,374,898	3,374,898	3,374,898	3,374,898	3,374,898	3,374,898	3,374,898	3,374,898
Equipment replacement							4,739,392		5,331,816			4,739,392
Beercaano O&M cost	3,477,084	7,356,671	7,356,671	7,356,671	7,356,671	7,356,671	7,356,671	7,356,671	7,356,671	7,356,671	7,356,671	7,356,671
Equipment replacement							2,885,951		4,950,972			0
Godey O&M cost	5,037,504	10,658,143	10,658,143	10,658,143	10,658,143	10,658,143	10,658,143	10,658,143	10,658,143	10,658,143	10,658,143	10,658,143
Equipment replacement							5,010,214		7,913,092			5,010,214
Adadle O&M cost	3,203,184	6,777,165	6,777,165	6,777,165	6,777,165	6,777,165	6,777,165	6,777,165	6,777,165	6,777,165	6,777,165	6,777,165
Equipment replacement							2,031,168		3,190,626			2,031,168
Kalafo O&M cost	7,413,996	15,686,227	15,686,227	15,686,227	15,686,227	15,686,227	15,686,227	15,686,227	15,686,227	15,686,227	15,686,227	15,686,227
Equipment replacement							5,141,394		8,759,412			5,141,394
Mustahil O&M cost	6,487,116	13,725,173	13,725,173	13,725,173	13,725,173	13,725,173	13,725,173	13,725,173	13,725,173	13,725,173	13,725,173	13,725,173
Equipment replacement							4,527,812		8,594,380			4,527,812
Rasso O&M cost	1,227,300	2,596,671	2,596,671	2,596,671	2,596,671	2,596,671	2,596,671	2,596,671	2,596,671	2,596,671	2,596,671	2,596,671
Equipment replacement							647,435		1,586,850			647,435
West ImeO&M cost	4,597,200	9,726,566	9,726,566	9,726,566	9,726,566	9,726,566	9,726,566	9,726,566	9,726,566	9,726,566	9,726,566	9,726,566
Equipment replacement							3,351,427		7,430,690			3,351,427

Note: submersible and ground pumps will be relaced in 2025 and 2030, and generators will be replaced in 2027

Table 3.48: O&M Cost and Replacement Cost for the Master Plan Water Supply Systems of 2 Towns from 2020 to 2030

(Unit: Birr/year)

Kabribeyah Town	2013	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
O&M cost	3,915,960	8,285,227	8,285,227	8,285,227	8,285,227	8,285,227	8,285,227	8,285,227	8,285,227	8,285,227	8,285,227	8,285,227
Equipment replacement	0	0	0	0	0	0	10,731,338	0	3,512,228	0	0	10,731,338
Total	3,915,960	8,285,227	8,285,227	8,285,227	8,285,227	8,285,227	19,016,564	8,285,227	11,797,455	8,285,227	8,285,227	19,016,564

(Unit: Birr/year)

Godey Town	2013	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
O&M cost	3,929,304	8,313,459	8,313,459	8,313,459	8,313,459	8,313,459	8,313,459	8,313,459	8,313,459	8,313,459	8,313,459	8,313,459
Equipment replacement	0	0	0	0	0	0	3,385,280	0	5,077,920	0	0	3,385,280
Total	3,929,304	8,313,459	8,313,459	8,313,459	8,313,459	8,313,459	11,698,739	8,313,459	13,391,379	8,313,459	8,313,459	11,698,739

Note: submersible and ground pumps will be replaced in 2025 and 2030, and generators will be replaced in 2027

Table 3.49: SRWDB: Training for Woreda Support

1 Module	1 RWB-WS: Woreda support
2 Period	5 days x 3 times (conducted with breaks)
3 Objective	The staff in charge will learn about the planned water supply facilities in the 16 target woredas and establish system of supporting them.
4 Target	Staff members of SRWDB workshop (5 people selected) The manager of the workshop staff (1 person)
5 Contents	To strengthen support to the 16 woreda water offices, establish reliable communication system between the two offices. Also the staff will learn about the specifications of the facilities and equipment to be constructed and installed in the woredas. - Establishing communication method with woreda water offices - Explanation of the specifications and maintenance methods of the systems in 16 woredas - Specifications of submersible pumps - Specifications of ground pumps - Specifications of generators - Procurement and distribution of spare parts - Procurement and distribution of chlorination chemicals - Effective utilization of Mobile workshop vehicles
6 Points of consideration at implementation	- Four vehicles and 3 workshop vehicles procured in the study should be effectively used to provide support to or work together with woreda water offices. - Promote internal discussion about the planning and measures to take - SRWDB is responsible for buying batches of chemicals and spare parts and for the distribution of the items to woredas
7 Expected outcome	SRWDB staff will gain an understanding of the outline of the specifications of the planned facilities and the maintenance work required for them. SRWDB then discusses and plans support provision that may be necessary on its own.
8 Expected training provider	SRWDB senior staff, Private consulting company
9 Materials and equipment needed	･Handouts showing the specifications of the planned facilities and equipment (as reference)

Table 3.50: 16 Target Woredas: Maintenance of Birka & Hafir Dam

1 Module	2 WR-BHDM: Birka and Hafir dam maintenance
2 Period	5 days
3 Objective	To learn about the operation and maintenance of the water supply system that collects surface runoff water.
4 Target	Technical staff members of woreda water office in charge of surface water collection system (2 persons) WASHCO members (2) and caretakers
5 Contents	Maintenance of Birka and Hafir dam based on the WASHCO training manual of Somali Region. - Difference in water quality due to difference in water sources (surface water and groundwater) - Practice of Birka maintenance - Practice of Haffir dam maintenance - Explanation of necessity of chlorination of water at household level - Explanation of importance of water fee collection - Explanation of the work of caretakers - Preparation of maintenance schedule
6 Points of consideration at implementation	Several WASHCOs can be combined to conduct the training
7 Expected outcome	WASHCO members and caretakers will be able to conduct maintenance of the facilities on their own.
8 Expected training provider	SRWDB, NGO
9 Materials and equipment needed	･Shovels ･Bucket ･Soil carrier ･Chlorination agent (sample)

Table 3.51: 16 Target Woredas: Hand Pump System Maintenance

1 Module	3 WR-HPM: Hand pump maintenance
2 Period	10 days
3 Objective	To learn about the operation of maintenance of water supply system with hand pump
4 Target	Technical staff member of woreda water office in charge of hand pump system or birka with hand pump (3 persons) WASHCO members and Caretakers (several from one site)
5 Contents	Hand pump system maintenance based on the WASHCO training manual of Somali Region. - Difference in water quality due to difference in water sources (surface water and groundwater - Function of hand pump (use of charts showing the interior of the hand pump) - Theory on hand pump maintenance (wearing parts and their functions) - Practice of hand pump maintenance (replacing the foot valve) - Necessity of chlorination of the well interior and its method (only for shallow wells) - Procurement of spare parts (collaboration with SRWDB) - Importance of water bill collection - Tasks of Caretaker/WASHCO and preparation of maintenance schedule
6 Points of consideration at implementation	- It is better to conduct the training after WASHCO formation. - Several WASHCOs can be combined to conduct the training.
7 Expected outcome	WASHCO members and caretakers together will be able to conduct maintenance of hand pump facilities (spare parts replacement) with little assistance from outside.
8 Expected training provider	SRWDB, NGO
9 Materials and equipment needed	･Tripod ･Chain block ･Spanners set ･Hand pump spare parts ･Maintenance manual of the hand pump system

Table 3.52: Common: Maintenance of Borehole with Submersible Pump System

1 Module	4 CM-BH&P-OM: Borehole and pump maintenance
2 Period	20 days
3 Objective	To learn about the operation and maintenance of borehole well and submersible pump system
4 Target	Technical staff members of woredas and town water office in charge of borehole system (3 persons) Caretakers / operators (all), SRWDB technician (1)
5 Contents	Maintenance of borehole well and O&M of the system of submersible motor pump driven by generators. - Difference in water quality due to difference in water sources (surface water and groundwater - Mechanism of the submersible motor pump - Mechanism of the generator - Function of the whole system - Theory on the maintenance of generator (names of spare parts and their function) - Specifications of the control panel and its operation - Practice of maintenance of generators (oil, filters replacement) - Procurement of spare parts - Assessment of operational condition of the equipment and trouble reporting - Procurement of fuel - Theory and method of chlorination (calculation of dosage) - Importance of water fee collection - Tasks of caretakers/operators and preparation of maintenance schedule - Roles and duties of woreda water office - Roles and duties of SRWDB - Discussion of O&M work and preparation of the work schedule
6 Points of consideration at implementation	- One technical staff member from woreda water office should be chosen to join the training. - It is preferable that one technical staff member from SRWDB join the training. - Regular monitoring of condition of the rise pipes in the well should be planned and conducted in Jarar Valley
7 Expected outcome	- Caretakers/operators will be able to operate borehole system and perform minor maintenance of the system almost by themselves. - Caretakers/operators will be able to properly assess the operational condition of the pumps and generators and properly report any problems immediately to the water office.
8 Expected training provider	Private consultant with SRWDB technical staff (after training) Private consultant with NGO member (qualified mechanic)
9 Materials and equipment needed	･Tripod ･Chain block ･Spanners ･Pliers ･Tool kit ･Insulation tape ･Electric tool kit ･Generator spare parts ･Millimeter ･Fuel ･Maintenance manual

Table 3.53: Common: O&M of River Water Intake System

1 Module	5 CM-RIS-OM: River intake system maintenance
2 Period	30 days
3 Objective	To learn about the operation and maintenance of the facilities for the river water intake system
4 Target	Technical staff members of woreda and town water office in charge of river water intake system management (3 persons) Caretakers / operators (all) Technical staff member of SRWDB (1 person)
5 Contents	Maintenance of river water intake system and operation of ground pumps driven by generators and their maintenance. - Difference in water quality due to difference in water sources (surface water and groundwater - The general function of the water supply system - Mechanism of ground pump - Regular maintenance of ground pump and practice of maintenance (packing replacement) - Mechanism of the generator - Theory of maintenance of generators (names and functions of wearing parts) - Practice of daily maintenance of generators (oil, filters replacement) - Procurement of spare parts - Procurement of fuel - Use of chlorination agent and calculation of dose - Procurement of chlorination agent - Importance of collection of water fee - Tasks of caretakers/operators and preparation of maintenance schedule - Roles and duties of woreda water office - Roles and duties of SRWDB
6 Points of consideration at implementation	- Several technical members from woreda water office should join the training - The system tends to be large and more than one operator will be needed. The selection and training of the operators will be done in the training. - The work follows that of the same system of towns but the WASHCO and water office get support from SRWDB in the case of serious problems.
7 Expected outcome	- The roles and duties of caretakers, operators, woreda water office, SRWDB in O&M of the system will be clear and they will continue the work in good collaboration. - Caretakers/operators will be able to recognize the operational condition of the equipment and be able to identify and report problems immediately.
8 Expected training provider	- Private consulting company with SRWDB or University staff (the technical staff should get prior training)
9 Materials and equipment needed	･Spare parts of generators and ground pumps ･Fuel for generators ･Chlorination chemical ･General tools such as pipe wrenches ･Electric tools ･Multi-meter ･O&M manuals

Table 3.54: Common: Regular WASHCO Training

1 Module	6 CM-WASH-T: WASHCO training
2 Period	10 days
3 Objective	To form WASHCO and the members learn about the operation and maintenance of the constructed new public water supply points.
4 Target	Elected WASHCO members at each public water point (7 persons/site)
5 Contents	- The training follows the WASHCO training of Somali Region (manual available). - Include the topic of money collection and accounting and financial management.
6 Points of consideration at implementation	- If possible, start the training from the stage of site selection to involve WASHCO more. - There are some minor differences in the contents of the training between WASHCOs of urban and rural areas. - WASHCOs should be combined to conduct training. - Refer to the points of consideration raised in this study.
7 Expected outcome	- WASHCO members will perform minimum maintenance of the facilities they are in charge of. - Water fees from the users will be collected properly.
8 Expected training provider	SRWDB, Town water supply utility office, Woreda water office
9 Materials and equipment needed	･WASHCO manual ･Flip chart ･Markers ･Notebooks and pens

Table 3.55: Common: WASHCO Follow up Training

1 Module	7 CM-WASH-FT: WASHCO training
2 Period	2 to 5 days depending on the situation
3 Objective	Provide complementary training to existing WASHCOs
4 Target	- WASHCO members who are in charge of public water taps - WASHCO members and caretakers/operators in charge of water supply system
5 Contents	Assessment of the present condition will be conducted at first. Training is in line with WASHCO training of Somali Region. - Discussion among the participants to identify problems - Discussion of solutions for the identified problems - Confirmation of daily activities based on the WASHCO manual - Provision of complementary training
6 Points of consideration at implementation	- If some members leave, find replacement in the training. - There are some minor differences in the contents of the training between WASHCOs of urban and rural areas.
7 Expected outcome	WASHCO members resume the activities or perform their duties more actively to do minimum maintenance of the facilities. Water fees from the users are also properly collected.
8 Expected training provider	SRWDB, Town water supply utility office, Woreda water office
9 Materials and equipment needed	･WASHCO manual ･Flip chart ･Markers ･Notebooks and pens

Table 3.56: Common: Training on Water and Sanitation Awareness Improvement for Residents

1 Module	8 CM-WS-AT: Water and sanitation awareness training
2 Period	3 days
3 Objective	- Give lecture on the water and sanitation and importance of water supply as public service to WASHCO members to disseminate the idea in the community. - Demonstrate proper use of chlorination agent to WASHCO and residents
4 Target	WASHCO members of existing and new facilities Representatives of the residents (total up to 30 people)
5 Contents	Lecture and practice - Lecture on hygienic use of water - Awareness lecture for the use of safe water (including demonstration) - Protection of water supply facilities and proper use - Knowledge of water disinfection and proper storage (boiling, priority of use) - Practice of water disinfection using chlorination agent - How to obtain chlorination agent - Approaches and methods about changing the awareness and mentality of the residents
6 Points of consideration at implementation	- Members of several WASHCOs in a woreda and leaders of the communities should be the target - It should be noted that low awareness of water and sanitation is the main obstacle in getting support to projects from residents.
7 Expected outcome	WASHCO members will explain to the community residents how to use the chlorination agent properly and how to get them. Then the use of chlorine agent will be promoted.
8 Expected training provider	SRWDB, NGO
9 Materials and equipment needed	･Flip chart ･Markers ･Notebooks and pens ･Chlorination agent ･Water and sanitation manual

Table 3.57: Kebribeyah Town: Scale Removal in Pipes and Pumps

1 Module	9 KB-PC: Pipe Cleaning
2 Period	5 days
3 Objective	To learn about the method of scale removal around ground pumps
4 Target	Operators of town water supply utility office (all) Technician of town water supply utility office (all) Engineer of town water supply utility office (1 person)
5 Contents	Lecture and practice - Sources of scale and factors causing scale build up - Preparation of tools for scale removal - Practice of scale removal - Preparation of scale removal work schedule
6 Points of consideration at implementation	In the course of detaching and assembling the pipes and also physically scraping off the scale in pipes, attention should be paid not to damage the pipes in the process.
7 Expected outcome	The operators will regularly clean the pipes and the burden to the pump system will be reduced. This will lead to prolonged life of the pump.
8 Expected training provider	SRWDB technical staff, Private consultant, Foreign engineer
9 Materials and equipment needed	･Pipe work tools set ･Scraper (handmade) ･Brush

Table 3.58: Kabribeyah Town: Operation of Water Treatment Facilities

1 Module	10 KB-WT: Water treatment
2 Period	10 days
3 Objective	To learn about basics of chlorine agents and appropriate dose of chlorination agent and input method
4 Target	Operator of town water supply utility office (all) Technician of town water supply utility office (all) Assistant operator of town water supply utility office (all)
5 Contents	Lecture and practice - Organic materials and disease-causing bacteria in drinking water - General methods of drinking water disinfection - Physico-chemical properties of chlorine and chlorine compounds - Method of chlorination (with Calcium hypochlorite) - Proper handling and storage of chlorine chemicals - Procurement of chlorination agent - Monitoring method (residual chlorine) - Practice of chlorine input to the system
6 Points of consideration at implementation	- The training should be conducted after the construction/installation of associated facilities/devices. - Technicians should especially understand the basic theories.
7 Expected outcome	Operators under the supervision of technicians input proper dose of chlorine agent to keep the residual chlorine at a desired level.
8 Expected training provider	AAWSA technical staff, Private consultant, Foreign engineers
9 Materials and equipment needed	･Chlorination agent ･Chlorine analysis kit ･Plastic drums of 200L capacity ･Scale ･Bucket ･Rubber gloves set

Table 3.59: Kabribeyah Town: Follow up of Water Treatment Plant Operation

1 Module	11 KB-WT-FUP: Water Treatment Follow up
2 Period	2 months after the training: Once a week (2 days at a time) 3 to 12 months after training: Every month (2 days at a time)
3 Objective	Follow up on the tasks the operators learned in training module KB-WT、KB-PC, KB-WS-AT to check the application of techniques at site and to give instructions for improvement.
4 Target	Operators and technicians of town water supply utility office at work Engineers from town water supply utility office (1 or 2)
5 Contents	- Confirmation of input of chemicals and cleaning of facilities at site - Discussion and identification of problems - Instruction for improvement
6 Points of consideration at implementation	- The trainer should be the one with ample experience because the topic at site can be variable depending on the situation of the site. - The follow up should be conducted during the operation stage.
7 Expected outcome	The operators and technicians at work will realize the problems and mistakes they are making and they will improve the situation.
8 Expected training provider	AAWSA technical staff, Foreign engineer, University and private consulting company.
9 Materials and equipment needed	･Flip charts ･Markers etc.

Table 3.60: Godey Town: Operation of Water Treatment Facilities

1 Module	12 GD-WT: Water Treatment
2 Period	20 days
3 Objective	To learn about the procedure of treating highly turbid water
4 Target	Technicians of Godey town water supply utility office (all) Operators of Godey town water supply utility office (all) Assistant operators of Godey town water supply utility office (all) Lab technicians of Godey town water supply utility office (all) Engineers from town water supply utility office (1 or 2)
5 Contents	Lectures and practice - Basics of drinking water treatment (coagulation, sedimentation, filtration, disinfection, residual chlorine) - Confirmation of required tasks at each component facility - Method of adjusting the dosage of coagulant - Method of adjusting the dosage of pH adjusting agent - Method of adjusting the dosage of chlorination agent - Use of chemical dosing tanks - Physico-chemical properties of the chemicals to be handled - Proper handling method and storage of the chemicals - Preparation of dosing schedule and procurement budget for each chemical - Method of water quality monitoring (turbidity, residual chlorine) - Simple method of estimating water flow rate in the system - Use of calculator
6 Points of consideration at implementation	- To make sure that the technicians and the engineer in charge of the town water supply utility office should understand the theoretical background and practical techniques as well. - Ensure that the operators and the lab technician monitor the quality of water that they treat every day. - Practice should be repeated so that they learn the work properly. - The training should be conducted immediately before the start of operation.
7 Expected outcome	Operators properly determine the dose of the chemicals and input the chemicals to the system under the supervision of operators. The turbidity is then effectively removed at the point of sedimentation pond.
8 Expected training provider	AAWSA, University and private consulting company (Jointly), Foreign engineer
9 Materials and equipment needed	･Water quality test kit ･Manual for handling the chemicals ･Samples of the chemicals ･Plastic drums of 200L ･Bucket ･Scale ･Rubber gloves ･Calculator

Table 3.61: Godey Town: Follow up of Water Treatment Plant Operation

1 Module	13 GD-WT-FUP: Water Treatment Follow up
2 Period	2 months after the training: Once a week (2 days at a time) 3 to 12 months after training: Every month (2 days at a time)
3 Objective	Follow up on the tasks the operators learned in training module GD-WT to check the application of techniques at site and to give instructions for improvement.
4 Target	Operators and technicians of town water supply utility office at work Engineers from town water supply utility office (1 or 2)
5 Contents	- Confirmation of input of chemicals and cleaning of facilities at site - Discussion and identification of problems - Instruction for improvement
6 Points of consideration at implementation	- The trainer should have ample experience because the topic at site can be variable depending on the situation of the site. - The follow up should be conducted during the operation stage.
7 Expected outcome	The operators and technicians at work will realize the problems and mistakes they are making and they will improve the situation.
8 Expected training provider	AAWSA technical staff, Foreign engineer, University and private consulting company
9 Materials and equipment needed	･Flip charts ･Markers etc.

Table 3.62: Godey Town: Maintenance of Water Treatment Plant

1 Module	14 GD-PM: Plant maintenance
2 Period	10 days
3 Objective	To learn about the facilities and equipment used in the treatment plant
4 Target	Operators of town water supply utility office (all) Technicians of town water supply utility office (all) Engineers from town water supply utility office (1-2 persons) Engineer from SRWDB (1 person)
5 Contents	Training mainly covers the maintenance of facilities used in the treatment plan - Ground pump maintenance (spare parts replacement) - Cleaning of pipes and valves - Maintenance of generators (spare parts replacement) - Cleaning of sedimentation pond - Cleaning of filtration chambers - Sludge disposal and storage method - Cleaning of reservoir tanks - Discussion and preparation of O&M work schedule
6 Points of consideration at implementation	- Based on the O&M plan proposed in this study, in consideration of the staffing situation and detailed specifications of the constructed facilities, the participants should discuss efficient O&M work schedule and put it into practice. - The sludge generated from the sedimentation pond will be great and an appropriate disposal or storage method should be sought in consideration of the environment.
7 Expected outcome	Operators and technicians will be able to perform the regular maintenance of the system and the treatment system will be sustainably operated.
8 Expected training provider	Technical staff of SRWDB, Technical staff of AAWAS, Foreign engineers
9 Materials and equipment needed	･Shovels ･Scrapers (self -made) ･Bucket ･Soil carrying pan ･Dewatering pump ･Small generator ･Hose ･Fuel

Table 3.63: Godey Town: Training for Water Quality Test at Site

1 Module	15 GD-WQ: Water quality
2 Period	20 days
3 Objective	To learn about the basic knowledge in water quality test employed in water treatment, and to acquire test skills
4 Target	Lab technicians of Godey town water supply utility office (all) Technicians of Godey town water supply utility office (all) Operators of Godey town water supply utility office (2)
5 Contents	Lecture and practice - Basics of water and chemical substances (property of water, acid and alkaline, oxidation and reduction, concentration, turbidity, coagulation and sedimentation, bacteria, characteristics of chlorine) - Types of coagulant and their functions (dependency on pH) - Types of chlorination agent and their functions - Method of Jar testing of coagulant - Method of testing turbidity - Method of testing residual chlorine - Method of measuring pH and EC - Simple method of measuring flow rate (no instruments used) - Use of calculator
6 Points of consideration at implementation	It is important that the technicians and the engineer in charge of the town water supply utility office also adequately understand the theory and the outline of the test procedures.
7 Expected outcome	The lab-technician will be able to obtain accurate test results every day and report it to the technicians and operators.
8 Expected training provider	Technical staff of AAWSA, Faculty of University, Foreign engineer
9 Materials and equipment needed	･Water test kit (turbidity, dried residual, residual chlorine, coli form) ･Color chart (quick reference to turbidity) ･Jar test kit ･pH meter ･EC meter ･Scale for weighing agents

Table 3.64: SRWDB: Training for Effective Use of Mobile Workshop

1 Module	16 RWB-MWS: Mobile workshop
2 Period	5 days x 6 times (discontinuous implementation)
3 Objective	To give SRWDB workshop staff a chance to familiarize the use of MWS vehicles and associated tools. To discuss the operation and maintenance work and schedule for MWS among the participants
4 Target	- SRWDB workshop staff (selected 5 persons) - Manager of the workshop (1 person)
5 Contents	In the training the participants will discuss the operation method of MWS procured in this study. Also based on the short-term training on MWS provided in 2013, the members will acquire further skills with the associated equipment. - Exchange of opinions to recognize the present situation of the use of MWS and resultant problem identification - Discussion of possible solutions to the identified problems - Lectures/talks to make realize the importance of proper maintenance work to change the mentality of the participants - Preparation of inventory of equipment associated with MWS and listing of spare parts and consumables for the equipment - Clarification of procurement route for the parts and consumables - Preparation of O&M schedule for the equipment associated with MWS - Preparation of budget schedule for the above work schedule - Lecture on work safety (high pressure gas, high voltage electricity etc.) - Practice of cutting and welding with gas welding machine - Practice of connecting wires with terminal tool kit - Review and practice of the use of other associated equipment - Practice of repair of pumps and generators - Final discussion among the participants
6 Points of consideration at implementation	- The training should be conducted discontinuously so the busy staff members can find time to participate in the training - Proper understanding of importance of O&M work does not exist anywhere in the region. Thus, the trainer should be someone who really appreciates the idea of proper O&M of the level of developed countries.
7 Expected outcome	SRWDB will utilize the MWS and associated equipment more effectively and because of realization of proper O&M of the equipment, the equipment will be used longer.
8 Expected training provider	Private consulting company (training required), Foreign engineer
9 Materials and equipment needed	・Notebooks ・Pens ・Spare parts for practice ・Fuel ・Malfunctioning pumps and generators for repair practice

Table 3.65: Woreda Water Office: Accounting and Finance

1 Module	17 WR-ACF: Accounting and Finance
2 Period	5 days
3 Objective	To learn basic theory and skills for proper financial management of the office and to get motivation in work.
4 Target	Clerical staff of woreda water/administration office (head, accountant, cashier)
5 Contents	- Basics of accounting - Accounting for public institutions - Method of book keeping - Proper handling of cash and fund - Reporting the accounting results - Roles of accountant, cashier, and office head
6 Points of consideration at implementation	- The contents should be in line with the current system of Somali region. - Since the target staff for one woreda is small, several woredas should be combined to give training - Accounting staff may come from woreda administration
7 Expected outcome	The staff of woreda water office (woreda administration office) can properly do accounting and keep good record of the office's financial status.
8 Expected training provider	Private consulting company
9 Materials and equipment needed	・Training manual ・Flip chart ・Calculator ・Notebook etc.

Note: Woreda water office does not have proper staff for accounting and finance, they may come from woreda administration.

Training Module	2015				2016				2017				2018				2019				2020				after 2021	No. of training
Outline of construction																										
Hafir dam and birka const. in 16 woredas																										
Borehole system const. in 16 woredas																										
River intake system const. in 16 woredas																										
Kabribeyah town																										
Godey town																										
1) SRWDB																										
01 RWB-WS	0.3												0.3											0.4		1
16 RWB-MWS		1																								1
2) Target woredas																										
7 woredas in Jarar Valley area																										
02 WR-BHDM								19				19				19				19				19		95
03 WR-HPM															1				1				1			3
04 CM-BH&P-OM													20				20									40
06 CM-WASH-T:	5	5	5	5	5	10	10	10	15	15	15	20	20	20	20	20										200
07 CM-WASH-FT					10	10					20	20							20	20			20	20	10	150
08 CM-WS-AT					10	10					30	30					30	30			30	30				200
17 CM-ACF			10																							10
9 woredas in Shebele river basin																										
02 WR-BHDM								27				27				27				27				27		135
03 WR-HPM							14				14				14				14				14			70
04 CM-BH&P-OM																5								5		10
05 CM-RIS-OM												20				20				23				23		86
06 CM-WASH-T:	5	5	5	5	10	10	10	10	15	15	15	15	20	20	20	20										200
07 CM-WASH-FT					10	10					20	20							20	20			20	20	10	150
08 CM-WS-AT					10	10					30	30					30	30			30	30				200
17 CM-ACF			10																							10
3) Kabribeyah town																										
04 CM-BH&P-OM									1																	1
06 CM-WASH-T:				2																						2
07 CM-WASH-FT									9																	9
08 CM-WS-AT				5																						5
09 KB-PC									1																	1
10 KB-WT										1																1
11 KB-WT-FUP											0.1	0.1	0.1	0.1											0.6	1
17 CM-ACF				1																						1
4) Godey town																										
05 CM-RIS-OM																	1									1
06 CM-WASH-T:													9													9
07 CM-WASH-FT																				6						6
08 CM-WS-AT													6													6
12 GD-WT																1										1
13 GD-WT-FUP																	0.1	0.1	0.1	0.1					0.6	1
14 GD-PM																1										1
15 GD-WQ															1											1
17 CM-ACF				1																						1

Note: the numbers in the cells indicates the number of times of execution of training module. The dark shaded cells signify the construction work is concentrated

Figure 3.9: Proposed Schedule of Short to Mid-term Training for Capacity Development

Table 3.66: WASHCO: Proposed Long-term Training Strategy for WASHCO

1. Training Type	WASHCO related Training
2. Period and Frequency	1) TOT for to be trainers for WASHCO training (5 years from 2014) 2) Regular WASHCO training and WASHCO follow up training (conduct as new construction plan arises from 2018, The follow-up should be conducted after about one year)
3. Objectives	1) To create WASHCO trainers at zone and woreda level 2) Formation of WASHCOs at newly constructed facilities and to follow their activities at the existing sites after the implementation of Master Plan projects.
4. Target	1) Staff of water office at woreda and zone level, Staff of SRWDB, Staff of NGOs 2) Existing WASHCO members, Residents living near newly constructed facilities
5. Contents	1) TOT to foster future WASHCO trainers - The concept of management of water supply facilities by WASHCO - Skills of good communication with the residents - Contents of WASHCO training and how to conduct the training - Lessons learned from the past training and possible solutions 2) Continuation of the Regular WASHCO related training (refer to module CM-WASH-T, CM-WASH-FT)
6. Points of consideration at implementation	1) TOT - In the beginning, the present trainer of SRWDB provides training to the staff of water offices in focal zones and woredas - The trainers should refer to ”Rural Water Supply and Sanitation and Hygiene Program, Community facilitator’s manual” which describes the principles of WASHCO training in Somali Region 2) Continuation of regular training and follow up training - Conduct follow up training only when the water office in charge judged it is necessary after monitoring of WASHCO activities - Assign the trainers who were trained in the TOT to be the trainer for follow up training as they are available so that the management system by WASHCO will be established at an early stage.

TOT: Training of trainers

Table 3.67: SRWDB: Proposed Long-term Training Strategy for SRWDB

1. Training Type	Capacity building for Workshop Staff
2. Period and Frequency	As it is necessary from 2014 for about 10 years
3. Objectives	To improve mainly the technical capacity of the workshop staff of SRWDB in maintenance of equipment and facilities and the system of conducting the maintenance work (institutional capacity).
4. Target	Technical staff of workshop of SRWDB and their managers

5. Contents	- The training contents follow the module RWB-MWS prepared in this study
	  - Establishment of procurement rules of spare parts and budget for the purpose
	  - Training for improving repair skills of broken machines
	  - Lectures to upgrade knowledge of staff in basic science and engineering
	  - Preparation of regular O&M plan
	  - Establishment of specification for equipment and materials to be procured
	  - Establishment of internal education system to foster capable technicians
	- Conduct site training (OJT) in towns and woredas
	- Take advantage of training courses offered by external organizations

6. Points of consideration at implementation	- It is desirable to conduct short and condensed training from time to time so the training will not interrupt their daily work. Also one of two persons at a time may be sent to join a long term training. - EWTEC regularly holds training courses in maintenance of electro-mechanical equipment in Addis Ababa. Some staff members should be sent to this training. - The region should try to employ people with higher education levels as the staff are trained. - SRWDB should promote communication with water offices of woredas, zones, and towns to exchange information.

OJT: On the job training
EWTEC: Ethiopian Water Technology Center

Chapter 4

Conclusions

4 Conclusions

4.1 Conclusions

a. Summary of the results

As a result of this study, the condition of the operation and maintenance of water supply facilities in the study area is summarized as follows.

The capacity of the governmental bodies of woreda water offices, town water supply utility offices, and SRWDB is low. In addition, the capacity of the resident groups, WASHCO, is also low. These organizations somehow mange to maintain the existing water supply facilities to keep the target water supply ratio. However, they are heavily dependent on large amount of external aids, and thus, it is difficult to cope with emergency water needs in the case of droughts. The ultimate cause of this situation is the shortage of budget for water supply of SRWDB. The other very important issue is the low level of education of the staff in various organizations. Lack of sufficient education of the staff prevents them from logically solving problems and from upgrading knowledge and skills on their own. The condition also creates the situation where the staff members can not appropriately manage money and items. The specific problems of each organization are summarized by its level in the following sections.

a.1 Management of facilities at the resident level

For the management of water supply facilities by the residents, it is necessary to shift the current system of management by caretakers to the management system by WASHCOs. To realize this, human resources for provision of future WASHCO training at woreda and zone levels are urgently needed to conduct the training at many sites as soon as possible. Also it will be necessary to conduct awareness raising campaign to facilitate the process of shifting management from the caretaker system to the WASHCO system. It takes a fair amount of time to change the mentality of the people because the target population is large. Nevertheless, the result of the WASHCO training associated with the pilot project in this study indicates that the training is effective in changing their attitudes even if conducted only for a short time.

a.2 Management of facilities at woreda and town levels

Woreda water utility offices are extremely weak in terms of human resources and of equipment. Thus it is mandatory to provide technical training along with supply of a set of minimal equipment and tools to perform their new duties after BPR. Town water supply offices are more or less in the same situation. Thus, for Kabribeyah and Godey Towns, a mid-term capacity development plan has been proposed for their staffs to make them perform the operation and maintenance of the facilities proposed in the master plan.

a.3 Management of facilities at the regional level

Due to the lack of sufficient staff training and appropriate equipment, the workshop of SRWDB is forced to repeat ad-hoc and reactive maintenance work and they can not fully utilize the pumps and generators that have been procured. In order for the SRWDB workshop to be able to exercise its high level of techniques and solid organizational effect, as the primary organization concerned with the O&M of water supply facilities, it is necessary for

the whole workshop (including the management) to first change their perception of maintenance work and then, to make effort to establish the system of conducting regular and planned maintenance work. It is also expected that the workshop will self-improve their technical capacity by taking advantage of the tools and equipment supplied to the workshop in this study. In this study, in connection with the O&M of the master plan facilities, a mid and long-term technical training that will be necessary in the long run has been proposed.

In order to actually implement the planned construction and expansion of water supply facilities in the 16 woredas and two towns, and then, to realize proper O&M of the facilities, first the appropriate budget should be secured and the O&M work has to be conducted accordingly. In consideration of this, the work and activities that will be necessary for construction and O&M the facilities in the sixteen woredas and the two towns were identified in this study. Then, the cost of conducting such O&M work was estimated.

b. Future direction

In this study, a set of vehicles and equipments to be used for emergency water supply activities and regular O&M activities were provided to SRWDB, the main counterpart body of this study. In addition, some training on the use of the equipment was conducted for the staff of SRWDB and some other organizations concerned although the training was short. So, SRWDB, by itself, is expected to continue similar measures intended to develop the capacity of its technical staff, now that the training has been conducted by the study team. In the study, the type of work and staff assignment necessary to operate and maintain the facilities proposed in the master plan was clarified and the cost required to conduct the work was also estimated. This is considered to be the important basic data when SRWDB prepares its own O&M and capacity development plans.