The Republic of Zambia
Ministry of Local Government and Housing

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT IN LUAPULA PROVINCE PHASE 3
IN
THE REPUBLIC OF ZAMBIA

April 2014

JAPAN INTERNATIONAL COOPERATION AGENCY

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

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SUMMARY

Summary

1. General Description

The Republic of Zambia (hereinafter referred to as “Zambia”), located in the southern part of the African continent, is a landlocked country bordering Tanzania, Malawi, Mozambique, Zimbabwe, Botswana, Namibia, Angola and the Democratic Republic of Congo. Its land area is about 752,610km^2, which is approximately twice larger than that of Japan. Zambia is located in the tropical zone between latitudes 8ºS and 18º S, and its altitudes are from 900m to 1,500m. Because of its geographical location, the country has a relatively mild tropical savanna climate and has distinctive rainy and dry seasons, with the former one from November to March and the other from April to October. It has an annual precipitation of 700mm to more than 1,500mm, which increases from south to north.

Zambia consists of nine provinces (Luapula, Northern, Eastern, Central, Copperbelt, Northwestern, Western, Lusaka and Southern) where the Project targets four districts (Nchelenge, Mwense, Mansa and Milenge) in Luapula Province. While the average yearly temperature of Zambia ranges from 15 ºC to 35 ºC, in the Project target area of Luapula Province, it ranges from 20 ºC to 25 ºC.

According to the census data (2010), the population of Zambia is about 13.10 million, and the annual population growth rate is 2.8%. In Luapula province, population is estimated to be about 0.99 million and annual population growth rate is estimated to be 2.5% (2010, Census).

As for the economy in Zambia, GNI is US$15.6 billion with US$1,160 as per capita GNI in 2011, and the economic growth rate shows 7.3% (World Bank 2009). The primary sector of economy comprises 20.5%; secondary, 33.3%; and tertiary, 46.3 % (CIA: Central Intelligence Agency, 2012). Zambia’s economy is deeply dependent on both production and export of copper as the main industry that occupies about 60% of exports of Zambia. According to this situation, Zambia’s economy has been easily affected by the amount of copper production and fluctuations of its international price. The previous government of President Mwanawasa gave priority to industry restructuring policy that mainly consisted of development of agriculture utilizing vast and fertile uncultivated land, and tourism taking advantage of its abundant touristic resources.

Although Zambia suffered some depression in economic growth rate during the world economic crisis in 2009, its economy is expected to recover due to the recent price increase in copper and high production of maize. Moreover, in April 2005 at the initiative for Heavily Indebted Poor Countries (HIPC), Zambia satisfied the criteria for ending the debt. This resulted in the debt relief enforced by multiple donors including Japan, and Zambia's burden on foreign debt was alleviated dramatically. Nonetheless, financial situation of the Zambian government continues to be severe, and the recent increase of international price of the crude oil has become a serious issue for Zambia's economy. Given these situations, to achieve Zambia's primary goal for poverty reduction, continuous aid from the international community is indispensable.

2. Background and Summary of the Project

The rate of access to safe water in the Republic of Zambia (hereinafter referred to as Zambia) in 2011 was 86% in urban areas and 50% in rural areas with an average of 64% (WHO/UNICEF JMP, 2013) which is one of the countries in Sub-Saharan Africa with the lowest access rate. In Zambia, the National Water Policy was revised in February 2010 and the Water Resources Management Act was enacted in 2011. Concerning rural water supply and sanitation, the National Rural Water Supply and Sanitation Programme (NRWSSP 2006-2015) was officially announced in November 2007 with aims to improve the rural water accessibility rate to 75% by 2015 in line with the MDGs (Millennium Development Goals). This objective is also raised in the Sixth National Development Programme 2011-2015 (SNDP). Furthermore, Vision 2030 (December 2006) stipulates that the national coverage rate for safe water of 63% in 2010 is to be increased to 80% in 2015 and eventually become 100% in 2030.

In order to contribute in achieving the above goals, in 2004, the Zambian government requested to the Japanese Government a Grant Aid for the "Project for Groundwater Development in Luapula Province" (hereinafter, referred to as "Phase I Project") targeting all 7 districts of Luapula Province which had the lowest access rate to safe water among the 9 provinces in Zambia. Upon executing the Basic Design Study in 2007, the "Phase I Project" started in 2008 and completed in 2010. Boreholes fitted with hand pumps were constructed at 200 sites in the 7 districts of Luapula Province to increase the number of beneficiaries with continuous access to safe water from about 162,000 persons (with access rate of 17% in 2007) to 212,300 persons (with access rate of 20% in 2010).

Based on the outcome of the "Phase I Project", in pursuit of further improvements in accessibility to safe and stable water in Luapula Province, the Zambian government made a new

request to the Japanese Government for the “Project for Groundwater Development in Luapula Province, Phase 2” (hereinafter, referred to as “Phase II Project”). The requested target areas were the 4 districts (Nchelenge, Mwense, Mansa and Milenge) excluding the 3 districts (Chiengi, Kawambwa and Samfya) which had been receiving assistance from the African Development Bank in the rural water supply and sanitation sector. Due to construction of boreholes with hand pumps at 216 sites in the 4 districts, the population with access to safe water in all of Luapula Province increased by 54,000 persons to improve the access rate from 23.1% to 25.6%.

In succession to “Phase I Project” and “Phase II Project”, with aims to further increase the access rate to safe and stable water in Luapula Province, in August 2011, the “Phase III Project” as Grant Aid was requested to the Japanese Government. This project, as a result of construction of 200 boreholes fitted with hand pumps and 5 piped water supply schemes at 4 target districts (Nchelenge, Mwense, Mansa and Milenge) of Luapula Province, the number of beneficiary population in all of Luapula Province will increase by about 82,000 persons with an anticipated growth in safe water access rate from the present 25.6% to 30.0%.

3. Summary of Results of the Study and Contents of the Project

In response to the request of “Phase III Project”, based on results and circumstances in the “Phase I Project” and “Phase II Project”, Japan International Cooperation Agency (hereinafter referred to as “JICA”) dispatched the preparatory survey team from 6th June until 20th September in 2013, and conducted field investigations such as verification of the contents of the request and survey on the present conditions of the requested sites.

Following the field survey, the study team analyzed the data acquired as a result of the field study, and prepared the Draft Preparatory Survey Report. After that, the study team for the draft explanation on the draft design was dispatched to Zambia from 7thMarch to 15th March, 2014 in order to explain the contents of the report and carry out discussions with the concerned authorities.

The Project plans to construct borehole water supply facilities fitted with hand pumps and piped water supply facilities in the above mentioned four districts in Luapula Province, and to secure a sustainable and safe water supply to direct beneficiaries of 82,000 residents. Also, implementation of software component activities are planned for the purpose of assistance in operation and maintenance of such water supply facilities.

The summary of the outline design is shown below.

【Facilities Construction】 : For Boreholes with Hand Pumps:
Construction of 200 boreholes fitted with Hand Pumps at 200 sites in 4 Districts (Nchelenge, Mwense, Mansa and Milenge) of Luapula Province

: For Piped Water Supply Schemes:
Construction of piped water supply schemes at 5 sites in 3 Districts (Nchelenge, Mwense and Milenge) of Luapula Province

【Technical Assistance】 : For Boreholes with Hand Pumps:
- Formation of V-WASHEs

: For Piped Water Supply Schemes:
- Formation of V-WASHEs
- Village awareness raising activities on operation and maintenance and sanitation
- Assistance to contracting with private operators for technical support

Direct Beneficiaries: For Boreholes:50 thousand, for Piped Water Supply Schemes:32 thousand, total:82 thousand

The 320 sites in 4 districts of Luapula Province being requested by the Zambian Government were screened according to the following criteria based on the agreement with the Zambian Government to verify the feasibility for implementation of the Japanese grant aid scheme.

(1) Boreholes with Hand Pumps

1) A demand for safe and stable water supply exists
2) Site is accessible and safe working conditions are assured
3) Adequate hydrogeological conditions (including satisfaction of Zambian water quality standards)
4) Extent of existing water supply facilities (exclusion if existing facilities are sufficient)
5) No duplication with other donor projects
6) Possibilities to form V-WASHEs
7) Site residents are willing to pay operation and maintenance costs for the water supply facilities

As a result of the screening, out of the requested 320 sites, 254 sites met the above criteria.

(2) Piped Water Supply Schemes

1) A proper operation and maintenance system can be created (possibilities to form water users' committees, and communities have willingness-to-pay and ability-to-pay operation and maintenance costs)
2) A demand for safe and stable water supply is existent (sufficient population, demand for public tap stands)
3) Site is accessible (no problems with safety management)
4) Extent of existing water supply facilities (exclusion if existing facilities are sufficient)
5) No duplication with other donor projects
6) Adequate hydrogeological conditions (including satisfaction of Zambian water quality standards)
7) Conditions for power supply

As a result of the screening, out of the requested 8 sites, 5 sites met the above criteria.

From the experience and knowledge acquired from the "Phase I Project" and "Phase II Project", to maintain a standard quality of drilling works, the assumption of 8 successful boreholes a month by one crew is determined to be feasible. Also, from a viewpoint of cost restriction, local contractors will be subcontracted and in consideration of their capacity and supervision by the Japanese contractor, a maximum of 3 crews is appropriate. Since access during the rainy season by heavy vehicles such as drilling rigs and trucks would become difficult, borehole drilling works will be suspended during that period. Therefore, excluding the 3 rainy season months (January to March), 9 months are possible for drilling. Assuming 8 successful boreholes per month, with a maximum of 3 crews, successful boreholes can be drilled at a total of 200 sites within the project implementation period.

As a result of the screening based on results of the social conditions survey held in this study, out of the 320 sites requested by the Zambian side, 254 sites were identified to have potential for new water source development in this project. The 54 sites not selected in the above procedure will be treated as alternative sites for drilling in this project. That is, due to results of borehole drilling works, if 2 drillings are unsuccessful at one site, a new drilling site will be selected from the 54 alternative sites in order of their priority ranking with consideration of the districts' and communities' preference to aim for 200 successful drillings to be implemented in this project.

District	Request	Suitable	Target	Alternative	Excluded
Nchelenge	90	70	56	14	20
Mwense	100	90	63	27	10
Mansa	60	51	38	13	9
Milenge	70	43	43	0	27
Total	320	254	200	54	66

Piped water supply scheme was not in the scope of “Phase I Project” or “Phase II Project”, and therefore the construction plan needed additional considerations. However, the basic concepts such as those on utilization of local contractors and suspension of construction works during rainy season, considering the poor accessibility to the site, will be the same as boreholes with hand pumps. By organizing two separate teams for pipe laying works and structural works of distribution tanks, the total of 9 months will become sufficient for completing 5 sites.

The request concerns construction of piped water supply schemes at several sites located in 3 districts (Nchelenge, Mwense and Milenge) of Luapula Province. To determine the possibility for implementation through the Japanese grant aid scheme, the requested sites were evaluated, as shown below, using results of the social survey, criteria agreed with the Zambian side, areal balance, and social conditions such as possibilities for commercial activities and water fetching time. Based on the above results, upon discussions with the Zambian Government, the following 5 sites were selected and agreed as the target sites for executing site surveys including test drillings.

District	Site Name
Nchelenge District	Kabuta
Mwense District	Kapala, Musangu, Kapakala
Milenge District	Milenge

Of the above 5 sites, the water source for Kabuta of Nchelenge District is a spring and sufficient yield was already confirmed through the site survey. For the other 4 sites, water sources are groundwater and their potentials were confirmed through test drillings.

Major contents of the “Phase III Project” are shown as follows.

(1) Boreholes with Hand Pumps

Construction Items	Specifications and Construction Works	Quantity
Borehole	- Depth: Not less than 30m, average 58.2m - Casing: PVC, Nominal Diameter 100mm - Screen: PVC, Slot Size 0.25mm to 1.0mm - Gravel packing, clay seal, cementation, etc. - Pumping test (step drawdown, continuous and recovery test) - Water quality analysis	200 nos.
Appurtenant Facility	Concrete, round shape, which is most frequently adopted in Zambia	200 nos.
Hand Pump	Afridev or India Mark-II (IM-II) To be selected according to quality and water level of the borehole (*)	Afridev: 196 nos. IM-2: 4 nos. (Estimate)
Iron Removal Plant	When iron content in groundwater exceeds Zambia’s standards, iron removal plant will be installed. Monitoring period for water quality will be established as iron contents in the pumped water may change after sometime.	8 nos.

(*) The number of each type of hand pump will be decided through confirmation of water qualities after drillings. Therefore, the final proportion of these hand pumps may change.

(2) Piped Water Supply System

Site	Supply Rate (m^3/day)	Water Source	Power Source	Tank Type	Pipe Length (m)		Tap Stand Number		Machi-nery House	Chlori-nator
					Transmission	Distribution	Households	Institutions		
Kabuta	120.3	Spring	Gravity	Ground	30	2,880	7	2	0	1
Kapala	134.8	Groundwater	Commercial	Elevated	630	2,031	9	0	1	1
Musangu	364.7	Groundwater	Commercial	Elevated	369	7,162	23	3	1	1
Kapakala	342.6	Groundwater	Commercial	Ground	630	4,529	22	1	1	1
Milenge	42.0	Groundwater	Solar	Ground	353	4,038	3	6	1	1
Total	1,004.4				2,012	20,640	64	12	4	5

(3) Software Component

1) Boreholes with Hand Pumps

Output1: Community based O&M structure is established in the target sites.

Activities: Project orientation for District staff and other stakeholders and reactivation and trainings for V-WASHE.

Output2: Communities' understandings on the safe and appropriate use of the water supplied from the constructed facility is increased.

Activities: Situation analysis on present water supply & sanitation environment, hygiene promotion activities

2) Piped Water Supply Schemes

Output1: Community based O&M structure is established in the target sites.

Activities: Project orientation for District staff and other stakeholders, formation of V-WASHEs and trainings for them etc.

Output2: Communities' understandings on the safe and appropriate use of the water supplied from the constructed facility is increased.

Activities: Trainings on facility Operation and Maintenance, follow-up trainings etc.

Output3: DLA support structure for the piped water supply facility O&M in rural areas is established.

Activities: Creation of manuals on Operation and Maintenance of the small scale piped water supply schemes, trainings on O&M etc.

Output4: Understanding of the stakeholders such as DLAs, community, and LuaWSC on the O&M structure is promoted.

Activities: Project orientation and explanation of the Project LuaWSC representatives, V-WASHE facilitators and community leaders

4. Project Period and Outline of the Construction Cost

The implementation schedule of the Project is shown below.

【Construction Stage】

1) Exchange of Notes (E/N)
2) Grant Agreement (G/A)
3) Consultant agreement
4) Detailed design: Detailed design study, preparation of tender documents

5) Software component
6) Tendering procedure and contractor contracting
7) Supervision of construction
8) Construction of boreholes fitted with hand pumps
9) Construction of piped water supply schemes
10) Completion and handing over

The implementation schedule of the Project needs about 22 months after E/N and G/A for carrying out detailed design, software component, borehole with construction, installation of hand pumps, construction of aprons, installation of iron removal plants and construction of piped water supply schemes.

Main Activities	Schedule
(a) Consultant agreement, formation of V-WASHEs, detailed design, cost estimation review, preparation of tender documents, approval of tender documents	6.0 months
(b) Tendering, contractor contracting, verification of contract, borehole drillings, installation of hand pumps, construction of appurtenant facilities, installation of iron removal plants, installation of submersible motor pumps, construction of distribution tanks, installation of transmission and distribution pipes, installation of electrical equipment, installation of solar powered pumping system (during the rainy season, main works will be suspended)	16.0 months
Total	22.0 months

As drilling machines and other heavy machines will have difficulties to access the sites during the rainy season, drilling works will be suspended during 3 months of the year. Therefore, a total of 9 months per year is possible to carry out borehole drilling works.

5. Evaluation of the Project

Relevance and effectiveness of the Project are expected as follows.

(1) Relevance

1) The beneficiaries of the Project are the residents in four districts of Luapula Province in Zambia and are estimated to be about 82,000 persons.
2) The objective of the Project is to improve the conditions in water supply and sanitation for the rural residents as one of the Basic Human Needs (hereinafter referred to as “BHN”)

3） Luapula Province, the target province of the Project, faces the lowest access rate to safe drinking water in Zambia, and sanitary environment as well as living standard are extremely poor. As a result of this project, various aspects of living standard such as economic activities, education and health are expected to be improved.

4） The borehole water supply facilities fitted with hand pumps constructed by this Project are predicted to be sustainably operated and maintained, and water tariff collected under responsibility of each level WASHEs.

5） The Project corresponds to the policy of NRWSSP (2006-2015), in which MLGH set objectives to increase the national coverage of water supply from 37% to 75%, and is supporting the objectives of the policy.

6） As the Project is construction of small-scale borehole water supply facilities fitted with hand pumps, there are no negative impacts on environmental and social aspects in groundwater development and daily operation of the water supply facilities. Also, active participation of women in formulation of V-WASHE is promoted.

7） The Project is possible to be implemented without any specific difficulties under Japan's grant aid scheme.

8） Most of the boreholes constructed previously through Japanese groundwater development projects in Zambia, have been used for more than 20 years since completion of their construction to assure residents of safe water for long periods. Also in this Project, while cost reduction is considered, the necessity for high quality construction works will be maintained the same as previous Japanese Projects.

As above mentioned, the relevance of this project is considered high.

(2) Effectiveness

In terms of effectiveness of the project the following table shows the expected outputs to be achieved through implementation of the Project.

Index	2013 (before)	2020 (after)
Increase in water coverage of Luapula Province	302,000 residents	384,000 residents
Stable supply of water	Unstable amount of water	30L/person/day
Access rate to stable water	25.6%	30.0%

The qualitative effects are shown below.

1) Reduction of waterborne diseases is expected because of improvements in sanitation conditions through use of safe and stable water.

2) Water fetching efforts will be reduced and safe water can be procured near settlements. Also, time saved can be used for other productive work by women and learning at school by children.

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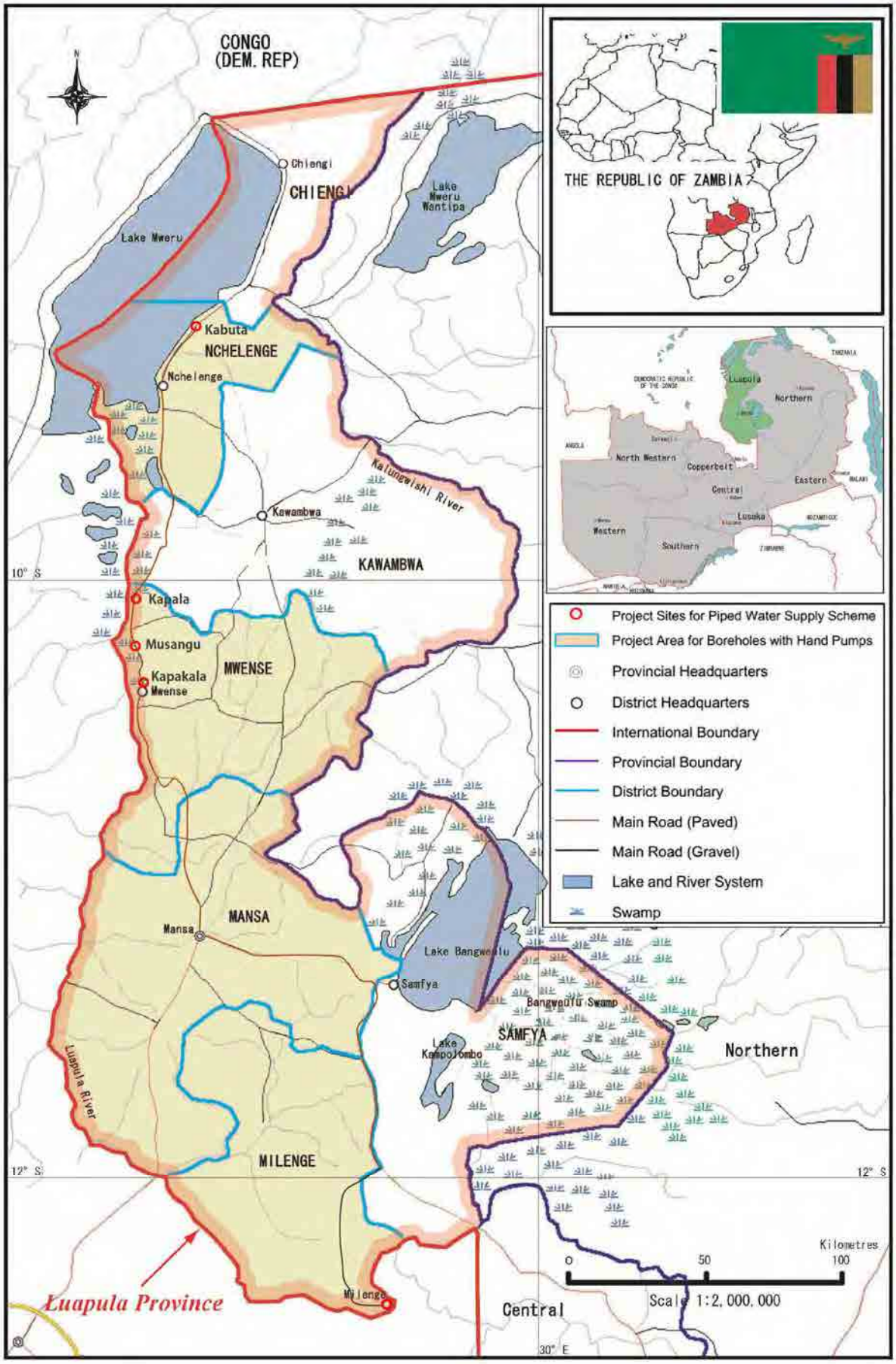

Location Map

Perspective（Boreholes with Hand Pumps）

Perspective　（Piped Water Supply Schemes）

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FIGURES

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ABBREVIATIONS

ABP	Area-Based Program
ADC	Area Development Committee
AfDB	African Development Bank
APM	Area Pump Mender
CBO	Community Based Organisation
CLTS	Community Led Total Sanitation
CU	Commercial Utility
DANIDA	Danish International Development Agency
DDCM	District Development Committee Meeting
DHID	Department of Housing and Infrastructure Development
DLA	District Local Authority
DoW	Director of Works
DPO	District Planning Officer
DTF	Devolution Trust Fund
DTH	Down -the-Hole
DWA	Department of Water Affairs
D-WASHE	District Water Sanitation, Health and Hygiene Education Committee
EHT	Environmental Health Technician
E/N	Exchange of Note
FPP	Focal Point Person
IRP	Iron removal plant
JICA	Japan International Cooperation Agency
LuaWSC	Luapula Water and Sewerage Company Limited
MDGs	Millennium Development Goals
MLGH	Ministry of Local Government and Housing
MoU	Memorandum of Understanding
NGO	Non-governmental Organization
NRWSSP	National Rural Water Supply and Sanitation Programme
NWASCO	National Water Supply and Sanitation Council
NWSSP	National Water Supply and Sanitation Programme
O&M	Operation and Maintenance
P-DHID	Provincial DHID
pH	Potential of Hydrogen
PST	Provincial Support Team
PVC	polyvinyl chloride
RHC	Rural Health Centre
RWSSP	Rural Water Supply and Sanitation Programme
RWSSU	Rural Water Supply and Sanitation Unit
SCM	Supply Chain Management
SOMAP	Sustainable Operation and Maintenance Programme
ToT	Training of Trainers
TWG	Thematic Working Group
UNICEF	United Nations Children's Fund
UNZA	University of Zambia
UWSSP	Urban Water Supply and Sanitation Programme

V-WASHE	Village Water Sanitation, Health and Hygiene Education Committee
WDC	Ward Development Committee
WHO	World Health Organisation
ZEMA	Zambia Environmental Management Agency
ZESCO	Zambia Electricity Supply Corporation
ZMW	Zambian Kwacha Currency Code (Rebased)

CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Background of the Project

The rate of access to safe water in the Republic of Zambia (hereinafter referred to as Zambia) in 2011 was 86% in urban areas and 50% in rural areas with an average of 64% (WHO/UNICEF JMP, 2013) which is one of the countries in Sub-Saharan Africa with the lowest access rate. In Zambia, the National Water Policy was revised in February 2010 and the Water Resources Management Act was enacted in 2011. Concerning rural water supply and sanitation, the National Rural Water Supply and Sanitation Programme (NRWSSP 2006-2015) was officially announced in November 2007 with aims to improve the rural water accessibility rate to 75% by 2015 in line with the MDGs (Millennium Development Goals). This objective is also raised in the Sixth National Development Programme 2011-2015 (SNDP). Furthermore, Vision 2030 (December 2006) stipulates that the national coverage rate for safe water of 63% in 2010 is to be increased to 80% in 2015 and eventually become 100% in 2030.

Luapula Province, the study target area of this project, "The Project for Groundwater Development in Luapula Province, Phase 3" (hereinafter, referred to as "Phase III Project"), is located in the northern part of Zambia and comprised of 7 districts (as of 2013, the province is divided into 11 districts, but for this project, the number will be kept at 7). This province has a land area of 51,000 km^2. The population of Luapula Province is 991,000, of which 80% remains below the poverty line, presenting the highest percentage in Zambia (Census, 2010). Furthermore, within the 9 provinces in the country, the access rate to safe water is the lowest where the rate remained at 23% in 2012 which does not even reach half the national average rate for rural areas. Presently, many villages with insufficient number of water supply facilities where hygiene promotion is inadequately provided rely on unsafe sources such as river, pond and shallow wells as their domestic water source. This leads to dire problems including increased water-borne diseases, increased burden of water fetching by women and children, and negative impact on economic activities and education of the residents. Moreover, the mortality rate of infants under 5 years old is 83 out of 1,000 (WHO, 2009) revealing an inferior sanitary environment. Therefore, to supply safe and stable water to the communities is the pressing issue.

In order to contribute in achieving the above goals, in 2004, the Zambian Government requested to the Japanese Government a Grant Aid for the "Project for Groundwater Development in Luapula Province" (hereinafter, referred to as "Phase I Project") targeting all 7

districts of Luapula Province which had the lowest access rate to safe water among the 9 provinces in Zambia. Upon executing the Basic Design Study in 2007, the "Phase I Project" started in 2008 and completed in 2010. Boreholes fitted with hand pumps were constructed at 200 sites in the 7 districts of Luapula Province to increase the number of beneficiaries with continuous access to safe water from about 162,000 persons (with access rate of 17% in 2007) to 212,300 persons (with access rate of 20% in 2010).

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1-2 Natural and Socio-Economic Conditions

1-2-1 Natural Conditions

1-2-1-1 Temperature and Rainfall

Monthly temperature and rainfall data at Mansa are shown as follows. The average minimum temperature in the project target area is 9℃ in July and the average maximum temperature is 33℃ in October. Rainy season is for three months, from January to March, whose average rainfall exceeds 200 mm/month.

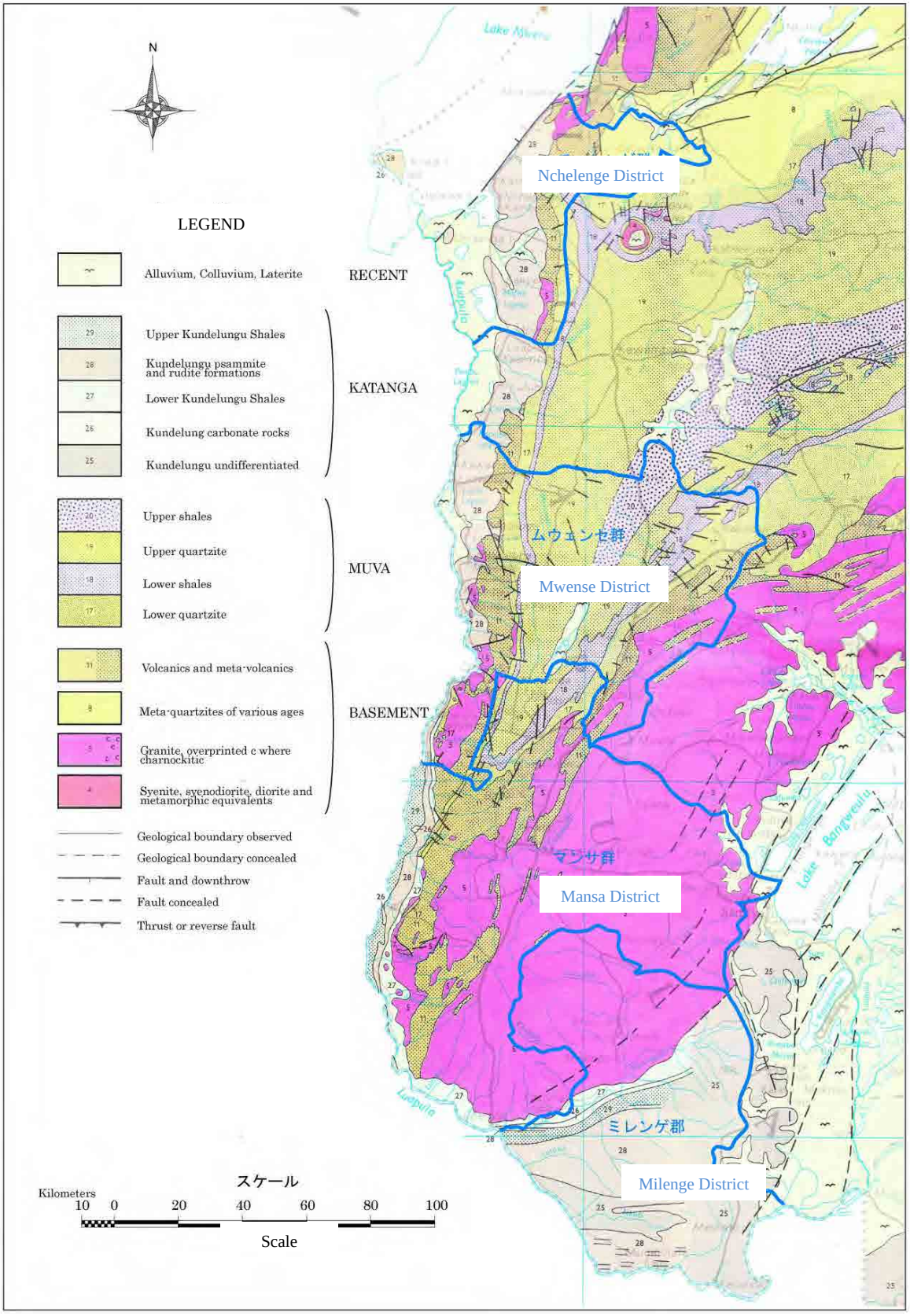
Table 1-1 Monthly Temperature and Rainfall Data at Mansa Observation Station

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Maximum Temperature (℃)	28	28	28	28	28	27	27	29	32	33	30	28
Minimum Temperature (℃)	17	17	17	15	12	10	9	11	14	16	17	16
Average Rainfall (mm)	256	261	226	29	1	0	0	0	4	27	157	242
Number of Rainy Days (days)	28	27	25	23	0	0	0	0	0	3	21	27

Source: Meteorological Bureau, average of data from 2006 to 2012

1-2-1-2 Hydrogeology

The project target area has a distribution of basement rocks (of Archaeozoic era to Early Proterozoic era from about 2 billion years ago), Muva supergroup (of Early Proterozoic era to Middle Proterozoic era from about 1.2-1.8 billion years ago), Katanga supergroup (of Late Proterozoic era to Early Palaeozoic era from about 1-0.45 billion years ago, of which those in the target area are before 700 million years) and alluviums. The geological map is shown below and geological formations are listed in the following table.



Source: Geological Map of Zambia, Geological Survey Department, 1994

Figure 1-1 Geological Distribution Map of Luapula Province and Surroundings

Table 1-2 Geological Classification

Geological Age	Geological Name	Composition
Cenozoic era	Alluvium	Gravel, sand, viscous soil
Palaeozoic era to Precambrian period	Katanga Supergroup	Sandstone, mudstone, conglomerate, shale
	Muva Supergroup	Sandstone, mudstone, quartzite, siliceous schist
Precambrian period	Basement Rocks	Granitic rocks Gneiss, metamorphic igneous rocks
Intrusive rocks		Basalt, amphibolite

1-2-1-3 Water Quality

Water qualities for this project shall be specified in conformity with the Zambian Water Quality Guidelines ZS190:1990. Most of the standard values in this guideline are referred from the WHO guidelines.

Table 1-3 Zambian Water Quality Standards

Parameter	Zambian Standard	WHO Guidelines, 4th Edition, 2011	Parameter	Zambian Standard	WHO Guidelines, 4th Edition, 2011
pH	6.5～8.0		Arsenic (As)	0.05 mg/ℓ	0.01 mg/ℓ
EC (μs/cm)			Total Solids (TS)		
Temperature (℃)			Calcium Hardness (Ca+)		
Taste		Acceptable to consumers	Alkalinity		
Odor		Acceptable to consumers	Ammonia (NH_4)	1.5 mg/ℓ	
Color		15 NTU	Nitrate (N-NO_2)	1.0 mg/ℓ	
Turbidity (NTU)		5 NTU (single sample), 1 NTU (median)	Nitrite (N-NO_3)	10.0 mg/ℓ	
Iron (Fe)	1.0 mg/ℓ	Acceptable to consumers	Boron (B)		0.3 mg/ℓ
Total Hardness (TH)	500 mg/ℓ	Acceptable to consumers	Copper (Cu)	1.0 mg/ℓ	2.0 mg/ℓ
Chloride (Cl)	250 mg/ℓ	Acceptable to consumers	Calcium (Ca)	200 mg/ℓ	
Lead (Pb)	0.01 mg/ℓ	0.01 mg/ℓ	Magnesium (Mg)	150 mg/ℓ	
Fluoride (F)	1.5 mg/ℓ	1.5 mg/ℓ	Total Coliforms	0/100 mℓ	0/100 mℓ
Cadmium (Cd)	0.005 mg/ℓ	0.003 mg/ℓ	General Bacteria	0/100 mℓ	0/100 mℓ
Manganese (Mn)	0.1 mg/ℓ	0.4 mg/ℓ			

1-2-2 Socio-Economic Conditions

A socio-economic survey was conducted at 320 requested sites. The survey looked into the social and economic conditions of those requested sites as well as various aspects in the socio-economic conditions: current water and hygienic environment, residents' perception on water and sanitation, communities' experience in community mobilization and activities, their willingness to participate in the Project and willingness to pay for water. The following section summarizes the result of the survey. More details in the content, method, questionnaires and result of the survey are found in appendix.

(1) Population

The following table shows the population in the target districts.

Table 1-4 Population in the Target Districts

District	Population (persons)		Population growth rate (%)		Current population (estimate) (persons) 2013
	2000	2010	1990-2000[1]	2000-2010	
Nchelenge	111,119	152,807	4.3	3.2	167,951
Mwense	105,759	119,841	2.1	1.3	124,576
Mansa	179,749	228,392	3.1	2.4	245,234
Milenge	28,790	43,337	3.7	4.2	49,030
Total in Luapula province	775,353	991,927	3.2	2.5	1,068,197

(2) Infrastructure

In the district capitals of Mansa, Mwense and Nchelenge districts, commercial power is available, and there are public services such as branch office of ministries and utility, hospitals as well as markets, stores and accommodation facilities, though the size of the cities is rather small and power supply is unstable. In these district capitals, urban water supply scheme is established and LuaWSC serves water to the urban population. Meanwhile, in rural area, hand pump facilities and traditional water sources such as shallow wells, rivers and ponds are more common.

In Milenge district, roads from the main road to the district capital and roads in the central part of the district are not yet paved. Even in the central part of the district, basic infrastructure such as water and electricity is not available, and therefore public services use solar power and diesel generator for electricity. In terms of water supply, there is no piped scheme where even in the district capital and main sources of water are hand pumps, shallow wells and rivers.

[1] Summary Report 2000 Census, Census population and housing, Central Statistical Office, 2003

Concerning the communication network, telecommunication towers are located alongside the main road and thus mobile telephones can be used anywhere in the area.

1-2-2-1 Socio-Economic Conditions of Target Sits for Boreholes fitted with Hand Pumps

(1) Size of the Population

The average population among target sites is 450 persons (median value). Population of district is 1,200 in Nchelenge, 350 in Mwense, 420 in Mansa and 400 in Milenge respectively. Distribution of population shows that 24.8% of all the sites have less than 250 people, 31.2% have 251-500 people, 11.9% have 501-750 people, 5.8% have 751-1,000 people, 4.2% have 1,001-1,250 people, 1.6% have 1251-1,500 people, 5.8% have 1,501-2,000 people, 7.7% have 2,001-3,000 people, and 7.1% have population more than 3,000. In terms of the average number of family members per household is 6.4 persons.

(2) Economic Activities

The following table shows the income sources of the households at the target sties for boreholes fitted with hand pumps.

Table 1-5 Household Income Sources（Target sites for boreholes fitted with hand pumps ）

	Agriculture	Livestock	Self-employed	Employee	Pension	Remittance	Daily worker	Fishery	Others
Nchelenge	81.9%	1.9%	43.9%	3.5%	0.7%	6.1%	29.3%	16.1%	1.3%
Mwense	85.5%	3.2%	15.3%	3.5%	0.5%	3.7%	9.6%	4.5%	0.3%
Mansa	83.1%	7.8%	31.1%	2.8%	0.6%	3.9%	19.7%	0.0%	1.7%
Milenge	87.9%	5.5%	4.7%	7.7%	0.5%	1.9%	4.9%	4.1%	0.8%
Total	84.5%	4.1%	24.6%	4.2%	0.6%	4.1%	16.3%	6.9%	1.0%

Average household income per month is ZMW150/month. At the district level, Nchelenge is ZMW200/month, Mwense is ZMW 100/month, Mansa is ZMW150/month, and Milenge is ZMW150/month.

Because the majority of households engage in agricultural activities as main income source, households tend to gain cash income during April to September when agricultural products are harvested.

(3) Conditions of Water Supply and Use

The following graph shows the water sources in the target sites for the hand pump facilities.

Almost half of the population still relies on the rivers and ponds for water supply.

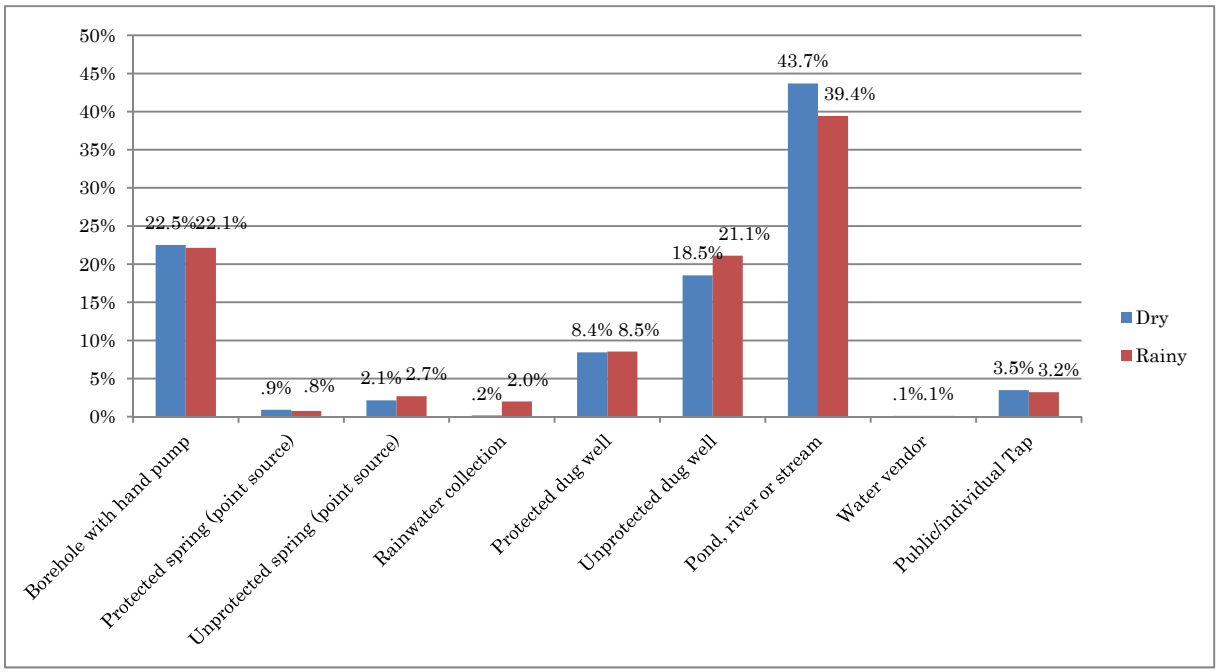


Figure 1-2 Main Sources of Domestic Water (Target sites for boreholes fitted with hand pumps)

(4) Conditions on Health and Sanitation

Major diseases that affect households in the survey target sites are malaria (82.8% of the households surveyed), Intestinal infections such as diarrhea, dysentery and cholera (70.7%), and respiratory illness (39.9%) (multiple answers). The high incidence of diarrheal diseases points to the fact that there is a lack of hygiene awareness of population.

(5) Operation and Maintenance of Existing Water Supply Facilities

Since most people use unprotected water sources at the survey target sites, operation and maintenance activities are limited to cleaning the surrounding of the water source, and water tariff is not collected.

For those sites where boreholes fitted with hand pumps exist, the Key Informant Survey revealed that in 78.2% of the sites that have boreholes fitted with hand pumps, V-WASHE is responsible for the Operation and Maintenance (O&M) of the hand pumps, followed by Village government (13.2%), School WASHE (4.5%), unknown (1.8%), no one (1.4%), and Health WASHE and others (0.5% respectively). Among these sits, 58% collect water user fees regularly (the mean figure of the sites are ZMW2/Month/Household).

(6) Needs for Improvement in Water Supply situation

The next graph shows the responses to a survey question on priorities in improvement of

living condition. According to the result, the top priority for the majority of respondents is improvement in water supply.

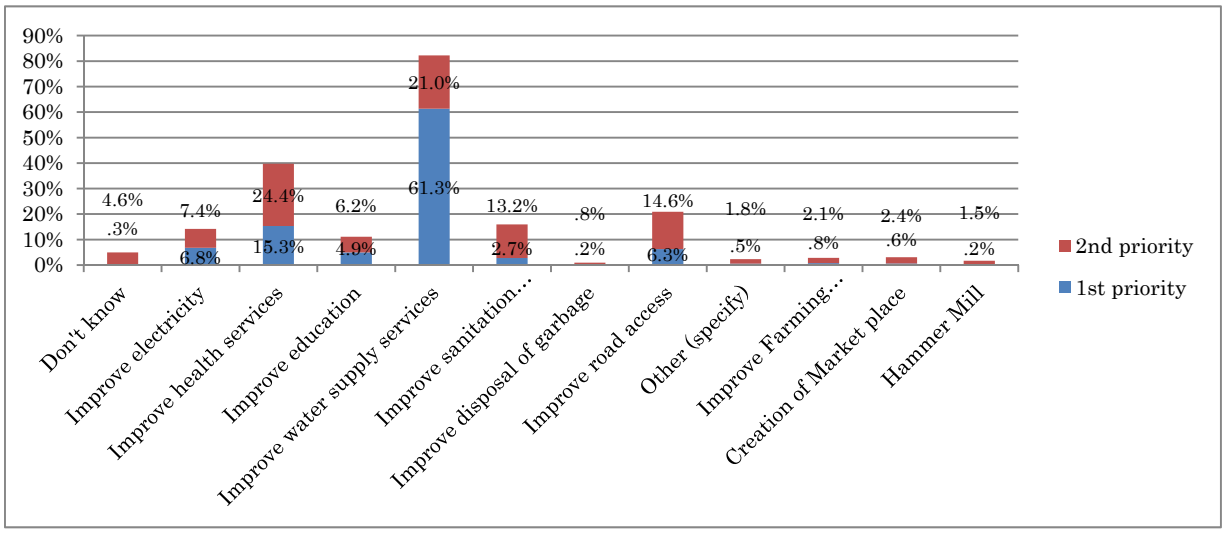


Figure 1-3 Priorities of Households concerning Living Condition Improvement (Whole survey target sites)

When people were asked about the current water sources, 69.6% of the households showed discontent on current situation. Main reasons include poor water quality, long distance to the source, instability of the water quality and insufficient quantity.

1-2-2-2 Socio-Economic Conditions of Target Sites for Piped Water Supply Schemes

(1) Size of Population

Although size of population at the target sites for piped water supply schemes varies from 2,000 to 10,000, these sites are, on average, relatively densely populated. Social infrastructures such as medium-scale market, schools and medical facilities are also in place. In addition, all the sites but Milenge are located alongside the main road and readily accessible by transportation. Average number of family members per household is 6.6 persons / household.

(2) Economic Activities

The following table shows household income sources of the survey target sites for piped water supply schemes. Compared to the hand pump target sites, the percentage of households with agriculture as income source is lower. Average household income per month is ZMW300 (Median value). Median figure for each districts are ZMW252/month in Nchelenge, ZMW300/month in Mwense, and ZMW525/month in Milenge, the capital of the district.

Table 1-6 Household Income Sources（Target sites for piped water supply schemes）

	Agriculture	Livestock	Self-employed	Employee	Pension	Remittance	Daily worker	Fishery	Charcoal Burning	Others
Nchelenge										
Kabuta	60.0%	0.0%	20.0%	0.0%	0.0%	5.0%	5.0%	30.0%	10.0%	35.0%
Kanyembo	30.0%	0.0%	15.0%	20.0%	0.0%	0.0%	5.0%	20.0%	5.0%	35.0%
Muatishi	84.2%	5.3%	5.3%	5.3%	0.0%	0.0%	10.5%	57.9%	5.3%	5.3%
Mwense										
Kapala	70.0%	15.0%	30.0%	5.0%	0.0%	0.0%	5.0%	35.0%	20.0%	10.0%
Musangu	95.0%	5.0%	0.0%	0.0%	0.0%	0.0%	5.0%	20.0%	0.0%	20.0%
Kapakala	80.0%	0.0%	5.0%	0.0%	5.0%	10.0%	10.0%	0.0%	10.0%	15.0%
Shichama	90.0%	0.0%	10.0%	5.0%	0.0%	5.0%	0.0%	0.0%	10.0%	20.0%
Milenge										
Milenge	25.0%	0.0%	25.0%	45.0%	0.0%	0.0%	30.0%	0.0%	0.0%	0.0%
TOTAL	66.7%	3.1%	13.8%	10.1%	0.6%	2.5%	8.8%	20.1%	7.5%	17.6%

(3) Conditions of Water Supply and Use

The following tables show water sources for domestic use in Dry season and Rainy season by target site, and the next figure shows the overall result.

Table 1-7 Domestic Water Sources (Dry season)（Target sites for piped water supply schemes）

	Borehole fitted with hand pump	Protected spring	Rainwater harvesting	Unprotected spring	River / pond	Others
Nchelenge						
Kabuta	0.0%	55.0%	0.0%	0.0%	45.0%	0.0%
Kanyembo	55.0%	0.0%	0.0%	0.0%	40.0%	5.0%
Muatishi	85.0%	0.0%	0.0%	0.0%	15.0%	0.0%
Mwense						
Kapala	35.0%	0.0%	0.0%	15.0%	50.0%	0.0%
Musangu	55.0%	5.0%	0.0%	40.0%	0.0%	0.0%
Kapakala	5.0%	0.0%	0.0%	0.0%	95.0%	0.0%
Shichama	90.0%	5.0%	0.0%	5.0%	0.0%	0.0%
Milenge						
Milenge	75.0%	0.0%	0.0%	15.0%	10.0%	0.0%
TOTAL	50.0%	8.1%	0.0%	9.4%	31.9%	0.6%

Table 1-8 Domestic Water Sources (Rainy season)(Target sites for piped water supply schemes)

	Borehole fitted with hand pump	Protected spring	Rainwater harvesting	Unprotected spring	River / pond	Others
Nchelenge						
Kabuta	0.0%	55.0%	0.0%	0.0%	45.0%	0.0%
Kanyembo	45.0%	0.0%	0.0%	0.0%	50.0%	5.0%
Muatishi	55.0%	5.0%	0.0%	0.0%	40.0%	0.0%
Mwense						
Kapala	45.0%	0.0%	0.0%	25.0%	30.0%	0.0%
Musangu	50.0%	5.0%	0.0%	40.0%	5.0%	0.0%
Kapakala	5.0%	0.0%	0.0%	0.0%	95.0%	0.0%
Shichama	70.0%	5.0%	0.0%	0.0%	25.0%	0.0%
Milenge						
Milenge	65.0%	0.0%	5.0%	15.0%	15.0%	0.0%
TOTAL	41.9%	8.8%	0.6%	10.0%	38.1%	0.6%

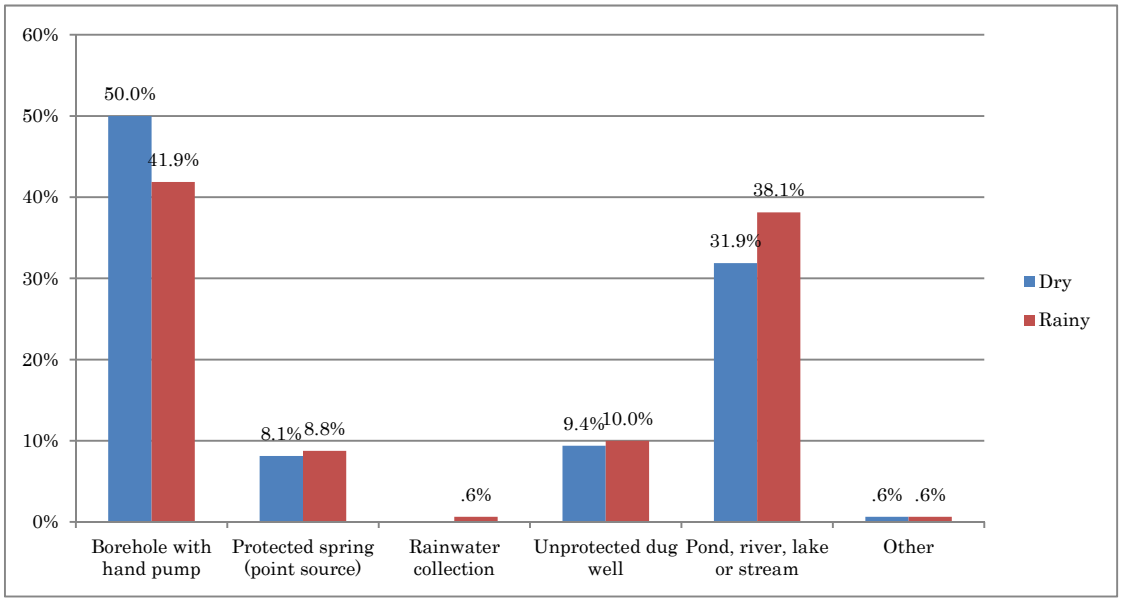


Figure 1-4 Main Sources of Domestic Water (Target sites for piped water supply schemes)

(4) Conditions of Health and Sanitation

Major diseases that affect households in the survey target sites are malaria (85.5% of the households surveyed), intestinal infections such as diarrhea, dysentery and cholera (62.9%), and respiratory illness (44.7%) (multiple answers). Though lower than hand pump target sites, the incidence of diarrheal diseases is high, indicating lack of hygiene awareness of the target population.

(5) Operation and Maintenance

Out of 30 hand pump facilities, 21 are managed by V-WASH, who carries out activities such as cleaning of the surrounding the area, locking of facilities outside work hours, and collecting water fees. 7 hand pumps out of remaining 9 are managed by school or health WASHEs and 2 have no organization attending them, and the reason can be attributed to the fact that both are non-operational.

Among the 30 hand pumps, 4 are permanently broken down. 3 of which had problems during installation or water level and the reason for the other hand pump's malfunction is unknown.

At all the sites, there are water user fees (ranging ZMW 1 to 8/month/household, at average of ZMW 2.16/month/household). However, survey showed that the collection rate is low, and there are only 2 sites where actual savings from water fees were observed. The poor collection rate were attributed to residents' inability or refusal of the water fee payment during the months

with low cash income, and the fact that some households choose unsafe water sources or other hand pumps where fees are not collected in order to avoid payment of the water fee, among other reasons. In case of Mwense district, water tariff was set in a way that vulnerable population such as those living under poverty, widows, people with disabilities, and elderly population are exempted from payment. As the majority of population falls into such categories, the exemption system fetters collection of adequate O&M fees.

(6) Needs for Improvement in Water Supply situation

Just as in the hand pump target sites, the majority of people recognize the needs for improving water supply situation. The graph below indicates that 80.0% of the respondents felt improvement of water supply was their first priority in living conditions.

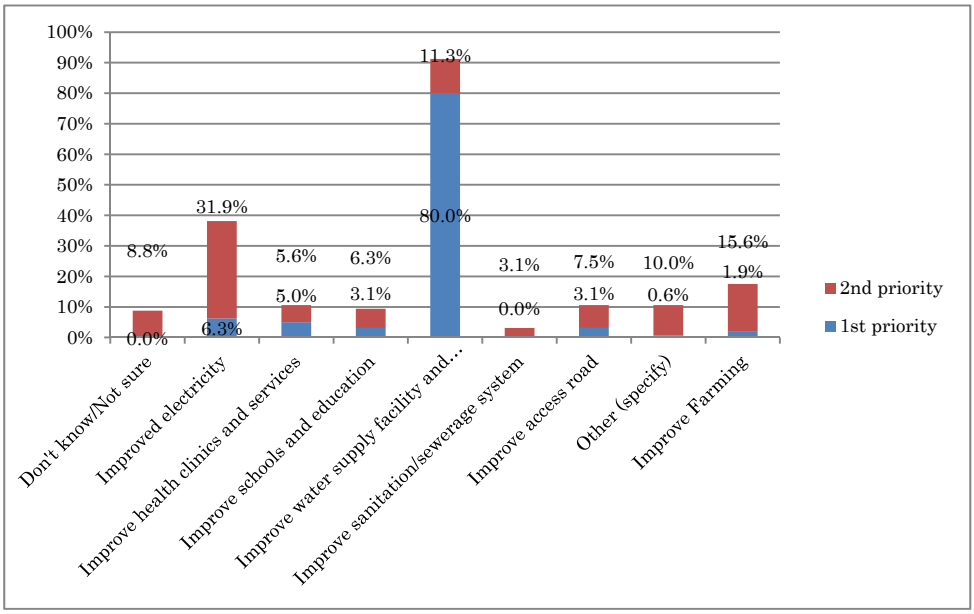


Figure 1-5 Priorities of Households concerning Improving Living Condition (Target sites for piped water supply schemes)

When people were asked about the current water sources, 68.1% of the households showed discontent on current situation. The primary reasons for their discontent include distance to the water source (50.5%), poor water quality (44.0%), long waiting hours at the facility (28.4%) and insufficient water quantity (21.1%) (multiple answers).

1-3 Environmental and Social Considerations

Since this project involves the construction of piped water supply schemes, land expropriation and involuntary resettlement were expected and therefore, the project was classified as Category B in accordance with JICA's Guidelines on Environmental and Social Consideration. However, results of field surveys revealed that land will be voluntarily provided by the target villages without need for land expropriation and the project scale is small to impart negligible impacts on the environment and society. Therefore, in accordance with Zambia's environmental impact assessment procedures, the project was evaluated as Category C.

1-3-1 Environmental Impact Assessment

(1) Project to have Environmental and Social Impacts

"Phase III Project" involves rural water supply using piped water supply schemes for 5 sites in 3 districts (Nchelenge, Mwense and Milenge) of Luapula Province in the Republic of Zambia. The planned water sources for the target sites are groundwater and spring. Also, as power sources, for sites where extensions from power grids are possible, commercial power is planned and for one site where extension is difficult, solar energy is planned. Moreover, at the site where spring is to be used as water source, water will be supplied by gravity and power is not needed.

(2) Baseline Environmental and Social Conditions

The national parks, game management areas, forest reserves, wetlands and heritage sites in the target province which are legally protected, as well as situation on resettlement/land expropriation and areas bordering neighbor countries are explained below.

1) Protected Areas

Several national parks, game management areas, forest reserves, wetlands and heritage sites protected under Zambian law are found in the target districts of Nchelenge, Mwense and Milenge. However, they are not located within distances to apply environmental or social impacts to the 5 target sites.

2) Involuntary Resettlement and Land Expropriation

In Zambia, about 94% of the country is officially designated as customary land[2], while the

[2] Customary lands are controlled by chiefs and headmen, but they act with consent of their people.

rest is state land[3], and tenure under customary lands does not allow for exclusive or individual rights to land, which implies that the whole land belongs to the community according to the Land Act of 1995. However, legislations related to involuntary resettlement and land acquisition for small scale projects are not strictly regulated in Zambia. Therefore, as a custom, problems are generally resolved through discussions with community organizations along with area representatives such as area councillors and district staffs in charge. For the present rural water supply plan, locations of the borehole drilling points as well as layouts of control houses, storage tanks and public tapstands were decided in the presence of the district representatives, area councillors and water user committees, and since the selected locations are the property of the target villages, use of the land was agreed and confirmation was made on the unnecessary resettlement of residents.

3) Areas Bordering Neighbor Countries

Since Luapula Province borders the Democratic Republic of Congo (DRC), refugees and illegal immigrants crossing the border from DRC have settled in areas near the border to carry out larceny and burglary acts which are degrading public safety in those areas. Therefore, if work is to be carried out near the border of DRC, then information on current situation at the area needs to be collected and sufficient safety precautions must be taken.

The border between Luapula Province and DRC is demarcated along the center of rivers and lakes. The distances from the target sites to the border line as well as to the coastline of DRC were surveyed. As a result, the site which is located farther than 20km from the border is Kabuta of Nchelenge District only and the other sites are within 20km even from the coastline. Therefore, careful attention is required.

(3) Environmental and Social Consideration Procedures in Zambia

As a consequence of rapid growth in population, phenomena such as urbanization, industrialization, increased agricultural demands and economic decline are posing a threat to sustainable use of the natural resources in Zambia. Subsequently, effects on economic, social and environmental sustainability over a long span are becoming eminent. Furthermore, since Zambia's ecosystems are diverse and support many livelihoods, measures to protect the environment and prevent degradation of natural resources are needed.

In this predicament, the National Conservation Strategy (NCS) was formulated in 1985 and identified key environmental issues and made recommendations for policies, programmes and

[3] State lands are managed by the President through the Commissioner of Lands.

actions to address these issues. The NCS stated the need to manage natural resources and the environment in the context of a centrally planned and controlled economy. In response to the recommendations of NCS, the Environmental Protection and Pollution Control Act (EPPCA) was enacted in 1990, which was amended in 1999, to become the supreme environmental law in Zambia. Under the EPPCA, the Environmental Council of Zambia (ECZ) was established to ensure the sustainable management of natural resources and protection of the environment as well as prevention and control of pollution. Then, in 2007, the government adopted the National Policy on Environment with the main purpose to create an umbrella policy for the welfare of the nation's environment so that socio-economic development will be achieved effectively without damaging the integrity of the environment or its resources. Moreover, through the Environmental Management Act of 2011, while continuing its original roles and responsibilities, the ECZ was renamed the Zambia Environment Management Agency (ZEMA). Presently, ZEMA is the agency in charge of environmental impact assessment.

In Zambia, before starting any development projects, the projects need to be screened and classified under 2 categories, where any project under the First Schedule requires the submission of an Environmental Project Brief (EPB) and those under the Second Schedule must submit an Environmental Impact Statement (EIS). Project Brief and Environmental Impact Statement should be submitted in conformity with the formats prepared by ZEMA. The decision on which category the project falls under is made by ZEMA upon submission of the project brief.

- Under First Schedule, water supply projects would fall under Item b. Water transport.
- Under Second Schedule, water supply projects would be categorized under the following conditions.
  - ✧ Item No. 2. Transportation
    - ➢ Sub-Item d. Pipelines: for water, diameter 0.5m and above and length 10 km
  - ✧ Item No. 3. Dams, Rivers and Water Resources
    - ➢ Sub-Item b. Exploration for, and use of, ground water resources: water to be extracted to be more than 2 million m^3/s
    - ➢ Sub-Item c. Water supply – reservoir surface area 50 m^2 or more

Since the present project is a rural water supply project and the above conditions for Second Schedule do not apply, "Phase III Project" falls under First Schedule only. Therefore, only an environmental project brief needs to be submitted while an environmental impact statement is not necessary, meaning an environmental impact assessment is not required.

(4) Environmental Scoping

In April 2004, JICA established "the Japan International Cooperation Agency Guidelines for Environmental and Social Considerations" (hereinafter referred to as "JICA guidelines") upon combining the previous guidelines of JBIC (Japan Bank for International Cooperation) and JICA. Since the establishment, all preliminary studies of grant aid projects conducted by JICA must follow the regulated procedure. Therefore, environmental and social consideration was carried out based on the results of environmental impact assessment made by JICA before commencement of this study, and the project was categorized according to the following 4 categories (these were previously categorized into 3 categories), depending on their possible impacts expected on the environment and societies of project target sites and surroundings.

Category A: Projects with potential significant and adverse impacts on the environment and society

Category B: Projects with potential limited adverse impacts on the environment and society, but less than that of Category A

Category C: Projects with minimal or no adverse impacts on the environment and society

Category FI: JICA investments to a financial institution or other legal entity in which, after JICA's approval of the financing, the financial institution will practically select and examine a specific subproject, but before JICA's financing approval (or project examination), the subproject cannot be specified and presumed to have potential environmental impacts

Here, conceivable impacts to be caused by implementing this project will be identified and examined from environmental and social aspects based on the scoping matrix described in the JICA Guidelines, consisting of 30 items under three fields. Also, environmental and social impacts based on zero option (without project) are shown in the table for comparison with the scoping results.

Table1-9 Scoping Matrix

Field		Impact	Evaluation			Description
			Con-struction	Oper-ation	Zero Option	
Pollution	1	Air pollution	C	D	D	**During construction:** Temporary emission of exhausts from construction machineries and specialty trucks are expected. **During operation:** No air pollution is generated since exhausts are not emitted during operation of water supply schemes. **Without project:** No air pollution causing factor.
	2	Water contamination	C	D	D	**During construction:** Impact is low since wastewater is controlled to prevent water contamination. **During operation:** Since the project purpose is to supply drinking water, generation of contaminated water is very low. **Without project:** No water contaminating factor
	3	Waste	C	D	D	**During construction:** Small amount of construction debris is generated. **During operation:** No waste from water supply facility **Without project:** No waste from water supply activities
	4	Soil contamination	C	D	D	**During construction:** Pollutants from construction works can contaminate soil. **During operation:** No impact since chemicals to contaminate soil are not used **Without project:** Water supply activities do not contaminate soil.
	5	Noise, vibration	C	D	D	**During construction:** Temporary noise and vibration from construction machineries and specialized trucks are expected **During operation:** No noise and vibration since power is electricity and solar. **Without project:** No noise and vibration from water supply activities.
	6	Ground subsidence	D	D	D	Since design water supply rate is low, possibility for subsidence from water source is low.
	7	Offensive odor	D	D	D	No odor causing factor during construction, operation and without project.
	8	Sediments	D	D	D	Since water sources for this project are spring and groundwater, bottom sediments of lakes and rivers are not affected.
Natural Environment	9	Protected area	D	D	D	National parks and protected areas are not found within distance from the target areas to have any effects.
	10	Ecology	C	D	D	**During construction:** As part of land clearing, trees may need to be cut, and may affect flora environment. **During operation:** Protected areas are not located within distance from the target areas to have any effect. **Without project:** Water supply activities do not affect ecology.
	11	Hydrometeor	D	D	D	Rural water supply facilities are small scale and design supply rates are small, and use of springs and groundwater do not have any effects on rivers.
	12	Topography, geology	C	D	D	**During construction:** Land clearing can affect topography. **During operation:** Since pipelines will be laid along the present topography, influence is expected to be small. **Without project:** Water supply activities do not affect topography and geology.
Social Environment	13	Resettlement	D	D	D	**During construction:** Candidate water source points were selected where houses are not found. **During operation:** Locations of pipeline laying, storage tanks and control houses were given consent by residents and districts.
	14	The poor	D	C	D	Domestic water is presently free, but after introduction of a fee system, the poor might have difficulties to obtain their water.
	15	Minority, indigenous	D	D	D	Minorities and indigenous people are not living at or near the target areas.
	16	Local economy such as employment and livelihood	B+	D	D	**During construction:** Increase in employment is anticipated. **During operation:** Since public taps will be installed near present residential areas, time for fetching water is expected to decrease.
	17	Land use, local	D	D	D	Locations of pipeline laying, storage tanks and control houses

Field		Impact	Evaluation			Description
			Con-struction	Oper-ation	Zero Option	
		resources use				were given consent by residents and districts.
	18	Water use	D	D	D	Due to management under a new water supply provider, water rights will be assured and responsibilities of water users will be clarified.
	19	Existing social infrastructures and services	D	D	D	New facilities will be located on public land and since clean water will be supplied, improvement in quality of domestic water can be anticipated.
	20	Social institutions such as social infrastructure and local decision making institutions	D	D	D	Since effective and sustainable water supply services can be achieved, formation of new service management organizations is anticipated.
	21	Misdistribution of damage and benefit	D	D	D	Since the facilities are public water facilities including public taps, significant misdistribution of benefits is not possible, and damages and benefits to surrounding areas are not expected.
	22	Local conflict of interests	D	D	D	In this project, since target residents can equally use water supply facilities, factors to cause local conflicts of interests cannot be conceived.
	23	Cultural heritage	D	D	D	Culture heritages are not located near target areas to cause any influence.
	24	Aesthetics	D	D	D	Although storage tanks and control houses will be newly constructed, they are not large enough to have any influence.
	25	Gender	D	D	D	Negative impacts on gender from this project cannot be expected.
	26	Children's rights	D	D	D	Negative impacts on children's rights from this project cannot be expected.
	27	Infectious diseases such as HIV/AIDS	C	D	A	**During construction:** Since laborers from other areas will temporarily flow into the target area, there is risk of infectious diseases. **During operation:** After project completion, due to improvement in access to clean water, improvements in public health conditions can be anticipated and can contribute to prevention of water-borne diseases such as cholera. **Without project:** Before the project, due to use of unsanitary water, outbreaks of water-borne diseases such as cholera are possible.
	28	Labor environment including work safety	C	D	D	**During construction:** Labor environment of construction workers need to be considered. **During operation:** Activities to have negative impacts on workers are not expected.
Others	29	Accidents	C	D	D	**During construction:** Accidents during construction need to be given consideration. **During operation:** Since vehicles and other heavy equipment are not used, accidents are not expected.
	30	Trans-frontier impact and climate change	D	D	D	Since this project is construction of rural water supply facilities and scale is small, impacts on trans-frontier and climate change are considered to be very small.

A+/-: Significant positive/negative impact is expected.
B+/-: Positive/negative impact is expected to some extent.
C+/-: Extent of positive/negative impact is unknown. (A further examination is needed, and the impact could be clarified as the study progresses)
D: No impact is expected.

(5) Monitoring Plan

The above scoping matrix was used to determine the impacts to be considered during the construction and operation of the target sites. Mitigation measures against the impacts as well as environment management and monitoring plans for those impacts are listed in the next page.

As explained previously, prior to the commencement of a water supply development project, the developer is required to submit the Project Brief to ZEMA, and ZEMA identifies the level of expected environmental and social impacts of the project and determines whether or not the project needs an EIA study. The developer is highly recommended to review and modify the plans after it finally obtains the result of ZEMA's decision.

Table 1-10 Provisional Environmental Management and Monitoring Plan

Impact		Mitigation Measures	Monitoring Methods	Responsibility	Implementation Schedule
Construction phase					
Accidents		1) Control of vehicles' routes around the construction sites for construction works 2) Safety control around the construction sites 3) Control methods will be confirmed between the developer and contractor. Additionally, the methods must be notified to people around the Project area.	1), 2) and 3) Regular safety patrol in and around the construction sites	Contractor	To be determined under the construction contracts between the contractor and the developer, under the local authority's supervision if necessary
Pollution	Water	1) Installation of treatment systems for wastewater from construction sites	1)-1 Regular quality monitoring and observation of flows of wastewater and sewerage 1)-2 Regular maintenance of the systems	Contractor Developer Local authority	
	Air	1) Selection of emission-controlled vehicles	1) Regular air quality monitoring around the construction sites		
	Construction Waste	1) Discussions with local authorities on locations for waste disposal and set up appropriate disposal points	1) Regular clearance and maintenance of waste disposal points		
	Noise and Vibration	1) Selection of appropriate machinery 2) Control of working period and daily time schedule	1) Regular monitoring of noise and vibrations around the construction sites 2) Monitoring of daily working schedule and routes of vehicles		
	Odor	1) Appropriate management of wastewater and wastes from construction works and wastes of workers 2) Protection of waste disposal points agreed with local authorities	1) Regular monitoring around the construction sites 2) Regular maintenance and monitoring of waste disposal points		
Land preparation		1) Site inspection to minimize amount of soil excavated and the area where grasses and small trees are cut.	1) Control of vehicular transportation at the area to be prepared	Contractor Developer Local authority	
Waste management		1) Discussions with local authorities on appropriate methods and locations for waste disposal 2) Prepare waste disposal points nearby construction sites	1) and 2) Regular monitoring and maintenance of the waste disposal systems	Contractor Developer Local authority	
Operation phase					
Establishment of new water supply systems and water service providers		1) Identification of existing socio-economic situations around the planned beneficial areas 2) Identification of requirements and conditions for establishing new water service providers 3) Establishment of water tariff systems	1) Conducting social assessments prior to the Project 2) Regular supervision during th establishment process 3) Regular discussion among the beneficiaries, the developer, the local authority and the new water service provider members if they exist	Developer Local authority Water service provider (after established)	To be discussed and determined when the new water service provider is established
Groundwater level		1) Operate pumps according to design pumping rates to avoid over pumping.	1) Daily water level measurements		To be discussed during guidance on pump operation and facilities maintenance
Waste management around public tapstands		1) Establishment of waste management systems 2) Maintenance and clearance of areas surrounding the tapstands	1) Create a monitoring and maintenance group and carry out regular monitoring of the system 2) Monitor clearance an maintenance of surroundings		To be discussed at the detailed design stage when locations of facilities are explained

(6) Stakeholders' Meeting

ZEMA has responsibilities to conduct public hearings during the EIA process. According to the "Environmental Impact Assessment Process in Zambia" of ZEMA, "A public hearing is a form of participation in which stakeholders and proponents are brought together in a forum to express their opinions and offer suggestions on a proposed undertaking in order to influence the decision making process". The objectives of the public hearings are as follows.

- To inform the target community on the outcome of the environmental assessment of the proposed project
- To verify the accuracy of the EIA findings in relation to the situation on the ground
- To confirm the participation of affected parties in the various decision making processes
- To offer the affected and interested parties the opportunity to express their opinions on issues considered outstanding
- To promote effective public participation and ensure confidence in the EIA process of ZEMA as well as support for the proposed undertaking

The participants in the public hearings should be ministries, sector agencies, local governments responsible for the project area, ZEMA, NGOs, surrounding communities and community groups as well as the developer.

1-3-2 Land Expropriation and Resettlement

In Zambia, laws and regulations specifically for land expropriation and resettlement were not enacted, and as a custom, decision making was generally carried out through discussions between the local authority and local communities. For "Phase III Project" which is a rural water supply undertaking, candidate locations of construction points were decided and agreed by water committees formed by residents of the target sites through consultation with area councillors and reporting to the district representatives. Therefore, problems with land expropriation and resettlement will not arise.

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2 Outline Design of the Requested Japanese Assistance

2-1 Basic Concept of the Project

2-1-1 Project Objective and Overall Goal

The rate of access to safe water in the Republic of Zambia (hereinafter referred to as Zambia) in 2011 was 86% in urban areas and 50% in rural areas with an average of 64% (WHO/UNICEF JMP, 2013) which is one of the countries in Sub-Saharan Africa with the lowest access rate. In Zambia, the National Water Policy was revised in February 2010 and the Water Resources Management Act was enacted in 2011. Concerning rural water supply and sanitation, the National Rural Water Supply and Sanitation Programme (2006-2015) was officially announced in November 2007 with aims to improve the rural water accessibility rate to 75% by 2015 in line with the MDGs. This objective is also raised in the Sixth National Development Programme 2011-2015 (SNDP). Furthermore, Vision 2030 (December 2006) stipulates that the national coverage rate for safe water of 63% in 2010 is to be increased to 80% in 2015 and eventually become 100% in 2030.

Luapula Province, the study target area of this project, "The Project for Groundwater Development in Luapula Province, Phase 3" (hereinafter, referred to as "Phase III Project"), is located in the northern part of Zambia and comprised of 7 districts (as of 2013, the province is divided into 11 districts, but for this project, the number will be kept at 7). This province has a land area of 51,000 km^2. The population of Luapula Province is 991,000 persons of which 80% is below the poverty line which is the highest in Zambia (Census, 2010). Also, within the 9 provinces in the country, the access rate to safe water is the lowest where the rate remained at 23% in 2012 which does not even reach half the national average rate for rural areas. Presently, water supply facilities are in shortage and in many villages where awareness activities for sanitation behavior improvement is insufficient, the residents must rely on unsanitary sources such as hand dug wells, rivers and lakes for their domestic water. As a consequence, serious impacts are being affected on various aspects such as increase in water-borne diseases, increase in burden of water fetching by women and children, as well as impacts on economic activities of residents, education and health. Moreover, the mortality rate of infants under 5 years old is 83 out of 1,000 (WHO, 2009) revealing an inferior sanitary environment. Therefore, to supply safe and stable water to the communities is the pressing issue.

In succession to “Phase I Project” and “Phase II Project”, with aims to further increase the access rate to safe and stable water in Luapula Province, in August 2011, the “Phase III Project” as Grant Aid was requested to the Japanese Government. This project, as a result of construction of 200 boreholes fitted with hand pumps and 5 piped water supply schemes at 4 target districts (Nchelenge, Mwense, Mansa and Milenge) of Luapula Province, the number of beneficiary population in all of Luapula Province will increase by about 82,000 persons with an anticipated growth in safe water access rate from the present 25.6% to 30.0%.

The overall goal and project purpose of this project are as follows.

Overall Goal : Accessibility to safe water supply schemes will improve and infection rates of water-borne diseases will decrease.

Project Purpose : Residents of project target areas will be able to receive safe and stable water supplies.

2-1-2 Outline of the Project

To achieve the project purpose mentioned above, this project will implement the construction of boreholes fitted with hand pumps and piped water supply schemes along with capacity development on operation and maintenance of the constructed facilities in 4 Districts of Luapula Province. As a result, a target population of about 82,000 persons will be able to receive a stable supply of safe water in anticipation of improvements in the present water supply conditions. Consequently, the following shows the outline of this project.

【Facilities Construction】 : For Boreholes with Hand Pumps:

Construction of 200 boreholes fitted with hand pumps at 200 sites in 4 Districts (Nchelenge, Mwense, Mansa and Milenge) of Luapula Province

: For Piped Water Supply Schemes:

Construction of piped water supply schemes at 5 sites in 3 Districts (Nchelenge, Mwense and Milenge) of Luapula Province

【Technical Assistance】 : For Boreholes with Hand Pumps:

- Formation of V-WASHEs
- Village promotion activities on operation and maintenance and sanitation

: For Piped Water Supply Schemes:

- Formation of V-WASHEs
- Village awareness raising activities on operation and maintenance and sanitation
- Assistance to contracting with private operators for technical support

The original request from Zambia to Japan included boreholes fitted with hand pumps at 320 sites and piped water supply schemes at 8 sites. However, due to restrictions in project scale as a grant aid project and construction period of one year, the target for this project became respectively, 200 sites (200 boreholes) and 5 sites. However, for boreholes with hand pumps, 54 other sites were retained as alternative sites.

The social condition survey was conducted at all requested sites, and for boreholes with hand pumps, based on their detailed site survey, 66 sites were excluded. Then the remaining 254 sites were prioritized and the top 200 sites were selected as the project target sites. For explanation of the selection procedure, refer to Section 2-2-1-1. The 54 sites with lower priorities were retained as alternative sites in case drillings become unsuccessful.

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

The basic policy and design considerations for this project are explained below.

2-2-1-1 Basic Policy

(1) Screening of Requested Sites

1) Boreholes with Hand Pumps

The 320 sites in 4 districts of Luapula Province being requested by the Zambian Government were screened according to the following criteria based on the agreement with the Zambian Government to verify the feasibility for implementation of the Japanese grant aid scheme.

a. A demand for safe and stable water supply exists
b. Site is accessible and safe working conditions are assured
c. Adequate hydrogeological conditions (including satisfaction of Zambian water quality standards)
d. Extent of existing water supply facilities (exclusion if existing facilities are sufficient)
e. No duplication with other donor projects
f. Possibilities to form V-WASHEs
g. Site residents are willing to pay operation and maintenance costs for the water supply facilities

As a result of the screening, out of the requested 320 sites, 254 sites met the above criteria (refer to subsequent section).

2) Piped Water Supply Schemes

For the requested 8 sites in 3 districts of Luapula Province, screening using the criteria listed below was carried out as agreed by the Zambian side to determine the feasibility of implementation under the Japanese grant aid scheme.

a. A proper operation and maintenance system can be created (possibilities to form water users' committees, and communities have willingness-to-pay and ability-to-pay operation and maintenance costs)
b. A demand for safe and stable water supply is existent (sufficient population, demand for

public tap stands)

c. Site is accessible (no problems with safety management)
d. Extent of existing water supply facilities (exclusion if existing facilities are sufficient)
e. No duplication with other donor projects
f. Adequate hydrogeological conditions (including satisfaction of Zambian water quality standards)
g. Conditions for power supply

(2) Considerations on Implementable Number of Schemes

1) Boreholes with Hand Pumps

From the experience and knowledge acquired from the "Phase I Project" and "Phase II Project", to maintain a standard quality of drilling works, the assumption of 8 successful boreholes a month by one crew is determined to be feasible. Also, from a viewpoint of cost restriction, local contractors will be subcontracted and in consideration of their capacity and supervision by the Japanese contractor, a maximum of 3 crews is appropriate.

Since access during the rainy season by heavy vehicles such as drilling rigs and trucks would become difficult, borehole drilling works will be suspended during that period. Therefore, excluding the 3 rainy season months (January to March), 9 months are possible for drilling. Assuming 8 successful boreholes per month, with a maximum of 3 crews, successful boreholes can be drilled at a total of 200 sites within the project implementation period.

2) Piped Water Supply Schemes

Since this type of water supply schemes were not included in "Phase I Project" and "Phase II Project", concepts on their implementation need to be newly considered. However, considerations on use of local contractors and suspension of work during the rainy season are the same as for construction of boreholes fitted with hand pumps. Although the number of sites is 5, by applying 2 teams of a plumbing crew and a distribution tank crew for each site, the works can be completed within the 9 months schedule.

(3) Selection of Project Target Sites

1) Boreholes with Hand Pumps

As a result of the screening based on results of the social conditions survey held in this study, out of the 320 sites requested by the Zambian side, 254 sites were identified to have potential for new water source development in this project. The target site screening list is shown in Annex 3.

Although the number of boreholes implementable for this project taking into consideration the one-year construction period is 200, the distribution of construction sites for each district was decided primarily using the proportionality of sites by districts in the original request.

Table 2-1 Proportionality of Implementable Site Number by Districts

District	Requested Number of Sites (A)	Percentage (B)=(A)÷320	Proportional Site Allocation (C)=200×(B)
1) Nchelenge	90	28.1%	56
2) Mwense	100	31.2%	62
3) Mansa	60	18.8%	38
4) Milenge	70	21.9%	44
Total	320	100%	200

2) Piped Water Supply Schemes

The request concerns construction of piped water supply schemes at several sites located in 3 districts (Nchelenge, Mwense and Milenge) of Luapula Province. To determine the possibility for implementation through the Japanese grant aid scheme, the requested sites were evaluated, as shown below, using results of the social survey, criteria agreed with the Zambian side, areal balance, and social conditions such as possibilities for commercial activities and water fetching time.

Table 2-2 Evaluation Results of 8 Candidate Sites for Piped Water Supply Scheme

District	Site Code	Requested Site		Population (persons)	Evaluation Result based on Criteria (from Social Survey)								
		Site Name	Water Source		a) O&M System		b) Water Supply Improvement Needs		c) Access	d) Usable Existing Water Facilities	e) Other Donors Overlap	f) Hydro-geology	g) Power Source
					V-WASHE	Above: WTP*1 Below: ATP (ZMW/HH/mon) *2	Demand (Coverage Rate)	Water Fetch Time (min/day)					
Nchlenge	NCIII-PW01	Kabuta	Spring	3,222	Formed	2.00 7.75	High (55%)	117	Possible	3 JICA HP 1 spring	None	Possible	Grid
	NCIII-PW02	Kanyembo	Borehole	2,910	Formed, collect fees	6.40 15.00	High (55%)	90	Possible	1 JICA HP	None	Possible	Grid
	NCIII-PW03	Muatishi	Borehole	2,447	Formed, collect fees	8.90 15.00	Normal (72.5%)	114	Possible	2 JICA HP 1 spring	None	Possible	Grid
Mwense	MWIII-PW01	Kapala	Borehole	4,333	Formed	6.62 25.00	High (40%)	119	Possible	1 JICA HP 1 other HP	None	Possible	Grid
	MWIII-PW02	Musangu Fill Station	Borehole	11,000	Formed	9.10 12.50	High (57.5%)	179	Possible	2 JICA HP 3 other HP	None	Possible	Grid
	MWIII-PW03	Kapakala	Borehole	10,512	Formed	11.48 10.00	Very High (5%)	68	Possible	1 JICA HP 1 other HP*3	None	Possible	Grid
	MWIII-PW04	Shichama	Borehole	10,000	Formed	10.32 12.50	Low (85%)	59	Possible	2 JICA HP	None	Possible	Grid
Milenge	MLIII-PW01	Milenge	Borehole	3,000	Formed	5.32 26.25	Normal (70%)	27	Possible	4 JICA HP 3 other HP	None	Possible	None

*1 For 6 persons per household using 30ℓ/c/d

*2 Calculated as 5% of average monthly income (adopted from World Bank as the general standard for water fees in developing countries[1])

[1] Refer to "Access, Affordability, and Alternatives: Modern Infrastructure Services in Africa", Africa Infrastructure Country Diagnostic, Background paper2, February 2008, The International Bank for Reconstruction and Development/The World Bank and "Can poor consumers pay for energy and water? An affordability analysis for

*[3] Function only during rainy season

Based on the above results, upon discussions with the Zambian Government, the following 5 sites were selected and agreed as the target sites for executing site surveys including test drillings.

District	Site Name
Nchelenge District	Kabuta
Mwense District	Kapala, Musangu, Kapakala
Milenge District	Milenge

Of the above 5 sites, the water source for Kabuta of Nchelenge District is a spring and sufficient yield was already confirmed through the site survey. For the other 4 sites, water sources are groundwater and their potentials were confirmed through test drillings.

(4) Alternative Sites and Their Priority Ranking

1) Boreholes with Hand Pumps

As explained previously, as a result of screening, the number of sites possible for water source development is 254 and within this number, boreholes fitted with hand pumps will be constructed at a total of 200 sites in order of higher priority for each district. For each district, the sites were prioritized by, first schools, then dispensaries, followed by higher populations implying priorities in order of higher water demands. Priority ranking was determined following the procedure shown below.

transition countries"、Samuel Fankhauser and Sladjana Tepic, May 2005, European Bank/WHO.

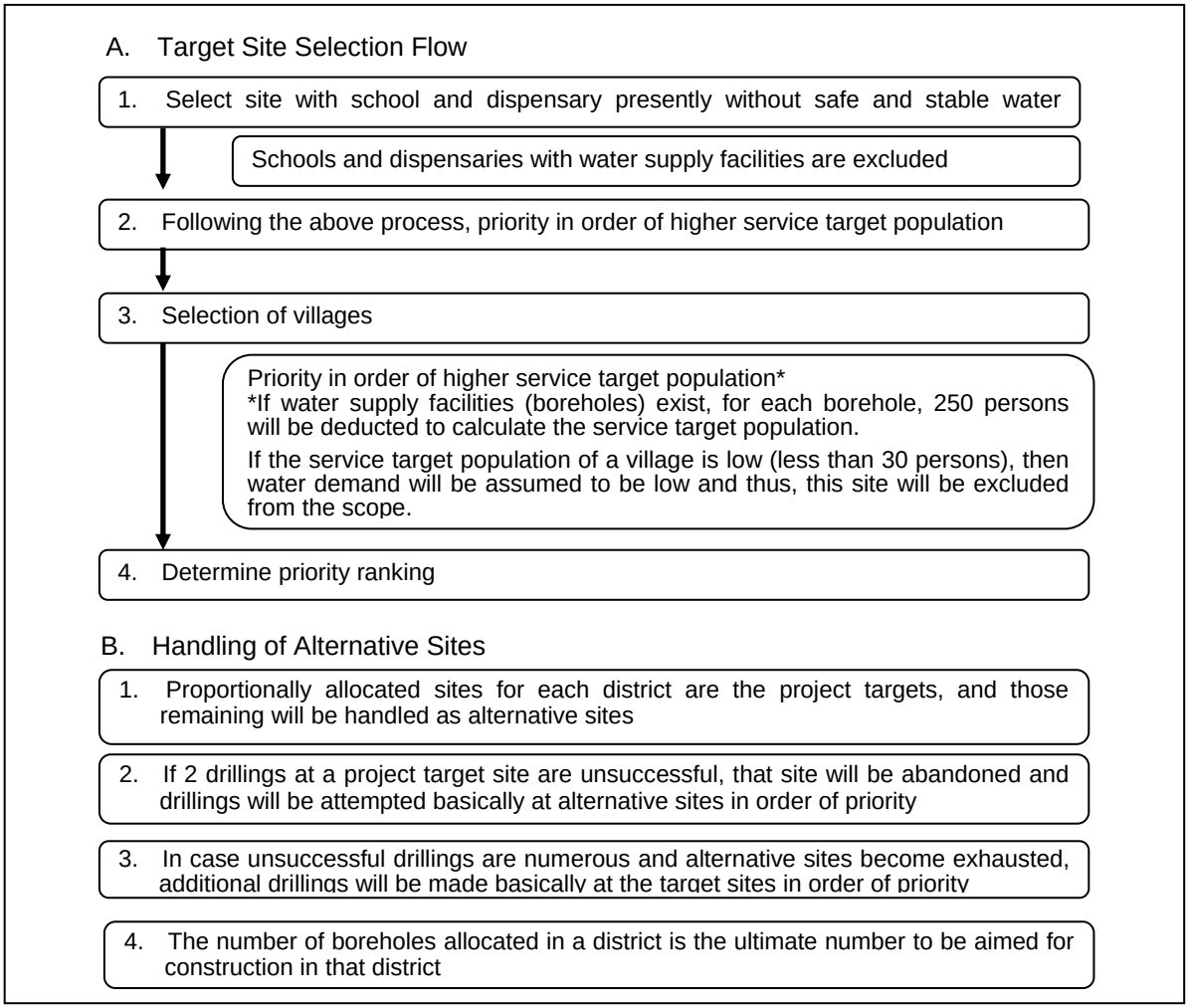


Figure 2-1 Target Site Selection Flow and Handling of Alternative Sites

The 55 sites not selected in the above procedure will be treated as alternative sites for drilling in this project. That is, due to results of borehole drilling works, if 2 drillings are unsuccessful at one site, a new drilling site will be selected from the 55 alternative sites in order of their priority ranking with consideration of the districts' and communities' preference to aim for 200 successful drillings to be implemented in this project. The project target site selection results are summarized in Table 2-3 (refer to Table 2-4 List of Project Target Sites for details).

If alternative sites become exhausted due to numerous unsuccessful drillings and exclusion of sites, second boreholes will be drilled at project target sites in order of higher number of population in principle. Furthermore, the number of implementation candidate sites for each district shown in Table 2-1 will not be modified even if unsuccessful drillings increase. Alternative sites will be selected after discussion with district and community.

Table 2-3 Summary of Project Target Site Selection Results

District	Request	Proportional	Suitable	Target	Alternative	Excluded
Nchelenge	90	56	70	56	14	20
Mwense	100	62	90	62＋1→63	28－1→27	10
Mansa	60	38	51	38	13	9
Milenge	70	44	43	44－1→43	0	27
Total	320	200	254	200	55－1→54	66

In Milenge District, the allocated site number was 44 sites based on the proportional number of the original request. However, as a result of the screening procedure, the number of sites inappropriate for borehole construction became numerously 27 sites resulting in 43 sites remaining as project target sites where the allocated number of 44 sites could not be secured. Therefore, one site was added to Mwense District where the officially requested site number was highest to adjust the allocation. Consequently the total number of target sites is unchanged at 200 boreholes.

2) Piped Water Supply Schemes

Out of the selected 5 sites, test drillings were conducted during the study at 4 sites excluding the site which will use a spring as water source. As a result, if yields possible for development can be assured, water supply schemes would be constructed in accordance with the yields. The maximum number of test drillings was 11. In case a sufficient yield for a site could not be secured within the 11 drillings, that site would have been excluded as a target for construction and not allocated to another site.

The results of test drillings are shown in Table 2-5. When 10 drillings were conducted, sufficient yields were secured at 3 sites only and at Kapala of Mwense District, 3 drillings were unsuccessful. Therefore, geophysical surveys were carried out at other locations in Kapala and drilled a 4th test well at a point having high potential. As a result, the yield of the 4th drilling was sufficient.

(5) Operation and Maintenance of Boreholes Fitted with Hand Pumps and Contributions from Residents

In this project, costs for operation and maintenance are based on contributions from the residents who are the users of the water supply schemes. Also, to promote sustainable operation and maintenance by the users as the main actors, support will be given through the software component program.

According to the basic policies of NRWSSP, operation and maintenance costs of the constructed water supply schemes for this project are, in principle, to be borne completely by the communities. On the other hand, NRWSSP specifies that, as a prerequisite to construct boreholes fitted with hand pumps, the beneficiary communities are obligated to contribute ZMW1,500 to cover part of the initial costs. However, concerning the bearing of the initial costs, due to economic difficulties in imposing the condition in impoverished areas and for fear of the burden to further the poverty situation, other donors, international organizations and NGOs (such as AfDB, UNICEF, Water Aid and Plan International) who are assisting similar water supply and sanitation projects in rural areas of Zambia are coping with this issue by such measures as lowering the cost to be borne or annulling the cost prerequisite. In this project, from the viewpoint of construction and schedule management, community contributions will not be imposed as prerequisite for construction, but coordination by the districts concerning initial cost bearing will be supported.

(6) Safety Control

Of the 200 sites for boreholes with hand pumps and 5 sites for piped water supply schemes, some of the project target sites are located near the border with Democratic Republic of the Congo. Although security is stable at the present, due to the unstable political situation of that country, conflicts can occur and refugees can enter the Zambian side. Therefore, to implement the project, the following will be the basic policy.

a. Procedures for safety measures of JICA will be observed.
b. Close contact will be kept with the implementing agency, JICA Zambia Office, Embassy of Japan and other concerns to collect relevant information and comply promptly with their instructions.

2-2-1-2 Policy Concerning Natural Conditions

(1) Temperature and Rainfall

The monthly temperature and rainfall data is shown in Section 1-2-1-1. The average minimum temperature in the project target area is 9℃ in July and the average maximum temperature is 33℃ in October. Therefore, since concrete materials are susceptible to temperature, their handling, mixing, casting and curing need careful attention.

The construction schedule should be prepared in consideration of the difficulties in access to borehole drilling sites during the rainy season. To approach the drilling points, since crossing

through farms is unavoidable, especially during the rainy season, large vehicles mounted with heavy equipment required for construction works frequently become stalled along unmaintained roads after the rains. For this reason, since this kind of works is usually not executed during the heavy rainfall months of January to March in Zambia, works for this project will also be stopped during these 3 months.

(2) Hydrogeology

The geological map and geological classification are shown in Section 1-2-1-2 and geological formations are listed in the following table.

Based on results of geological field reconnaissance and 416 drillings from “Phase I Project” and “Phase II Project”, the basic policies for groundwater development will as explained below.

The granitic rock distributed areas of basement rock formations have become highly weathered sands and clays down to depths of 20m to 30m. In some areas, weathering down to further depths can be conceived. Since permeability of sandy portions are higher than clayey portions, in areas weathered in deeper layers, groundwater development will target those depths. Also, in areas comprised of relatively fresh rocks in the whole area, large fractured areas will be targeted for groundwater development as much as possible. In areas distributed with meta-volcanic rocks and meta-quartzites as basement, since groundwater development success rates are low, fractured zones will be carefully searched while assessing topographic lineaments.

The Muva supergroup consists of sandstones, quartzites, shale and their alternations. Since possibility for development in the shale layer is expected to be low, sandstones and quartzites will be targeted. However, due to low permeability of the bedrock, development of fissure water in fractured zones will be pursued. In areas of lithofacies where many fault lineaments can be observed, good development of fractured or sheared zones can be expected. Development will be conducted upon fully identifying the tendencies of these lineaments.

With the exception of Mansa District and western part of Milenge District, the project area is distributed by the Katanga supergroup. Although sandstones and conglomerates are predominant in the whole area, some areas show predominance of shale where possibilities for groundwater development is low. In areas distributed with horizontal bedrocks consisting of sandstones and conglomerate with bed thicknesses less than 1cm, groundwater exists inside voids of conglomerates and around bed planes to form good aquifers. In areas where weathering of sandstones and conglomerates have advanced and sandy and gravelly materials are distributed, aquifers equivalent to unconsolidated layers of sand and gravel can be expected.

However, since such weathered bedrocks also contain many clay and silt resulting in low permeability in some areas, careful attention is needed. In areas consisting of hard agglomerates of sandstones and conglomerates with relatively few fractures, since possibilities for occurrence of groundwater are low except in relatively concentrated fractured zones, groundwater development will be carried out by carefully exploring the fractured zones.

The average success rate of 447 boreholes drilled (328 successful and 119 unsuccessful) during "Phase I Project" and "Phase II Project" was 73% and the breakdown of this figure into geological formations is as follows.

Geological Formation	Borehole Drilling Success Rate
Alluvium	100.0%
Katanga Supergroup	76.0%
Muva Supergroup	77.8%
Basement Rocks	74.6%
Intrusive Rocks	34.4%

Although distribution range of intrusive rocks is limited, success rates of this formation are very high. Alluviums are distributed along lakes and rivers and their success rates are high. The success rates of the remaining 3 formations are similar, but the success rates for the Muva supergroup and Katanga supergroup of sedimentary rocks are slightly higher.

Candidate points for drilling will be selected giving priority to demands of local residents in accordance with hydrogeological conditions through results of field reconnaissance and geophysical soundings. In addition, the selection will give careful considerations on the possibilities of groundwater contamination from domestic wastewater and other community activities.

(3) Water Quality

The Zambian Water Quality Standard is shown in Section 1-2-1-3. For pH value, although the Zambian standard is 6.5–8.0, groundwater of the project target area shows pH levels of 5.0-6.0. Since the present drinking water standards of WHO does not set a health-based guideline value for pH and these levels do not affect human health, in this project, the pH value will be set at 5.0 or above similar to the "Phase II Project".

2-2-1-3 Policy for Social and Economic Conditions

(1) Community's Willingness and Ability to Bear the Cost of Operation and Maintenance Costs

For the Operation and Maintenance (O&M) costs of the water supply schemes constructed under the Project, the Project will adhere to the Zambian policy of full cost recovery through collection of user fees stipulated in the National Water Policy (1994, 2010) and the NRWSSP. Water fees should be decided with considerations to both the community's willingness to pay (WTP) and ability to pay (ATP) as well as cost of the facilities O&M. Therefore, the community members' WTP and their ATP studied under the socio-economic survey of the Project are used for project design in determining the scale and specifications of the facilities, and facilities O&M costs that are affordable. Details of O&M cost estimations and affordability study using WTP and ATP for each facility type is described in Section 2-5-2 "Operation and Maintenance Cost".

(2) Hygiene Situation

Under the socio-economic survey conducted in candidate sites for construction of boreholes fitted with hand pumps and small piped water supply schemes (1,861 samples from sites for boreholes fitted with hand pumps, and 160 samples from sites for small piped water supply schemes are collected respectively), the majority of the surveyed households identified intestinal infections such as diarrhoea, dysentery and cholera as major diseases that affect households. The prevalence of diseases which could be prevented through good hygiene practices indicates lack of hygienic practices and information in the communities. This is adduced by the survey's findings that the communities' recognition of causes for diarrhoea is weak, with many identifying a cause as "contaminated drinking water" but very few pointing out "handling food inappropriately". Importance is given, therefore, to include hygiene education as part of the software component programme in order to maximise the benefits of safe water provided through the constructed water supply schemes. In confirming to the WASHE (Water, Sanitation and Health Education) approach that promotes sanitation dissemination coupled with water supply and environmental hygiene improvement, the Project will promote hygiene education through software component.

2-2-1-4 Policy on Construction / Procurement

All contractors for construction works in Zambia are required to register with the National Council for Construction. They are classified from grade "1" to grade "6", and the scale of the public works which they can engage is decided based on the grade. The top level is grade "1"

for which most of them are foreign construction firms. For construction of piped water supply schemes, from the viewpoint of technical expertise and financial stability, use of contractors of high grade is most suitable.

On the other hand, construction of boreholes fitted with hand pumps and iron-removal plants is planned to be carried out by local drilling companies. Many experienced drilling companies of origins such as India and China are available in the country. The contractor is to be selected based on experiences of the previous “Phase I Project” and “Phase II Project” as well as results of the study.

Construction materials required for this project, such as cement, reinforced bars, aggregates, gravel for boreholes, plastic products (polyvinyl chloride pipes and polyethylene pipes) are locally available. Equipment such as submersible motor pumps, pump control equipment, PV modules, chlorination equipment, valves and hand pumps are imported products but available locally. Locally available materials were confirmed to be satisfactory in quality. Therefore, they are planned to be utilized in this project. Moreover, since manufacturers' local agencies have their offices in the capital, Lusaka, and industrial town of Kitwe, imported products procurable from these local agencies will be used in consideration of effectiveness in operation and maintenance.

2-2-1-5 Policy on Use of Local Companies

Concerning construction of boreholes with hand pumps, many drilling companies are available in the country and several contractors have abundant work experience with borehole construction in districts away from Lusaka. These drilling companies have enough technical capabilities and financial resources to work as a subcontractors for this project.

Moreover, some foreign construction companies with sufficient construction records including experiences as subcontractors for Japanese projects can be found. Therefore, these local companies will be preferably used for the project, partly for activating local economy, creating local employment opportunities and transferring construction technologies to these companies. However, constructing the planned facilities under the guidance and supervision of the Japanese contractor is essential for quality, safety and schedule control of the works.

2-2-1-6 Policy on Operation and Maintenance

The types of water supply schemes recognized under NRWSSP in rural areas are boreholes

fitted with hand pumps and protected shallow wells. This is due to the fact that selection of water supply technology in the country has been determined by administrative boundaries where rural areas are demarcated with boreholes with hand pumps and urban and peri-urban areas with piped water supply schemes. The O&M structure also has been determined accordingly: for rural areas, the community formed V-WASHEs take the main O&M responsibilities of their water supply schemes, while for urban areas, the eleven Commercial Utilities (CUs)[2], who are given authority to provide water and sewerage services by DLAs, are in charge of O&M for the entire system under the license provided by National Water Supply and Sanitation Council (NWASCO). Thus, in Zambia, the O&M structure for rural water supply is designed with boreholes fitted with hand pumps in mind.

MLGH developed, as part of NRWSSP efforts, the National O&M guidelines (2007). The guidelines state 5 O&M principles of, 1) cost sharing by communities, 2) sustainable supply chains, 3) O&M mechanisms, 4) choice of appropriate technology, and 5) capacity building. The government also published the O&M Manual (2010) describing steps and methodologies to establish the O&M structure for boreholes fitted with hand pumps, and advocating for establishment of the following 5 mechanisms at each district:

1) Community Contribution Mechanism
2) Repair Work Mechanism
3) Toolkit Management Mechanism
4) Supply Chain Mechanism of Spare Parts
5) Monitoring Mechanism

The Project conforms to the above approach, adopting a community based O&M structure for the schemes to be constructed under the Project, and will provide support for capacity development of V-WASHEs in the target sites.

On the other hand, nationally established O&M structures for piped water supply schemes in rural settings do not exist. MLGH is going through discussions to renew the current policy by formulating the National Water Supply and Sanitation Policy. The methodology for selecting water supply technology is being amended not to depend on administrative boundaries, and consequently the O&M structure for piped water supply schemes also is being reconsidered. Some of the suggestions include structures where CUs manage piped water supply schemes regardless of their location, or where V-WASHEs manage the schemes with some activities

[2] Seven other private water schemes are operating under NWASCO license in order to secure domestic water for their employees and for productive activities, aside from their main productive activities as a company.

beyond their capacities being delegated to CUs.

Involvement of user communities, who can carry out daily scheme operation and preventative maintenance at the community level, is crucial for O&M of piped water supply schemes in rural areas, both in term of practicality and sustainability. However, if repair and replacement activities that require technical skills cannot be taken care of by the communities is needed, involvement of LuaWSC or private companies also becomes necessary.

To develop the most pertinent O&M plan based on current situation on the ground, the Project examined capacities and roles of existing actors in the target areas concerning O&M of piped water supply schemes in rural areas, and evaluated the following 5 O&M options.

1. V-WASHE managed:	Daily operation and maintenance by V-WASHE; small repairs by communities; major rehabilitations and replacements of facilities contracted to private companies
2. V-WASHE managed:	Daily operation and maintenance by V-WASHE; small repairs by communities; major rehabilitations and replacements of facilities contracted to LuaWSC.
3. V-WASHE managed:	Daily operation and maintenance by communities; small repairs, major rehabilitations and facilities replacements contracted to LuaWSC.
4. V-WASHE managed:	V-WASHE signs a concession contract with LuaWSC to manage the entire scheme according to the method agreed in the contract; LuaWSC reports the operational performance to V-WASHE, who monitors the state of O&M and makes payments to LuaWSC.
5. LuaWSC managed:	Management rights of the scheme is transferred to the LuaWSC to provide full water provision services and O&M of the scheme; involvement of communities will be minimum.

Following the evaluation, the Project discerned that O&M structure No. 1, where the V-WASHE and communities manage the majority of O&M activities of the scheme except for technical matters of major rehabilitations and replacements which need involvement of private companies, as the most suitable option. Section 2-4-2 describes the details of the evaluation of different O&M options.

2-2-1-7 Policy on Grade of Facilities

(1) Boreholes with Hand Pumps

One of the schemes to be constructed in this project is boreholes fitted with hand pumps, but if the iron contents of water exceeds the Zambian guideline value (1 mg/ℓ), the borehole will be considered as being unsuccessful, and basically iron removal plants will be installed.

The type of hand pumps to be adopted will be those having possibilities for procuring parts from the spare parts shops in each district constructed in SOMAP3 being promoted by DHID of MLGH.

Furthermore, pH values of groundwater in the project target area are often 5 to 6 showing acidic properties. Therefore, in selecting hand pumps, considerations are necessary to select steel parts coming in contact with water which are acid resistant. As a consequence, hand pumps not using metal for water contacting parts will be preferentially installed.

(2) Piped Water Supply Schemes

Although standards for drinking water quality and unit water supply rate issued by Zambia Bureau of Standard are available, design criteria and standards related to piped water supply schemes are not yet prepared. As a result, designs are often based on standards of donor countries, such as EU regional standard and British national standard. In this project, designs and construction works are to be conducted principally in accordance with international standards or Japanese standards. However, the project will apply related laws and regulations of Zambia wherever possible. Moreover, from a sustainability point of view, specifications will be determined on the assumption that spare parts can be procured locally or from neighboring countries at low costs.

2-2-1-8 Policy on Construction Method and Schedule

(1) Policy on Construction Method

The drilling method suitable for the Project area is rotary drilling with mud circulation method or down-the-hole (DTH) hammer method, taking into account geologic features of the local areas and construction period. Drilling rigs suitable for these drilling methods include truck mounted top head drive rigs or table type rigs that are most frequently used in Zambia. As drilling capacities for these equipment, the completed drilling diameter should be 203mm (8”) for mud circulation method and 152mm (6 1/4”) for DTH method, and capable of drilling down to 100m depths.

Regarding construction of reinforced concrete foundations for hand pumps and appurtenant facilities including concrete aprons, drainage ditches and soakaway pits as well as iron removal plants, these will be constructed by manpower due to their small scales.

Since works necessary for construction of piped water supply schemes are general civil works, a special construction method is not required, but construction will be carried out by combined use of general-purpose construction machineries and manpower. Construction machineries such as concrete mixers and backhoes are locally available and therefore, basically they will be procured in the local market.

(2) Policy on Construction Schedule

The number of days required for the construction works is estimated based on results of "Phase I Project" and "Phase II Project" implemented at the same target area of this Project. From past experiences, constructing a total of 8 successful boreholes per month by one team is considered to be possible. The Japanese contractor is advised to hire local drilling companies as subcontractors for the sake of cost reduction. Borehole drilling works are scheduled to be carried out with a maximum of 3 teams in consideration of their capabilities as well as construction supervision by the Japanese contractor. In addition, since heavy machineries such as drilling rigs and cargo trucks would have difficulties in access to the drilling sites during the rainy season, borehole drilling works will be halted during that period. Therefore, drilling works are scheduled based on a total of 9 months per year excluding the 3 months of the rainy season.

The piped water supply scheme consists of concrete works that include construction of distribution tanks and machinery houses, as well as electrical works such as installation of submersible motor pumps. Among this, plumbing works are identified as the works most critical in terms of time scheduling when materials procurement within the construction period is considered. Therefore, careful considerations on effective crew formation and suitable scheduling are needed in order to complete the construction works within the specified timeframe.

At the site in Nchelenge District where spring is used as water source, the groundwater level rises during the rainy season to cause difficulties in trenching. At the site in Milenge District, access to the site by heavy machines becomes difficult during the rainy season. Therefore, construction works at these sites are scheduled to be carried out during the dry season between April and September.

2-2-2 Basic Plan (Construction Plan)

2-2-2-1 Overall Plan

(1) Contents of the Request

1) Facilities Construction

・Boreholes fitted with hand pumps

Construction of boreholes fitted with hand pumps at a total of 320 sites in 4 districts (Nchelenge, Mwense, Mansa, Milenge) of Luapula Province

・Piped water supply schemes

Construction of piped water supply schemes at a total of 8 sites in 3 districts (Nchelenge, Mwense, Milenge) of Luapula Province

2) Technical Assistance

Implementation of software component programme to support the following issues.

・Roles and activities of V-WASHEs on operation and maintenance of water schemes
・Method of repairing hand pumps (TOT for area pump menders)
・Operation and maintenance of water schemes using solar energy
・TOT on operation and maintenance of iron removal plants (IRPs)
・Hygiene and sanitation education and sensitization
・Practical training on operation and maintenance of hand pumps to communities

(2) Number of Project Target Sites

The number of project target sites, as described in 2-2-1-1(3), is 200 boreholes fitted with hand pumps and 5 piped water supply schemes based on results of the socio-economic survey and restriction in construction period of one year.

1) Boreholes with Hand Pumps

As a result of screening based on results of the socio-economic survey carried out during the Preparatory Survey, 254 sites out of the requested 320 sites were identified as having possibilities for new groundwater developments under the Project. On the other hand, due to the construction period restriction of one year, the possible number of construction sites for the Project is 200. Then the remaining 54 sites will be treated as alternative sites in case 200 successful boreholes cannot be obtained due to local geological characteristics. Lists indicating the selection results of site classifications for each district are shown below. Screening lists are shown in Appendix 8-1. Maps showing the project site locations for each district are presented in Appendix 8-2.

Table 2-4 List of Project Sites

1. List of Project Target Sites for Nchelenge District

Site Code	Site Name	Population	Priority	Result
NCIII-02	Mukumbwa	1,850	1	Project
NCIII-46	Mweru Primary School	150	2	Project
NCIII-88	Siseli	7,750	3	Project
NCIII-87	Chafuma	6,222	4	Project
NCIII-17	Mukanso	5,750	5	Project
NCIII-66	Mutabwa	3,250	6	Project
NCIII-57	Kafwala	3,200	7	Project
NCIII-51	Kaseka B (Lakeside)	3,028	8	Project
NCIII-43	Daison	2,750	9	Project
NCIII-80	Shichishipula	2,750	10	Project
NCIII-47	Katuna	2,505	11	Project
NCIII-27	Mukange	2,500	12	Project
NCIII-41	Kabulo	2,500	13	Project
NCIII-42	Elyabu	2,500	14	Project
NCIII-48	Yanga	2,500	15	Project
NCIII-64	Kasheta	2,500	16	Project
NCIII-24	Mulwe	2,450	17	Project
NCIII-70	Shimpundu	2,327	18	Project
NCIII-04	Seketeni	2,319	19	Project
NCIII-68	Mulonda	2,250	20	Project
NCIII-07	Chapita	2,000	21	Project
NCIII-22	Chipayeni	2,000	22	Project
NCIII-23	Chipakila	1,750	23	Project
NCIII-60	Chimpulumba	1,750	24	Project
NCIII-67	Kambwali Local Court	1,550	25	Project
NCIII-20	Chinyanta	1,500	26	Project
NCIII-44	Mutono 1	1,500	27	Project
NCIII-53	Shindoni	1,500	28	Project
NCIII-84	Samashi	1,500	29	Project
NCIII-45	Mutono 2	1,450	30	Project
NCIII-36	Nakafwaya Central	1,425	31	Project
NCIII-86	Sekeleti	1,350	32	Project
NCIII-09	Mushili	1,250	33	Project
NCIII-58	Chofwe Kabila	1,200	34	Project
NCIII-06	Chikange	1,100	35	Project
NCIII-08	Kaeketi	1,100	36	Project
NCIII-11	Chipulumushi	1,000	37	Project
NCIII-79	Kalubuli	1,000	38	Project
NCIII-89	Chishima	1,000	39	Project
NCIII-54	Kanwa	950	40	Project
NCIII-72	Matete	950	41	Project
NCIII-63	Belu	900	42	Project
NCIII-30	Mfundawula	876	43	Project
NCIII-39	Mubanga	750	44	Project
NCIII-50	Mubamba B	700	45	Project
NCIII-52	Kasonkomona	700	46	Project
NCIII-76	Mutepuka Main	700	47	Project
NCIII-71	Chibi	637	48	Project
NCIII-03	Katuta	600	49	Project
NCIII-81	Kaputo	550	50	Project
NCIII-61	Miyemba	500	51	Project
NCIII-14	Mutete	470	52	Project
NCIII-65	Lupili	450	53	Project
NCIII-21	Muselu	422	54	Project
NCIII-16	Choncho	400	55	Project
NCIII-59	Labani	350	56	Project
NCIII-83	Chula	350	57	Alternative
NCIII-10	Kalipe	285	58	Alternative
NCIII-15	Labi	220	59	Alternative
NCIII-01	Mutiwanama	200	60	Alternative
NCIII-73	Chimpulumba	170	61	Alternative
NCIII-75	Mutepuka-Filubo Section	160	62	Alternative
NCIII-25	Nalukoji	150	63	Alternative
NCIII-34	Kanguluma	140	64	Alternative
NCIII-05	Bulaya	100	65	Alternative
NCIII-19	Chomba	70	66	Alternative
NCIII-35	Chisushi	70	67	Alternative
NCIII-29	Mateyo	60	68	Alternative
NCIII-37	Lukokesha	50	69	Alternative
NCIII-26	Swaba	49	70	Alternative
NCIII-33	Katele	Inaccessible		Cancelled
NCIII-18	Kapambwe Section 1	Inaccessible		Cancelled
NCIII-82	Kabuta East	Inaccessible		Cancelled
NCIII-77	Chansa Fisali	Project overlap		Cancelled
NCIII-28	Kampampi	Project overlap		Cancelled
NCIII-85	Chishima	For piped scheme		Cancelled
NCIII-49	Mubamba Primary School	Project overlap		Cancelled
NCIII-38	Kanyembo East	Inaccessible		Cancelled
NCIII-74	Pingwila	Inaccessible		Cancelled
NCIII-56	Block 6	Inaccessible		Cancelled
NCIII-55	Block 4	Inaccessible		Cancelled
NCIII-90	Musafili	Inaccessible		Cancelled
NCIII-31	Chifungula	Inaccessible		Cancelled
NCIII-69	Block 3	Inaccessible		Cancelled
NCIII-32	Nakafwaya	Low demand		Cancelled
NCIII-62	Lembati	Low demand		Cancelled
NCIII-13	Chabilikila Section 2	Low demand		Cancelled
NCIII-78	Lumbanama	Low demand		Cancelled
NCIII-40	Chandwe	Low demand		Cancelled
NCIII-12	Chabilikila Section 1	Low demand		Cancelled

2. List of Project Target Sites for Mwense District

Site Code	Site Name	Population	Priority	Result
MWIII-61	Kanchinshi Community School	720	1	Project
MWIII-62	Chibondo Primary School	450	2	Project
MWIII-45	Muchinga Community School	141	3	Project
MWIII-02	Chiengwe	6,500	4	Project
MWIII-90	Bundebunde	5,392	5	Project
MWIII-77	Chalwe West	4,600	6	Project
MWIII-84	Chakwangasha	2,983	7	Project
MWIII-26	Kapena	2,495	8	Project
MWIII-27	Kaswika	2,400	9	Project
MWIII-28	Mumpolokoso	2,090	10	Project
MWIII-37	Shingwe	1,250	11	Project
MWIII-78	Chalwe East	1,183	12	Project
MWIII-97	Kabusha South	1,160	13	Project
MWIII-100	Kambule	950	14	Project
MWIII-99	Chibende	850	15	Project
MWIII-17	Twaba A	807	16	Project
MWIII-18	Twaba B	807	17	Project
MWIII-63	Losa Mukunkutu	720	18	Project
MWIII-31	Kashingwa	580	19	Project
MWIII-67	Punaya	574	20	Project
MWIII-16	Mutoto	568	21	Project
MWIII-79	Chibumbu North	530	22	Project
MWIII-22	Muyembe	517	23	Project
MWIII-01	Chombe	500	24	Project
MWIII-20	Mukopa A	500	25	Project
MWIII-70	Chiwasha	500	26	Project
MWIII-14	Nandwe	495	27	Project
MWIII-29	Chikonkolo	490	28	Project
MWIII-46	Chatukwa	490	29	Project
MWIII-93	Chitasu	490	30	Project
MWIII-50	Lubamba	480	31	Project
MWIII-41	Chibundu	456	32	Project
MWIII-15	Kampamba	410	33	Project
MWIII-35	Shichama East	400	34	Project
MWIII-12	Mwenso	389	35	Project
MWIII-49	Ndebe	375	36	Project
MWIII-13	Lundumuna	370	37	Project
MWIII-52	Mushashi	365	38	Project
MWIII-68	Musalula	360	39	Project
MWIII-94	Ponga	360	40	Project
MWIII-72	Mofati	350	41	Project
MWIII-32	Malitini	315	42	Project
MWIII-21	Mukopa B	300	43	Project
MWIII-56	Chisokobwe	300	44	Project
MWIII-36	Kateule South	287	45	Project
MWIII-25	Chisonge	280	46	Project
MWIII-57	Kapesha	261	47	Project
MWIII-51	Matente	258	48	Project
MWIII-74	Muchisha	256	49	Project
MWIII-54	Mutanti	252	50	Project

Site Code	Site Name	Population	Priority	Result
MWIII-34	Kambo	250	51	Project
MWIII-55	Nabashila	250	52	Project
MWIII-80	Chikumbi	250	53	Project
MWIII-91	Lukumani	250	54	Project
MWIII-40	Kabila	240	55	Project
MWIII-73	Chibamba	240	56	Project
MWIII-64	Mweshi	239	57	Project
MWIII-07	Namfumu Wakatindi	200	58	Project
MWIII-11	Kusengu	200	59	Project
MWIII-23	Tonde	200	60	Project
MWIII-42	Kateule	200	61	Project
MWIII-44	Rosa Mukuntu	200	62	Project
MWIII-58	Benard	200	63	Project
MWIII-85	Fisaka	200	64	Alternative
MWIII-76	Kapotwe	192	65	Alternative
MWIII-39	Motondo	189	66	Alternative
MWIII-33	Shichilenge	174	67	Alternative
MWIII-96	Chitupi	172	68	Alternative
MWIII-08	Kalumba	170	69	Alternative
MWIII-19	Kabangwe	170	70	Alternative
MWIII-30	Kasanda	160	71	Alternative
MWIII-98	Kantondi	160	72	Alternative
MWIII-03	Musangati	150	73	Alternative
MWIII-38	Chakwa	150	74	Alternative
MWIII-75	Tondo	146	75	Alternative
MWIII-65	Sitwala	138	76	Alternative
MWIII-53	Poleni	137	77	Alternative
MWIII-89	Kabuta	135	78	Alternative
MWIII-48	Chilongoshi	130	79	Alternative
MWIII-83	Simaria B	130	80	Alternative
MWIII-87	Sitima	114	81	Alternative
MWIII-43	Black	104	82	Alternative
MWIII-06	Chifuba	100	83	Alternative
MWIII-59	Tangwe	100	84	Alternative
MWIII-95	Maisa	100	85	Alternative
MWIII-86	Chelekubi	80	86	Alternative
MWIII-10	Chimbini	68	87	Alternative
MWIII-47	Halland	68	88	Alternative
MWIII-66	Jacobo	60	89	Alternative
MWIII-05	Shikabila	32	90	Alternative
MWIII-60	Kayanike	Inaccessible		Cancelled
MWIII-71	Kapala	For piped scheme		Cancelled
MWIII-81	Kapakala East	For piped scheme		Cancelled
MWIII-04	Mubuka	Low demand		Cancelled
MWIII-24	Mutamba	Low demand		Cancelled
MWIII-09	Chibwe Kabuta	Low demand		Cancelled
MWIII-88	Kapondo	Low demand		Cancelled
MWIII-92	Kalasa	Low demand		Cancelled
MWIII-82	Kapakala West	Low demand		Cancelled
MWIII-69	Kawama B	Low demand		Cancelled

3. List of Project Target Sites for Mansa District

Site Code	Site Name	Population	Priority	Result
MAIII-20	Mulala Primary School	2,608	1	Project
MAIII-48	Mwela Primary School	380	2	Project
MAIII-47	Fibobo Community School	310	3	Project
MAIII-31	Fiyongoli Primary School	220	4	Project
MAIII-46	Chile Community School	100	5	Project
MAIII-23	Kasanga-1 Health Post	1,331	6	Project
MAIII-24	Lusaya	4,806	7	Project
MAIII-22	Chipense	3,857	8	Project
MAIII-58	Sumbu B	3,500	9	Project
MAIII-26	Mumbwe	2,700	10	Project
MAIII-59	Chikuwe 2	2,570	11	Project
MAIII-60	Kasheshe	2,280	12	Project
MAIII-08	Chiputa	2,000	13	Project
MAIII-14	Mbulwa	1,876	14	Project
MAIII-18	Kabengele	1,850	15	Project
MAIII-16	Chikoyi	1,704	16	Project
MAIII-32	Mounga Village	1,600	17	Project
MAIII-55	Maikeneke Market	1,250	18	Project
MAIII-19	Sande Facite	840	19	Project
MAIII-25	Chambo	770	20	Project
MAIII-36	Kansapule	683	21	Project
MAIII-29	Nshenda	602	22	Project
MAIII-50	Chimpala	544	23	Project
MAIII-09	Katanga	542	24	Project
MAIII-04	Sambe	516	25	Project
MAIII-21	Kaisala	480	26	Project
MAIII-06	Matenda	450	27	Project
MAIII-54	Kolota	450	28	Project
MAIII-13	Lukupwa	420	29	Project
MAIII-17	Obedi	420	30	Project

Site Code	Site Name	Population	Priority	Result
MAIII-56	Lemmy	379	31	Project
MAIII-33	Lukali	360	32	Project
MAIII-37	Mashatini	354	33	Project
MAIII-34	Langi	352	34	Project
MAIII-03	David Chilambe	350	35	Project
MAIII-30	Mapesa	350	36	Project
MAIII-49	Lole	312	37	Project
MAIII-02	Fitobola	300	38	Project
MAIII-07	Matipa	300	39	Alternative
MAIII-43	Yasakwa Lay By	300	40	Alternative
MAIII-45	Chopote	270	41	Alternative
MAIII-15	Kasaka	259	42	Alternative
MAIII-57	Sumbu A	240	43	Alternative
MAIII-11	Sakeni	222	44	Alternative
MAIII-05	Kalikeka	220	45	Alternative
MAIII-12	Chaiwa	200	46	Alternative
MAIII-35	Chbende	170	47	Alternative
MAIII-44	Sunday	160	48	Alternative
MAIII-52	Matipa	150	49	Alternative
MAIII-40	Mpembea	105	50	Alternative
MAIII-10	Mpota	102	51	Alternative
MAIII-41	Katangwe A	Inaccessible		Cancelled
MAIII-51	Mofat 1	Inaccessible		Cancelled
MAIII-01	Chabwe 2	Project overlap		Cancelled
MAIII-28	Kafusha	Inaccessible		Cancelled
MAIII-53	Musenga Primary School	Inaccessible		Cancelled
MAIII-38	Kasongolole	Inaccessible		Cancelled
MAIII-27	Chimoto	Inaccessible		Cancelled
MAIII-42	Katangwe B	Inaccessible		Cancelled
MAIII-39	Jim	Inaccessible		Cancelled

4. List of Project Target Sites for Milenge District

Site Code	Site Name	Population	Priority	Result
MLIII-01	Lwela Secondary School	650	1	Project
MLIII-53	Shitambuli Primary School	300	2	Project
MLIII-49	Mumbotuta Primary School	260	3	Project
MLIII-50	Changwe-Lungo Primary School	250	4	Project
MLIII-48	Kanyesha	5,500	5	Project
MLIII-17	Chipundu	5,400	6	Project
MLIII-59	Katena	3,579	7	Project
MLIII-20	Ng'Anda Imo	1,800	8	Project
MLIII-12	Helena Musonda	1,200	9	Project
MLIII-29	Saimoni	850	10	Project
MLIII-60	Lesa Mukali	786	11	Project
MLIII-70	Mashika	750	12	Project
MLIII-16	John Nkumba	691	13	Project
MLIII-05	Pollen	680	14	Project
MLIII-19	Fikombo	680	15	Project
MLIII-44	Muselenga	680	16	Project
MLIII-04	Nkumbula	665	17	Project
MLIII-06	Milomo	640	18	Project
MLIII-03	Mpite	630	19	Project
MLIII-35	Kabola	630	20	Project
MLIII-62	Sailas	482	21	Project
MLIII-11	Chengo	480	22	Project
MLIII-31	Chimese	480	23	Project
MLIII-10	Chilimabwe	478	24	Project
MLIII-43	Kabunda	460	25	Project
MLIII-09	Muluka	455	26	Project
MLIII-02	Bene Kund	430	27	Project
MLIII-47	Pwele	400	28	Project
MLIII-61	Masheto	400	29	Project
MLIII-45	Chansange	380	30	Project
MLIII-52	Changwe Village	380	31	Project
MLIII-69	Chilufy Kabinda	380	32	Project
MLIII-46	Stephano	350	33	Project
MLIII-07	Goliat	340	34	Project
MLIII-30	Thomas	330	35	Project

Site Code	Site Name	Population	Priority	Result
MLIII-13	Kasepa	307	36	Project
MLIII-08	Chituta	300	37	Project
MLIII-42	Sakeni	230	38	Project
MLIII-66	Kalali	132	39	Project
MLIII-58	Kaloko	110	40	Project
MLIII-18	Kampemba	80	41	Project
MLIII-36	Mukonkani	54	42	Project
MLIII-14	Loyi Mwape	30	43	Project
MLIII-41	Sando	Inaccessible		Cancelled
MLIII-15	Milenge Secondary School	Project overlap		Cancelled
MLIII-40	Kashila	Inaccessible		Cancelled
MLIII-37	Mogani Mulelema	Inaccessible		Cancelled
MLIII-39	Ponga-Ponga 2	Inaccessible		Cancelled
MLIII-26	Kabesa	Inaccessible		Cancelled
MLIII-34	Tali Meke	Inaccessible		Cancelled
MLIII-38	Ponga-Ponga	Inaccessible		Cancelled
MLIII-51	Allan Senga	Inaccessible		Cancelled
MCIII-54	FitikoO	Inaccessible		Cancelled
MCIII-55	Ng'Omba	Low demand		Cancelled
MCIII-65	Musumali	Low demand		Cancelled
MCIII-64	Mwangula	Low demand		Cancelled
MCIII-67	Kalamba	Low demand		Cancelled
MCIII-57	Kokonsholo	Low demand		Cancelled
MCIII-56	James	Low demand		Cancelled
MLIII-63	Kapu	Low demand		Cancelled
MLIII-68	Thomas	Low demand		Cancelled
MLIII-21	Mpanse	Inaccessible		Cancelled
MLIII-22	Lumfilwa	Inaccessible		Cancelled
MLIII-23	Chungu	Inaccessible		Cancelled
MLIII-24	Chisengele	Inaccessible		Cancelled
MLIII-25	Mulala	Inaccessible		Cancelled
MLIII-27	Lupiya	Inaccessible		Cancelled
MLIII-28	Lupiya 2	Inaccessible		Cancelled
MLIII-32	Lungo Mukuta	Inaccessible		Cancelled
MLIII-33	Lungo Mukuta 2	Inaccessible		Cancelled

2) Piped Water Supply Schemes

As candidate sites for construction of piped water supply schemes, 5 sites were chosen following the procedure explained in 2-2-1-1 (3). Among the 5 sites, at 4 sites using groundwater as water source (3 in Mwense District and 1 in Milenge District), water supply schemes would be constructed if development potentials can be confirmed and enough yields can be secured through test drillings. The test drilling locations were decided totally from topographical reconnaissance and results of geophysical surveys (electric prospecting). The results of test drillings are shown in Table 2-5.

Table 2-5 Results of Test Drillings

District Name	Site Name	Drilling Code	Drilling Depth (m)	Work Description	Final Discharge (ℓ/min)
Mwense	Kapala	No.1	102	Drilling of 6.5 inch hole	(0) Backfilled
		No.2	102	Drilling of 6.5 inch hole	(0) Backfilled
		No.3	92	Drilling of 6.5 inch hole	(0) Backfilled
		No.4	128	Casing with 6 inch pipe	200
	Musangu	No.1	102	Drilling of 6.5 inch hole	(5) Backfilled
		No.2	134	Casing with 8 inch pipe	400
	Kapakala	No.1	111	Drilling of 6.5 inch hole	(5) Backfilled
		No.2	97	Casing with 8 inch pipe	360
Milenge	Milenge	No.1	106	Casing with 6 inch pipe	140
		No.2	106	Drilling of 6.5 inch hole	(25) Backfilled
		No.3	106	Casing with 6 inch pipe	25

N.B.: ・For Work Description
Drilling refers to drilling only, as a result of insufficient discharge.
Casing refers to inserting casing as a result of sufficient discharge through drilling.
・Final Discharge means the pumping rate obtained by pumping test.

As results of test drillings at 4 sites, enough discharges to cover the target populations for Kapala, Musangu and Kapakala were secured. However, for Milenge, since the water discharge was only 1/3 of the expected flow rate, the service population had to be reduced to 1/3 of the target population. For reasons mentioned above, piped water supply schemes will be constructed at the 4 sites where test drillings were conducted.

For Kabuta site in Nchelenge District, as the result of spring yield survey, water discharge from the natural spring is sufficient to supply the target population. Consequently, piped water supply schemes will be constructed at 5 sites in total.

The water quality analyses results for water sources of those 5 sites are shown in Table 2-6. For samples from the 4 drilling sites in Mwense and Milenge Districts, all parameters satisfied the Zambian Standard. From the sample of the spring in Nchelenge, bacteria were detected. The cause for this was considered to be that the spring water was contaminated along the ground surface. However, since the water to be supplied will be chlorinated, the problem can be resolved.

Table 2-6 Results of Water Quality Analyses for 5 Piped Water Supply Scheme Sites

Parameter	Unit	Zambian Standard	Nchelenge District		Mwense District						Milenge Distirct	
			Kabuta		Kapala		Musangu		Kapakala		Milenge	
			Source: spring		Source: borehole		Source: borehole		Source: borehole		Source: borehole	
			Site	Lab	Site	Lab	Site	Lab	Site	Lab	Site	Lab
pH		6.5-8.0	6.0	6.64	6.8	6.60	5.1	5.55	6.9	6.89	6.9	6.86
EC	μs/cm		95.1		35.2		4.9		43.4		12.4	
Temperature	℃		25.9		26.2		25.0		25.2		23.8	
Taste			None		None		None		None		None	
Odor			None		None		None		None		None	
Color			Clear	7	Clear		Clear		Clear		Clear	
Turbidity			Clear	0.68	Clear		Clear		Clear		Clear	
Fe	mg/ℓ	1.0		0.09	<0.2	0.16	<0.2	0.09	<0.2	0.22	<0.2	<0.01
Total Hardness	mg/ℓ	500		92		148		nil		277		nil
Chloride	mg/ℓ	250		10		14.0		8.0		22.0		5.0
Lead	mg/ℓ	0.01		<0.01		<0.01		<0.01		<0.01		<0.01
Fluoride	mg/ℓ	1.5		0.05	0	0.12	0	0.04	0	0.14	0	0.02
Cadmium	mg/ℓ	0.005		<0.0002		<0.002		<0.002		<0.002		<0.002
Manganese	mg/ℓ	0.1		<0.01	<0.5	<0.01	<0.5	<0.01	<0.5	<0.01	<0.5	<0.01
Arsenic	mg/ℓ	0.05		<0.0002	0	<0.03	0	<0.03	0	<0.03	0	<0.03
Total Solid				60		179		43		243		7.2
Calcium Hardness				72		88		nil		156		nil
Alkalinity				90		138		22		270		12
Ammonia	mg/ℓ	1.5		<0.01		0.17		<0.01		<0,01		<0.01
Nitrogen Nitrite	mg/ℓ	0.100		0.003		0.019		0.004		0.009		0.001
Nitrogen Nitrate	mg/ℓ	10.0		0.18		1.11		<0.01		<0.01		<0.01
Boron				<0.3		<0.02		<0.02		<0.02		<0.02
Copper	mg/ℓ	1.0		<0.003		<0.003		<0.003		<0.003		<0.003
Calcium	mg/ℓ	200		28.8		32.0		nil		62.4		nil
Magnesium	mg/ℓ	150		4.8	10-20		0-1		10-20		2-5	
Coliform	#/m ℓ	0/100		14	0	0	0	0	0	0	0	0
Bacteria	#/m ℓ	0/100		44	0	0	0	0	0	0	0	0

N.B.: Site: Analysis at the site, Lab: Analysis in the laboratory

2-2-2-2 Facilities Construction Plan (Boreholes with Hand Pumps)

(1) Design Criteria

Taking into consideration the guidelines and designs that are traditionally and locally applied in the country, and experience of “Phase I Project” and “Phase II Project” as well as results of this Study, the following design criteria will be adopted for this Project.

Water supply scheme	:	Borehole fitted with hand pump and iron removal plant
Unit water supply rate	:	30ℓ/person/day adopted from unit water supply rate guidelines indicated in Zambia’s rural water supply program
Design service population	:	250 persons per hand pump
Design water supply rate	:	30ℓ x 250 persons = 7.5m^3/day

Specifications and design conditions for water supply schemes are shown in Table 2-7 below.

Table 2-7 Design Conditions for Boreholes fitted with Hand Pumps

Item	Specifications and Design Conditions
1. Success rate of borehole drilling	Based on the analysis of successful and unsuccessful boreholes of previous projects according to the geological group, 70.2% will be adopted.
2. In case of unsuccessful boreholes	In case the first attempt is unsuccessful, a second drilling will be carried out for a maximum of 2 drilling attempts at one site. In case the second attempt is judged as unsuccessful, groundwater potential in the area is assumed to be low. Then the site will be cancelled.
3. Number of sites targeted for water source development	Although originally 320 sites were requested, the number of boreholes implemented in this project taking into consideration the one-year construction period is 200.
4. Type of hand pump and standard accessories	The type of hand pump to be selected based on availability of spare parts, pumping water level and groundwater quality will be India Mark II or Afridev. The applicable dynamic water level for Afridev pumps will be modified from higher than -30m to higher than -35m. India Mark II pumps will be adopted for cases of dynamic water levels below -35m. Standard accessories: spare parts kits and maintenance tools
5. Water quality guidelines	Zambian standard ZS190:1990 guidelines will be adopted with the exception for pH being set as over 5.0
6. Installation of Iron Removal Plant (IRP)	In case iron content in groundwater exceeds the Zambian guideline, IRP designed in the "Phase II Project" will be installed. Since iron in groundwater can increase with time, a water quality monitoring period of two months after completion of the facilities will be arranged.
7. Unit water supply rate	30ℓ/person/day (*)
8. Design service population	250 persons per hand pump×200＝50,000 persons
9. Borehole discharge	Over 0.2ℓ/sec (*)
10. Borehole diameter (final drilling diameter)	For consolidated formations: not less than φ152mm (6-1/4") For unconsolidated formations: not less than φ213mm (8-1/2")
11. Borehole depth	Not less than 30m(*) with average of 58.2m
12. Pumping water level	Based mainly on hand pump characteristics: ・ Within 35m : Afridev ・ More than 35m : India Mark II
13. Casing pipes and screens	Nominal diameter of φ100mm (4")(*) or more, Material: PVC
14. Screen slot size	0.25mm to 1.0mm
15. Other conditions for drilling site selection	At least 30m away from pit latrines or any other source susceptible to contaminate groundwater, such as waste dumping sites.(*)
16. Others	Aprons, drainages and soakaways will be constructed, and the borehole will be completed with gravel packing, cementation and bottom plug. (*)

(*) National Guidelines for Sustainable Operation and Maintenance of Hand Pumps in Rural Areas, MLGH/JICA, 2007

(2) Facilities Design

1) Boreholes as Water Sources

All boreholes to be constructed within this project will be installed with casings, screens and gravel packing. Pumping tests were carried out to determine appropriate pumping yields. Furthermore, water quality analyses were conducted in the field and at public laboratories.

2) Types of Hand Pumps

Types of hand pumps to be installed as water source facilities will be of either India Mark-II (steel riser pipes and connecting rods) or Afridev (PVC riser pipes and stainless steel connecting rods), both being widely used in Zambia. The selection will depend on the dynamic water level of the borehole. In spite that recently new types of hand pumps are being manufactured (e.g., India Mark II using PVC or stainless steel riser pipes), the hand pump type will be selected in accordance with availability of spare parts in each district.

3) Appurtenant Facilities

At each site, a drainage channel and soakaway pit will be installed next to a circular-shaped apron, which is commonly adopted in Zambia. If water cannot easily infiltrate into the soil, a discharge with an open dispersion pan as the final outlet will be installed.

4) Iron Removal Plant

The iron removal plant will be of reinforced concrete structure (no water proof finishing will be applied for cost reduction).

(3) Setting Success Rates of Boreholes

According to the result of “Phase I Project”, the success rate was 75.5% (200 successful boreholes and 65 unsuccessful boreholes). In the “Phase II Project”, the success rate was 69.2% (216 successful boreholes and 96 unsuccessful boreholes) due to many unsuccessful boreholes in Mwense and Milenge Districts. Based on these results, success rates for each geological formation were examined following the procedure mentioned below.

- Using the geological map of Luapula Province, areas were classified into similar geological formations.
- Successful and unsuccessful boreholes of “Phase I Project” (135 boreholes in 4 districts) and “Phase II Project” (312 boreholes in 4 districts) were identified as to which geological group they are located in.
- Success rates for each geological group were calculated.

・Boreholes of “Phase III Project” were classified as to which geological group they belong to.
・By calculating “number of boreholes×success rate” for each geological group, the necessary number of borehole drillings were obtained.

The classification of geological formations is shown as follows.

Table 2-8 Geological Classification

Geological Era	Geological Formation	Geologic Characteristic	Geological Group
Cenozoic	Alluvium	Gravel, Sand, Clay	⑤
Paleozoic～ Pre-Cambrian	Katanga formation	Sandstone, Mudstone, Conglomerate, Shale	④
	Muva formation	Sandstone, Mudstone, Quartzite, Quartzite schist	③
Pre-Cambrian	Basement	Granite, Gneiss, Metamorphic igneous rock	②
Intrusive Rock		Basalt, Amphibolite	①

The success rates for each geological classification are as follows.

Table 2-9 Success Rates for Each Geology

Geological Group	Phase I Project			Phase II Project			Total			Success Rate (%)
	Successful Number	Unsuccessful Number	Total Number	Successful Number	Unsuccessful Number	Total Number	Successful Number	Unsuccessful Number	Total Number	
⑤	5	0	5	7	0	7	12	0	12	100.0
④	67	9	76	104	45	149	171	54	225	76.0
③	8	3	11	20	5	25	28	8	36	77.8
②	31	9	40	75	27	102	106	36	142	74.6
①	1	2	3	10	19	29	11	21	32	34.4
Total	112	23	135	216	96	312	328	119	447	73.4

Based on the above results, the success rates for this project were calculated as follows.

Table 2-10 Success Rates for "Phase III Project"

Geological Group	Success Rate for each Geology of Phase I and Phase II (%) (a)	Phase III Project	
		No. of Sites (b)	No. of Drillings (c)=(b)/(a)
⑤	100.0	6	6
④	76.0	117	154
③	77.8	1	1
②	74.6	62	83
①	34.4	14	41
Total		200	285
		Success Rate ⇒	70.2%

From the above results, the success rate of borehole drillings is estimated as 70.2%.

(4) Final Borehole Depths

The final depths of boreholes including successful and unsuccessful cases in "Phase I Project" was an average of 59.2m (135 boreholes) and for "Phase II Project", an average of 57.8m (312 boreholes). Therefore, the total average depth of boreholes was 58.2m. See the table below for details.

Table 2-11 Final Borehole Depths of "Phase I Project" and "Phase II Project"

District	Phase I Project (4 districts)		Phase II Project (4 districts)		Total	
	Drilled Number	Average Drilled Depth (m)	Drilled Number	Average Drilled Depth (m)	Drilled Number	Average Drilled Depth (m)
Nchelenge	29	57.1	93	58.9	122	58.5
Mwense	39	60.7	72	65.3	111	63.7
Mansa	34	60.1	72	52.1	106	54.7
Milenge	33	58.0	75	54.8	108	55.8
Total	135	59.1	312	57.8	447	58.2

(5) Priority Ranking and Handling of Alternative Sites

As mentioned in Section 2-2-1-1 (4), the number of sites possible for water source development is 254 and, of these sites, 200 sites are targeted for water source development in this Project. The remaining 54 sites not selected as target sites were classified as alternative sites for this Project. That is, if any of the already selected sites needs to be cancelled based on drilling results, a new drilling site will be selected from these 54 alternative sites in order of their priority. In other words, this Project's goal is to successfully construct a total of 200 boreholes. In case the number of unsuccessful boreholes increases and alternative sites

become exhausted, target sites in order of original higher population will become the candidate sites for second drillings. The selection of alternative sites will be decided after discussion with district and community.

(6) Types of Hand Pumps

In “Phase II Project”, India Mark II and Afridev pumps were adopted. For cases where groundwater level is higher than 30m below the ground, India Mark II is selected if pH is more than 7.0 (alkaline), and Afridev is installed if pH is less than 7.0 (acidic). For cases where groundwater level is deeper than 30m below the ground, India Mark II is basically selected regardless of the pH value.

Cases where iron content exceeded 1.0mg/ℓ were observed when India Mark II was installed for previous boreholes including those of “Phase I Project”. In order to avoid this situation, installation of Afridev pumps which use less steel parts than India Mark II pumps is advisable. This phenomenon was demonstrated in SOMAP3, the technical cooperation project of JICA.

Based on the above, if the dynamic water level of the borehole is higher than 35m below ground, Afridev pump is selected regardless of pH value. If dynamic water level is deeper than 35m below ground, India Mark II pump is chosen. If iron content exceeds 1.0mg/ℓ during the monitoring period , an iron removal plant will be constructed.

Under the above preconditions, the number of installations for each of the two types of hand pumps will be decided according to dynamic water levels in previous projects.

- Among the 112 boreholes of “Phase I Project”, 110 boreholes (98.2%) were grouped as (1) and 2 boreholes (1.8%) as (2).
- Among the 216 boreholes of “Phase II project”, 211 boreholes (97.7%) fall into (1) and 5 boreholes (2.3%) into (2).
- In total, 321 boreholes (97.9%) were classified as those having DWLs higher than 35m below ground and 7 boreholes (2.1%) had DWLs lower than 35m below ground.
- By applying these ratios to “Phase III Project”, 196 boreholes (97.9%) have DWLs higher than 35m below ground and 4 boreholes (2.1%) have DWLs lower than 35m below ground.
- Consequently, 196 boreholes will be equipped with Afridev hand pumps and 4 boreholes will have India Mark II hand pumps in “Phase III Project”.

Boreholes with DWLs deeper than 35m are concentrated in Nchelenge and Mwense Districts with formations belonging to sedimentary rock alternations of Katanga supergroup and they are

topographically located on slopes adjacent to rivers and lakes.

(7) Iron Removal Plants

Determination on the installation of iron removal plants (IRPs) for “Phase III Project” was made through the following procedure.

- If DWL after borehole drilling is less than 35m below ground, Afridev pump will be installed and for DWLs more than 35m below ground, India Mark II pump will be installed.
- In case Afridev pump is to be installed in the borehole and iron content exceeds the Zambian standard of 1.0mg/ℓthrough water quality monitoring two months after installation, this iron can be considered as having “geologic origin”. In this case, IRP is to be constructed.
- In case India Mark II pump is installed in the borehole and pH is lower than 7.0 (acidic), even if iron content is below 1.0mg/ℓ in the water quality monitoring, the value has possibilities to increase in the future according to results of water quality surveys carried out in “Phase I Project” and SOMAP3. In this case, the iron is considered to be of “materialistic origin” and IRP is to be constructed.
- According to the above, IRP is to be constructed for boreholes susceptible to iron from “geologic origin” and “materialistic origin”.

In consideration of the above conditions for installation of IRPs, iron contents and pH values of the 328 boreholes of “Phase I Project” and “Phase II Project” were reviewed and boreholes were divided into those of geologic origin and materialistic origin. The results were applied to boreholes of “Phase III Project” and are shown in Table 2-12.

The decision on whether to install IRPs will be based first on results of water quality monitoring to be carried out 2 months after installation of hand pumps and commencement of water supply upon confirming the tendencies in pH lowering and iron increase, and finally through discussions with district counterparts.

Table 2-12　Determination Results for IRP Installation

District	Phase I Project（4 Districts）					Phase II Project（4 Districts）				
	Number of Boreholes	Afridev DWL≦35m		India Mark II DWL＞35m		Number of Boreholes	Afridev DWL≦35m		India Mark II DWL＞35m	
		No. of Boreholes	Fe ＞1.0mg/ℓ	pH≧7.0	pH＜7.0		No. of Boreholes	Fe ＞1.0mg/ℓ	pH≧7.0	pH＜7.0
Nchelenge	26	4	0	0	0	64	55	1	0	4
Mwense	31	19	0	1	1	44	29	0	0	1
Mansa	26	9	2	0	0	61	53	2	0	0
Milenge	29	15	2	0	0	47	35	0	0	0
Total	112	47	4	1	1	216	172	3	0	5
			GO		MO			GO		MO

DWL: Dynamic water level　　GO: Geologic origin　　MO: Materialistic origin

Project	No. of Boreholes	Geologic Origin	Materialistic Origin	Total
Phase I Project	112	4	1	5
Phase II Project	216	3	5	8
Total	328	7	6	13
Phase III Project	200			8

(In this table, from the total numbers of boreholes in Table 2-16, under the assumption that 13 IRPs were needed for 328 boreholes drilled, for the 200 boreholes of this project, 8 IRPs would be needed.)

From the above, the number of IRPs for “Phase III Project” is estimated as 8 units.

Concerning the method of iron removal, treatment by oxidation (conventional method) and biological treatment (iron bacteria method) are typical methods. In the former method, iron extracted by oxidation is filtered using sand and gravel. For the latter method, by using bacteria, iron content of water is removed by precipitation and this method is being used in water treatment plants. Considerations on the iron removal method for this project are explained below.

Treatment by oxidation involves ferrous iron dissolved in raw water being separated as a ferric iron compound by aeration, and removed by filtration using sand and gravel. This method is widely used in Zambia where “Phase I Project” and “Phase II Projects” also used this method. Depending on the iron concentration, the filter media needs to be cleaned about once a month.

In the iron bacteria method, iron contained in raw water is absorbed and iron bacteria is separated from water by sand filtration. Since iron bacteria accumulates on the sand surface,

periodic removal of only this surface layer is needed, which is easier than the conventional method of washing the entire sand layer, creating possibilities for easier operation and maintenance.

However, problems associated with the use of iron bacteria method are as follows.

- Risks are involved in acceptance by target communities of the iron bacteria method since this is a biological method
- Necessity to confirm existence of iron bacteria in raw water which have iron removal effects
- Difficulties in assuring an cultural environment for iron bacteria
- Although a method which is generally accepted by local people and conventional method should be applied in consideration of the basic concept for grant aid projects, the iron bacteria method is not yet established in Zambia.

From the above considerations, in this project, iron removal plants adopting the conventional method of oxidation using sand as the main filter media to remove iron will be selected.

(8) Appurtenant Facilities for Hand Pumps

Appurtenant facilities for hand pumps include concrete apron, drainage ditch, and soakaway pit. Design of appurtenant facilities will be those generally adopted in Zambia. As mentioned in (7) above, in this Project, iron removal plants will be installed at sites where water contains iron above the Zambian standard. In order to remove iron more effectively, however, the hand pumps will be positioned at a higher level than the normal position and concrete steps will be constructed to allow users to use the facility more comfortably.

(9) Measures against Asbestos

Any facilities installed and constructed in this Project will not use asbestos. In addition, no materials and equipment containing asbestos will be procured. Since facilities are not planned to be demolished or dismantled in this Project, measures against asbestos dispersion will not be considered, but dispersion prevention measures will be taken if any demolishing or dismantling become necessary.

2-2-2-3 Facilities Construction Plan (Piped Water Supply Schemes)

(1) Target Year and Design Service Population

1) Target Year

Originally, MLGH requested to apply a target year of 2030 for piped water supply schemes based on VISION 2030. However, from the viewpoint that grant aid schemes are implemented in response to urgent requests, year 2020, 4 years after completion of this project, was decided to be more appropriate and thus the target year of 2020 was set.

2) Design Service Population

Population figures of the target sites have been identified based on the social survey conducted during the preparatory survey. However, since some boreholes with hand pumps constructed in “Phase I Project” and “Phase II Project” are existing in the target sites, design service populations are determined by subtracting the number of borehole users (250 persons per unit) from the target populations.

Moreover, according to latest demographic statistics (Census 2010) for the country, population growth rates are as follow (Table 2-13). Differences with respect to social conditions can be confirmed. For example, Milenge District which became independent from Mansa District in 1998 has a population growth rate remarkably higher than the other districts in the province. Therefore, population growth rates of each district provided by the demographic statistics are adopted.

Table 2-13 Population Growth Rates for each District

District	Population Growth Rate (%)
Nchelenge	3.2
Mwense	1.3
Milenge	4.2

Design service populations for year 2020, estimated from present populations (2013) applying the above-mentioned population growth rates are shown below.

Table 2-14 Design Service Populations for 2020

District	Target Site	Population		Number of Boreholes with Hand Pumps (Beneficiary Population)	Design Service Population (2020)
		Present (2013)	Projected (2020)		
Nchelenge	Kabuta	3,222	4,017	3 (750persons)	3,267
Mwense	Kapala	4,333	4,743	1 (250persons)	4,493
	Musangu	11,000	12,041	2 (500persons)	11,541
	Kapakala	10,512	11,507	1 (250persons)	11,257
Milenge	Milenge	3,000	4,001	2 (500persons)	3,501
Total		32,067	36,309	9 (2,250persons)	34,059

(2) Unit Water Supply Rate and Design Water Supply Rate

1) Unit Water Supply Rate

In Zambia, unit water supply rates for public tap stands are not yet established. Therefore, the standard of 40 liters/cap/day (ℓ/c/d) for domestic use in peri-urban areas according to the Zambia Bureau of Standards (ZS361 2009) was used as reference. However, this standard is applied to public communal tap stands shared by 2 or 3 households, or one tap in the yard of a household.

On the other hand, the service level planned for this project is water supply through public tap stands capable of serving a maximum of 500 persons per tap stand. Moreover, the standard stipulates that the designer can make judicious modifications in conformity with proposed total demands on the basis of prevailing socio-economic situations. According to the Luapula Water and Sewerage Company Limited (LuaWSC), the unit water supply rate for domestic use of 40 ℓ/c/d is more than enough for public tap stands. Based on the above information, 30 ℓ/c/d, same as the unit supply rate for boreholes with hand pumps, was decided to be adopted for this project.

2) Design Water Supply Rate

Since public institutions such as clinics and schools were identified in the target area, demands of institutions are added to residential water demands which are estimated by multiplying the population by the unit supply rate. On the other hand, the amount for water leakages is not considered in this plan because the design period is short at less than four years after completion, and the entire pipeline network is completely new.

Design Water Supply Rate = Target Population Count × Unit Water Supply Rate (30 ℓ/c/d)
＋ Institutional Supply Rate

Water supply rates for institutions are derived from multiplying the number of users, estimated from results of the social conditions survey, by the unit supply rate of 10 ℓ/c/d based on the Zambia Bureau of Standards ZS361 2009. The results are shown below. Although population growth rates are applied to students in determination of water demands for schools, growth rates against demands for clinics are not considered since improved access to safe water will contribute to positive impacts on health of the population.

Table 2-15 Water Demands for Institutions

District	Target Site	Students (2013)	Students (2020)	Patients (2013)	Water Demand (m^3/day)	Remarks
Nchelenge	Kabuta	1,653	2,061	170	22.3	
Mwense	Kapala					No schools or clinics
	Musangu	1,598	1,749	100	18.5	
	Kapakala	448	490		4.9	No clinics
Milenge	Milenge	1,079	1,439		14.4	No clinics
Total		4,778	5,739	270	60.1	

The design water supply rates for each target site are shown below.

Table 2-16 Design Water Supply Rate for Target Sites

District	Target Site	Design Service Population	Water Supply Rate for Households (m^3/d)	Water Supply Rate for Public Facilities (m^3/d)	Design Water Supply Rate (m^3/d)
Nchelenge	Kabuta	3,267	98.0	22.3	120.3
Mwense	Kapala	4,493	134.8		134.8
	Musangu	11,541	346.2	18.5	364.7
	Kapakala	11,257	337.7	4.9	342.6
Milenge	Milenge	1,233(*)	37.0(*)	5.0(*)	42.0(*)
Total		31,791	953.7	50.7	1,004.4

(*) The maximum borehole yield is estimated as 8.4 m^3/hr from results of pumping tests, and daily pumping hours is expected to be 5 hours during the rainy season. As result, a conservative estimate of daily water supply capability is 42.0 m^3/day. Therefore, the design service population was adjusted from 3,501 to 1,233 which is the number capable of being supplied in consideration of the borehole capacity.

3) Peak Factor

Since Zambia does not have standards for hourly or seasonal peak factors, water schemes need to be designed without over-specifications or under-specifications in consideration of balance between factors such as convenience, impacts, capital costs and operation and maintenance costs. Especially, peak factors for the service level using public tap stands, where residents fetch water using containers, is different from house connections in which household members can draw water directly whenever the need arises. Concerning seasonal peak factor, the unit consumption rate normally increases during high-temperature hours in the dry season.

However, climate of the target area has a pattern characterized by low temperatures during the dry season from May to September, and high temperatures during the rainy season from October to March. The neighboring country of Tanzania, where climate conditions are geographically similar, possesses water supply design standards (Design Manual for Water Supply and Waste Water Disposal, Third Edition) including seasonal peak factors based on experiences, and the seasonal peak factor of 1.0 is applied for the case of public tap stands. Therefore, for this project, 1.0 is also adopted as the seasonal peak factor and design of pumping facilities and water transmission lines is carried out based on this peak factor.

For hourly peak factor, a maximum hourly peak factor of 3.04 is applied which was investigated during the construction for the urgent "Water Supply Project in Satellite Area of Lusaka in the Republic of Zambia". Capacities of distribution tanks and diameters of water distribution lines are determined based on the peak factor.

(3) Scheme Composition

Compositions of water supply facilities for each site are shown below.

Table 2-17 Facilities for Each Site

Site	Design Population	Supply Rate (m^3/day)	Water Source	Power Source	Tank Type	Pipe Length (m)		Tap Stand Number		Machinery House	Chlorinator
						Transmission	Distribution	Households	Institutions		
Kabuta	3,267	120.3	Spring	Gravity	Ground	30	2,880	7	2	0	1
Kapala	4,493	145.5	Groundwater	Commercial	Elevated	630	2,013	9	0	1	1
Musangu	11,541	364.7	Groundwater	Commercial	Elevated	369	7,162	23	3	1	1
Kapakala	11,257	342.6	Groundwater	Commercial	Ground	630	4,529	22	1	1	1
Milenge	1,233	42.0	Groundwater	Solar	Ground	353	4,038	3	6	1	1
Total	31,791	1,015.1				2,012	20,622	64	12	4	5

1) Water Supply Scheme using Spring (Kabuta in Nchelenge District)

This water supply scheme consists of a spring intake, water transmission line, ground type distribution tank with chlorination room, water distribution line and public tap stands. In this scheme, water is distributed from a spring to public tap stands by gravity.

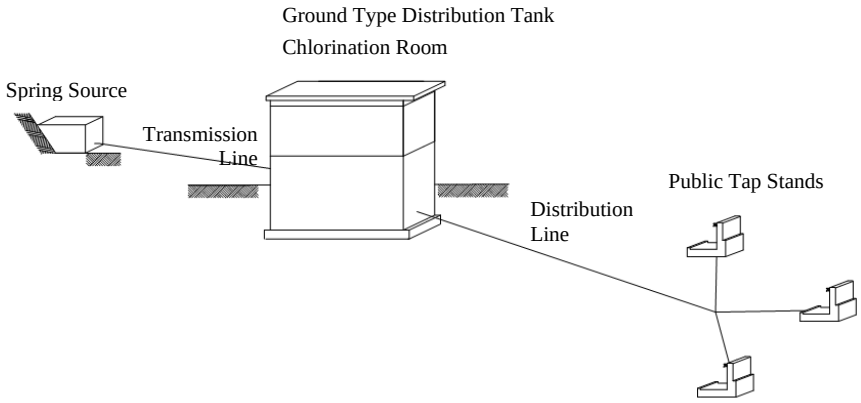


Figure 2-2 Water Supply Scheme Type 1

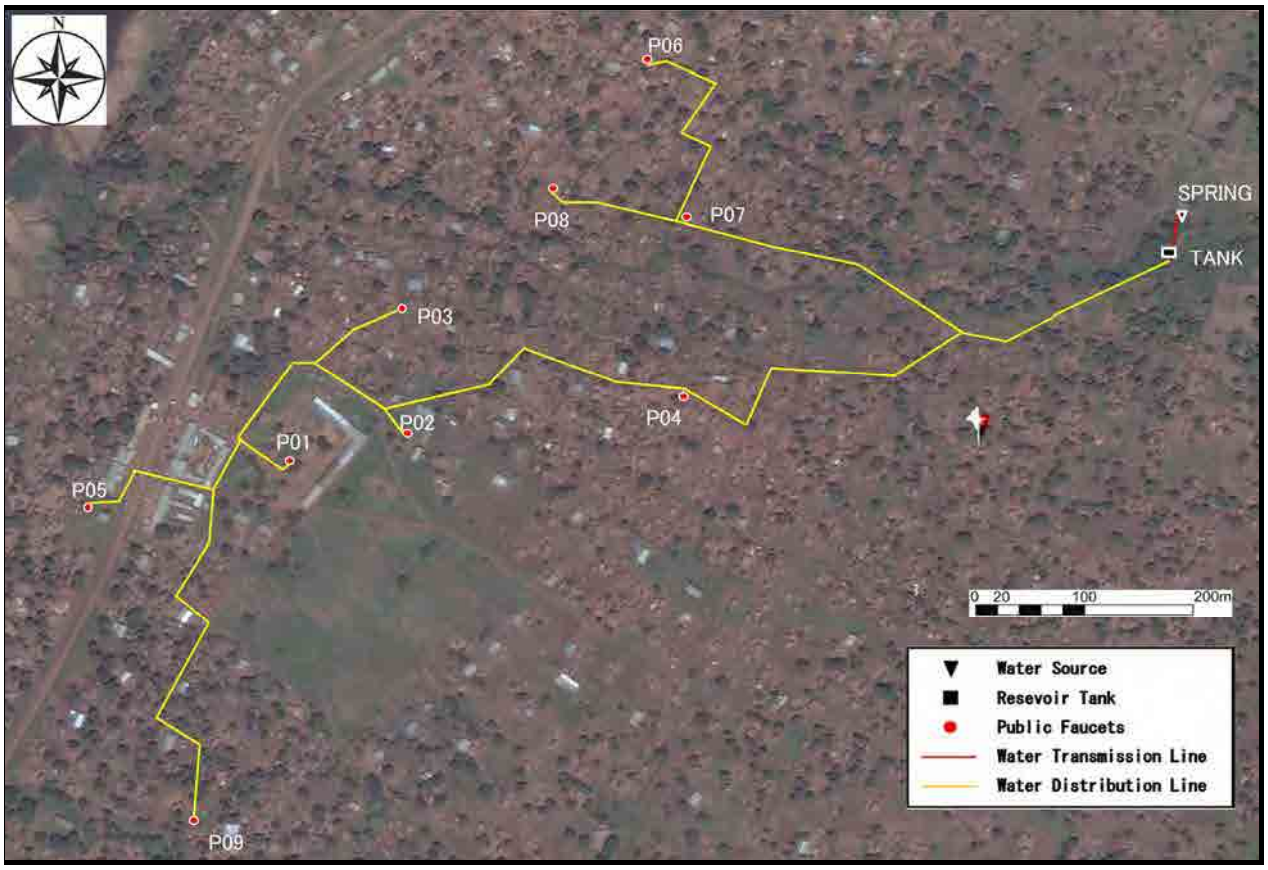


Figure 2-3 Facilities Layout Plan for Kabuta in Nchelenge District

2) Water Supply Scheme using Groundwater and Elevated Distribution Tank (Kapala and Musangu in Mwense District)

This water supply scheme consists of a borehole, machinery house with chlorinator, water transmission line, elevated distribution tank, water distribution lines and public tap stands. Since the target areas have flat geographical features, elevated type distribution tanks with 5 m effective head were planned to secure the necessary residual head at the public tap stands.

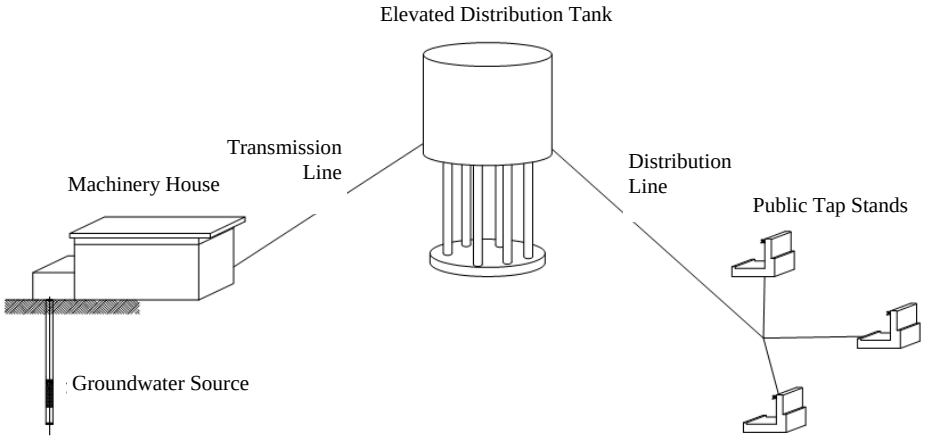


Figure 2-4 Water Supply Scheme Type 2

Figure 2-5 Facilities Layout Plan for Kapala in Mwense District

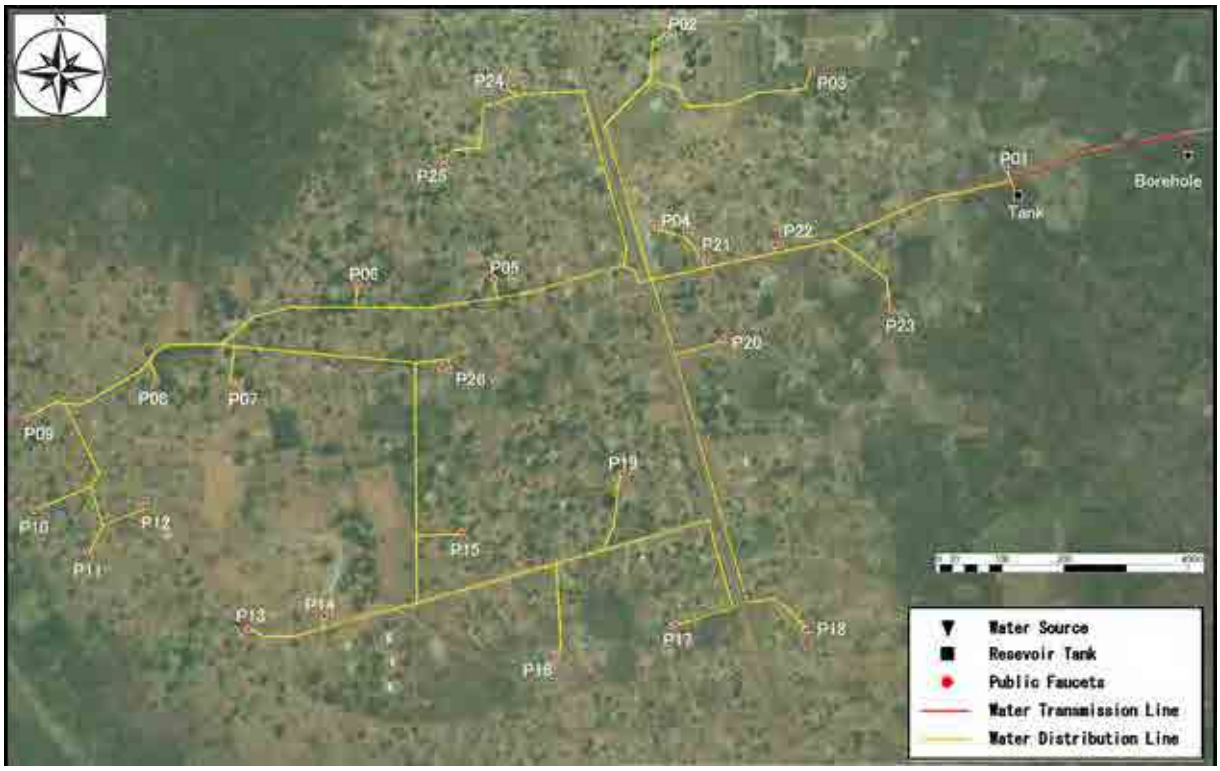


Figure 2-6 Facilities Layout Plan for Musangu in Mwense District

3) Water Supply Scheme using Groundwater and Ground Distribution Tank (Kapakala in Mwense District and Milenge in Milenge District)

This water supply scheme consists of a borehole, machinery house with chlorinator, water transmission line, ground distribution tank, water distribution lines and public tap stands. Since geographical features of the target areas show many undulations, ground type distribution tanks are positioned at points of high altitude and water is supplied through public tap stands by gravity.

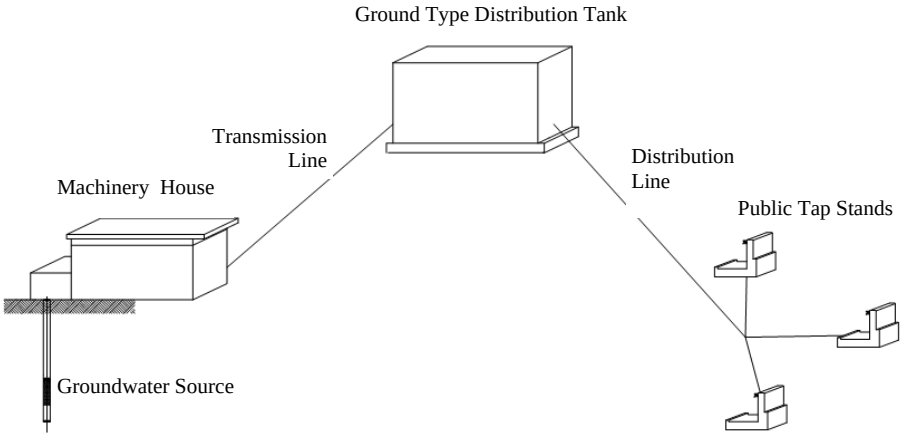


Figure 2-7 Water Supply Scheme Type 3

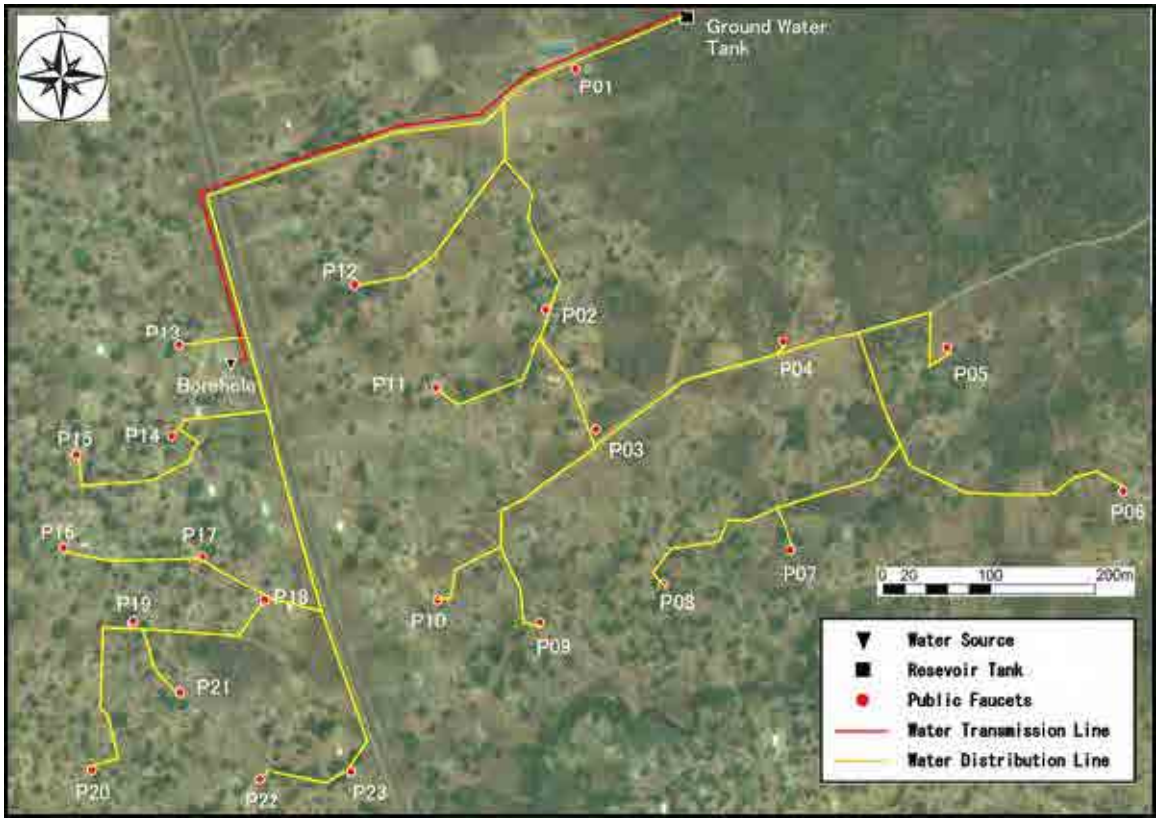


Figure 2-8 Facilities Layout Plan for Kapakala in Mwense District

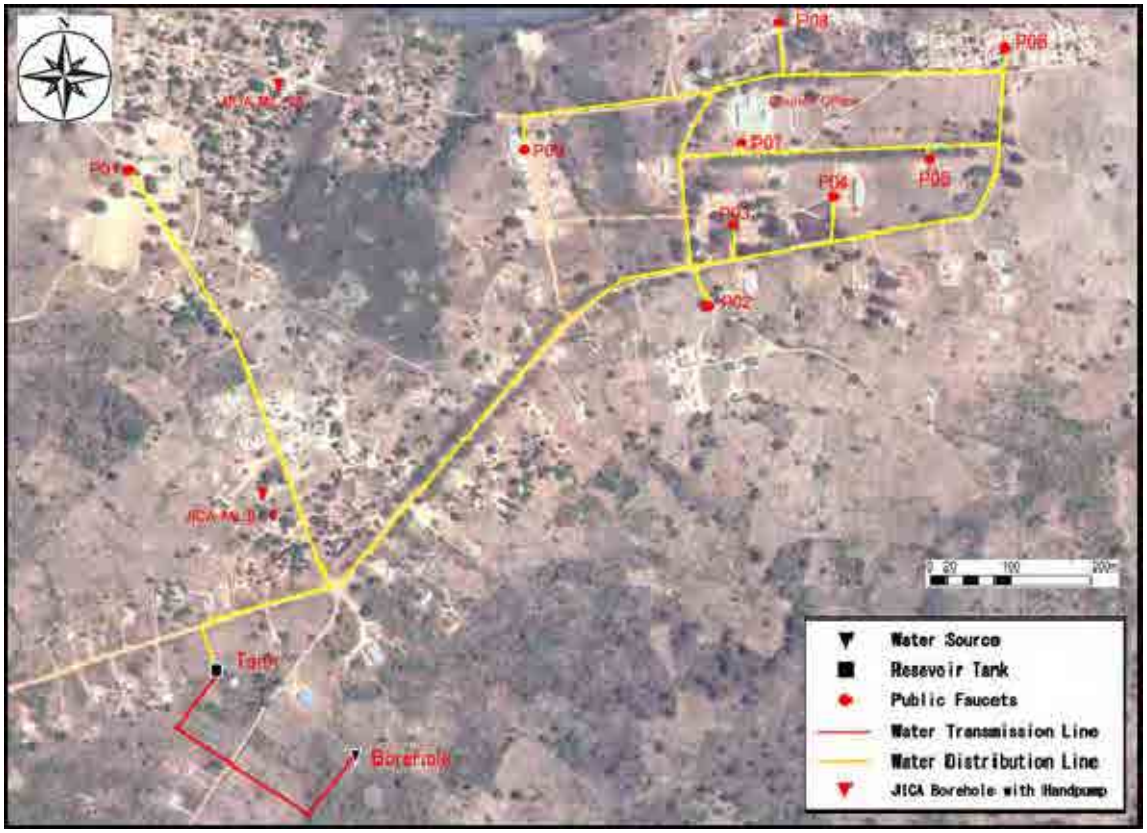


Figure 2-9 Facilities Layout Plan for Milenge in Milenge District

(4) Description of Facilities

1) Power Source

Water sources and power sources for each site are shown below.

Table 2-18 Water Sources and Power Sources

District	Target Site	Water Source	Power Source
Nchelenge	Kabuta	Spring	Gravity
Mwense	Kapala	Groundwater	Commercial power
	Musangu	Groundwater	Commercial power
	Kapakala	Groundwater	Commercial power
Milenge	Milenge	Groundwater	Photovoltaic

Power sources for each piped water supply scheme are explained below.

a. Kabuta in Nchelenge District

The spring source for Kabuta is located at a high elevation on a mountain range. Spring yields were measured for 4 months from July to November 2013, and the results revealed that these are expected to meet the water demand. Spring sources are considered to be ideal water sources since water can be distributed without power resulting in lower operation and maintenance expenses. In addition, the planned chlorination unit does not require electrical power.

b. Kapala, Musangu, Kapakala in Mwense District

The 3 target sites (Kapala, Musangu and Kapakala) in Mwense District are all located along the national highway and thus, accessible to the national commercial power grid aligned along the highway. According to LuaWSC and other institutions, commercial power is available for 12 hours or more per day. However, they are experiencing problems associated with pump operation due to low voltages in the morning and evening. However, the Zambia Electric Supply Company (ZESCO) has contracted Chinese companies to upgrade the 66 kV grid line between Pensulo and Kasama to a 330 kV line, and the electric power situation of the region is likely to improve remarkably within two years.

On the other hand, the nearest filling station is located more than 100 km one-way and diesel prices are high at more than ZMW8.5/ℓ. Therefore, use of diesel generators for these sites is considered to be unsuitable with respect to sustainable operation and maintenance.

Concerning use of solar as a power source, since DC submersible motor pumps which can fulfil the required hydraulic power of about 30 m^3/hr with 50m hydraulic head is difficult to procure from local markets, AC submersible motor pumps need to be adopted using solar inverters. However, most solar-powered water pump systems currently operating in Zambia are identified as using DC submersible motor pumps without solar inverters.

Moreover, experiences in other projects showed that the component which often created problems is the solar inverter. Therefore, introducing solar-powered water pump systems which utilize solar inverters are considered to be unsuitable. In addition, local solar dealers are not used to large scale solar-powered water pump systems, and the target sites are located about 900 km away from the capital, Lusaka. Therefore, for Kapala, Musangu and Kapakala in Mwense District, national commercial power grids are scheduled to be utilized as power sources.

c. Milenge in Milenge District

Although the target site is located in the center of Milenge District, a commercial power grid is not accessible. According to the Rural Electrification Agency (REA), a project for 25 km extension of the national commercial power grid from Musaila of Samfya District, where an existing national grid is located, to Milenge is in progress. Although clearing of lands such as weeding has already been carried out, as of August 2013, concrete plans for the extension have not yet been formulated.

Furthermore, possibilities for the target site become electrified in the near future is considered to be low since existing national commercial power grids are located about 150 km away. Therefore, selecting the option of using commercial power grids as power sources for this project is considered to be unrealistic.

Moreover, use of diesel generator is difficult for Milenge in terms of operation and maintenance since the nearest filling station is distant at more than 200 km one-way from the target site and diesel prices are expensive. Therefore, conclusion is made that solar power is suitable for Milenge. Also, DC submersible motor pump which does not need solar inverter is planned to be applied since the required hydraulic power is small at 42.0 m^3/day.

2) Pumping Facility

Except for Kabuta of Nchelenge District which utilizes a spring and supplies water by gravity, groundwater is used as water sources for all other sites. Groundwater is pumped up using submersible motor pumps and water is planned to be supplied to distribution tanks. Information on pumping for each site is shown below.

Table 2-19 Information on Pumping

District	Target Site	Daily Water Supply Rate (m^3/day)	Pumping Hours	Pumping Rate (m^3/hr)	Power Source
Mwense	Kapala	134.8	16	8.4	Commercial
	Musangu	364.7	16	22.8	Commercial
	Kapakala	342.6	16	21.4	Commercial
Milenge	Milenge	42.0	5	8.4	Photovoltaic

For the 3 sites in Mwense District where national commercial power grids will be utilized as power sources, voltage drops especially in the morning and evening are expected. Therefore, pumping systems will be incorporated with control devices such as voltage regulators and motor protective relays to protect the submersible motor pumps. Also, concerning riser pipes, to

prevent electrolytic corrosion from joining dissimilar metals, instead of stainless steel, non-metallic pipes will be used.

3) Distribution Tank

Distribution tanks for each site are planned as follows in consideration of topographical features, ground altitudes and locations of public tap stands. Tank capacities are decided as follows based on pumping/supply patterns and water demand patterns surveyed in Zambia in the past. However for Kabuta where spring source with gravity distribution is adopted, the tank capacity has been decided as 30 m^3 which is 6 hours of the daily water demand due to limitation in altitude of the spring point and land availability.

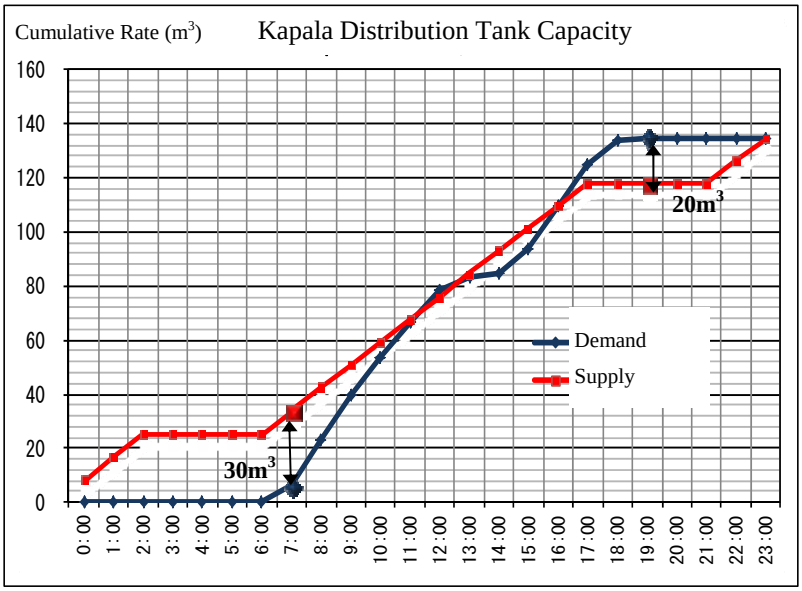
Table 2-20 Type and Capacity of Distribution Tanks

District	Target Site	Tank Type	Tank Capacity
Nchlenge	Kabuta	RC ground type	30 m^3
Mwense	Kapala	RC elevated type (5m effective height)	50 m^3
	Musangu	RC elevated type (5m effective height)	120 m^3
	Kapakala	RC ground type	110 m^3
Milenge	Milenge	RC ground type	30 m^3

a. Distribution Tank Capacity

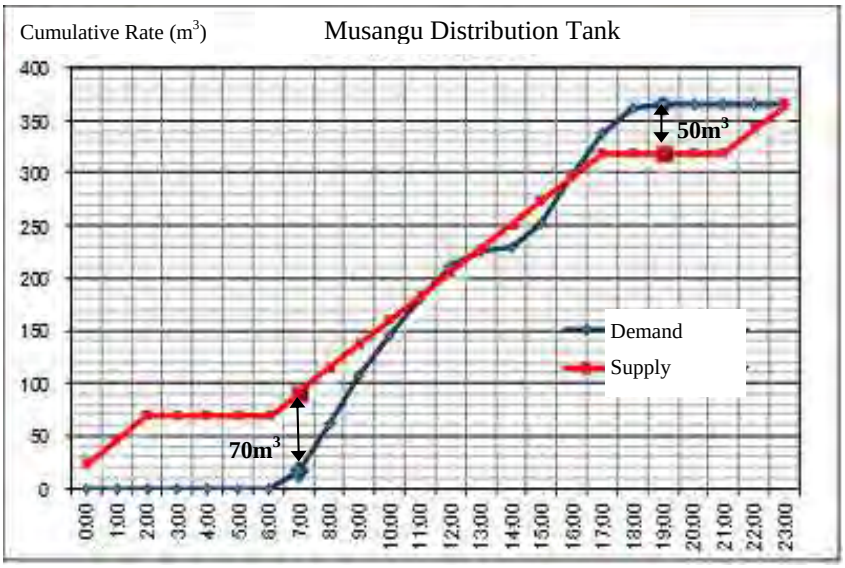
① Kapala in Mwense District

This piped water supply scheme will utilize the national commercial power grid as power source. The water supply pattern is shown in the right graph considering the situation where low voltages occur twice at morning and evening. The required tank capacity is decided as 50 m^3 from the sum of maximum accumulated volume stored when demand drops below average (30 m^3) and maximum accumulated volume available when demand is above average (20 m^3).



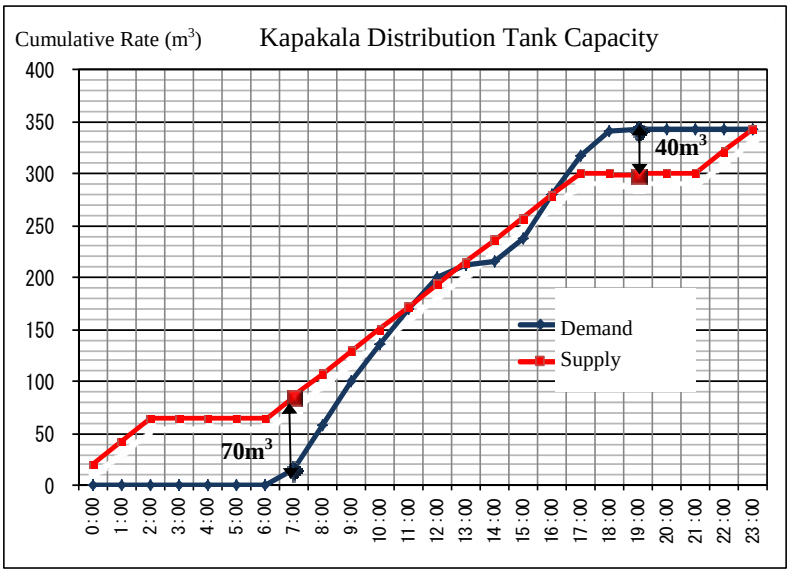
② Musangu in Mwense District

This piped water supply scheme will utilize the national commercial power grid as power source. The water supply pattern is shown in the right graph considering the situation where low voltages occur twice at morning and evening. The required tank capacity is decided as 120 m^3 from the sum of maximum accumulated volume stored when demand drops below average (70 m^3) and maximum accumulated volume available when demand is above average (50 m^3).



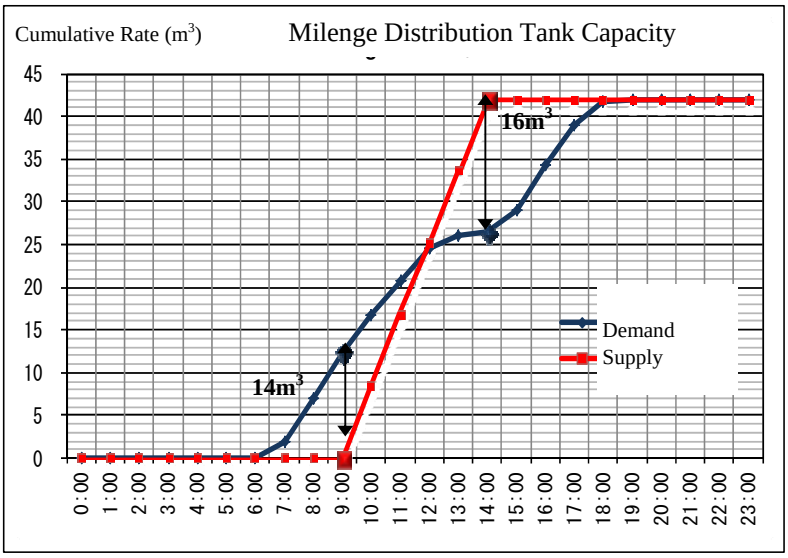
③ Kapakala in Mwense District

This piped water supply scheme will utilize the national commercial power grid as power source. The water supply pattern is shown in the right graph considering the situation where low voltages occur twice at morning and evening. The required tank capacity is decided as 110 m^3 from the sum of maximum accumulated volume stored when demand drops below average (70 m^3) and maximum accumulated volume available when demand is above average (40 m^3).



④ Milenge in Milenge District

The piped water supply scheme in Milenge will utilize solar as the power source. Pumping hours is 5 hours from 10:00 to 14:00 in consideration of sunshine hours during the rainy season. The required tank capacity is decided as 30 m^3 from the sum of maximum accumulated volume stored when demand drops below average (14 m^3) and maximum accumulated volume available when demand is above average (16 m^3).



Ground Distribution Tank

For ground type distribution tanks, the structure is made by reinforced concrete in consideration of durability, easy maintenance and partial reparability. In addition, since the tank is constructed above the ground, construction works are not laborious.

For Kabuta, groundwater level will be expected to become high during the rainy season and the semi-ground tank constructed in water-bearing soil will tend to float when the tank becomes

empty. Therefore, concrete material will need to be selected by making sure that the weight of the tank structure is greater than the uplift, which is equal to the weight of the groundwater displaced by the tank.

Elevated Distribution Tank

Elevated distribution tanks in Zambia are often made of galvanized steel. However, water leakages were identified from most of the tanks during the field survey. Also, for introducing galvanized steel tanks in this project, quality is concerned since groundwater and spring sources have corrosive characteristics (low pH).

On the other hand, presently, fiberglass (GRP, FRP) tanks are not widely used in Zambia and repairs require specialized skills. Therefore if aspects of operation and maintenance are considered, use of these materials at the present time is difficult.

In this Project, elevated tanks made of reinforced concrete are planned since they have greater strength and durability with longer life expectancy as compared to galvanized steel and fibreglass. In addition, since only 2 elevated tanks are planned for the project, construction schedule for distribution tanks is not so tight and materials necessary for repair works are easily obtained. Some elevated tanks made of reinforced concrete are found in Luapula Province. They were constructed by local contractors, and contractors with experiences in construction of large-scale watertight concrete structures were also identified. If construction works are supervised by a Japanese contractor, causes for concern are few since the planned heights of elevated tanks are low (5m effective head).

b. Foundation for Tanks

Geological surveys were carried out at the planned construction sites for distribution tanks and the following standard penetration test (SPT) results were confirmed.

Table 2-21 Results of SPT

Target Site	Standard Penetration Test (N-Value)										Remarks
	0-1m	1-2m	2-3m	3-4m	4-5m	5-6m	6-7m	7-8m	8-9m	9-10m	
Kabuta	>50										Sampler damaged at -0.95m due to hard bedrock
Kapala	5	51									Hard rock confirmed at -1.7m
Musangu	8	7	7	6	13	21	27	27	27	32	
Kapakala	>50										Sampler damaged at -0.10m due to hard bedrock
Milenge	13	7	6	6	6	6	14	28	40	>50	

As shown in above table, since bedrocks were identified within 2m from the ground surface at Kabuta of Nchelenge District and Kapala and Kapakala of Mwense District, foundations for structures are planned to be placed on the bedrocks. In Musangu where an elevated tank is planned to be constructed, the bottom of the foundation will be placed in clayey sand 5m below the ground level and safety factor of 3.0 is applied in the foundation design to reduce the ultimate capacity to an acceptable design capacity. In Milenge where a ground tank is planned to be constructed, the bottom of the foundation will be placed in clayey sand between 0m and 1m below the ground surface since N value of more than 10 has been identified in the soil layer. Since N value between 6 and 7 is identified beyond 2m below natural ground surface, conservative N value of 7 with safety factor of 3.0 is applied in the foundation design.

4) Transmission and Distribution Pipelines

For water transmission and distribution, gravity will be applied for all sites. Basically, all pipes will be laid underground except areas where excavation is difficult due to soil conditions and for internal plumbing such as pipes inside machinery houses and plumbing for distribution tanks. Minimum residual pressures required at public tap stands for this project are decided as about 5m based on discussions with LuWSC and concerned authorities.

The minimum diameter of pipes is set as ND40 in order to prevent blockages inside pipes from deposition of earth and sand. Furthermore, isolation valves are used for facilitating maintenance. Air valves are to be installed for release of accumulated air and washout valves are used at terminals of piping networks where altitudes are low to periodically discharge sediments in the networks. Information on transmission pipes and distribution pipes to be installed in this project is as follows.

Table 2-22 Pipe Lengths and Diameters

District	Target Site	Transmission Pipe (m)	Distribution Pipe (m)	Diameter (mm)
Nchelenge	Kabuta	30	2,880	ND40-ND140
Mwense	Kapala	630	2,013	ND40-ND110
	Musangu	369	7,162	ND40-ND160
	Kapakala	630	4,529	ND40-ND160
Milenge	Milenge	353	4,038	ND40-ND110
Total		2,012	20,622	

In terms of pipe material, polyvinyl chloride (PVC) and polyethylene (PE) pipes are locally available in Zambia. PVC pipes are decided to be used for pipeline networks since PE pipes have concerns for quality control in joining of pipes. Since most of the piping routes are not paved, PN10 (resistance pressure of 1.0 Mpa) class PVC pipes are selected in consideration of

their decrease in pressure-resistant ability due to high temperatures in summer.

For above ground pipe laying, internally coated steel pipes such as epoxy coated steel pipes are utilized. In order to prevent deterioration in water quality, pipe networks are designed so that water will not be retained more than 24 hours in the networks. The network calculation results (PVC pipe with Hazen-Williams factor C=140) for Musangu in Mwense District is shown in the following figure.

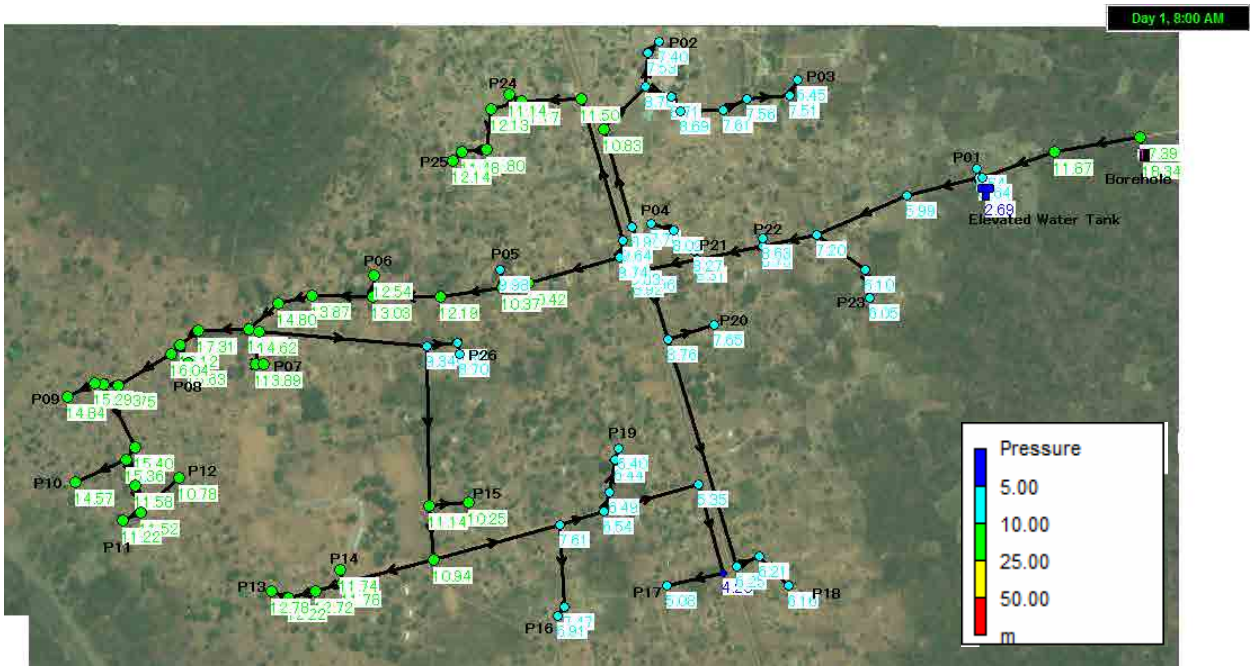


Figure 2-10 Results of Residual Hydraulic Pressure Calculations for Musangu of Mwense District

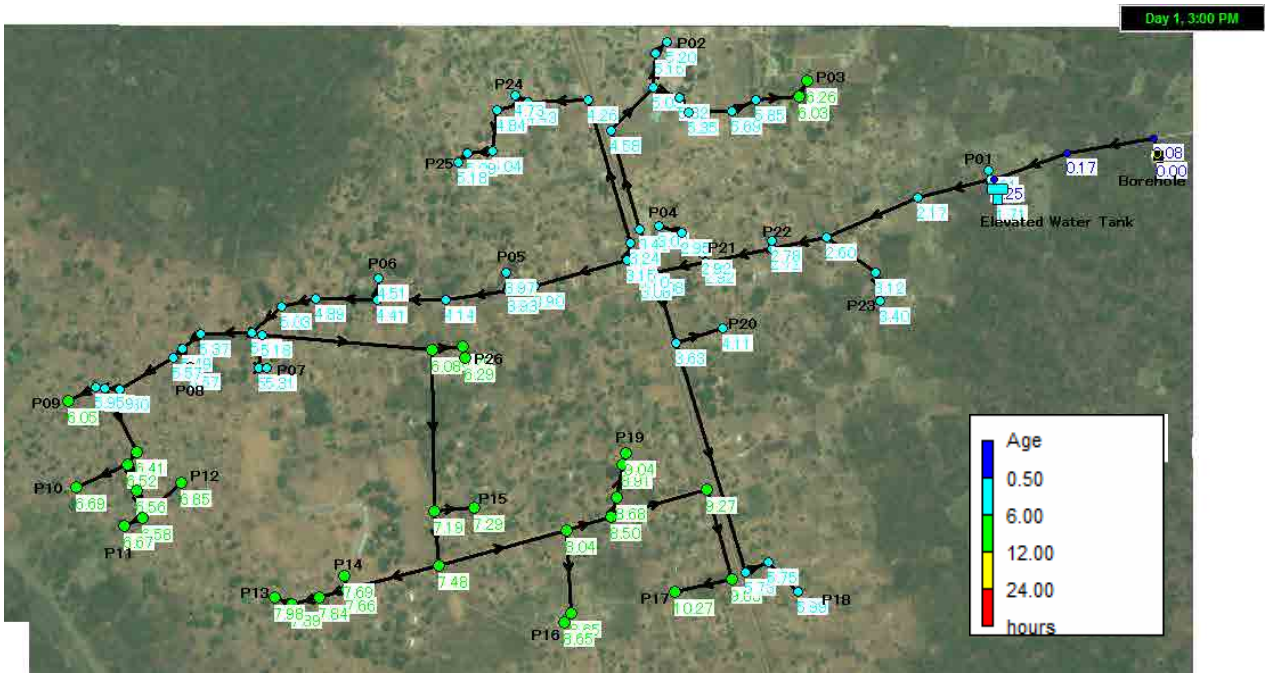


Figure 2-11 Results of Calculations for Water Detention Time at Pipeline Terminal Points for Musangu of Mwense District

5) Machinery House and Electrical Equipment

The 3 target sites in Mwense District which will use national commercial power grids as power sources are located on both sides of the power grids along the national highway. Electrical works such as extending the 33-kV power grid into machinery houses and installations of transformers are needed. Electrical power will be mainly consumed by submersible motor pumps and chlorination equipment.

Equipment to be installed in machinery houses consist of electrical installations, pumps, chlorination equipment, control equipment and plumbing. Electrical installations consist of power receiving and distributing equipment, and lighting. Pumping and chlorination equipment are submersible motor pumps and chlorine disinfection units. Control equipment are tank water level control devices, and plumbing consists of control valves, water flow meters, pressure gauges, strainers and piping.

As a measure to be taken against lightning in this project, since the height of the machinery house is about 2m which is lower than the steel tower for power lines and surrounding structures and forests, possibilities for being struck by lightning directly is considered to be low. Therefore, measures against induced lightning will be taken. As a specific measure, lightning arrestors will be installed on electrical submersible motor pumps.

6) Chlorination

For this project, instead of surface water, groundwater which has good water quality will be used, but regardless of the water source, more than 0.2 mg/ℓ of residual chlorine at the water tap is required for piped water supply schemes in Zambia. Moreover, the chlorine contact time is planned as 30 minutes or more. For the 3 sites in Mwense District (Kapala, Musangu and Kapakala) and Milenge of Milenge District, in consideration of safety and reliability of electrical power, a hydraulically driven dosing device to mix chlorine in proportion to the supply rate is planned

On the other hand for Kabuta in Nchelenge District, since the roof of the semi-underground distribution tank is easily accessible, the method being used by LuaWSC will be adopted. Containers connected by a hose are placed at the top and bottom, and in the bottom container, the water level is constantly controlled by the rising and lowering motion of a float to automatically open and shut a valve. Therefore, the required dosage of calcium hypochlorite diluted in the container can be assured.

【Container with Float Valve】

【Hydraulic Driven Dosage Device】

Figure 2-12　Chlorination Facility

Concerning chlorine disinfection agents, LuaWSC uses calcium hypochlorite powder which can be procured from LuaWSC or shops in major cities.　In this project, calcium hypochlorite powder will be used since this is safer to handle as compared to other agents such as chlorine gas, and this material is available locally.

7)　Public Tap Stands

The number of users per tap is decided as 250 persons.　Two taps on one public tap stand is basically chosen and thus, the number of users per tap stand is estimated as 500 persons.　Since the communities were fully involved in making decisions on the siting of tap stands, their layout should be convenient as possible, and walking distances to each tap stand are decided as less than 250m.　In addition to water meters and valves, soakaways are attached to each public tap stand for proper drainage.　The type of tap will be chosen with emphasis on future operation and maintenance aspects such as availability of spare parts since taps have shorter design life and some parts such as washers tend to wear out easily.

8)　Solar Powered Pumping System

In Zambia, some solar powered water pumping systems have been installed through support from donors such as Water Aid.　Since these are small-scale solar pumping systems with pumping rates of less than 10 m^3/hr, DC motor pumps which do not need inverters to convert the DC to AC are used.　The DC motor pump, which local contractors are accustomed to dealing with, is planned to be used for the solar powered water pumping system of Milenge District since the required hydraulic power is small at only 8.4 m^3/hr.

a.　Solar Irradiation

Although horizontal irradiation data were recorded until about 1991 by the Zambia Meteorological Department（ZMD）, data after that year are not available.　The weather

observation station of ZMD is located at Mansa and Kawambwa Districts in Luapula Province. Monthly average horizontal irradiations from 1980 to 1991, measured at the Mansa District weather observation station nearest to Milenge District, and monthly average horizontal irradiations in Milenge and Mansa Districts published by NASA Langley Research Center, Atmospheric Science Data Center (ASDC) are shown in the following figure.

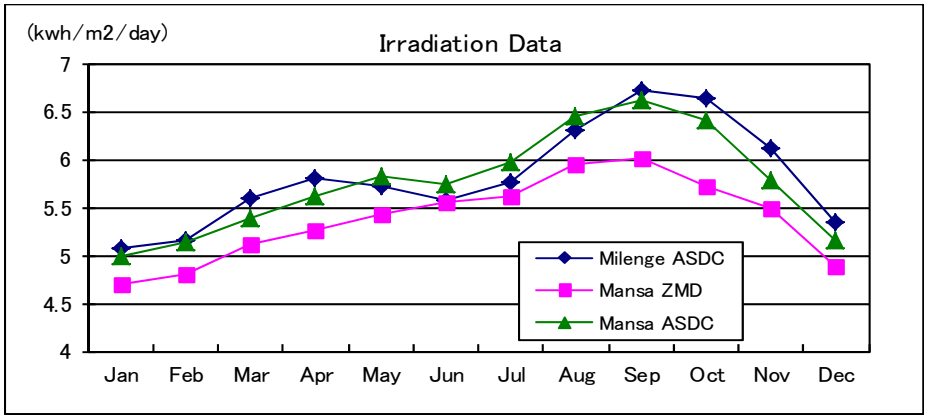


Figure 2-13 Monthly Average Horizontal Irradiation in Milenge and Mansa Districts

The above figure shows that monthly horizontal irradiations become the lowest in January of the rainy summer season, and 4.7 kWh/m^2/day recorded in Mansa by ZMD is lower than the value by ASDC of 5.0 kWh/m^2/day. When the values for Milenge of 5.1 kWh/m^2/day and Mansa of 5.0 kWh/m^2/day in January recorded by ASDC are compared, a higher value is shown for Milenge District. From the above, the lowest value of 4.7 kWh/m^2/day in January recorded by ZMD will be adopted as the level surface insolation for designing.

Concerning tilt angle of PV panels at latitudes of 12.4 degrees, setting the angle as close to horizontal as possible is preferable to maximize energy for the summer in January. However, tilt angle of 15 degrees is applied for the project in consideration of operation and maintenance aspects such as ease of clearing dirt deposited on the panel surface.

Clearness index K of the region in January is 0.5 according to ASDC. The tilt factor for tilt angle 15 degrees in January in the Southern hemisphere is about 0.90. Therefore, in this plan, the irradiation incident of 4.23 (4.7 kWh/m^2/day×0.90) is adopted as the available solar energy.

b. Sunshine Hours

Although some vendors specializing in solar power technology are available in the capital of Lusaka, they have no consistency on adoption of the average sunshine hours. Some vendors use 6 hours average sunshine hours per day while others use 5 hours average sunshine hours per

day for months that generate the least number of sunshine hours.

International Atomic Energy Agency (IAEA) and United Nations Educational, Scientific and Cultural Organization (UNESCO) had jointly investigated solar irradiations over Zambia in 1983 (Solar Irradiation over Zambia, November, 1983) and following data on sunshine hours per day are presented.

Table 2-23 Monthly Average Sunshine Hours in Mansa

Month	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
Sunshine Hours	4.9	5.5	6.4	8.1	9.5	10.3	10.3	10.4	9.1	8.2	6.9	6.0

Source: Solar Irradiation over Zambia, November 1983

According to the table, the least number of sunshine hours is 4.9 in the rainy season of January. However, although the above data are for Mansa which is located about 150km away from Milenge District, according to sunshine hours data for January of ASDC, meteorological conditions is better in Milenge than in Mansa. Therefore, rather than 4.9 sunshine hours, 5.0 hours being used by local solar equipment dealers will be applied for this project.

As a result, the design parameters of the PV system for Milenge (such as design population, solar power generation system, pumping facility, distribution tank capacity and public tap stand number) will be planned under the condition that 42.0m^3/day of water can be supplied during the rainy season in January when meteorological conditions are the worst in the year in order to prevent any hindrances in operation and service throughout the year.

c. Theft Prevention Measures

From past project experiences in other countries, as techniques for stealing PV modules, frames and stands of PV arrays are frequently cut. In many cases, thieves come from neighboring countries and they sell the PV modules abroad. Therefore, instead of aluminum PV arrays often used in developed countries, highly durable galvanized steel will be adopted and the PV arrays are surrounded by fence as a measure for theft prevention.

2-2-3 Outline Design Drawings

2-2-3-1 Boreholes with Hand Pumps

Outline drawings for boreholes, appurtenant facilities and iron removal plants to be constructed in this project are presented in the following pages.

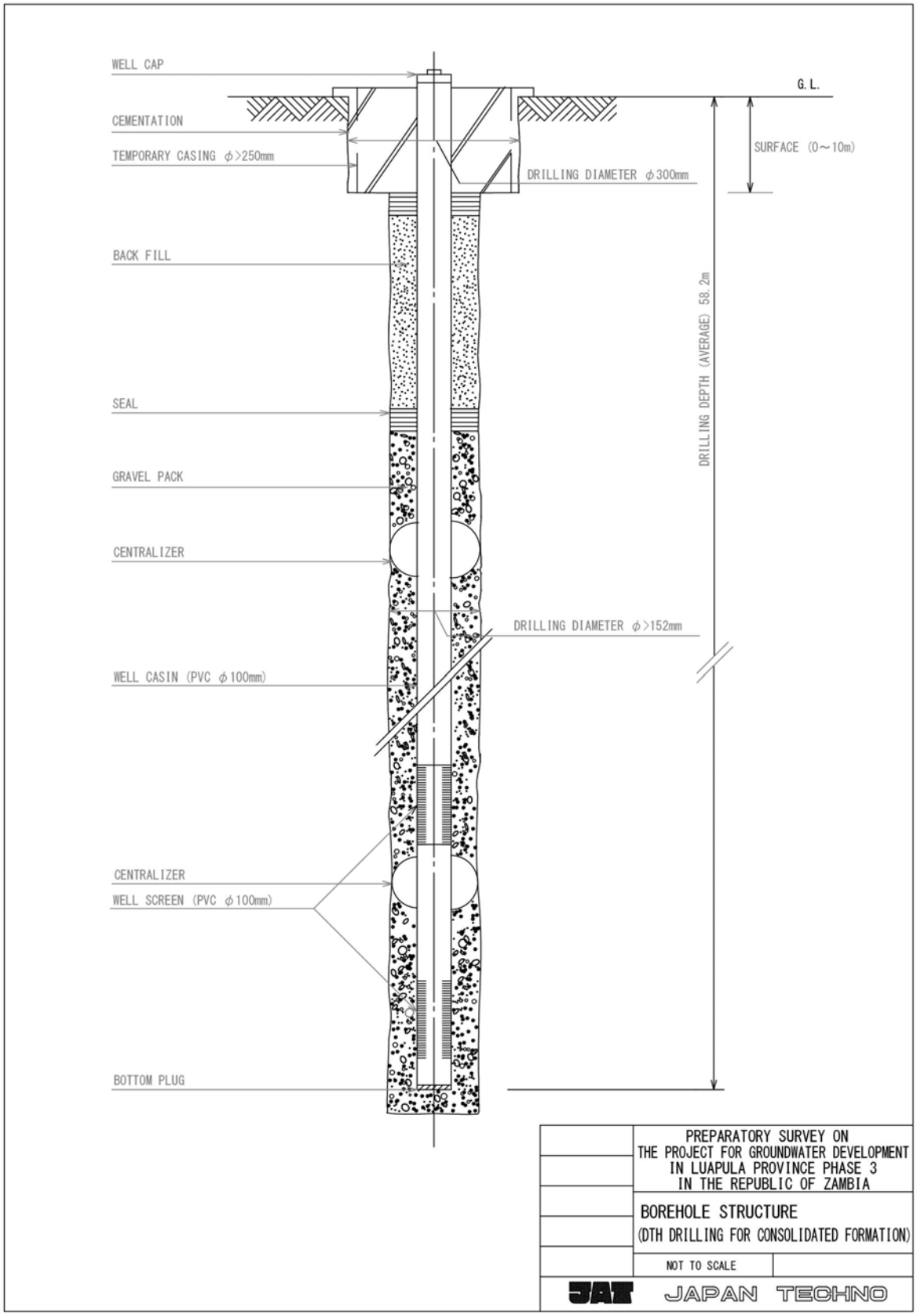


Figure 2-14 Standard Drawing for Borehole Structure (DTH Drilling)

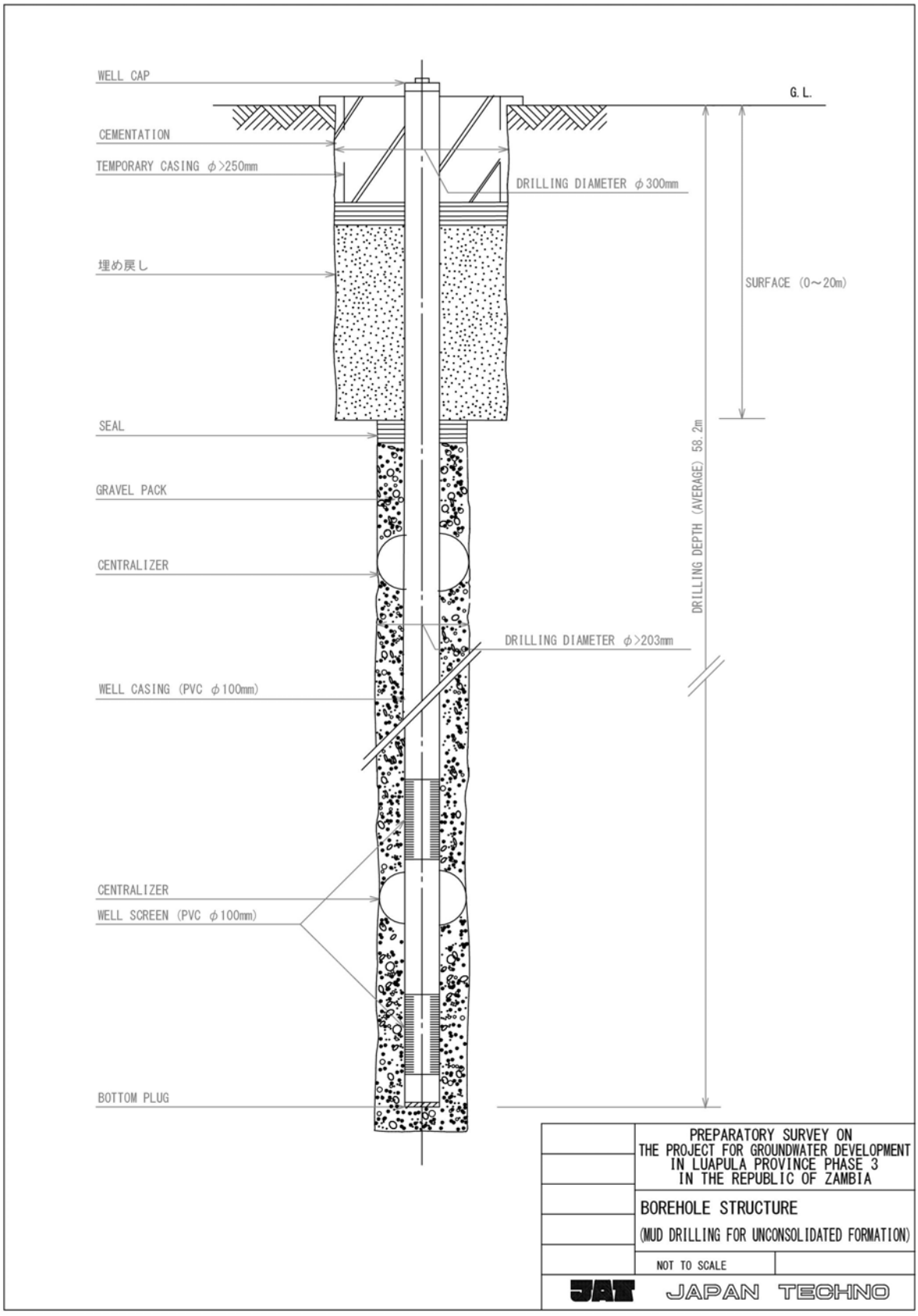


Figure 2-15 Standard Drawing for Borehole Structure (Mud Circulation Drilling)

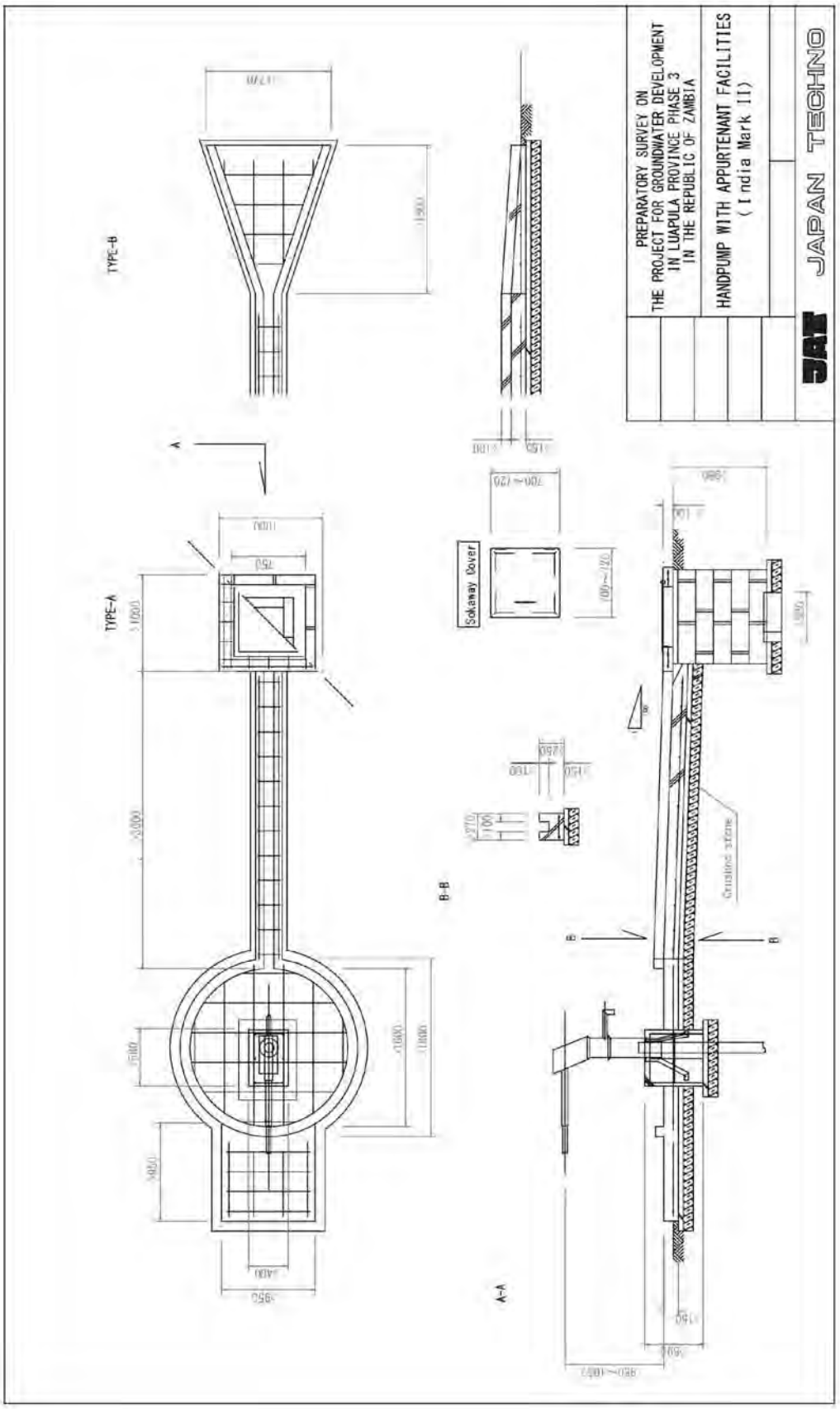


Figure 2-16 Standard Drawing for Borehole Appurtenant Facilities (India Mark II)

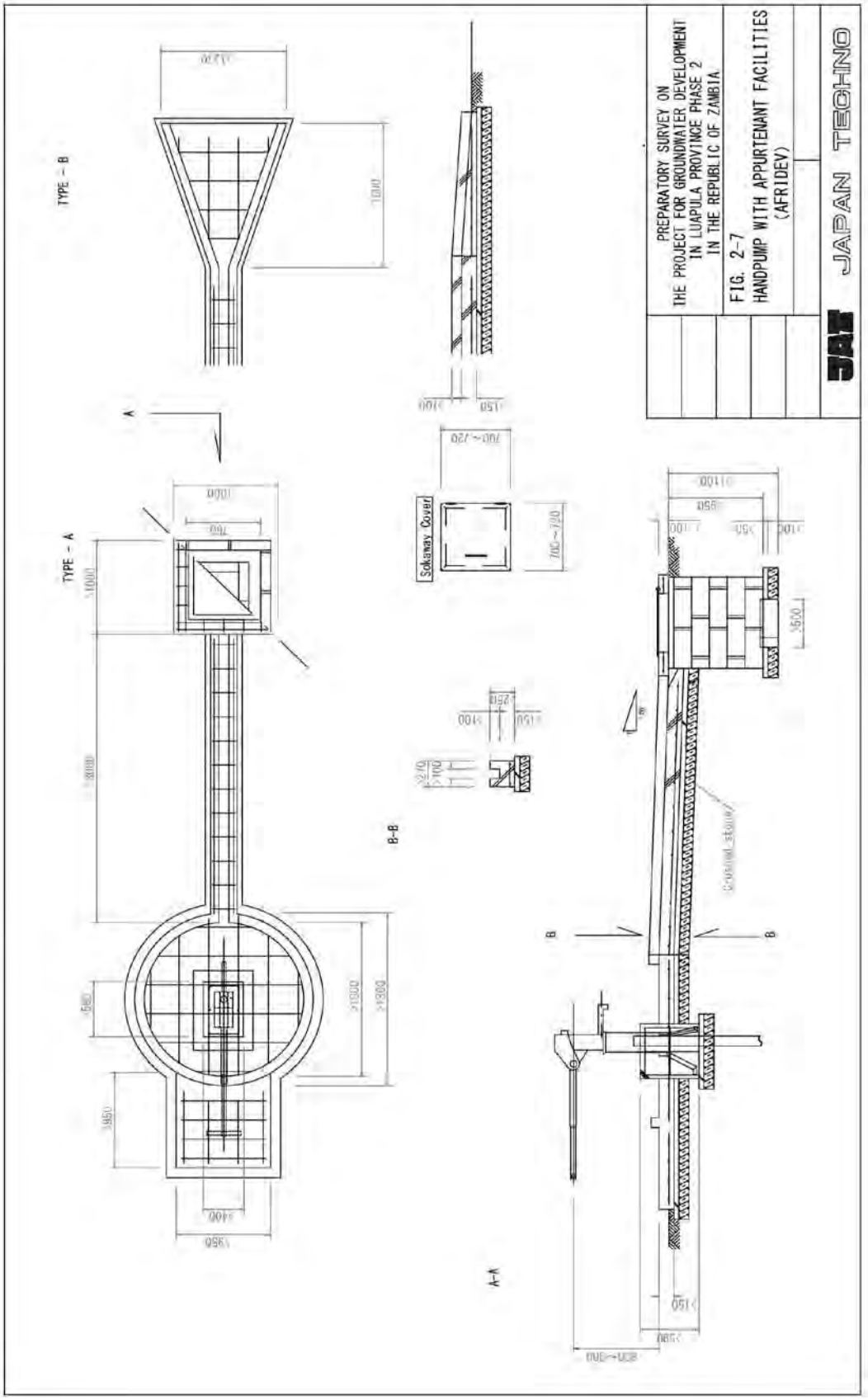


Figure 2-17 Standard Drawing for Borehole Appurtenant Facilities (Afridev)

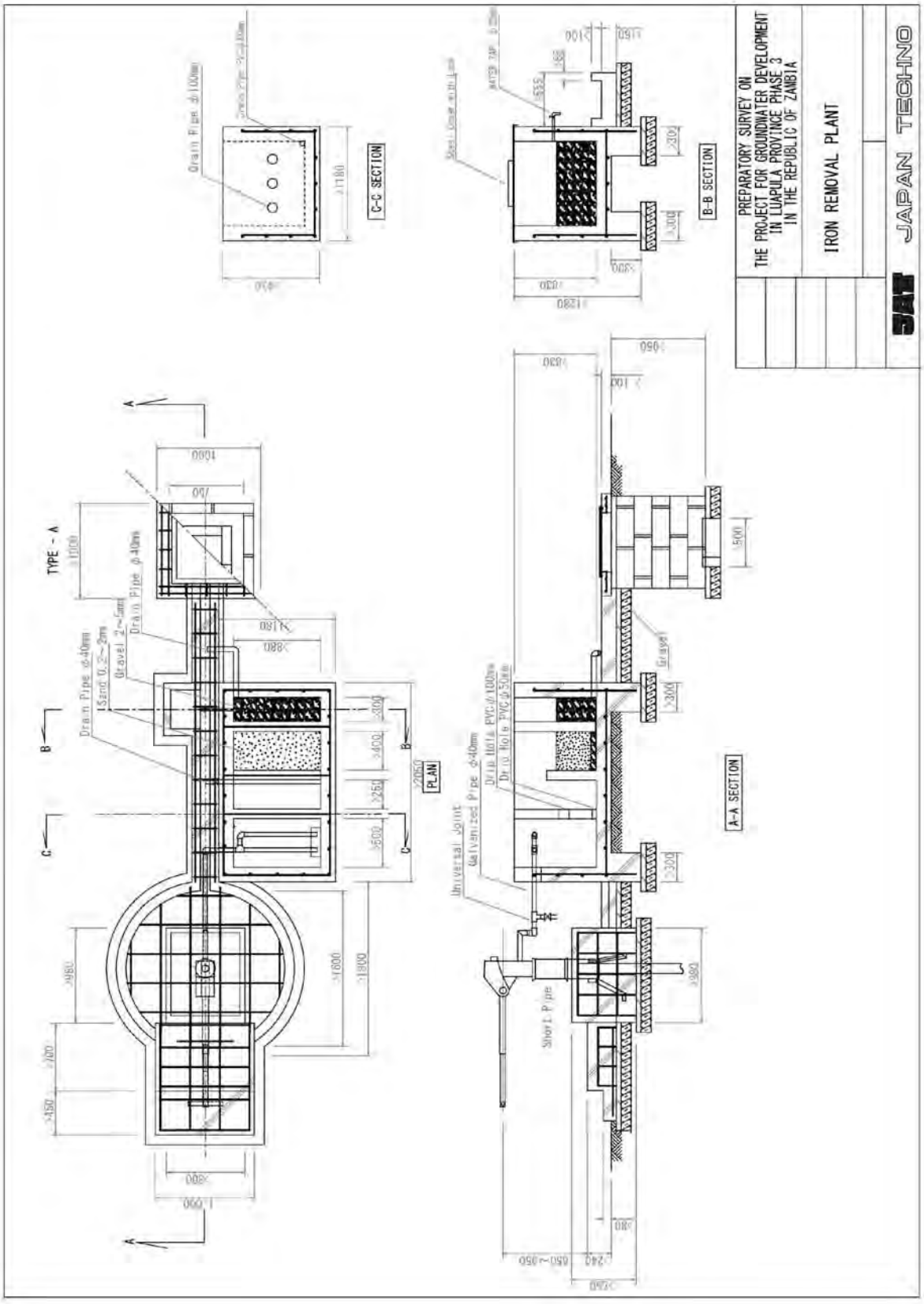


Figure 2-18 Standard Drawing for Iron Removal Plant

2-2-3-2 Piped Water Supply Schemes

Outline drawings for piped water supply schemes to be constructed in this project are as shown in the following pages.

Figure 2-19 Structural Drawing of Ground Type Distribution Tank ($30m^3$: Milenge in Milenge District)

Figure 2-20 Structural Drawing of Ground Type Distribution Tank ($110m^3$: Kapakala in Mwense District)

Figure 2-21 Structural Drawing of Ground Type Distribution Tank ($30m^3$: Kabuta in Nchelenge District)

Figure 2-22 Structural Drawing of Elevated Distribution Tank ($50m^3$: Kapala in Mwense District)

Figure 2-23 Structural Drawing of Elevated Distribution Tank($120m^3$: Musangu in Mwense District)

Figure 2-24 Structural Drawing of Machinery House

Figure 2-25 PV Module Layout Drawing (Milenge in Milenge District)

Figure 2-26 Structural Drawing of Public Tap Stand (2 Tap)

Figure 2-27 Drawing of Net Fence (Milenge in Milenge District)

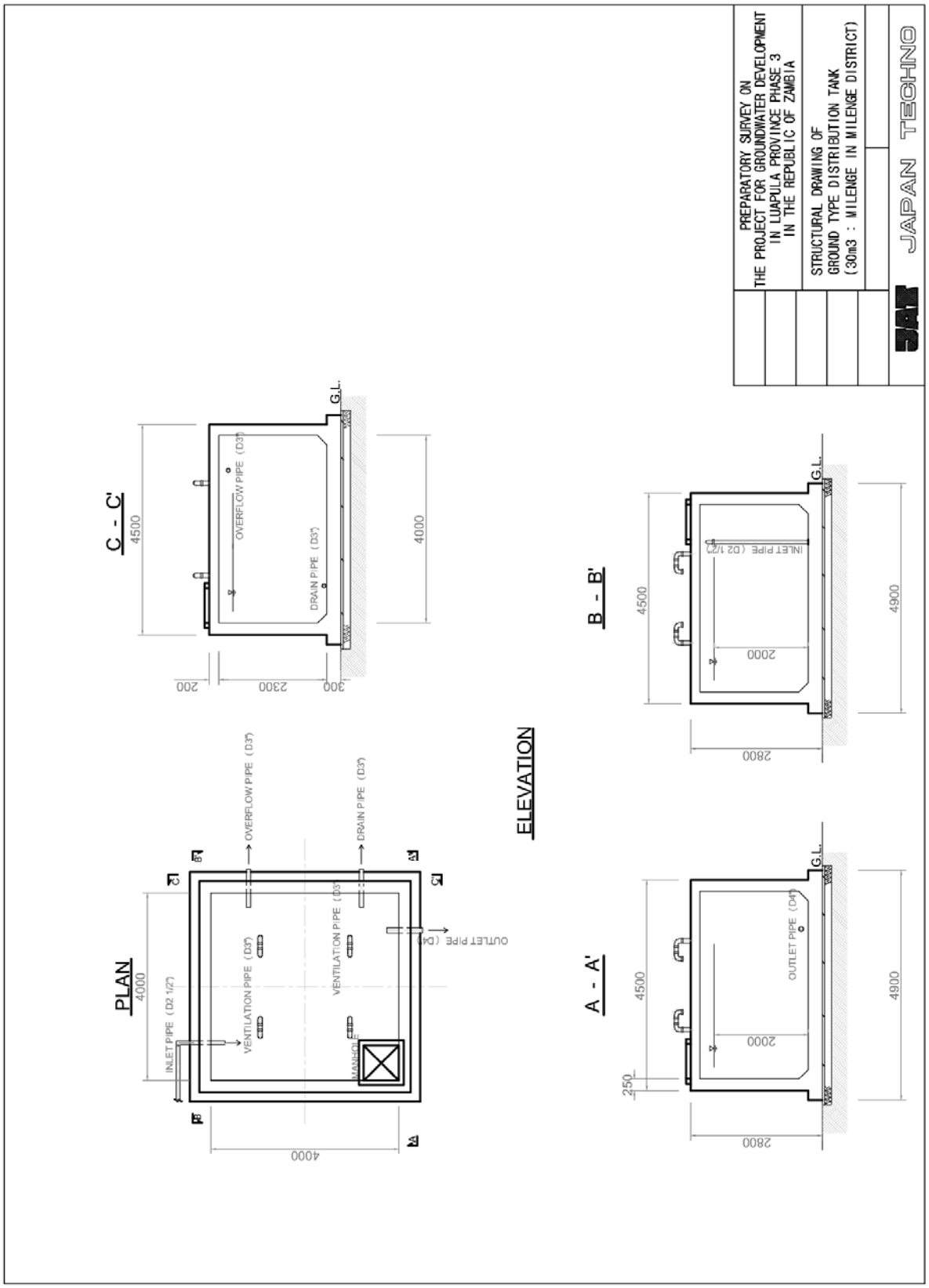


Figure 2-19 Structural Drawing of Ground Type Distribution Tank (30m^3: Milenge in Milenge District)

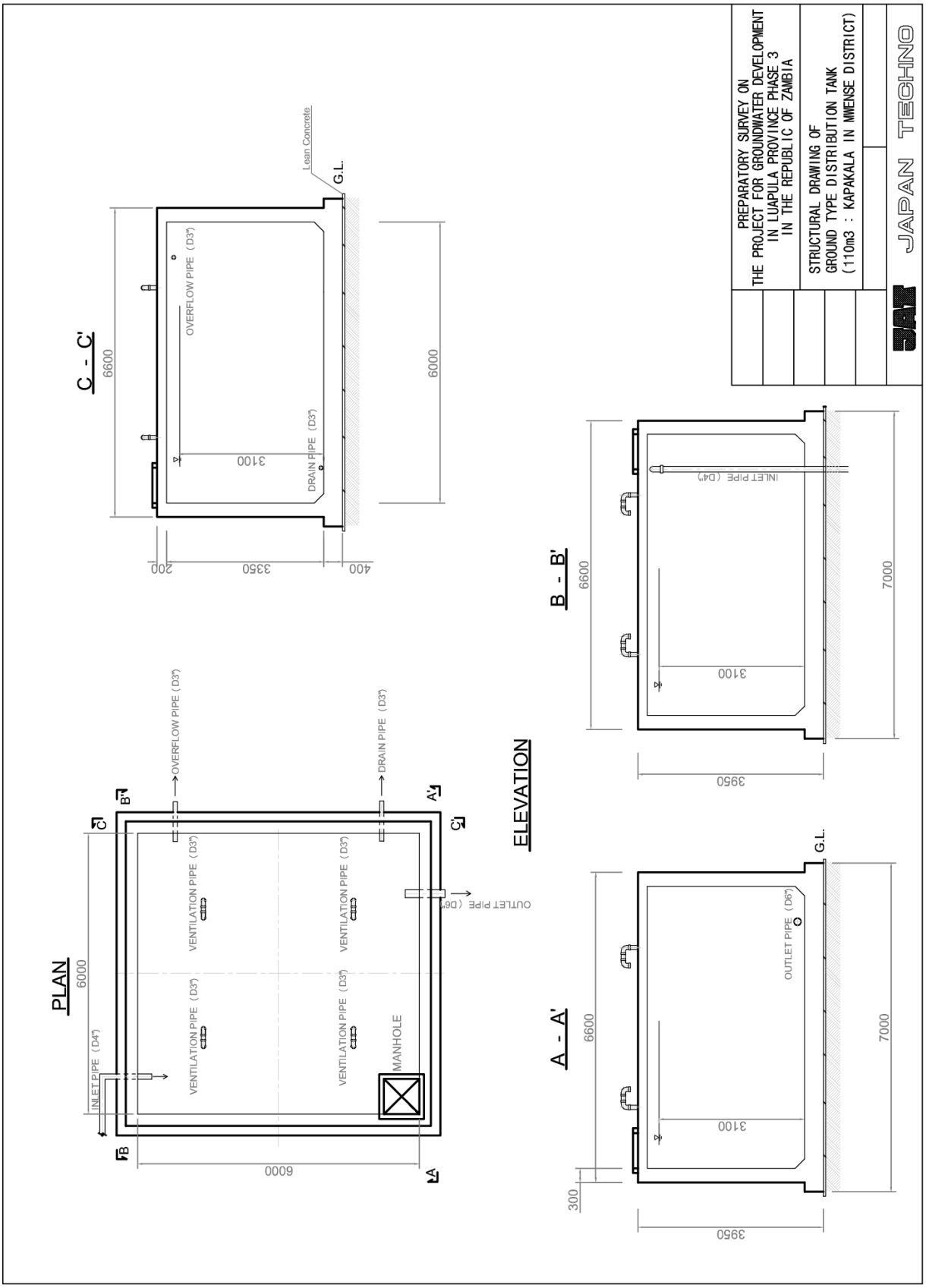


Figure 2-20 Structural Drawing of Ground Type Distribution Tank (110m^3: Kapakala in Mwense District)

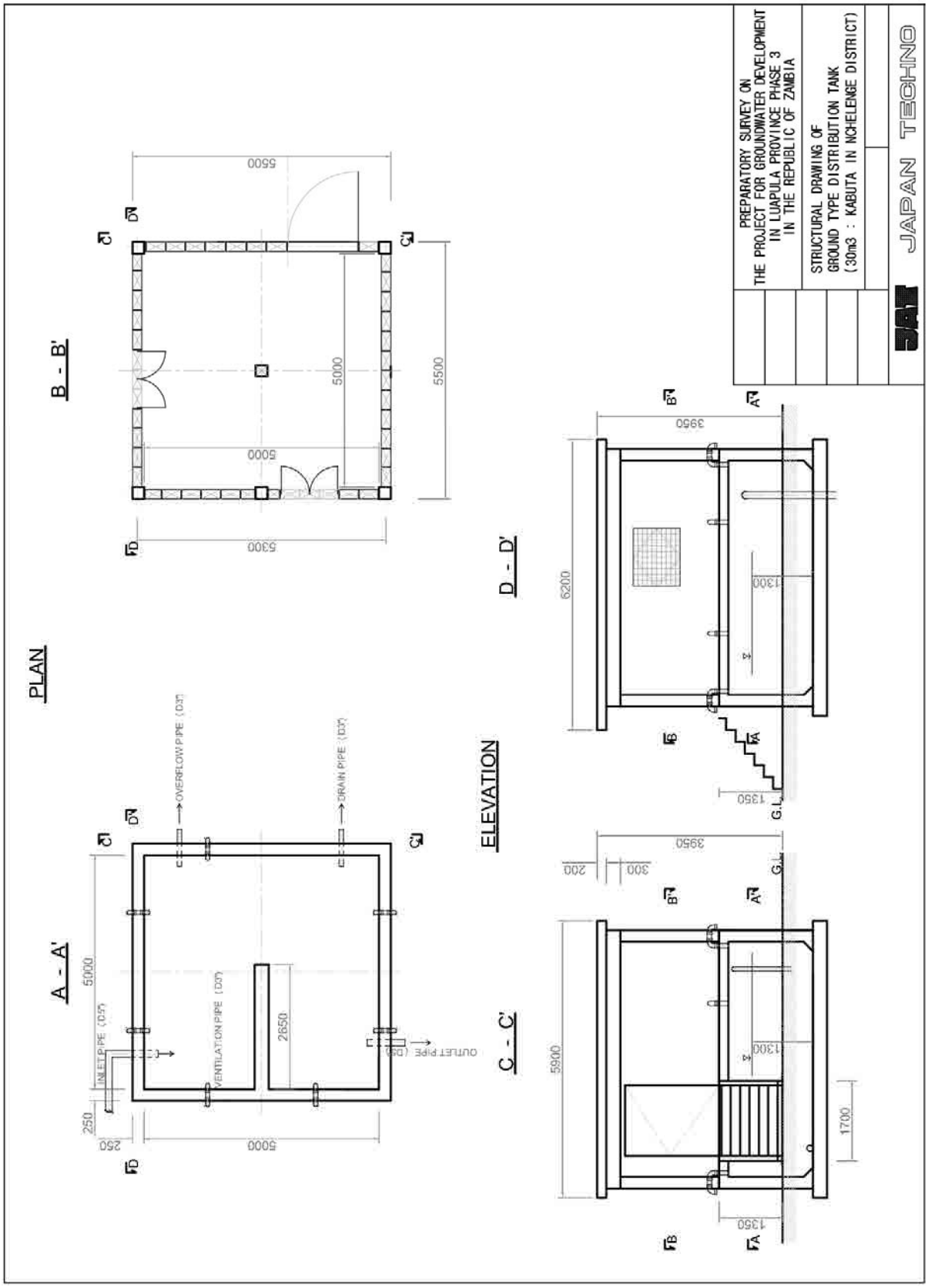


Figure 2-21 Structural Drawing of Ground Type Distribution Tank (30m3: Kabuta in Nchelenge District)

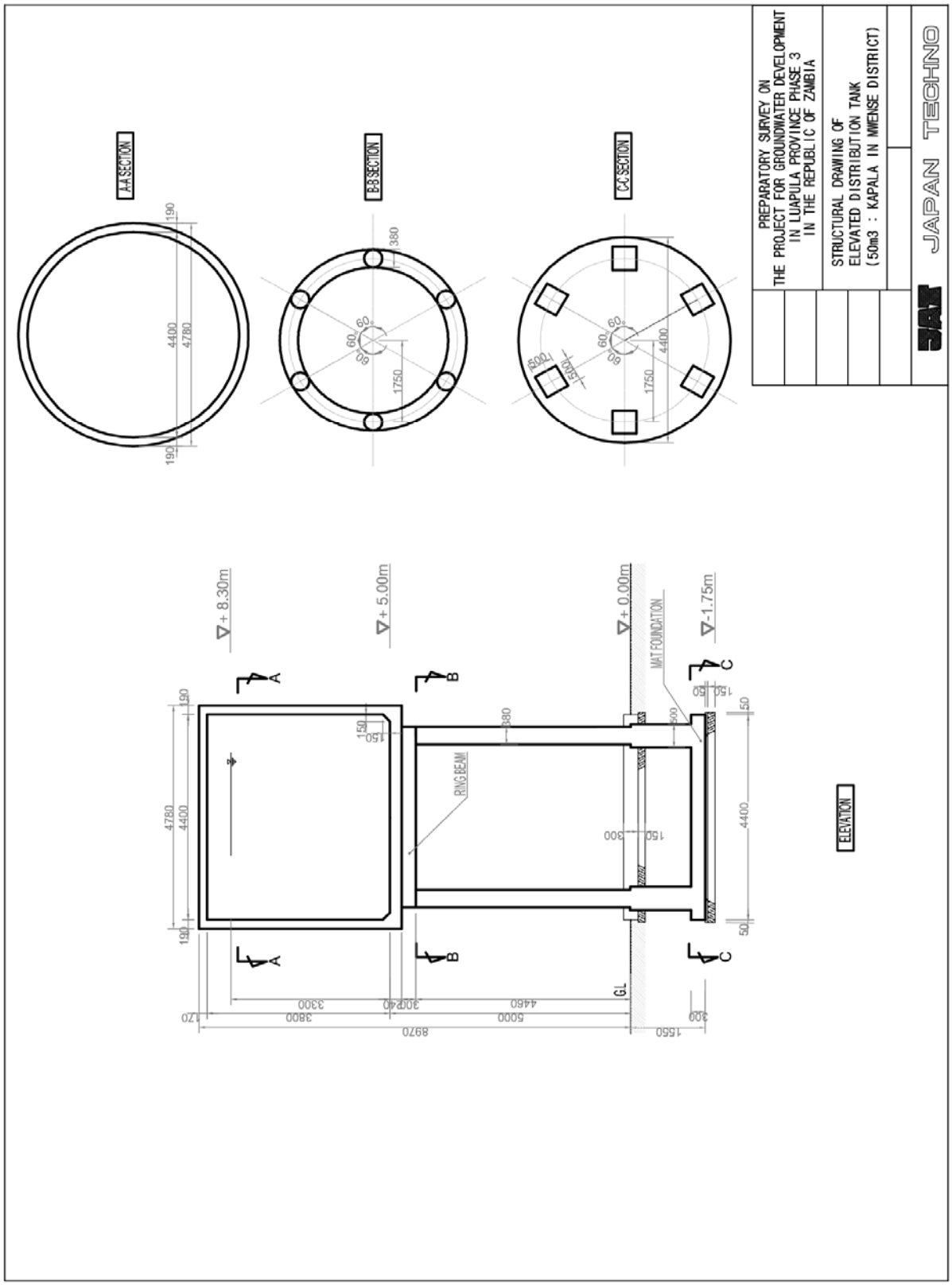


Figure 2-22 Structural Drawing of Elevated Distribution Tank (50m^3: Kapala in Mwense District)

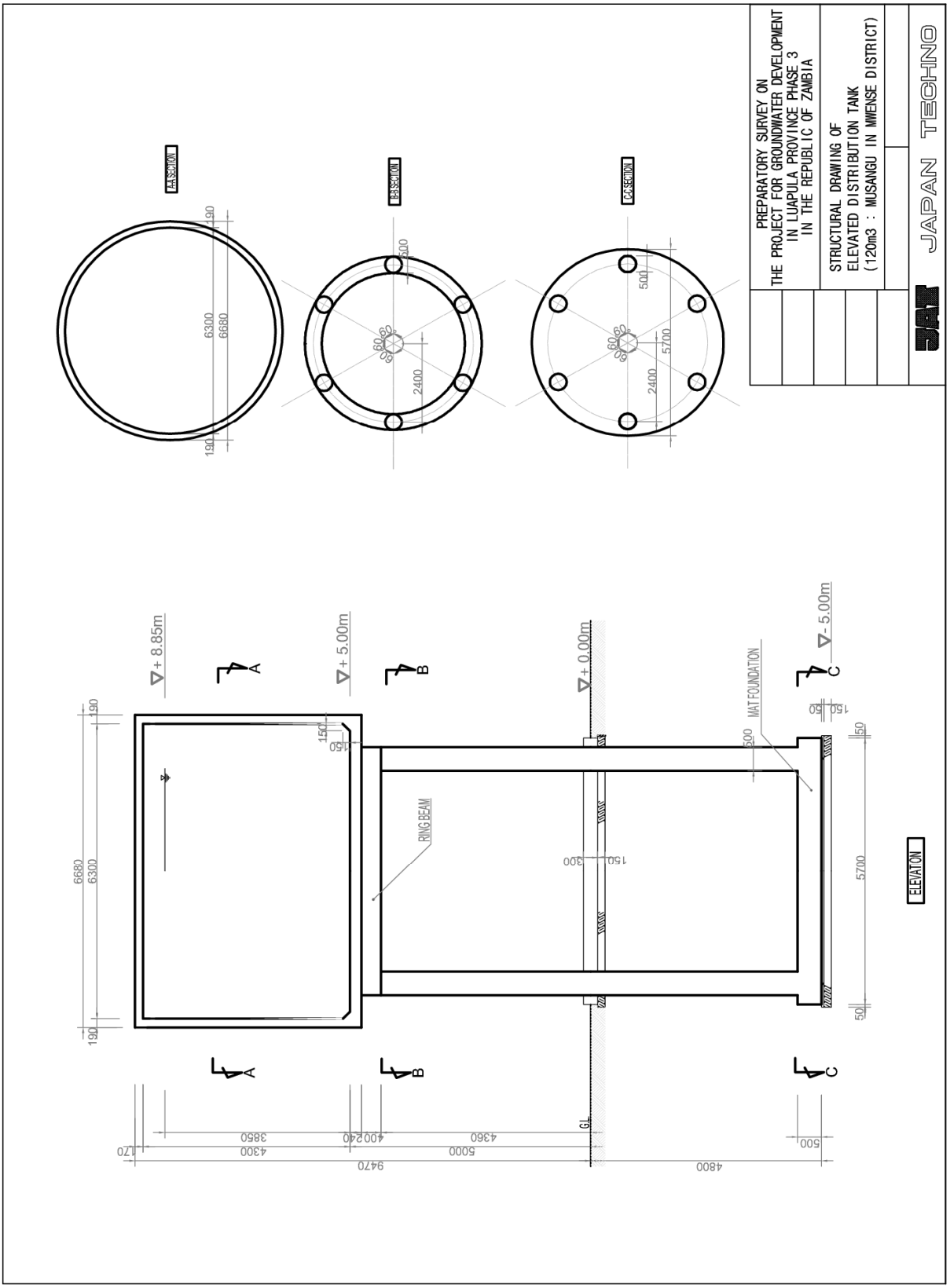


Figure 2-23 Structural Drawing of Elevated Distribution Tank (120m^3: Musangu in Mwense District)

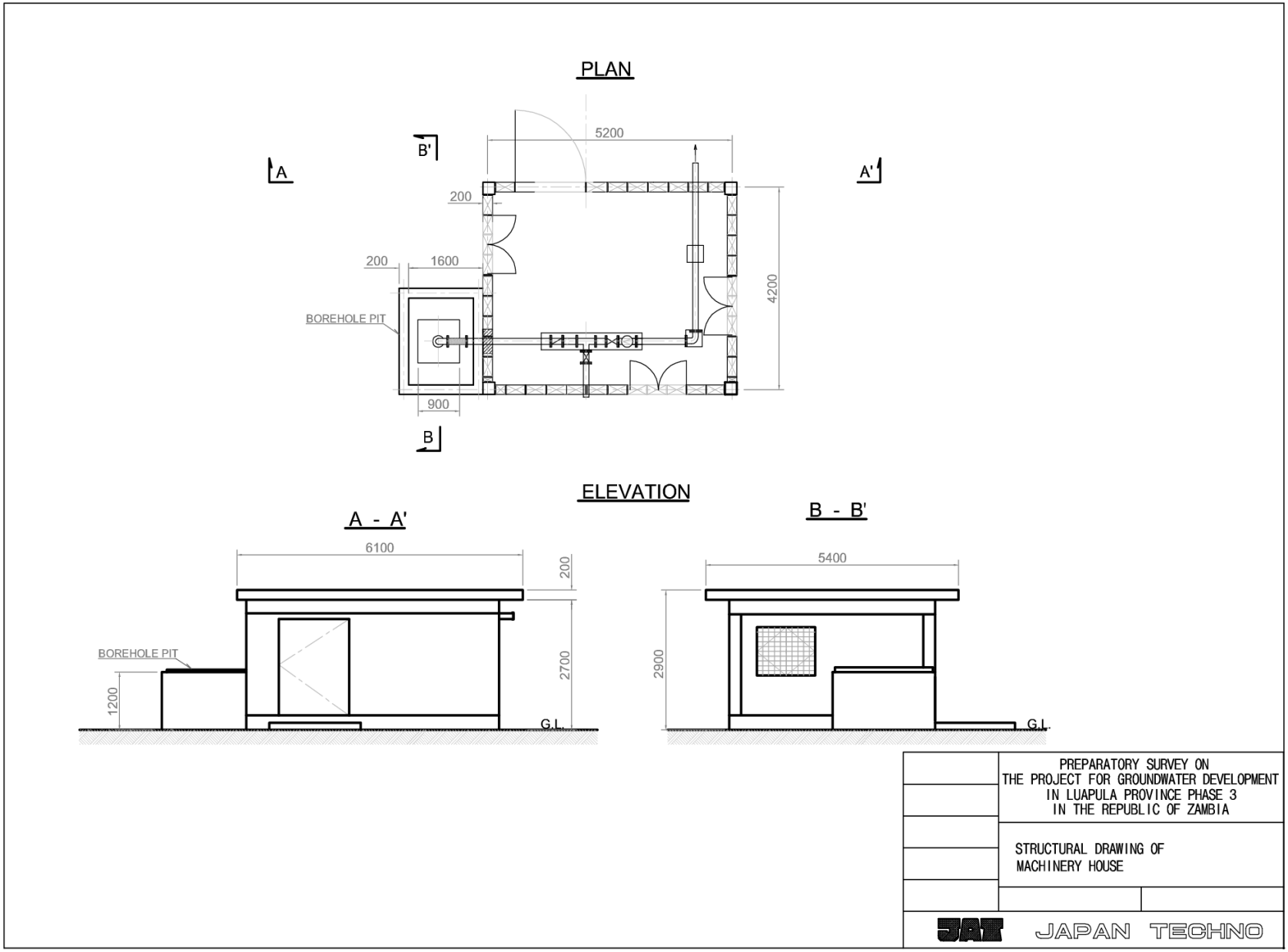


Figure 2-24 Structural Drawing of Machinery House

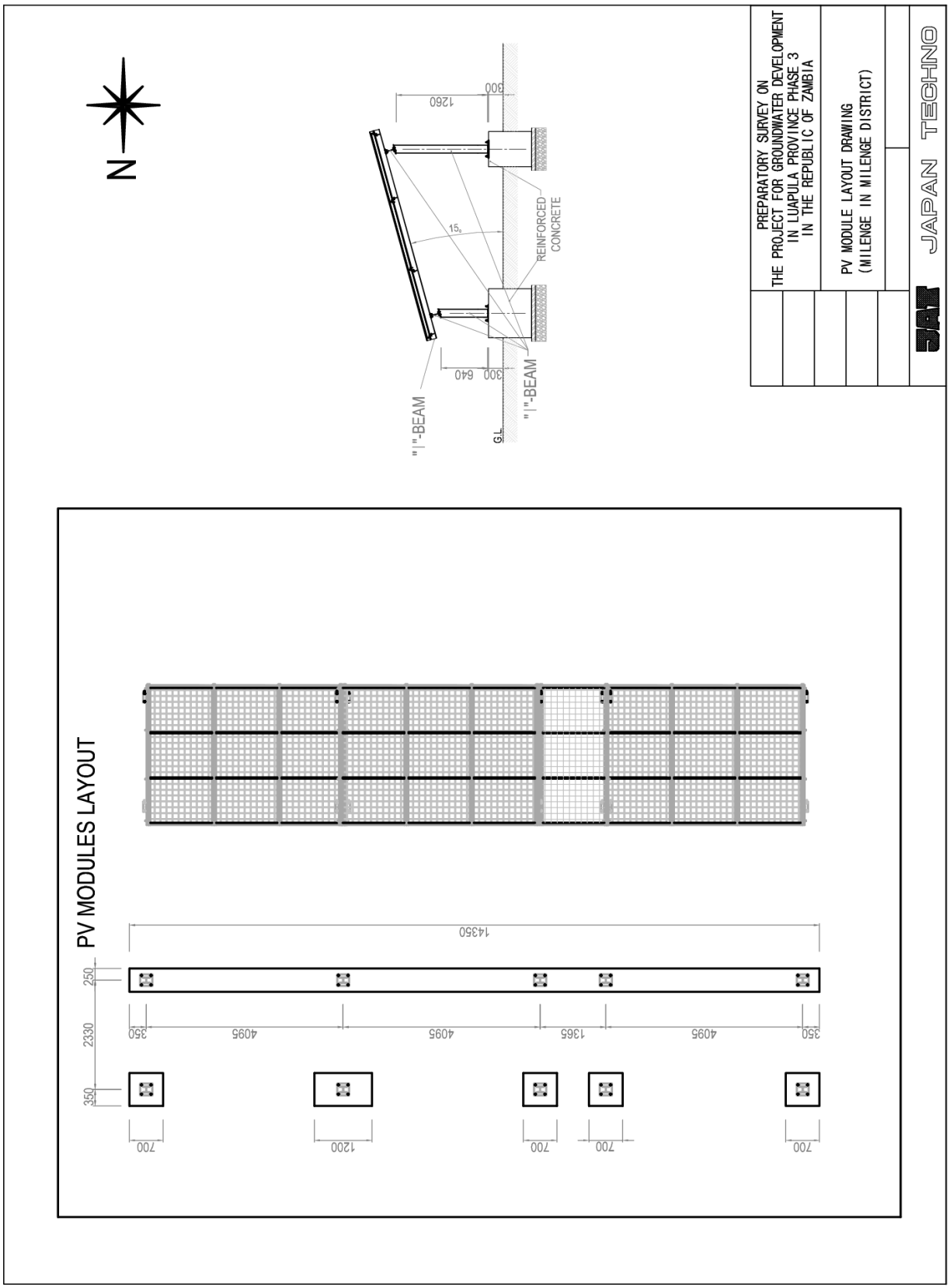


Figure 2-25 PV Module Layout Drawing (Milenge in Milenge District)

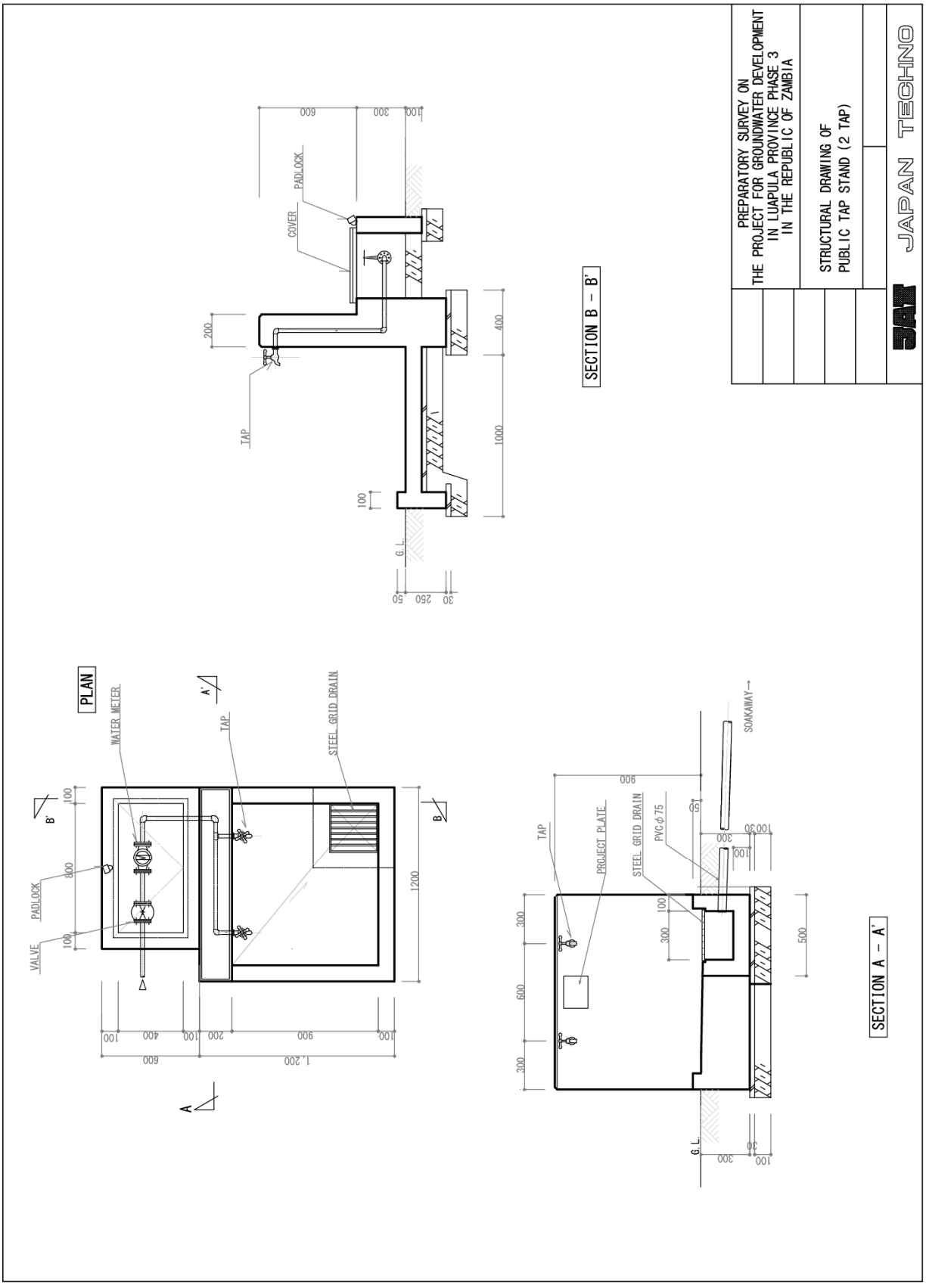


Figure 2-26 Structural Drawing of Public Tap Stand (2 Tap)

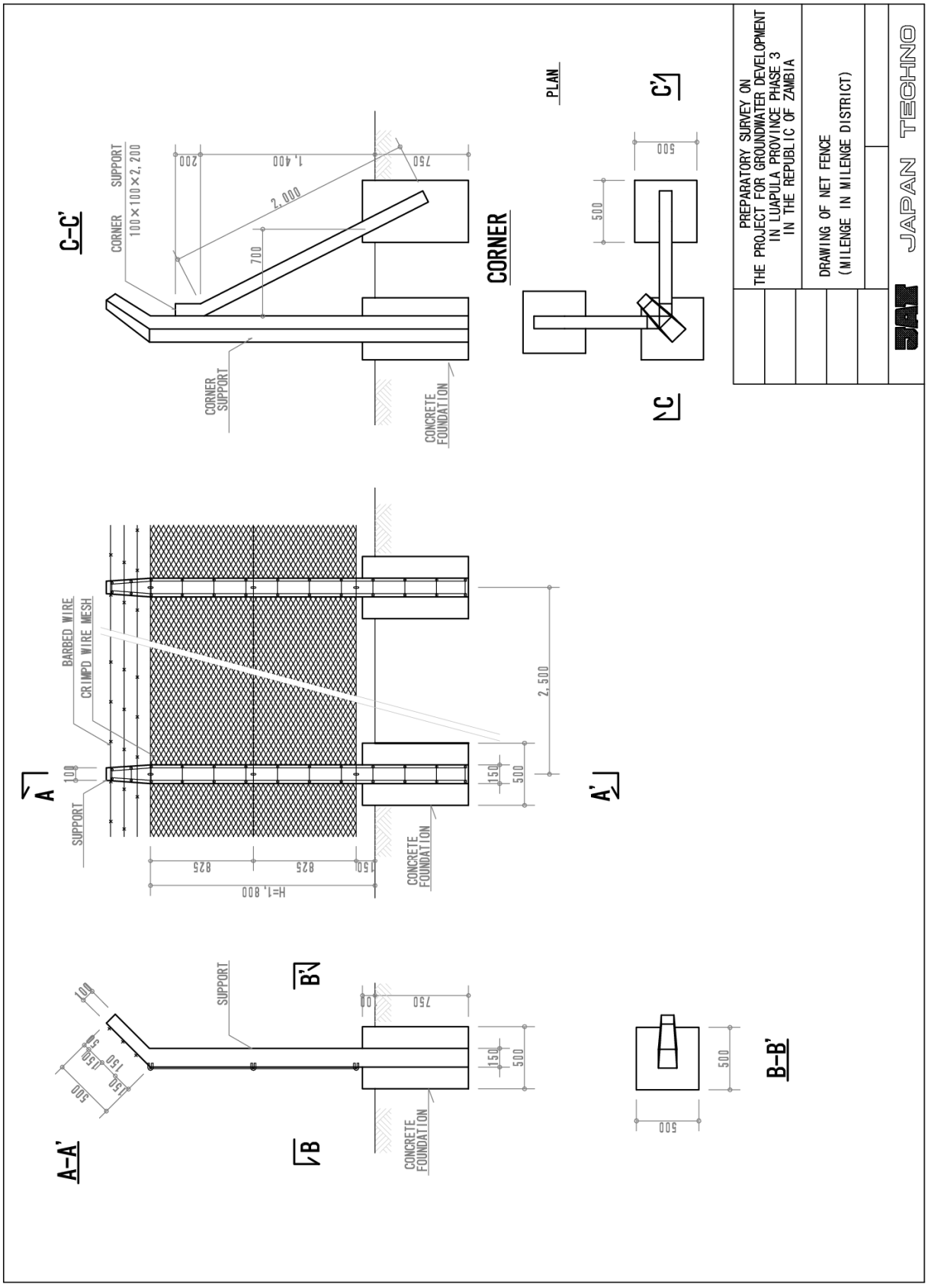


Figure 2-27 Drawing of Net Fence (Milenge in Milenge District)

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The contractor to execute the works for this Project under the Japanese Grant Aid scheme will be a Japanese firm. The contractor will complete procurement and construction of water supply schemes within the period stipulated in the contract under the supervision of a Japanese consultant.

As the project implementation plan, appropriate construction schedule and implementation organization considering implementation under a general grant aid scheme need to be planned. Figure 2-28 shows the project implementation organization.

Wherever possible, the Project will apply Zambian standards in the design and procure locally distributed goods and materials based on specifications in consideration of cost reduction. Utilization of Japanese engineers as much as possible is desirable considering the requirements in quality and schedule management. However, in view of cost reduction, the project will utilize local human resources for supervision to a possible extent. Section 2-2-4-4 “Consultant Supervision” explains the main personnel and their work descriptions.

MLGH/DHID as the implementation agency has responsibilities from detailed designing up to construction of the facilities as well as scheme operation and maintenance. During the construction stage, the persons in charge from DHIDs and provincial office will supervise the works, and V-WASHEs will maintain the schemes after completion. D-WASHEs will be responsible for sensitization activities to V-WASHEs and monitoring.

On the other hand, after the Exchange of Notes between both countries and Grant Agreement between the Zambian Government and JICA, a Japanese consultant will be recommended by JICA to the Zambian side as the supervisory consultant. The consultant will carry out the detailed design study; prepare the tender documents; assist the tendering and conclusion of the contract (between MLGH and the selected contractor); and supervise the construction works.

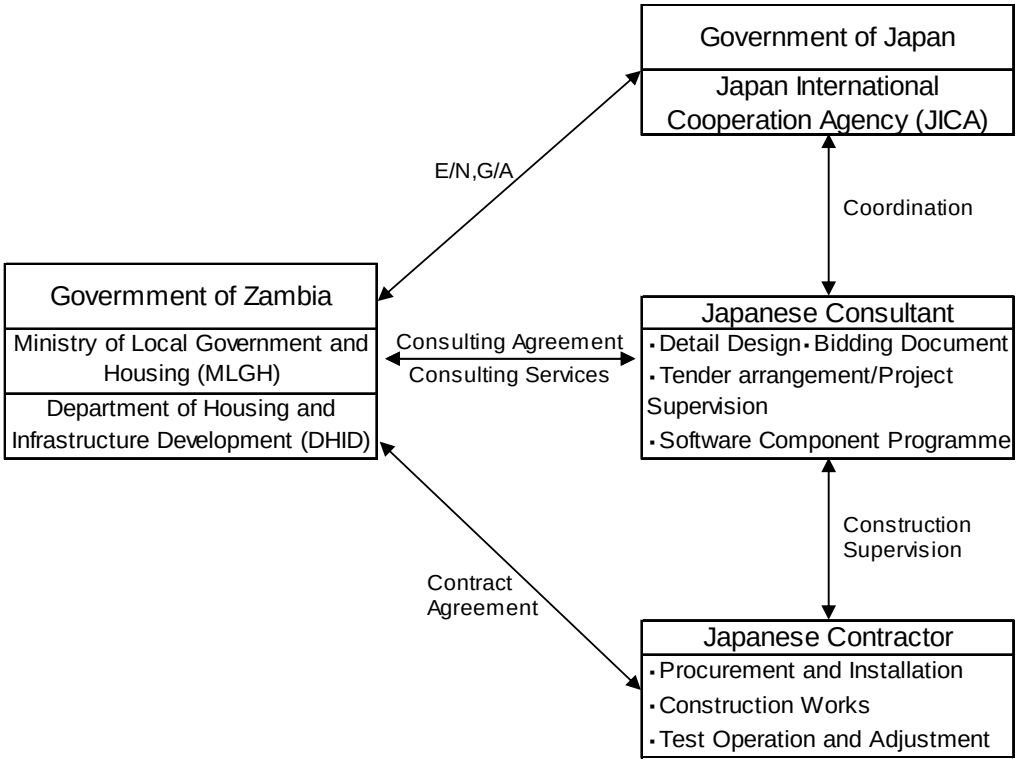


Figure 2-28 Roles and Responsibilities of Stakeholders for Project Implementation

2-2-4-2 Implementation Conditions

(1) Construction Plan

The project target area is distributed over a large area of 350km from north to south and 100km from east to west. Therefore, construction works should be carried out in concentrated groups to avoid delays even in case unanticipated incidents occur.

(2) Climate Conditions

Climate in the target area is tropical which has distinct dry and wet seasons. Since access conditions become remarkably worse during the rainy season, the situation should be incorporated into the construction schedule by carrying out works which are susceptible to rains during the dry season to shorten the whole time period.

(3) Procedures for Tax Exemptions

Hand pumps, submersible motor pumps and solar pumping systems as well as other equipment are expected to be procured from abroad. Therefore, the contractor must fully understand the relevant laws of Zambia and act promptly so that the Zambian side can process tax exemptions without delay.

(4) Safety Control

The fundamental safety measures are as follows.

1) Although some of the project sites are located along the border with the Democratic Republic of the Congo, the security conditions are stable at present. However, during the construction period, more information will be collected and communication with relevant organisations will be made as soon as possible to arrange necessary measures, in case conditions change.

2) A construction logistics plan should be prepared and vehicle overloading must be prevented. Moreover, since streetlights are not installed in the target area creating an unsafe environment for night driving, in principle, night travel will not be allowed.

3) During pipe laying works, backfilling should be carried out as soon as possible for public safety and prevention of pipe material theft.

2-2-4-3 Scope of Works

The scope of works of the Zambian side and Japanese side consists of the following.

(1) Scope of Works of Zambian Side

1) Concerning Construction of Boreholes fitted with Hand Pumps

a. Securing, clearing and levelling of the land for construction works at 200 sites
b. Preparation of access roads (clearing, repairing, expansion, etc.) to drilling points
c. Securing, clearing and levelling of space for storage of materials, base camps and sub-base camps
d. Allocation of necessary counterparts necessary for implementation of the Project (at least one officer from both MLGH headquarters and PST, and 1 or 2 officers from each target district)
e. Supervision and guidance on sustainable operation and maintenance of the constructed facilities

2) Concerning Software Component

The responsibilities of the Zambian side for the software component programme include provision of activities fees, personnel assurance and allocation of their allowances. Refer to “Section 2-2-4-7 Software Component Plan” for details. Other responsibilities of the Zambian

side are listed in “Section 2-3 Obligations of Recipient Country” and “Section 2-5-1-1 Cost Borne by the Zambian Government”.

(2) Scope of Works of Japanese Side

1) Concerning Construction of Water Supply Schemes

a. Construction of 200 boreholes fitted with hand pumps in 4 districts of Luapula Province (Nchelenge, Mwense, Mansa, Milenge)
b. Construction of 5 piped water supply schemes in 3 districts of Luapula Province (Nchelenge, Mwense, Milenge) including procurement of equipment and materials and extension of power lines from existing grids to machinery houses
c. Construction and demolition of temporary works (such as stock yards and offices)
d. Execution of quality inspections mentioned in “Quality Control Plan”

2) Concerning Software Component

Implementation of the software component will include formation and re-activation of V-WASHEs which will operate and maintain the constructed water supply schemes, as well as capacity development on integrated knowledge, technical and management skills to operate and maintain the facilities.

2-2-4-4 Construction Supervision

As the Project will be implemented under the Japanese Grant Aid scheme, a Japanese consultant firm will be in charge from detailed design to supervision of the construction. Also, supervision of the software component including community sensitization, mobilization, and training on operation and maintenance will be carried out through an NGO or a local consultant. The major service items are described below.

Table 2-24 Outline of Consultant’s Activities

Stage		Activity
1.	Pre-Implementation Stage	Preparation of detailed design Supervision of software component activities Preparation of tender documents Assistance in tendering Evaluation of tender results Assistance in contracting procedures
2.	Project Implementation Stage	Supervision of construction and procurement Supervision of software component activities Inspection and operation guidance Preparation of reports

During the detailed design stage for this project, the target site situation will be confirmed and to avoid problems with land acquisition related to construction of water supply schemes, consent will be obtained from target residents through discussions with the implementing agency and D-WASHEs.

During the construction stage, quality control and schedule management will be carried out through arrangements and coordination with relevant authorities such as the implementing agency to ensure smooth implementation of the project. A special consideration should be paid to document preparation for tax exemption.

The hydrogeologist and resident engineer will be in charge of supervision of borehole construction including such tasks as selection of drilling points and arrangements for unsuccessful boreholes. The resident engineer will supervise the construction of IRPs and training on operation and maintenance of IRPs. The resident engineer and the personnel in charge of operation and maintenance will carry out the software component through spot supervision. The assigned tasks of each Japanese consultant are summarized as follows.

Table 2-25 Roles of Consultants during Detailed Design Stage

Consultant Staff	Main Scope of Work (Detailed Design)
Chief Consultant	・As team leader for this project, to lead discussions with the implementing agency, conduct detailed design study at the target sites, prepare and verify tender documents, and supervise tendering procedures ・To confirm the obligations of the Zambian side, and coordinate with other donors
Hydrogeologist	・To implement geological surveys at the sites and hold discussions with the villagers to determine the drilling points ・To implement the detailed design study and prepare the tender documents
Geophysical Engineer	・To perform electrical prospecting at the target sites and analyse data and give the results/information on the prospection to the hydrogeologist for use in the decision process of drilling points at each target site ・Because of the large number of sites and their expanded locations, two teams will perform the survey
Water Supply Engineer	・To prepare detailed design and tender documents for piped water supply schemes
Cost Estimation/ Tender Document/ Execution Plan	・To conduct survey on availability and prices of local materials and equipment, carry out cost estimation during detailed design, prepare tender documents and draft the pre-qualification conditions
Operation & Maintenance / Sanitation Education	・To explain O&M procedures to the implementing agency and concerned authorities at districts before commencement and after completion of construction works ・To support the selection procedure of the NGO/Local Consultant to be sub-contracted for software component activities, and technically support and supervise the said activities

Table 2-26 Roles of Consultants during Supervision of Construction Works

Consultant Staff	Main Scope of Work (Construction Supervision)
Resident Engineer 1 (Boreholes with Hand Pumps)	・As preparation for construction of boreholes with hand pumps, to guide the contractor and verify preparation of equipment and personnel of the contractor at the commencement of construction works to ensure proper works ・To be stationed at the target area for supervision works of construction and procurement of boreholes with hand pumps ・To report regularly to the implementing agency, organize regular meetings with the contractor, manage quality control during construction, conduct security management, and report periodically to Japan ・To conduct inspections after completion of construction works for boreholes with hand pumps, and hand over to the Zambian side
Resident Engineer 2 (Piped Water Supply Schemes)	・As preparation for construction of piped water supply schemes, to guide the contractor and verify preparation of equipment and personnel of the contractor to ensure proper works. ・To be stationed at the target area for supervision works of construction and procurement of piped water supply schemes. ・To report regularly to the implementing agency, organize regular meetings with the contractor, manage quality control during construction, conduct security management, and report periodically to Japan ・To conduct inspections after completion of construction works for piped water supply schemes and hand over to the Zambian side
Hydrogeologist (Spot supervision)	・To arrive at the target area before commencement of the construction works to transfer the sites for borehole drillings to the contractor. Also, to give technical advice on drilling supervision to the resident engineer of the consultant in order to improve the success rates of borehole drillings ・To carry out necessary additional geophysical surveys in accordance with progress in unsuccessful drillings
Supervision Engineer (support at commencement and completion)	・To organize the project management (establish a project management framework) before commencement of the construction works ・To conduct inspections after completion of construction works, and hand over to the Zambian side ・To make reports to the implementing agency, concerned authorities at the districts and Japanese organizations such as Japanese Embassy in Zambia
Operation & Maintenance/ Sanitation Education	・To supervise software component activities performed by NGO/local consultant during the project implementation

2-2-4-5 Quality Control Plan

Following are the methods for quality control of the construction works as well as equipment and materials to be used.

(1) Equipment, Materials and Tax Exemption

The Project plans to control the quality of equipment and materials to be used through the following process.

a. The contractor will order the equipment and materials only after confirmation of their qualities.
b. As soon as possible after the contractor has ordered the equipment and materials, the contractor will submit necessary documents for tax exemption procedures to the implementing agency and request assistance for the tax exemptions.
c. The field engineers of the contractor will reexamine the equipment and materials upon their arrival at the sites.
d. The contractor will submit necessary documents such as data for quality tests at the factory, strength tests and other information to the consultant for purposes of quality management of the equipment and materials.
e. The resident engineer of the consultant will verify qualities before construction, layout and installation, and decide on whether the equipment and materials can be used for the Project or not.

On the other hand, equipment for borehole drillings possessed by local private companies are expected to be used under the responsibility of the Japanese contractor. However, before mobilization of the equipment into the Project area, the consultant will verify the capacities of the equipment, their maintenance conditions and appropriateness of tools and consumables to the geological conditions of the Project area. Also, the consultant will confirm with the contractor on measures to be taken in case problems occur with the equipment.

(2) Construction of Boreholes with Hand Pumps

1) Drilling of Boreholes

a. Samplings of drilling cuttings are taken at 2m intervals (1m intervals in case of sediments) and at points where stratums change to assess the hydrogeological conditions.
b. After electrical logging, identification of aquifers and screen positions will be carried out by the contractor for approval by the consultant.
c. After casing pipes, screens and gravel packs are placed, clay seal and backfill with drilling slime are required. Also, cementation and sanitary sealing will be placed.
d. Pumping tests and their data analyses will be conducted by the contractor for approval by the consultant.
e. Water samples are taken shortly before the end of constant rate pumping tests to evaluate the amounts of water that can be pumped from the wells. Water quality testing at the field and laboratory will be conducted on water samples.

2) Hand Pump Installation and Construction of Appurtenances

a. Foundations for hand pumps must be carefully constructed to ensure verticality when installing riser pipes.
b. For sites requiring IRPs, careful attention is needed since hand pumps at some sites may need to be installed at higher levels as explained previously.
c. Attention needs to be paid to ensure proper inclinations of drainage ditches.
d. For water penetrating geologic formations, closed type buried soakaways will be installed, and for formations with clay or rock, diffusing type open drain pans will be installed.

3) Concrete Works for Iron Removal Plant and Foundations of Pumps

The Project plans to use job-mixed concrete as the Project sites are located in scattered areas and relatively small amounts of concrete is needed for each facility. Mix proportioning and measurement of concrete will be made manually, while mixing will basically use a portable mixer. Based on the proportion acquired from trial mixings, job-mixed concrete will be examined through slump tests, simple chloride content tests and air content tests. Compressive strengths will be tested in the laboratory on concrete aged 7 days and 28 days.

(3) Construction of Piped Water Supply Schemes

1) Concrete Works

Ready mix concrete cannot be used in this project since the target sites are scattered over a wide area. Moreover, since the volume of concrete required per day is small ranging from $5m^3$ to $20m^3$, concrete is to be mixed on site. In principle, batching and mixing of concrete at site are to be performed manually using portable mixers. Field tests of concrete such as slump tests, concrete air entrainment tests and testing of chloride content will be carried out during concrete works. Compressive strengths of concrete for 7-days strength and 28-days strength are to be implemented at authorized public or private laboratories.

Moreover, special attention must be paid to quality control of concrete in case of mixing at site. Adjustment in water-cement ratio of concrete is difficult since moisture contents of aggregates change with weather conditions. Concerning cover depths of reinforcing bars, bar spacers with confirmed compressive strengths are to be used to ensure the specified concrete cover conditions to achieve proper reinforcement of structures. The consultant will inspect the quality of workmanship before casting concrete.

2) Earth Works

In order to minimize short and long term subsidence of storage tanks, backfilling is implemented in layers of 30cm thickness each using proper compaction equipment. After excavation and leveling works, bearing capacities of foundations are confirmed in the presence of the consultant.

3) Pipe Laying Method

Hydraulic tests on mechanical strength and absence of leakages along transmission and distribution pipelines are carried out to inspect qualities of workmanship. Since sand mixed with rock particles are distributed in the target area, for foundations and backfilling of buried PVC pipes, good quality sand must be used to prevent damaging of pipes.

2-2-4-6 Procurement Plan

Main construction equipment and materials required for this project are cement, aggregates, steel, wood, piping materials (such as polyvinyl chloride pipes, steel pipes and valves), submersible motor pump equipment, chlorination equipment and hand pumps. The procurement plan is formulated to utilize local materials wherever possible in consideration of cost, time necessary for procurement, and operation and maintenance aspects. However, if any problems are identified in terms of their quality and availability, they are to be procured from third countries or Japan.

Among the construction materials, since cement and polyvinyl chloride pipes are manufactured in Zambia, they are readily available and their qualities are acceptable. Aggregates, steel materials and wood are also planned to be procured locally. In terms of submersible motor pumps, pump control equipment, PV modules, inverters for photovoltaic systems and chlorination equipment, agencies for these equipment have their offices in Zambia and their procurement within certain fixed periods is possible. Therefore, they are planned to be procured through their agencies upon consideration of operation and maintenance aspects including supply of spare parts. On the other hand, since large diameter steel pipes and valves are difficult to procure locally, they will be considered to be procured from third countries such as South Africa and Europe, or Japan.

Both India Mark-II and Afridev hand pumps can be procured from distributors in Lusaka, the capital city of Zambia. However, since delivery of Afridev hand pumps requires longer time than India Mark-II types, their procurement arrangements need to be made well in advance.

Table 2-27 Procurement Classification of Equipment

Item	Origin			Remarks
	Zambia	Japan	Others	
Construction Equipment and Materials				
Cement, sand, aggregates, steel, wood	○			
Hand pump	○			
Casing, screen, bottom plug, hole cover	○			
Polyvinyl chloride pipe	○			
Steel pipe	○			
Valve, water flow meter, pressure gauge	○			
Submersible motor pump	○			
Pump control equipment	○			
Chlorination equipment	○			
PV module	○			
Solar inverter	○			
Power transformer	○			
Incoming control panel	○			
Plate, sticker		○		
Construction Machinery	○			

2-2-4-7 Software Component Plan

2-2-4-7-1 Operation and Maintenance Issues in the Target Area

Surveys were made on basic policies, implementing structure and capacities of stakeholders for O&M of boreholes fitted with hand pumps and piped water supply schemes, and discerned the following issues to consider for determining appropriate approaches and designing an effective project.

(1) O&M for Boreholes with Hand Pumps

1) Communities' Understanding on Roles and Responsibilities within the Operation and Maintenance Structure and Sense of Ownership

With the NRWSSP being rolled out, some sites already have V-WASHEs organised by communities where hand pumps are already constructed. However, degrees of O&M activities implemented are not uniform. Also, if no hand pumps are existing, the site would not have a V-WASHE. Capacity development at community level for formation and reinforcement of V-WASHEs, thus will be appropriate. Mobilisation of District staffs, Ward Development Committees (WDCs), and APMs trained in the target four districts under the technical cooperation project SOMAP3, as well as activities to be carried out by the Zambian Government themselves will be considered when dealing with capacity development necessary

for the formation of V-WASHEs and for O&M activities.

2) Promotion of Hygiene Knowledge and Practice

The majority of households in the target sites fetch their domestic water from rivers, ponds, unprotected shallow wells and other unsanitary sources. The socio-economic survey conducted under the Project found that 70.7% of households surveyed stated diarrhoea, cholera and dysentery as the major diseases affecting the households, after malaria (82.8% of households surveyed), indicating lack of hygiene practice. Also, the same survey revealed that communities' understanding on causes of diarrhoea is limited, with 82.6% identifying "drinking contaminated water" as the cause, while a few identified other causes such as "through vectors such as flies". To maximise the benefits from supply of safe water, hygiene education is important. Understanding the importance of safe water is also essential to understand the importance of facilities O&M, importance of water fee collection and participation in O&M activities. Therefore, the Project will support hygiene education activities.

(2) O&M for Small Scale Piped Water Supply Schemes

1) Operation and Maintenance Structure of Small Scale Piped Water Supply Schemes in Rural Areas

Currently, an established national O&M structure for small scale water supply schemes in rural areas does not exist, and therefore roles and responsibilities for stakeholders are not yet established. As a nationalised O&M structure is non-existent, a contract for management of the whole or part of a scheme between a community, a private company and LuaWSC is unusual and not well established. Considering the situation, the survey identified necessary activities and capabilities for O&M of schemes to be constructed and evaluated capacities of each stakeholder such as DLAs, private companies, LuaWSC and communities to formulate the O&M plan that is suitable for the current situation of the target area. The Project places importance to promote understanding of the O&M structure and define clearly roles and responsibilities of each actor amongst stakeholders.

2) DLA Monitoring and Support Structure for O&M Activities for Small Scale Piped Water Supply Schemes

In the O&M of piped water schemes, the DLAs are not directly involved. However, DLAs still play a significant role being the major shareholder of LuaWSC and as a member of the board of directors, exercising a monitoring role. In the O&M structure for piped water supply schemes to be constructed under the Project, DLAs and LuaWSC are expected to carry out monitoring of the O&M implementing status. In the case of major rehabilitation/replacement

were contracted to a private company, they are also expected to carry out monitoring of compliance with the contract and intervention if breach of contract occurred. Since the target DLAs have no experience or knowledge in monitoring and supporting piped water supply schemes, capacity development targeting Rural Water Supply and Sanitation Officers (RWSSOs) and other district staffs to support establishing a piped water supply scheme O&M structure, and monitoring and supporting of O&M activities will be needed.

3) Lack of Community Human Resources for O&M of Small Scale Piped Water Supply Schemes

Currently the O&M structure for small scale piped water supply schemes in rural areas in the country is not established and the target sites do not possess experience in managing piped water supply schemes. The Zambian national policy advocates on "achievement of full cost recovery for water supply and sanitation services through user charges in the long run" and formation of community organisations to be in charge of water fee collection and daily water supply facility O&M, and its capacity building will be essential for sustainable operation of the constructed facilities. The Project thus will provide support for establishment of V-WASHEs and O&M capacity building trainings for them. The project designed 3 different types of piped water supply schemes according to power source: gravity, commercial power and solar energy. Therefore capacity development must bear in mind the different skills required to operate and maintain each type of scheme and accommodate them in accordance with the differences.

4) Challenges to Operation and Maintenance Costs of the Constructed Facility

The O&M is estimated to be high compared with boreholes with hand pumps if major rehabilitation/replacement cost, salary of the tap attendants and accountants were included, posing possible challenges to realisation of sustainable contribution system. As a counter measure, it is strongly recommended that parts of the O&M costs, namely major rehabilitation/replacement cost and salary of the guard (in the case of Milenge), are borne by the Zambian government and make a payment arrangement with the tap attendants and accountants work on a voluntary basis to reduce cost share of the community. Which then makes the O&M cost collection more realistic. When such organization is used, support to V-WASHE through software component and appropriate budget measure by the Zambian government becomes important.

5) Promotion of Hygiene Practice and Awareness

Access to safe water can lead to prevention of water borne diseases. However this can only be achieved when water is handled through correct hygiene practices. As the socio-economic

survey conducted under the Project found lack of information and understanding on the causes of diarrhoea, hygiene education will be included in the O&M plan to maximise benefits of safe water supply, promote use of water supply facilities and encourage water fee contributions.

2-2-4-7-2 Objective of Software Component and its Approach

Taking the above mentioned issues into account, the Project will, through the software component, support establishment of the community based O&M structure at the target sites to ensure sustainable use and maximum effects from the water supply schemes to be constructed.

Upon designing the activities plan for boreholes with hand pumps, the Project will consider the O&M structure already established or being established in the 4 districts, and arrange the plan to conform to the existing O&M implementing framework. At the 4 districts, 2 Japanese Grant Aid projects implemented capacity development of DLAs on training of WASHE facilitators and APMs. The projects also provided trainings targeting WASHE facilitators who provide community O&M trainings, and APMs who are in charge of facilities repairs as well as formation and capacity development of V-WASHEs at the target sites. In addition, currently a technical cooperation project, SOMAP3, is delivering direct support for establishment of the SOMAP O&M model whose dissemination is being promoted by MLGH under the NRWSSP.

Through those efforts, establishment of the O&M structure at the 4 districts is being realised. The Project's software component programme for boreholes fitted with hand pumps, thus will mobilise the available resources within the districts, namely DLA staffs, D-WASHE members, WASHE facilitators and APMs, and optimise the support to absolutely necessary activities. More precisely, the scope of assistance will be on orientation for DLAs, WDCs (WASHE Facilitators), APMs, local traditional leaders and communities; selection of candidate sites for facilities to be constructed; formation of V-WASHEs; and training on O&M for sites installed with iron removal plants (IRPs). A local consultant will be managing the WASHE facilitators allocated by the Zambian government on their progress in activities implementation and providing any assistances necessary, since these activities need to be implemented without delay from detailed design up to the initiation of construction. On the other hand, provision of trainings on O&M structure for V-WASHEs and caretakers as well as hygiene training will be under the responsibility of the Zambian government to be implemented by WASHE facilitators and APMs under supervision of DLA staffs.

As for piped water supply schemes, neither MLGH, Provincial DHID nor DLAs have experience in establishment of the O&M structure for this type of schemes and thus would be

challenging for MLGH and DLAs alone to establish coordination of a structure with private companies and LuaWSC on facilities repairs, and provide trainings to communities on O&M responsibilities. Therefore, formation of V-WASHEs and O&M training will be supported by the Japanese side. Further, as DLAs are responsible for operation of the facilities to be constructed, assistance will be provided to strengthen monitoring and support capacity enhancement of DLAs for piped water supply schemes. With these efforts, DLAs collaborates with LuaWSC are expected to become able to conduct monitoring of O&M activities of schemes, and sustainably provide necessary support to communities.

2-2-4-8 Implementation Schedule

The implementation schedule of the Project is shown below.

【Construction Stage】

1) Exchange of Notes (E/N)
2) Grant Agreement (G/A)
3) Consultant agreement
4) Detailed design: Detailed design study, preparation of tender documents
5) Software component
6) Tendering procedure and contractor contracting
7) Supervision of construction
8) Construction of boreholes fitted with hand pumps
9) Construction of piped water supply schemes
10) Completion and handing over

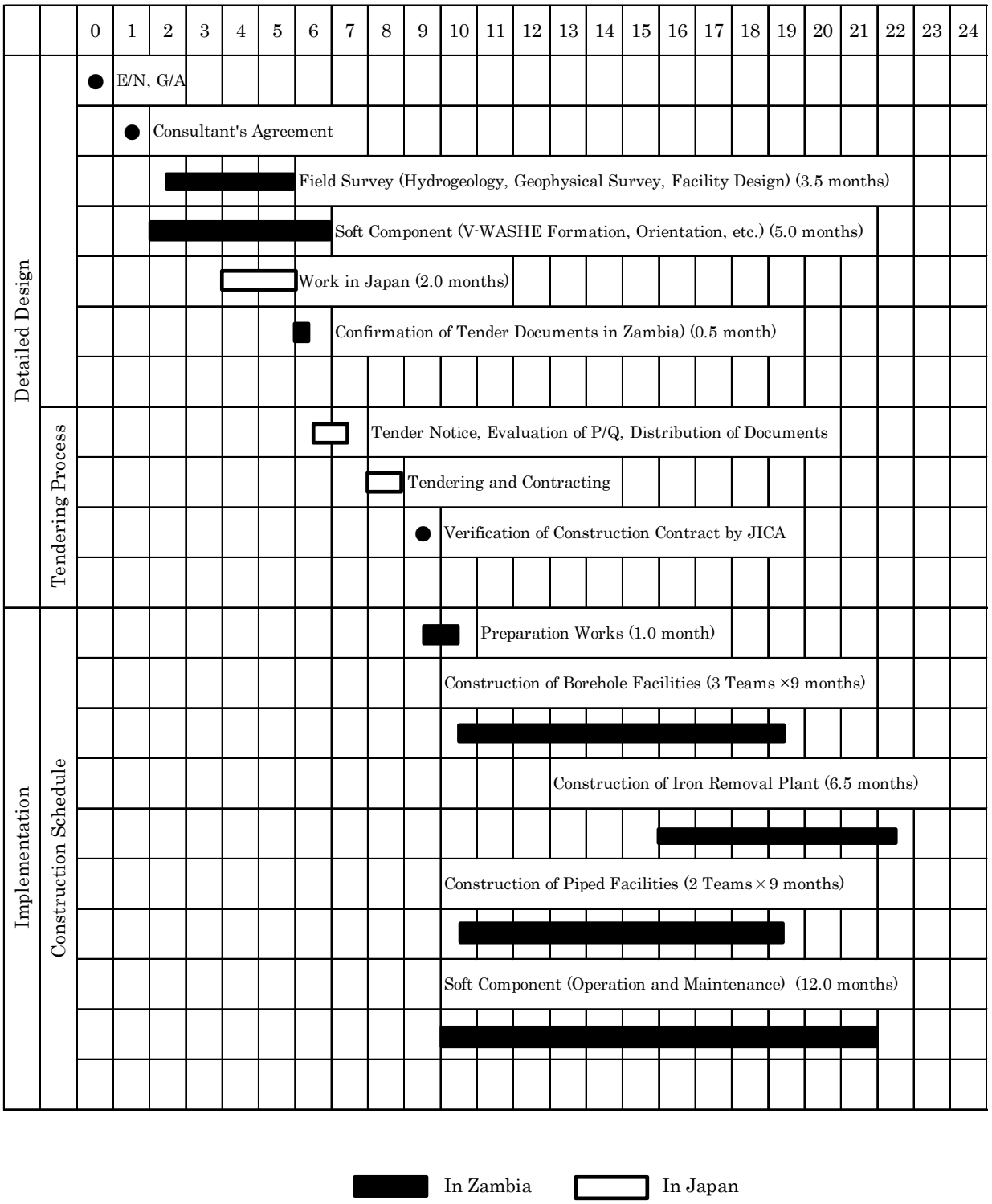
The implementation schedule of the Project needs about 22 months after E/N and G/A for carrying out detailed design, software component, borehole construction, installation of hand pumps, construction of aprons, installation of iron removal plants and construction of piped water supply schemes.

Table 2-28 Contents of Main Activities and Schedule

Main Activities	Schedule
(a) Consultant agreement, formation of V-WASHEs, detailed design, cost estimation review, preparation of tender documents, approval of tender documents	6.0 months
(b) Tendering, contractor contracting, verification of contract, borehole drillings, installation of hand pumps, construction of appurtenant facilities, installation of iron removal plants, installation of submersible motor pumps, construction of distribution tanks, installation of transmission and distribution pipes, installation of electrical equipment, installation of solar powered pumping system (during the rainy season, main works will be suspended)	16.0 months
Total	22.0 months

As drilling machines and other heavy machines will have difficulties to access the sites during the rainy season, drilling works will be suspended during 3 months of the year. Therefore, a total of 9 months per year is possible to carry out borehole drilling works. Based on the above policy, the implementation schedule for the Project is prepared as shown in the Table 2-29.

Table 2-29 Implementation Schedule



2-3 Obligations of Recipient Country

2-3-1 Obligations of Zambian Side

When the Government of Japan decides to implement the Project under the grant aid scheme, the Government of Zambia must confirm undertaking the following responsibilities in order for the Project to proceed in a smooth manner.

- NRWSSP regulates that community should contribute ZMW1,500 as a condition for commencement of construction of water supply schemes. As agreed in the field survey, the implementing agency and district government are to conduct sensitization activities to the community members and collect the above mentioned contributions for the Project.
- The implementing agency is to allocate a project manager (PM) in the target area in accordance with the Project and bear the expenses for the PM.
- To allocate D-WASHE members from the target districts during the Project period to participate in inspections of construction works and software component activities to be conducted by a local consultant, and bear expenses of the D-WASHE members.
- To exempt Japanese nationals from customs duties and internal taxes which will be imposed in the recipient country with respect to the supply of equipment and materials and services under the verified contracts and to accord Japanese nationals such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work. Especially, regarding tax exemption of the procured materials, MLGH has responsibilities to request relevant organizations to assure tax exemptions.
- To ensure prompt procedures for customs clearance and internal transportation of procured equipment.
- To secure land necessary to construct the water supply schemes and to clear, level and reclaim the land prior to commencement of the construction.
- To secure land necessary for base camps and stockyards for the contractor in the target districts during the construction period.
- To prepare, rehabilitate and/or expand access routes to construction sites and provide necessary incidental facilities in and around the project sites.
- To conduct necessary procedures (such as those for road crossing of pipes or power extensions) without delay.
- To facilitate community members to establish fences around borehole facilities.
- To operate and maintain the schemes constructed and equipment procured under the grant aid properly and effectively, and to appoint necessary staffs for the operation and maintenance.
- To bear all expenses other than those covered by the grant aid.

・To prepare enough budget necessary for activities of staffs in conducting software component.

・As the responsible agency for “Phase III Project”, MLGH is to allocate suitable staffs capable of handling any issues of the Japanese side during the project.

2-3-2 Feasibility and Adequacy

According to lessons learnt from “Phase I Project” and “Phase II Project”, the items mentioned above are imperative for achieving the outcomes of this Project. Therefore, the Government of Zambia is expected to secure necessary budget for conducting the above items and facilitate the smooth implementation of the Project.

2-4 Project Operation Plan

2-4-1 Operation and Maintenance Structure

In Zambia, the government has been promoting the WASHE (Water, Sanitation, and Health Education) approach since the mid-90s and based on which, has been making efforts to establish the community based O&M structure for rural water supply schemes. Efforts include formation of V-WASHEs, capacity development of V-WASHE members on O&M activities, and capacity development of stakeholders who promote activities of V-WASHEs. As mentioned in Section 2-2-1-6, "Policy on Operation and Maintenance", the basic principles and the O&M model to be established in each district are now explained in the O&M Guidelines and O&M Implementation Manual and MLGH is rolling out the O&M model nationally under NRWSSP.

The boreholes fitted with hand pumps to be constructed under the Project will be incorporated into the targeted four districts' framework supported under NRWSSP and JICA Technical Cooperation Project to establish the O&M structure. On the other hand, since an established government policy on O&M structure for piped water supply schemes in rural areas does not exist, the Project assessed capacities of stakeholders in the target sites, DLAs and Luapula Province to determine the most pertinent O&M option. From the situation analysis, the Project opts for the community based O&M structure, where the principal responsibilities are attributed to community members, the users of the facilities, same as the structure for boreholes fitted with hand pumps. The scheme is to be maintained by community members led by V-WASHE to implement daily O&M activities, while major repairs and replacement works will be made by private companies through signing of a service provision contract. This O&M structure utilises the same framework of community based O&M structure for boreholes fitted with hand pumps being promoted by the government. The structure using community organised V-WASHEs as the main actors, while using private entities (such as APMs and private companies) for repairs beyond the community's capacity, with support provision by DLAs, will be the common theme for both boreholes fitted with hand pumps and piped water supply schemes. Further, LuaWSC will conduct regular monitoring of the facility O&M to provide technical support.

Organisation charts of the O&M structure for both boreholes fitted with hand pumps and piped water supply schemes are illustrated in the next page. In addition, roles and responsibilities of each stakeholder are described below.

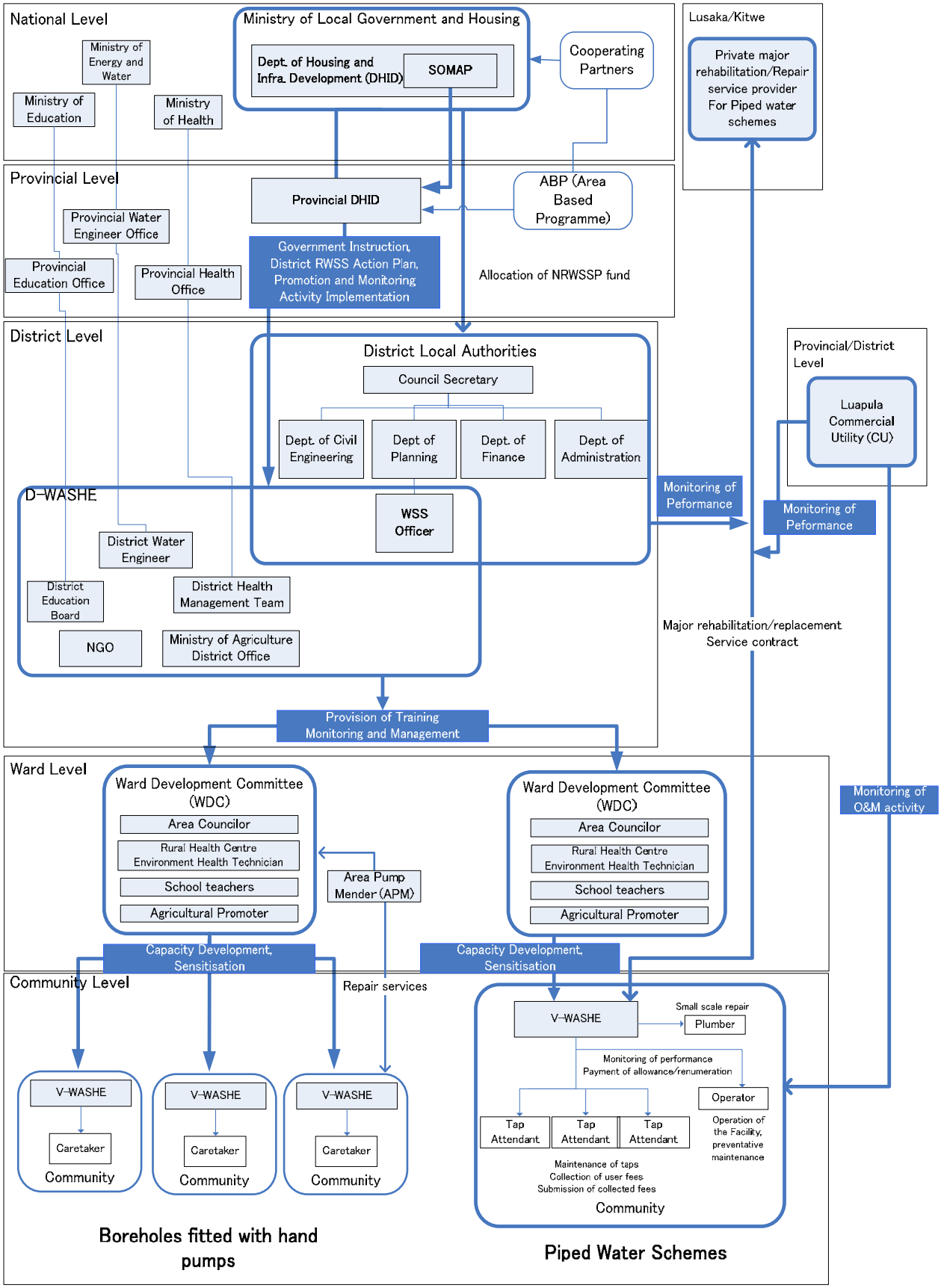


Figure 2-29 Operation and Maintenance Structure for Water Supply Schemes

(1) Village Water, Sanitation, and Health Education Committee (V-WASHE)

The community that will use a water supply scheme forms a V-WASHE to take principal responsibilities for O&M of the scheme. The main roles of the V-WASHE are identifying improvement needs for water supply and sanitation related matters; preparation of an action plan and its implementation; daily preventative maintenance of the scheme; managing facilities repairs; water fee collection and management of the collected funds; dissemination of information on proper use of facilities and hygiene practices; and coordination between the community and public authorities. V-WASHE consists of a chairperson, vice chairperson, secretary and accountant. For hand pump schemes, caretakers also form part of the V-WASHE, and for piped water supply schemes, tap attendants and scheme operators will be employed under management of V-WASHEs.

In addition, for the solar powered scheme, a guard will also be hired to protect the solar equipment. The tap attendant will be in charge of the tapstand assigned to him/her to open the tap during agreed hours and lock it outside of the hours, and manage the water usage situation as well as collect water fees from registered users of the scheme. Furthermore, a selected and trained population from the community will be placed to perform small scale repairs on taps and pipelines when needs arise, and the V-WASHE will pay a repair fee accordingly. This position can be occupied by already existing APMs should s/he happen to live in the vicinity.

(2) Area Pump Mender (APM)

For repairs beyond the community's capacity, V-WASHEs request services from the APMs who are private for-profit hand pump repairers. The DLAs request communities to select individuals within their wards who meet a set of criteria[3] to be trained by the DLAs to become APMs. Toolkits for repairs are kept at toolkit centres created as part of the O&M mechanism and APMs rent the toolkits through a small fee for their repair works. An APM may also be selected as the plumber for a piped water supply scheme, if criteria such as residing near the scheme are met.

(3) Ward Development Committee (WDC)

Based on the decentralisation policy (2002) and decentralisation implementation plan 2009-2013 (2009), the government is carrying out revision of the Local Government Act (1991) to incorporate WDCs as the governmental structure under DLAs. As of the time of this survey, factors such as selection criteria, procedures and scope of their activities were yet to be revealed. However, the WDC is to be composed of community representatives and government/public officials[4] at community level, like the predecessor of the WDC, Area Development Committee (ADC) [5]. Functions of WDCs include coordination between communities and districts,

[3] DLA sets criteria for selecting APMs. General criteria sought include, 1) a resident of the area, 2) has trust from the community, 3) willing to work as an APM, and 4) has technical knowledge for bicycle repairs, or is a plasterer.
[4] Environmental health technicians (EHTs) of Rural Health Centres (RHCs) under the Ministry of Health, school teachers, agricultural extension staffs, etc.
[5] ADCs had been established since 2006 based on the decentralization implementation plan and decentralization policy, but there was no policy to formalize the institution. Together with the preparation to establish WDCs,

promotion of community participation in area development planning at ward level, and provision of information or technical support on developmental issues in the area.

With relation to water supply and sanitation projects, WDCs form V-WASHEs, provide capacity trainings on themes such as financial management and organisational management, promote hygiene, and monitor activities of V-WASHEs. Furthermore, a member of WDC chosen by the District from each ward manages the toolkit centre[6], collects rental fees and manages the finance. Establishment of the WDC is planned under MLGH's 2014 budget, and although there is no official structure in place currently, the government workers who had been members of the former ADC and who possess facilitation experiences in water supply and sanitation projects are present at Ward level. Therefore utilisation of such personnel until the establishment of the WDC to conduct monitoring, or capacity development at community level is possible.

(4) District Local Authority (DLA)

DLAs prepare O&M action plans to conduct series of O&M activities such as capacity development of the above-mentioned stakeholders, allocation of hand pump spare parts and repair toolkits within the district, and monitoring, as the main responsible entity of the rural water supply and sanitation project. Each district has one Rural Water Supply and Sanitation officer (RWSS officer)[7] under the Director of Works (DOW) or Director of Planning (DOP). The officer prepares, implements and manages the District Rural Water Supply and Sanitation plan, including the O&M action plan, as the principal actor.

Apart from the above, according to the SOMAP O&M model, operation of spare parts shops, the key for establishment of the spare parts supply chain for hand pumps, is to be managed by the DLA. The operation is carried out under the RWSS Officer as manager, together with the procurement/stock management officer appointed by the DLA.

For piped water supply schemes, activities such as formation of V-WASHEs, capacity development training, scheme O&M management and monitoring require a certain level of expertise and skill, and direct involvement of the RWSS Officer is essential. DLAs will prepare and implement appropriate support plans, based on the community's needs, including utilisation of skills from the private sector.

(5) District Water, Sanitation, and Health Education Committee (D-WASHE)

The district level carries actors such as extension officers from Ministries involved in water supply and sanitation projects and NGOs who cooperate with DLAs. D-WASHEs, comprised

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activities of ADCs had stopped (de facto, abolished).

[6] The DLAs select schools or RHCs located in the heart of a ward as the toolkit center.

[7] At the initial stage of the NRWSSP, establishment of the RWSS Unit was promoted as the main responsible body in charge of the district's rural water supply and sanitation projects. However, with the limitation of government funding among other factors, the establishment of the Unit was not achieved in all districts.

of representatives of these organisations and DLAs, coordinate rural water supply and sanitation activities of each organisation in the districts, as well as provide support to preparation and implementation of district action plans.

(6) Private Company

Private companies under contract provide regular scheme inspections and repair services beyond communities' abilities. The companies situated in Lusaka or other big regional centres such as Kitwe, will be utilised since private companies with appropriate skills are not available in Luapula Province. For early repair actions, the target community and private company will sign a contract in advance for repairs and inspection service provision. The contract signing will be intervened and monitored by DLAs, and compliance with the contract by both sides will also be monitored.

(7) Luapula Water and Sewerage Company Limited (LuaWSC)

LuaWSC provide following technical support to V-WASHE with funding of the government.

a. Monitoring of the facility operation in areas such as water quality and residual chlorine.
b. In case V-WASHE signs a contract with a private company for major rehabilitations and scheme inspections, LuaWSC inspects and supervises the quality of repair/inspection services provided by the contracted private company.

2-4-2 Identification of Most Viable O&M Structure for Piped Water supply Schemes

As the following table shows, 5 O&M structures were considered for piped water supply schemes divided broadly into Options 1, 2, 3 and 4 which grant principal responsibilities of scheme O&M to communities, and Option 5 where the LuaWSC takes responsibilities for scheme O&M. The biggest advantage of the community based O&M structure where the V-WASHE makes decisions over scheme O&M and commissions parts of the O&M activities as necessary, is lower in O&M cost compared to LuaWSC managed option. Further, by providing capacity trainings on scheme operation, minor repairs, accounting, etc., human resources from the community itself can be used. This enables rapid response to O&M needs since they are situated in the vicinity of the scheme, and community ownership can also be developed through participation in scheme O&M. However, note that for major rehabilitations/replacements, or inspections of pumps beyond communities' capacities, involvement of another party with technical skills becomes essential.

Table 2-30 O&M Comparison Table for Piped Water Supply Schemes

No.	Ownership	O&M structure	Activities				Comparison				
			Daily Operation	Daily Maintenance	Small Repair	Major rehabilitation, replacement	O&M Cost: Monthly water fee per Household(ZMW)*1		Ability to Pay	Advantage	Issues
1	V-WASHE	Major responsibility taken by V-WASHE, while a private company provides major rehabilitation and replacement work through contract	V-WASHE	V-WASHE	V-WASHE	V-WASHE (Repair Service Contract with private companies)	Kabuta	1.58	7.75	- Low O&M cost, therefore Low contribution bearing by the households - Unaffected by operation of the CU	- Communication and response time for repair may take time since private companies are situated in the capital Lusaka. - Support from the District is essential.
							Kapala	5.41	25.00		
							Musangu	2.75	12.50		
							Kapakala	2.75	10.00		
							Milenge	2.38	26.25		
2	V-WASHE	Major responsibility taken by V-WASHE, while the CU provides major rehabilitation and replacement work through contract	V-WASHE	V-WASHE	V-WASHE	V-WASHE (Repair Service Contract with the CU)	Kabuta	1.58	7.75	- Application of the CU's expertise - The O&M cost is lower amongst other options	- Willingness of the CU is unclear - Current CU structure is not designed for supporting rural water supply scheme
							Kapala	5.38	25.00		
							Musangu	2.74	12.50		
							Kapakala	2.73	10.00		
							Milenge	2.37	26.25		
3	V-WASHE	Major responsibility taken by V-WASHE, while the CU provides both small repair and major rehabilitation and replacement work through contract	V-WASHE	V-WASHE	V-WASHE (Repair Service Contract with the CU)	V-WASHE (Repair Service Contract with the CU)	Kabuta	1.58	7.75	- Application of the CU's expertise	- Willingness of the CU is unclear - Current CU structure is not designed for supporting rural water supply scheme
							Kapala	5.41	25.00		
							Musangu	2.69	12.50		
							Kapakala	2.69	10.00		
							Milenge	2.87	26.25		
4	V-WASHE (Management of CU's O&M performance)	Commissioning of overall O&M activities from V-WASHE to the CU through contract	Community Members (Contracted by the CU)	Community Members (Contracted by the CU)	CU	CU	Kabuta	9.93	7.75	- Application of the CU's expertise	- Willingness of the CU is unclear - Current CU structure is not designed for supporting rural water supply scheme
							Kapala	11.61	25.00		
							Musangu	4.69	12.50		
							Kapakala	4.50	10.00		
							Milenge	28.85	26.25		
5	CU	Devolving the entire scheme and the authority for service provision and O&M activities to the CU as a part of their property	CU	CU	CU	CU	Kabuta	23.63	7.75	- Water fee will be within affordable range as the price requires to be the figure set by the CU (ZMW 1.6/m3 as of the time of the survey)	- Current CU structure including HR, financial status is not in the state to expand its business to rural water supply schemes with small population
							Kapala	20.19	25.00		
							Musangu	7.50	12.50		
							Kapakala	6.75	10.00		
							Milenge	154.70	26.25		

*1 When water fee collection rate is 80% and Household average population is as follows (Kabuta 6.85, Kapala 7.95, Musangu 6.25, Kapakala 6.25, and Milenge 6.10; from Socio-Economic Survey)

(Figure of O&M cost based on precondition that the government bears the cost for facility repair / replacement and salary of the guard)

In Option 1, the community represented by the V-WASHE performs the principal O&M activities and signs a contract with a private company for major rehabilitations and scheme inspections. Although no private companies with skills and experiences to cater for rural piped water supply schemes are available in Luapula province presently, the Project recognises availability of several such companies in Lusaka, as well as in Kitwe. The water fee is amongst the lowest of the options.

In Option 2, the community represented by the V-WASHE performs the principal O&M activities and signs a contract with LuaWSC for major rehabilitations and scheme inspections. While involvement of LuaWSC, who possesses experience and technical skills in the region, is effective, currently LuaWSC expresses little interest in partial participation in O&M of piped water supply schemes, including contracting and commissioning. The water fee is amongst the lowest of the options.

For Option 3, the structure is similar to Option 2, but the degree of LuaWSC's involvement is wider and extends to not only major rehabilitations and scheme inspections, but also to minor repairs such as repairing of pipe leakages and tap malfunctions. The challenge of this option, as with Option 2, is the low interest expressed by LuaWSC. The water fee is amongst the lowest of the options.

In Option 4, the community, represented by the V-WASHE, commissions overall O&M activities to LuaWSC through a contract, and the V-WASHE monitors and manages the performance of LuaWSC on scheme O&M. The advantage of this option is that the scheme can be managed through trained human resources of LuaWSC to ensure the quality of O&M activities. On the other hand, the human resources capacity of LuaWSC, and higher O&M cost compared to the Options 1, 2, and 3 pose challenges.

In Option 5, the DLAs devolve entire piped water supply schemes to LuaWSC, and the schemes are to be incorporated as part of LuaWSC's service provision facilities. Involvement of communities is limited, where likely responsibilities include contract employment by LuaWSC as tap attendants or facilities operators. Under LuaWSC's operation, a service standard required by NWASCO will be applied to the schemes, and as the schemes are required to be managed by an employer of LuaWSC, O&M cost will be higher. The policy of NWASCO requires water price of public taps to be affordable to the users for pro-poor purposes and thus the high O&M cost cannot be recovered through water fee collection. The trial calculation of O&M cost for Option 5 indicates difficulties in cost recovery within each scheme independently, which signify needs for cross-subsidy from more profitable individual house connections and industrial, institutional or commercial connections. Since the cost recovery rate from collected water fees of LuaWSC was 46% (NWASCO Urban and Peri-urban Water Supply and Sanitation Sector Report 2011/2012), operation of rural piped water supply schemes under LuaWSC can be said to pose a big challenge from business and financial perspectives.

From evaluation of the above options, the most practical O&M structure for piped water supply schemes is community (V-WASHE) managed O&M with major repairs and inspection service provided by a private company. To complement for the lack of experience of D-WASHE and community in O&M of the piped water supply facilities, LuaWSC will provide quarterly monitoring under instruction of the MLGH. In addition, if financial performances of LuaWSC improve and cross-subsidy of rural piped water supply schemes by house connections and other water provisions become possible, then O&M and service provision of the schemes by LuaWSC would be desirable since LuaWSC possess expertise and they are located in the region, and so repairs and inspection works can be accomplished more swiftly and economically. The

Project recommends, therefore, that the implementing agency bear in mind the possibility of future devolution of the schemes to LuaWSC and follow up on LuaWSC's business plans and financial performances as well as share information on schemes to be constructed and seek possible coordination.

2-4-3 Basic Policy on Operation and Maintenance

(1) Policy Common to Boreholes with Hand Pumps and Piped Water Supply Schemes

1) Raising Community Awareness on Scheme Ownership and Roles and Responsibilities for O&M

The community members form the responsible body for scheme O&M and are also users of the scheme. Therefore, the Project will encourage increased understanding on not only the rights as users but also responsibilities and duties over scheme O&M prior to scheme construction. Scheme construction will begin after the Project receives understanding and consensus of communities through exposition on communities' roles in O&M including contribution to O&M costs. At this stage, an O&M agreement stating roles and responsibilities of DLAs and communities will be signed by both parties.

2) Capacity Development of Community Members on Scheme O&M

At target sites for construction of piped water supply schemes as well as boreholes fitted with hand pumps, V-WASHEs composed of community members will be formed. For formation of a V-WASHE, the member composition, roles and responsibilities of the V-WASHE will be explained to the community and participation of both genders will be encouraged. In addition, the Project will give consideration on the sites' social composition and care will be taken to assure participation of every community member from different groups/classes that benefit from the water supply in the decision making process.

For the V-WASHEs formed or re-organised, the Project, through software component, will provide trainings on organisational management, preparation of water supply and sanitation action plans, promotion of community participation, preventative maintenance and repairs, use of private resources, financial management, and monitoring. For piped water supply schemes, since 3 different types of facilities using different power sources will be constructed, different capacity development training contents to cater for each type will be developed.

3) O&M Cost to be borne by Communities

O&M costs of the schemes to be constructed under the Project are described in Section 2-5-2 "Operation and Maintenance Cost". DLAs will conduct orientation for V-WASHEs on the outline of scheme O&M, bearing in mind the above mentioned information on O&M costs to help them prepare the V-WASHE action plans. The V-WASHE at each site sets their own water fee and fee collection method based on aforementioned O&M cost information and socio-economic conditions at each community. As O&M costs differ depending on conditions

such as type of water supply scheme, condition of use, or hydrogeological conditions, training for V-WASHEs will include financial management training that enables the members to determine the O&M cost and water fee using the O&M cost information provided by DLAs and actual conditions of scheme use.

For the O&M cost of the piped water supply schemes, however, attention should be paid to the fact that the O&M cost borne by households will be higher than the water fee currently paid by households in the target sites if major rehabilitation/replacement cost and personnel expenses such as salary of the tap attendants, accountants, security guards (in the case of Milenge) were included in the O&M cost. Therefore, it is posing challenges to sustainability of O&M fee collection. As a counter measure, the Project held a discussion with the government of Zambia and reached an agreement on the structure where the government covers part of the O&M costs, namely the facility rehabilitation / replacement costs and provision of salary for the guard (in the case of Milenge), while tap attendants and accountants work on a voluntary basis. Section 2-5-2-2 describes the detail of this arrangement.

4) Improved Hygiene Practice

To realise improvements in hygiene through stable use of safe water, importance is placed not only on sustainable operation and maintenance of the scheme, but also on dissemination of information on significance of safe water and promotion of understanding on proper handling of water sources to be used as drinking water. Results of the socio-economic survey suggesting low understanding over causes of diarrhoea by the surveyed households, hence inadequate understanding of hygiene, pose concerns that full benefits of improved hygiene through construction of safe water supply schemes would be hindered. The Project will provide through software component, facilitation training on community led total sanitation (CLTS) to V-WASHEs so they can improve sanitation and hygiene practices, along with scheme O&M.

(2) Policy for each Water Supply Scheme Type

1) Boreholes with Hand Pumps

DLAs of the target 4 districts are conducting activities according to the District O&M action plan (2012-2014) prepared under SOMAP3 support with funding provided from JICA Zambia Office. As a result, spare parts shops at each district are in operation and at the ward level, APMs and WASHE facilitators who participated in orientations on SOMAP O&M model are being allocated. The Project will fully utilise and mobilise such resources in an effort to establish the O&M structure.

2) Piped Water Supply Schemes

a. Establishment of O&M Structure in Target Areas

A national O&M structure for piped water supply schemes in rural areas is yet to be organised. As reference structures are so few, examples of community-private repair service contracts could not be confirmed. Therefore, software component will promote understanding on the O&M structure of piped water supply schemes to be constructed by the Project as well as roles and responsibilities of each stakeholder including MLGH, Province, DLAs, and community members. Soft component will also provide capacity development trainings to stakeholders concerned with scheme O&M and promote participation of private entities.

b. Monitoring of O&M status of the Piped Water Supply Schemes by DLAs and LuaWSC and Establishment of the Support Structure.

Since piped water supply schemes require high expertise and technical skills for their O&M, direct involvement of RWSS Officers of DLAs in O&M support provision towards communities is needed. Such support includes formation of V-WASHEs, provision of capacity development trainings and monitoring of the O&M status. DLA, as the responsible body for rural water supply and sanitation issues in its jurisdiction, will also evaluate the standard of the repair/rehabilitation service provided by a private company if the works was contracted a private company. Since DLAs have no experience in such tasks and a structure designed to support V-WASHE by DLAs and LuaWSC does not exist, software component will compile O&M manuals for piped water supply schemes in rural areas and provide capacity development support to prepare DLAs for the tasks.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

2-5-1-1 Cost Borne by the Zambian Government

Total: ZMW 287,430 (JY5.26 million)

Cost Item	Total	Calculation	Remarks
Personnel cost for siting during detailed design (project sites)	ZMW3,350	MLA: 67days×1per×ZMW50/day/person	D-WASHE member will join hydrogeological teams
Personnel cost for siting during detailed design (alternative sites)	ZMW350	MLA: 7days×1per×ZMW50/day/person	D-WASHE member will participate in site transfer
Personnel cost during geophysical survey (project sites)	ZMW5,000	MLA: 50days×2pers×ZMW50/day/person	D-WASHE members will participate in geophysical survey
Personnel cost during geophysical survey (alternative sites)	ZMW1,000	MLA: 20days×1per×ZMW50/day/person	D-WASHE member will participate in geophysical survey
Personnel cost during site transfer (borehole with hand pump)	ZMW2,500	MLA: 25days×2pers×ZMW50/day/person	D-WASHE and PST members will participate in site transfer
Personnel cost during site transfer (piped water supply scheme)	ZMW500	MLA: 5days×2pers×ZMW50/day/person	D-WASHE and PST members will participate in site transfer
Personnel cost during inspection before handover (borehole with hand pump)	ZMW4,000	MLA: 200sites/5sites/day×2pers×ZMW50	D-WASHE and PST members will participate in facilities construction handover
Personnel cost during inspection before handover (piped water supply scheme)	ZMW500	MLA: 5sites×1day×2pers×ZMW50	D-WASHE and PST members will participate in facilities construction handover
Costs during software component activities	ZMW246,001		D-WASHE members, WDC, fuel, vehicle, etc.
Advising Commission for Authorisation to Pay (A/P)	ZMW1,093	Agreement/Contract : ZMW319.15×2times Amendment: ZMW212.8×2times	Opening of A/P: JY6,000/time A/P amendment : JY4,000/time
Payment commission to the bank	ZMW23,136		
Total	ZMW287,430 (JY5.26million)		

N.B.: MLA: Missing Lunch Allowance, PST: Programme Support Team, WDC: Ward Development Committee

The above-mentioned required cost is about 100,000 ZMW per year, when it converts into an enforcement period (from 2014 to 2016). Compared with the average project investment budget for the past four years (from 2010 to 2013) of DHID which is an implementing agency, it is 1% or less. Therefore, it is considered that the cost can be paid by DHID.

In addition, the information about the above-mentioned enforcement matter and the cost was shared with the Zambia side and it was confirmed with the Minutes of Discussions.

2-5-1-2 Conditions for Estimation

(1)	Estimation base:	September 2013
(2)	Exchange rate:	US$1.0 = JY99.38 US$1.0 = ZMW5.430512 ZMW1.0 = JY18.3003
(3)	Construction Period:	Approximately 24 months from E/N, including detailed design survey, tendering process and construction. See Implementation Schedule for more details.
(4)	Others:	This Project is to be implemented in accordance with the guidelines for Grant Aid Assistance of the Japanese Government.

2-5-2 Operation and Maintenance Cost

The O&M costs of the water supply schemes to be constructed under the Project are indicated below. The figures are rounded at the second decimal point.

2-5-2-1 Boreholes with Hand Pumps

The O&M cost of boreholes fitted with hand pumps consists of repair and inspection costs borne by the community, and monitoring cost of WDCs and DLAs. The table below describes the summary of O&M cost of boreholes fitted with hand pumps.

Table 2-31 Summary of O&M Cost of Boreholes fitted with Hand Pumps

(Currency: ZMW)

Item	Unit Cost	Quantity	Amount (Annual)
1. O&M Cost of Scheme	1,343.16/borehole	200	268,632.00
2. Monitoring Activities Cost of DLAs	2,104.00/District	4	8,416.00
3. Monitoring Activities Cost of WDCs	768.00/Ward	45	34,560.00
		Total	311,608.00

(1) O&M Cost of Boreholes fitted with Hand Pumps

For calculation of the O&M cost of boreholes fitted with hand pumps, the method introduced to the four districts under SOMAP3 support is applied. Items calculated are 1) total cost of annually required spare parts, 2) repair fee for APMs, and 3) O&M activities cost (including transport and stationery) of V-WASHEs. As used by the DLAs under SOMAP3, to calculate the annual spare parts cost, the price of each spare part set at each district by the DLA is multiplied by the number of spare parts needed per scheme per year. The tables below show the O&M cost for each scheme type of India Mark II and Afridev.

Table 2-32 O&M Cost and Water Fee borne by Households per Scheme (India Mark II)

（Unit：ZMW）

Item	Nchelenge	Mwense	Mansa	Milenge	Average
1) Cost of Spare Parts /Month*1	62.97	60.57	57.20	62.49	60.81
2) Repair Fee for APMs[8]/Month*1	41.67	25.00	37.50	29.17	33.34
3) O&M Activities Cost of V-WASHEs (Transport, Stationery, etc.) /Month*2	20.00	20.00	20.00	20.00	20.00
O&M Cost Total/Month/Scheme	124.64	105.57	114.70	111.66	114.15
Household Population (Average)*4	6.47	6.19	6.55	6.36	6.37
Monthly Water Fee/Household	**3.23**	**2.61**	**3.01**	**2.84**	2.91
Monthly Household Income (Median)*3	150.00	100.00	200.00	150.00	150.00
Ratio of Water Fee to Household Income	2.2%	2.6%	1.5%	1.9%	1.9%
Willingness to Pay/Month/Household (Median)*3	7.28	6.96	11.79	9.44	8.87

Table 2-33 O&M Cost and Water Fee borne by Households per Scheme (Afridev)

(Unit：ZMW)

Item	Nchelenge	Mwense	Mansa	Milenge	Average
1) Cost of Spare Parts /Month*1	63.56	61.13	57.73	63.07	61.37
2) Repair Fee for APMs[9]/Month*1	41.67	25.00	17.50	29.17	28.34
3) O&M Activities Cost of V-WASHEs (Transport, Stationery, etc.) /Month*2	20.00	20.00	20.00	20.00	20.00
O&M Cost Total/Month/Scheme	125.23	106.13	95.23	112.24	109.71
Household Population (Average)*4	6.47	6.19	6.55	6.36	6.37
Monthly Water Fees/Household	**3.24**	**2.63**	**2.50**	**2.86**	2.80
Monthly Household Income (Median)*3	150.00	100.00	200.00	150.00	150.00
Ratio of Water Fee to Household Income	2.2%	2.6%	1.3%	1.9%	1.9%
Willingness to Pay/Month/Household (Median)*3	7.28	6.96	11.79	9.44	8.87

Notes of Table 2-32 and 2-33:

∗1 Reference: Spare parts price list of each district, fee price list table for APMs

∗2 Reference: Results of survey

∗3 Median is used for income to avoid influences of minority households that earns more, while mean is used for household population to represent the entire number of population.

∗4 Reference: Average Household Population: From Socio-Economic Survey (JICA, 2013)

[8] Includes repair fees and biannual inspection fees, which will minimize the cost of repairs by exercising preventative measures regularly and identifying faults at the earliest stage.

As shown above, the average O&M cost of all the districts for both types of schemes of India Mark II and Afridev is ZMW 111.93 per month, which is ZMW 1,343.16 annually. In cases where 250 persons use a facility, and where average household population is 6.37 (from the Socio-Economic Survey), the average monthly water fee per household is calculated to be ZMW 2.85.

The O&M cost and water fee are evaluated in terms of affordability. When willingness to pay (WTP) is observed, median household WTPs are ZMW0.04/20ℓ in Mansa, ZMW0.033/20ℓ in Milenge, and ZMW0.025/20ℓ in both Mwense and Nchelenge (from Socio-Economic Survey). For the case where an individual uses 30ℓ per day from the constructed scheme, and where each household consists of the average household population identified in the Socio-Economic Survey, in Nchelenge, each household is willing to spend ZMW7.30 per month. The figures in other districts are, ZMW7.00 in Mwense, ZMW11.80 in Mansa and ZMW9.40 in Milenge, and the monthly water fee remains well within the willingness to pay figure, as indicated in the above table.

When considering the ability to pay (ATP), the international standard benchmark of the proportion of water fees to disposable household income, used by international organisations such as the World Bank is 3 to 5 %[10]. In the four districts, the median household income is ZMW150.00 and the weight the water fee occupies in the income is 1.9%, confirming the affordability of the O&M costs from the perspective of ATP.

The Socio-Economic survey conducted in candidate sites for construction of the boreholes fitted with hand pumps shows 28.5% of the surveyed households pays water fee, with median being ZMW2.00 While 58.3% of the households who pay water fee spend ZMW1.00 to ZMW2.00, 15.9% spend ZMW2.00 to ZMW12.00, and 10.2% spend ZMW12.00 or above. As there had been no established guidelines for how to set water fee price, price may be set in arbitrary manner in many cases, not considering the actual O&M costs required, making it lower than the calculated figure. Still, the calculated figure on average is at ZMW 2.86, which is not more than ZMW1.00 or so from the current fee price. Together with the fact that a quarter of the surveyed household who pay water fee is already paying ZMW2.00 or more, when importance of contributing towards O&M costs and the contents of O&M costs are communicated adequately to the community through software component programme,

[10] ATP is calculated with the standard figure of 5% of the household income, as adopted by the World Bank and other organisations. Reference; "Access, Affordability, and Alternatives: Modern Infrastructure Services in Africa", Africa Infrastructure Country Diagnostic, Background Paper 2, February 2008, The International Bank for Reconstruction and Development / The World Bank, "Can poor consumers pay for energy and water? An affordability analysis for transition countries", Samuel Fankhauser and Sladjana Tepic、May 2005, European Bank/WHO

collection of calculated O&M cost will be realistic.

Also, the method of calculating the O&M cost for the constructed facilities is in accordance with the technical cooperation project SOMAP, which is providing trainings on procedure of determining the O&M cost for the water supply facility, and procedure of setting water fee based on the required O&M amount, as part of the capacity development activities in the four target districts of Luapula province.

As described above, the O&M cost to be covered by the facility users is within their willingness and ability to pay. Thus, by provision of the information about O&M costs and by reaching agreement to contribute towards the facility O&M through software component programme, establishment of the community contribution is achievable.

(2) Monitoring Activities Cost of DLAs

At the target four districts, the DLAs are to conduct monitoring of O&M status of the existing facilities in the district as part of the District Rural Water Supply and Sanitation Plan, and provide O&M support to the community accordingly, and reflect the results to the new plan. The current plan (2012-2014) includes provisions for instructions to V-WASHEs, and monitoring of existing water supply schemes by DLA staffs and WDC members. DLA staffs visit the community biannually, focusing especially on the communities with reported O&M issues from WDCs and APMs. WDCs conduct monitoring quarterly within their jurisdiction.

The facilities to be constructed under the Project will be included in the above mentioned monitoring activities of DLAs and WDCs, together with other existing facilities, and this may not be entirely pertinent to discern the monitoring activities particular to the facilities related to the Project. However, for reference, calculated amount for the monitoring activities cost of DLAs is shown below.

Table 2-34 Monitoring Activities Cost of DLAs

(Unit : ZMW)

Item	Unit Cost (ZMW)		Quantity		Total (ZMW)	Remarks
Fuel	9.20	/ℓ	12	day	1,104.00	6 days/biannual ×10/day ×Fuel 9.2/× 2 times
Monitoring Allowance	50.00	/day	12	day	600.00	6 days/biannual×allowance×2 times
Quarterly Report Preparation Cost	100.00	/time	4	time	400.00	Report Preparation Unit Cost× 4 times
				Total	**2,104.00**	

(3) Monitoring Activities Cost of WDCs

Similar to the above Sub-section (2), monitoring activities cost of WDCs for reference is described below.

Table 2-35 Monitoring Activities Cost of WDCs

(Unit : ZMW)

Item	Unit Cost (ZMW)		Number		Total (ZMW)	Remarks
Fuel	9.20	/ℓ	4	day	368.00	1day/quarterly×10ℓ /day ×Fuel 9.2/ℓ ×4 times
Monitoring Allowance	50.00	/day	4	day	200.00	1day/quarterly×Allowance×4 times
Quarterly Report Preparation Cost	50.00	/time	4	time	200.00	Report Preparation Unit Cost× 4 times
				Total	**768.00**	

2-5-2-2 Piped Water Supply Schemes

For calculation of the O&M cost for small scale piped water supply schemes, responsibilities of the costs for scheme operation, management, repairs/inspections were allocated to the community, while the government is responsible for provision of facilities rehabilitations/replacements, and salaries for the guard (in the case of Milenge). The O&M cost also includes monitoring activities cost of DLAs. The table below describes the summary.

Table 2-36　Summary of O&M Cost of Small Scale Piped Water Supply Schemes

（Unit：ZMW）(Annual)

District	Nchelenge	Mwense*			Milenge
Site / Item	Kabuta	Kapala	Musangu	Kapakala	Milenge
1. Scheme O&M Cost	6,177.12	27,736.44	46,137.96	45,005.64	4,621.32
2. Monitoring Activities Cost of DLAs	1,843.46	716.79	716.79	716.79	1,030.91
3. Salary of the guard	0	0	0	0	257.64
Total	8,020.58	56,189.23	46,854.75	45,722.43	5,909.87

*Monitoring costs of Mwense District are calculated by distributing the cost equally to the three sites located within the District (Kapala, Musangu and Kapakala).

District	Nchelenge	Mwense*			Milenge
Site / Item	Kabuta	Kapala	Musangu	Kapakala	Milenge
4. Replacement cost of pumps (once/7years)		18,883.87	50,015.95	50,015.95	
5. Replacement cost of solar pumping system (once/ 10years)					39,212.64
6. Replacement cost of valves, chlorinators, etc. (once/20years)	14,669.52	67,818.24	89,700.48	82,100.16	23,970.24
Total	14,669.52	86,702.11	139,716.43	132,116.11	63,182.88

Details of items 1, Scheme O&M Cost. Is as indicated below.

a. Scheme operational cost: Electricity, chlorine, operator salary
b. Management cost: Activities cost of V-WASHE
c. Repair and routine inspection cost
d. Risk management cost: Inflation rate, etc.

The following tables describes how the costs are calculated.

Table 2-37 Conditions for Cost Calculation on O&M of Piped Water Supply Schemes

(Year 2016:at the beginning of operation)

Cost	Item	Calculation Method
Operational Cost*1	Electricity	Power consumption amount (design water supply rate/design pumping rate) x ZMW0.24/kWh x VAT16%
	Chlorine	Surveyed local price
	Operator Salary	Average monthly rural income in Zambia (Living Conditions Monitoring Survey Report, 2006 and 2010, National Statistical Office) ZMW644/8hr x required work time at each site (Kabuta and Milenge: 1hr (chlorine dosage, facilities preventative maintenance), 3 sites in Mwense: 16 hrs. (Attending power facilities during scheme operational hours)
Management Cost*1,2	O&M Activities Cost	Based on administration cost of Mulundu village, Mwense District
Maintenance Cost (Small repairs/routine inspections)	Materials	Calculated under assumption of 1% of direct construction cost and repair frequency of 5 years.
Rehabilitation/Replacement(Pumps, chlorinator, valves)	Repair Service Provision Fee	Transport, human resource costs and other costs based on LuaWSC's experience
	Pump	Calculated as 110% of pump price, service life of 7 years (except for the solar powered equipment in Milenge site, calculated with service life of 10 years)
	Chlorinator and Valve	110% of facility cost, service life of 20 years
Risk Management Cost	Inflation Rate	Inflation rate calculated as 7.9%

*1 Tap Attendants and accountant are voluntary bases based on arrangements for similar existing schemes of Murundu village in Mwense District.

*2 Based on arrangements for similar existing schemes of Murundu village in Mwense District, it divided proportionally according to the water supplied population of each target site.

Table 2-38 Monthly O&M Cost of Piped Water Supply Schemes

(Year 2016: at the beginning of operation)

(Unit:ZMW)

Item	Operation Cost /day			Management cost/day	Maintenance / repair Cost/day	Inflation buffer rate	**Total/day / Facility**	**O&M cost/month /facility**
Site Name	Electricity	Chlorine	Salary of Operator	V-WASHE activity cost				
Kabuta	0.00	4.01	2.68	4.24	3.80	1.16	17.16	514.76
Kapala	9.83	2.26	42.93	6.45	4.67	1.16	77.05	2,311.37
Musang	33.43	5.92	42.93	16.67	11.07	1.16	128.16	3,844.83
Kapakala	33.43	5.73	42.93	16.67	8.56	1.16	125.02	3,750.47
Milenge	0.00	0.70	2.68	1.87	5.77	1.16	12.84	385.11

From the perspectives of affordability and willingness to pay, the above calculated O&M cost per household per month was analysed. The water supply service population at the beginning of operation year 2016, is calculated based on the current population determined by the

socio-economic survey and population growth rate determined by Census 2010. Average household population is determined from the socio-economic survey, and a water fee collection rate of 80%, estimated from the experience of the Mulundu village's piped water supply scheme in Mwense district, was applied to determine the water fee per household, and then the water fee was compared against ATP, which was determined as 5% of the monthly household income and WTP (Willingness to Pay) surveyed. The following table shows the summary.

Table 2-39 Monthly Water Fee per Household for Piped Water Supply Schemes

(Unit: ZMW)

Site	Monthly O&M Cost/Scheme	Water Supply Service Population (2016)	Monthly Water Fee/person (80% Collection Rate)	Average Household Population	Monthly Water Fee/Household	Willingness to Pay	Ability To Pay
Kabuta	514.76	2,792	0.23	6.85	1.58	2.00	7.75
Kapala	2,311.37	4,255	0.68	7.95	5.40	6.62	25.00
Musangu	3,844.83	10,935	0.44	6.25	2.75	9.10	12.50
Kapakala	3,750.47	10,678	0.44	6.25	2.75	11.48	10.00
Milenge	385.11	1,233	0.39	6.10	2.39	5.32	26.25

When the O&M cost was compared against ATP and WTP (Willingness to Pay) surveyed, the O&M cost is less than the ATP and WTP in all target sites. Therefore, the O&M cost is considered to be realistic.

As stated above, collection of the O&M cost is expected to be sustainable in all target sites if MLGH and the districts bear part of the O&M costs, namely the facility rehabilitation/replacement costs and salary for the guard (in the case of Milenge).

(2) Monitoring Activities Cost of DLAs and LuaWSC

As the target three districts have little experience in O&M of piped water supply schemes in rural areas, it is important that the DLAs provide regular monitoring on O&M status and necessary technical assistance, and accumulate data for future projects of similar nature. Various support and follow ups toward V-WASHEs from the DLAs are expected especially at the initial stage of the O&M, and thus, outside the already planned biannual monitoring of existing water supply schemes, additional quarterly monitoring for piped water supply schemes should be planned. In addition, LuaWSC is expected to provide quarterly monitoring under instruction and funding of the government. The monitoring includes water quality inspection and if the repair/rehabilitation service was contracted to a private company, LuaWSC will evaluate quality of the service. The cost related to the DLAs' monitoring is shown below.

Table 2-40　Monitoring Activities Cost of DLAs

(Unit:ZMW)

Nchelenge						
Item	Unit Cost (ZMW)		Quantity		Total (ZMW)	Remarks
Fuel	9.2	/ℓ	12	day	843.46	3 days(1 day/Site/month×1 site)/Quarter×7.64 ℓ /day ×Fuel Unit Cost×4 times＝ZMW 552 ※Fuel：Nchelenge-Kabuta Return 53.5km at 7km/ℓ =7.64 ℓ
Monitoring Allowance	50	/day	12	day	600.00	3 days/Quarter×Daily Allowance×4 times＝ZMW 600
Quarterly Report Preparation Cost	100	/time	4	time	400.00	Report Preparation Cost×4times ＝ZMW 400
Total					**1,843.46**	

Mwense						
Item	Unit Cost (ZMW)		Quantity		Total (ZMW)	Remarks
Fuel	9.2	/ℓ	12	day	1,150.37	3days(1day/Site/month×3Sites)/Quarter×10.42 ℓ /day× Fuel Unit Cost×4 times＝ZMW 2,318.4 ※Fuel：Mwense 3 sites return:73km at 7km/ℓ =10.42 ℓ
Monitoring Allowance	50	/day	12	day	600.00	3 days/Quarter×Daily Allowance×4 times＝ZMW 600
Quarterly Report Preparation Cost	100	/time	4	time	400.00	Report Preparation Cost×4times ＝ZMW 400
Total					**2,150.37**	

Milenge						
Item	Unit Cost (ZMW)		Quantity		Total (ZMW)	Remarks
Fuel	9.2	/ℓ	12	day	30.91	3days(1day/Site/month×1 site)/Quarter×0.28 ℓ day ×Fuel Unit Cost×4 times＝ZMW 55.2 ※Fuel: Milenge Boma-Facility location return: 2km at 7km/litre =0.28 litre
Monitoring Allowance	50	/day	12	day	600.00	3 days/Quarter×Daily Allowance×4 times＝ZMW 600
Quarterly Report Preparation Cost	100	/time	4	time	400.00	Report Preparation Cost×4times ＝ZMW 400
Total					**1,030.91**	

2-6 Other Relevant Issues

(1) Organization for Borehole Drilling

For borehole drilling works, reservoir tank construction works and transmission/distribution pipe installation works under the Project, use of local resources is expected. Several local contractors having capacities to perform the requirements of the Project are available, but the contractors must pay attention to select suitable drilling companies mainly from viewpoints of their technical capacities and financial status.

(2) Organization for Implementation Works of MLGH

MLGH, as the implementing agency of the Zambian Government, is requested to assure designation of responsible persons and sector-wise C/Ps throughout the project period, and clearly demarcate their responsibilities. Regarding documents, information and various procedures, MLGH is asked to respond quickly whenever they are requested.

(3) Tax Exemptions

To avoid delays in construction works and to make effective use of the Project period, prompt and smooth arrangements for tax exemptions are required. The contractor, under the contract for construction, should prepare as soon as possible the list of materials and equipment to be used in the Project and request the implementing agency for necessary support on clearance of custom duties and tax exemptions. MLGH, as implementing agency, should promptly conduct the requested procedures.

(4) Budget Allocation for Districts to Support Project Activities

During the Project implementation, PST and D-WASHE members will participate in activities such as software component, site survey, inspections and handover of water schemes. Also, after completion of the construction works, D-WASHE members will periodically visit the Project sites for monitoring on O&M situations in each site. As funds for those activities of D-WASHE members in the Project will be allocated by MLGH to each target district, disbursement of the funds is expected to be carried out smoothly.

(5) Construction Schedule in Consideration of Rainy Season

Taking into consideration the natural conditions in Zambia, attention needs to be paid in supervision of works during the rainy season. During the rainy season from January to March, construction works will be basically postponed. The contractor is required to carefully prepare the construction schedule upon understanding the natural environment and infrastructure situation in Zambia. Especially, enough information must be collected to prepare a suitable

schedule for mobilization of construction equipment such as drilling rigs and construction materials, as well as completion of the works within the specified period of time.

CHAPTER 3

PROJECT EVALUATION

Chapter 3 Project Evaluation

3-1 Preconditions

(1) Project Implementation Organization

At the time of project commencement, the implementation organisation of MLGH and target districts does not change.

(2) Advising Commission for Authorization to Pay (A/P) and Bank Commission

The Zambian government must bear the costs of advising commission for Authorization to Pay (A/P) and payment commission to the bank arranged under the grant aid system.

(3) Prompt Custom Clearance

The construction period under the grant aid system is limited where 1 year and 10 months after the E/N is planned for this project. This period is from the detailed design stage to completion of construction, and therefore, custom clearance of all imported construction equipment and materials needs to be carried out promptly.

(4) Tax Exemption

Among the materials and services procured based on the approved contract, custom duties on Japanese citizens, internal taxes and other levies must be exempted. For the Japanese services provided based on the approved contract, all the processes necessary for the entry and stay of Japanese service providers must be undertaken.

In the previous Japanese grant aid project, there was a delay in tax exemption process due to the lack of consent from the Zambian government on some types of taxes to be exempted. It is essential that this process is fulfilled timely in order to complete the construction in a limited period. As responsibility of the executing agency or the Project, MLGH is expected to handle this process quickly.

3-2 Necessary Inputs by Recipient Country

When the Government of Japan decides to implement the Project under the grant aid scheme, the Government of Zambia must confirm undertaking the following responsibilities in order for the Project to proceed in a smooth manner.

(1) NRWSSP regulates that community should contribute ZMW1,500 as a condition for

commencement of construction of water supply schemes. As agreed in the field survey, the implementing agency and district government are to conduct sensitization activities to the community members and collect the above mentioned contributions for the Project.

(2) As the implementing agency of the Project, MLGH should assign a person in charge of the Project as well as persons in charge of different subject matters for the Project prior to the beginning of the project implementation so that the role allocation is clear prior so as to ensure the smooth project implementation.

(3) The implementing agency is to allocate a project manager (PM) in the target area in accordance with the Project and bear the expenses for the PM.

(4) To allocate D-WASHE members from the target districts during the Project period to participate in inspections of construction works and software component activities to be conducted by a local consultant, and bear expenses of the D-WASHE members.

(5) It is essential that District staff is deeply involved before, during and after the construction in a continuous manner. The cost incurred in their field activities must be borne by the MLGH and paid through the Districts

(6) To secure land necessary to construct the water supply schemes and to clear, level and reclaim the land prior to commencement of the construction.

(7) To secure land necessary for base camps and stockyards for the contractor in the target districts during the construction period.

(8) To prepare, rehabilitate and/or expand access routes to construction sites and provide necessary incidental facilities in and around the project sites.

(9) To conduct necessary procedures (such as those for road crossing of pipes or power extensions) without delay.

(10) To facilitate community members to establish fences around borehole facilities.

(11) To operate and maintain the schemes constructed and equipment procured under the grant aid properly and effectively, and to appoint necessary staffs for the operation and maintenance.

(12) To bear all expenses other than those covered by the grant aid.

3-3 Important Assumptions

(1) Zambia continues the operation and maintenance system of constructed water supply facilities (organisation of Zambian government for water sector does not change).

(2) Spring yield and boreholes pumping rates do not decrease (groundwater potential does not decline unexpectedly)

(3) Quality of water sources in the target sites do not degrade unexpectedly.

(4) Socio-economic situation of the target groups do not exacerbate

(5) Trained WASHE trainers, WASHE facilitators, APM and V-WASHE continue their activities in the project sites
(6) DHID, the responsible unit of MLGH, and provincial DHID are well staffed.

3-4 Project Evaluation

3-4-1 Relevance

Relevance of the Project is as follows.

(1) The beneficiaries of the Project are the residents in four districts of Luapula Province in Zambia and are estimated to be about 82,000 persons.
(2) The objective of the Project is to improve the conditions in water supply and sanitation for the rural residents as one of the Basic Human Needs (hereinafter referred to as "BHN")
(3) Luapula Province, the target province of the Project, is faces the lowest access rate to safe drinking water in Zambia, and sanitary environment as well as living standard are extremely poor. As a result of this project, various aspects of living standard such as economic activities, education and health are expected to be improved.
(4) The borehole water supply facilities fitted with hand pumps constructed by this Project are predicted to be sustainably operated and maintained, and water tariff collected under responsibility of each level WASHEs.
(5) The Project corresponds to the policy of NRWSSP (2006-2015), in which MLGH set objectives to increase the national coverage of water supply from 37% to 75%, and is supporting the objectives of the policy
(6) As the Project is construction of small-scale borehole water supply facilities fitted with hand pumps, there are no negative impacts on environmental and social aspects in groundwater development and daily operation of the water supply facilities. Also, active participation of women in formulation of V-WASHE is promoted.
(7) The Project is possible to be implemented without any specific difficulties under Japan's grant aid scheme.
(8) Most of the boreholes constructed previously through Japanese groundwater development projects in Zambia, have been used for more than 20 years since completion of their construction to assure residents of safe water for long periods. Also in this Project, while cost reduction is considered, the necessity for high quality construction works will be maintained the same as previous Japanese Projects.

3-4-2 Effectiveness

(1) Quantitative Effects

Effects anticipated by the project are shown in the Table 3-1 for each parameter.

Table 3-1 Quantitative Effects

Parameter	Base Value (2013)	Goal (2020)
Service Population (persons)	302,000	384,000
Water Supply Rate	Unstable	30 litre/capita/day
Water Supply Coverage Rate	25.6%	30.0%

(2) Qualitative Effects

The qualitative effects are shown below.

1) Water fetching efforts will be reduced and safe water can be procured near settlements. Also, time saved can be used for other productive work by women and learning at school by children.
2) Due to the support to be given to use of safe and stable water and sanitation promotion activities, improvements in awareness of users to enhance the sanitation conditions can be anticipated.

APPENDICES

APPENDIX-1

MEMBER LIST OF THE SURVEY TEAM

Appendix-1 Member List of the Survey Team

(1) Field Survey

Name	Position	Affiliation
Mr. Yoshihide TERANISHI	Team Leader	Chief Representative JICA Zambia Office
Mr. Yuji UNE	Rural Water Supply	Visiting Senior Advisor, JICA
Mr. Itsuro TAKAHASHI	Cooperation Planning	Special Advisor, Water Resources Management Division 2, Global Environment Department. JICA
Mr. Tetsuo YABE	Chief Consultant / Groundwater Development Planning	Japan Techno Co., Ltd.
Mr. Shoji FUJII	Water Supply Facilities Planning/ Environmental and Social Consideration	Japan Techno Co., Ltd.
Mr. Kazuhiro ARITA	Water Supply Facilities Design/ Solar Power System	Japan Techno Co., Ltd.
Mr. Masao UEMATSU	Hydrogeology/ Geophysical Survey	Earth System Science Co., Ltd.
Mr. Hiroshi ISHII	Test Drilling Supervision	Japan Techno Co., Ltd.
Ms. Saori IWAMOTO	Social Conditions Survey /Operation and Maintenance	Japan Techno Co., Ltd.
Ms. Nagisa KOZUKA	Procurement & Construction Planning/ Cost Estimation 1	Japan Techno Co., Ltd.
Mr. Masatoshi IWAMOTO	Procurement & Construction Planning/ Cost Estimation 2	Japan Techno Co., Ltd.

(2) Explanation of Draft Report

Name	Position	Affiliation
Mr. Yoshihide TERANISHI	Team Leader	Chief Representative JICA Zambia Office
Mr. Yuji UNE	Rural Water Supply	Visiting Senior Advisor, JICA
Mr. Yuto YANAGAWA	Cooperation Planning	Water Resources Management Division 2, Global Environment Department. JICA
Mr. Tetsuo YABE	Chief Consultant / Groundwater Development Planning	Japan Techno Co., Ltd.
Mr. Kazuhiro ARITA	Water Supply Facilities Design/ Solar Power System	Japan Techno Co., Ltd.

APPENDIX-2

SURVEY SCHEDULE

Appendix-2 Survey Schedule（Field Survey）

	Date		Officials		Consultant								
			Team Leader	Water Supply Plan	Project Coordinator	Chief Consultant / Groundwater Development Planning	Water Supply Facilities Planning/ Environmental and Social Consideration	Water Supply Facilities Design/ Solar Power System	Hydrogeology/ Geophysical Survey	Test Drilling Supervision	Social Conditions Survey/Operation and Maintenance	Procurement & Construction Planning/ Cost Estimation
			Yoshihide TERANISHI	Yuji UNE	Itsuro TAKAHASHI	Tetsuo YABE	Shoji FUJII	Kazuhiro ARITA	Masao UEMATSU	Hiroshi ISHII	Saori IWAMOTO	Nagisa KOZUKA
1	6/5	Wed		Dep: Malawi	Dep:Tokyo	Dep: Tokyo, Arr: Lusaka					Dep: Tokyo, Arr: Lusaka	
2	6/6	Thu	Courtesy call:MLGH	Arr:Lusaka, Courtesy call:MLGH, JICA	Courtesy call:MLGH, JICA	Courtesy call:MLGH, JICA					Courtesy call:MLGH, JICA	
3	6/7	Fri		Site Survey at Kaoma in Western Province							Preparation for site survey	Market survey
4	6/8	Sat		Site Survey at Kaoma in Western Province,Move to Lusaka							Preparation for site survey	Preparation for site survey
5	6/9	Sun		Move from Lusaka to Mansa							Data Compilation	Data Compilation
6	6/10	Mon		Meeting with CPs in Luapula province, Site Survey							Preparation for site survey	Preparation for site survey
7	6/11	Tue		Meeting with CPs in Luapula province, Site Survey							Preparation for site survey	Market survey
8	6/12	Wed		Meeting with CPs in Northern province, Site Survey							Preparation for site survey	Market survey
9	6/13	Thu		Site Survey,Move from Mansa to Lusaka							Preparation for site survey	Preparation for site survey
10	6/14	Fri		Site Survey (Southern Province)							Preparation for site survey	Preparation for site survey
11	6/15	Sat		Team Meeting							Preparation for site survey	Preparation for site survey
12	6/16	Sun		Team Meeting							Move to Mansa	Data Compilation
13	6/17	Mon	Courtesy Call to MLGH, Meeting with CPs (ADB,UNICEF,WaterAid,USAID,etc)								Supervision of LC	Market survey
14	6/18	Tue	Discussion on M/D								Supervision of LC	Market survey
15	6/19	Wed	Discussion on M/D								Supervision of LC	Preparation for site survey
16	6/20	Thu	Signing M/D, Report to JICA Zambia, Embassy of Japan								Supervision of LC	Market survey
17	6/21	Fri	Dep: Lusaka	Preparation for site survey							Supervision of LC	Market survey
18	6/22	Sat	Arr: Tokyo	Preparation for site survey							Supervision of LC	Market survey
19	6/23	Sun		Data Compilation							Data Compilation	Data Compilation
20	6/24	Mon		Selection of LC, Meeting with CPs				Dep: Tokyo	Dep: Tokyo		Supervision of LC	Market survey
21	6/25	Tue		Site survey preparation				Arr: Lusaka	Arr: Lusaka		Move to Lusaka	Selection of LC
22	6/26	Wed		Selection of piped scheme site				Courtesy call:JICA	Site Survey :Mwense		Selection of piped scheme site	Market survey
23	6/27	Thu		Selection of piped scheme site					Site Survey :Milenge		Selection of piped scheme site	Market survey
24	6/28	Fri		Selection of piped scheme site				Preparation for site survey	Site Survey :Nchelenge		Selection of piped scheme site	Market survey
25	6/29	Sat		Preparation for site survey				Move to Milenge	Preparation for site survey		Selection of piped scheme site	Market survey
26	6/30	Sun		Move to Mansa				Supervision of LC:Milenge	Preparation for site survey		Data Compilation	Move to Mansa
27	7/1	Mon		Site Survey :Nchelenge				Supervision of LC:Milenge	Supervision of LC:Milenge	Dep: Tokyo	Move to Mansa	Site Survey :Nchelenge
28	7/2	Tue		Site Survey :Mwense				Supervision of LC:Milenge	Supervision of LC:Milenge	Arr: Lusaka	O&M plan related works	Site Survey :Mwense
29	7/3	Wed		Site Survey :Mansa				Supervision of LC:Milenge	Supervision of LC:Milenge	Preparation for site survey	Meeting with CPs	Site Survey :Mansa
30	7/4	Thu		Site Survey :Milenge				Visit District office:Milenge	Visit District office:Milenge	Courtesy call:JICA	Meeting with LusWSC	Site Survey :Milenge
31	7/5	Fri		Site Survey :Mansa				Supervision of LC:Mwense	Supervision of LC:Mwense	Supervision of LC	Meeting with LusWSC	Site Survey :Mansa
32	7/6	Sat		Move to Lusaka				Supervision of LC:Mwense	Supervision of LC:Mwense	Supervision of LC	Supervision of LC	Move to Lusaka
33	7/7	Sun		Data Compilation				Supervision of LC:Mwense	Supervision of LC:Mwense	Preparation for site survey	Data Compilation	Data Compilation
34	7/8	Mon		Selection of LC, Meeting with CPs				Supervision of LC:Mwense	Supervision of LC:Mwense	Move to Mansa	Supervision of LC	Selection of LC
35	7/9	Tue		Selection of LC, Meeting with CPs				Supervision of LC:Mwense	Supervision of LC:Mwense	Visa renewal	Meeting with DHID:Milenge	Selection of LC
36	7/10	Wed		Supervision of LC				Supervision of LC:Mwense	Supervision of LC:Mwense	Visit District office: Milenge	Meeting with DHID: Mansa	Market survey
37	7/11	Thu		Meeting with MLGH, Supervision of LC				Supervision of LC:Mwense	Supervision of LC:Mwense	Move to Milenge	Meeting with DHID: Nchelenge,Mwense	Market survey
38	7/12	Fri		Supervision of LC				Supervision of LC:Mwense	Supervision of LC:Mwense	Supervision of LC:Milenge	Meeting with LusWSC	Market survey
39	7/13	Sat		Supervision of LC				Supervision of LC:Mwense	Supervision of LC:Milenge	Supervision of LC:Milenge	O&M plan related works	Market survey
40	7/14	Sun		Data Compilation				Supervision of LC:Mwense	Supervision of LC:Milenge	Supervision of LC:Milenge	Move to Lusaka	Data Compilation
41	7/15	Mon		Supervision of LC				Design related works	Data Compilation	Supervision of LC:Milenge	Supervision of LC	Market survey
42	7/16	Tue		Supervision of LC				Move to Mansa	Visit District office:Mwense	Supervision of LC:Milenge	O&M plan related works	Market survey
43	7/17	Wed		Supervision of LC				Site Survey :Milenge	Site Transfer	Supervision of LC:Milenge	Meeting with NWASCO	Market survey
44	7/18	Thu		Supervision of LC				Site Survey :Mwense	Move to Lusaka	Supervision of LC:Milenge	O&M plan related works	Market survey
45	7/19	Fri		Meeting with MLGH, CPs				Site Survey :Mwense	Data Compilation	Supervision of LC:Milenge	Meeting with MLGH DHID	Market survey
46	7/20	Sat		Meeting with CPs				Supervision of LC:Mansa	Dep: Lusaka	Supervision of LC:Milenge	O&M plan related works	Market survey
47	7/21	Sun		Data Compilation				Site Survey :Mwense	Transit	Supervision of LC:Milenge	Data Compilation	Data Compilation
48	7/22	Mon		Meeting with CPs				Move to Lusaka	Arr: Tokyo	Supervision of LC:Milenge	O&M plan related works	Market survey
49	7/23	Tue		Report to JICA				Visa renewal		Supervision of LC:Milenge	Meeting with SWSC	Market survey
50	7/24	Wed		Meeting with MLGH, Dep:Lusaka		Dep: Kansai	Design related works			Supervision of LC:Milenge	Meeting with MLGH,Local suppliers	Market survey
51	7/25	Thu		Transit		Arr: Lusaka	Design related works			Supervision of LC:Milenge	Meeting with LWSC,UNICEF	Market survey
52	7/26	Fri		Arr: Tokyo		Meeting with MLGH, ZEMA	Design related works			Supervision of LC:Milenge	Meeting with Water Aid,Local Suppliers	Market survey
53	7/27	Sat				Meeting with LC	Design related works			Supervision of LC:Milenge	Meeting with LWSC	Market survey
54	7/28	Sun				Data Compilation	Move to Mansa			Supervision of LC:Milenge	Data Compilation	Data Compilation
55	7/29	Mon				Meeting with ZEMA・ SEICC・ZAWA	Site Survey :Milenge			Visa renewal	O&M plan related works	Meeting with CPs
56	7/30	Tue				Meeting with MLNREP	Design related works			Supervision of LC:Mwense	Visit: World Vision	Market survey
57	7/31	Wed				Meeting with MLNREP	Design related works			Supervision of LC:Mwense	Data Compilation	Move to Mansa

Date			Officials			Consultant						
			Team Leader	Water Supply Plan	Project Coordinator	Chief Consultant / Groundwater Development Planning	Water Supply Facilities Planning/ Environmental and Social Consideration	Water Supply Facilities Design/ Solar Power System	Hydrogeology/ Geophysical Survey	Test Drilling Supervision	Social Conditions Survey/Operation and Maintenance	Procurement & Construction Plannig/ Cost Estimation
			Yoshihide TERANISHI	Yuji UNE	Itsuro TAKAHASHI	Tetsuo YABE	Shoji FUJII	Kazuhiro ARITA	Masao UEMATSU	Hiroshi ISHII	Saori IWAMOTO	Nagisa KOZUKA
58	8/1	Thu					Meeting with ZEMA	Design related works		Supervision of LC:Mwense	Dep: Lusaka	Supervision of LC:Milenge
59	8/2	Fri					Move to Mansa	Site Survey :Mwense		Supervision of LC:Mwense	Transit	Supervision of LC:Milenge
60	8/3	Sat					Site Survey :Milenge	Site Survey :Nchelenge		Supervision of LC:Mwense	Arr: Tokyo	Supervision of LC:Mwense
61	8/4	Sun					Site survey preparation	Supervision of LC:Mwense		Supervision of LC:Mwense		Move to Lusaka
62	8/5	Mon					Site Survey :Mwense	Supervision of LC:Mwense		Supervision of LC:Mwense		Dep: Lusaka
63	8/6	Tue					Site Survey :Mwense	Site Survey :Mwense		Supervision of LC:Milenge		Transit
64	8/7	Wed					Site Survey :Mwense	Site Survey :Nchelenge		Supervision of LC:Milenge		Arr: Tokyo
65	8/8	Thu					Site Survey :Nchelenge	Supervision of LC: Nchelenge		Data Compilation		
66	8/9	Fri					Site Survey :Nchelenge	Supervision of LC:Mwense		Supervision of LC:Mwense		
67	8/10	Sat					Supervision of LC:Mwense	Site Survey :Mwense		Supervision of LC:Mwense		
68	8/11	Sun					Supervision of LC:Mwense	Data Compilation		Supervision of LC:Mwense		
69	8/12	Mon					Supervision of LC:Mwense	Design related works		Supervision of LC:Mwense		
70	8/13	Tue					Site Survey :Mwense	Move to Lusaka		Data Compilation		
71	8/14	Wed					Move to Lusaka	Design related works		Supervision of LC:Mwense		
72	8/15	Thu					Meeting with ZEMA	Design related works		Supervision of LC:Mwense		
73	8/16	Fri					Meeting with MLNREP	Design related works		Supervision of LC:Mwense		
74	8/17	Sat					Meeting with LC	Design related works		Supervision of LC:Mwense		
75	8/18	Sun					Data Compilation	Data Compilation		Supervision of LC:Mwense		
76	8/19	Mon					Meeting with ZEMA・ ZAWA	Design related works		Visa renewal		
77	8/20	Tue					Dep: Lusaka	Move to Mansa		Supervision of LC:Mwense		
78	8/21	Wed					Transit	Visa renewal		Supervision of LC:Mwense		
79	8/22	Thu					Arr:Osaka	Supervision of LC: Nchelenge		Supervision of LC:Mwense		
80	8/23	Fri						Supervision of LC:Mwense		Supervision of LC:Mwense		
81	8/24	Sat						Move to Kitwe		Supervision of LC:Mwense		
82	8/25	Sun						Data Compilation		Supervision of LC:Mwense		
83	8/26	Mon						Move to Lusaka		Supervision of LC:Mwense		
84	8/27	Tue						Design related works		Supervision of LC:Mwense		
85	8/28	Wed						Design related works		Supervision of LC:Mwense		
86	8/29	Thu						Design related works		Supervision of LC:Mwense		
87	8/30	Fri						Report to JICA		Supervision of LC:Mwense		
88	8/31	Sat						Design related works		Supervision of LC:Mwense		
89	9/1	Sun						Data Compilation		Supervision of LC:Mwense		
90	9/2	Mon						Dep: Lusaka		Supervision of LC:Mwense		
91	9/3	Tue						Transit		Supervision of LC:Mwense		
92	9/4	Wed						Arr: Tokyo		Supervision of LC:Mwense		
93	9/5	Thu								Supervision of LC:Mwense		
94	9/6	Fri								Supervision of LC:Mwense		
95	9/7	Sat								Supervision of LC:Mwense		
96	9/8	Sun								Supervision of LC:Mwense		
97	9/9	Mon								Supervision of LC:Mwense		
98	9/10	Tue								Supervision of LC:Mwense		
99	9/11	Wed								Supervision of LC:Mwense		
100	9/12	Thu								Supervision of LC:Mwense		
101	9/13	Fri								Supervision of LC:Mwense		
102	9/14	Sat								Supervision of LC:Mwense		
103	9/15	Sun								Supervision of LC:Mwense		
104	9/16	Mon								Supervision of LC:Mwense		
105	9/17	Tue								Supervision of LC:Mwense		
106	9/18	Wed								Move to Lusaka		
107	9/19	Thu								Meeting with LC		
108	9/20	Fri								Dep: Lusaka		
109	9/21	Sat								Transit		
110	9/22	Sun								Arr: Tokyo		

Appendix-2　Survey Schedule（Explanation of Draft Final Report）

Date			Officials			Consultant	
			Team Leader	Water Supply Plan	Project Coordinator	Chief Consultant / Groundwater Development	Water Supply Facilities Design/ Solar Power System
			Yoshihide TERANISHI	Yuji UNE	Yuto YANAGAWA	Tetsuo YABE	Kazuhiro ARITA
1	3/7	Fri		13:15 Malawi⇒15:45 Johannesburg 19:05 Johannesburg⇒21:10 Lusaka			
2	3/8	Sat		Data Compilation	16:25 Tokyo⇒20:30 Hong Kong 23:50 Hong Kong⇒07:20 Johannesburg	22:00 Tokyo⇒05:00 Dubai	
3	3/9	Sun		Data Compilation	10:30 Johannesburg⇒12:30 Lusaka	09:25 Dubai⇒14:35 Lusaka	
4	3/10	Mon	Meeting with JICA Zambia Meeting with MLGH Explanation of Inception Report				
5	3/11	Tue		Explanation of Inception Report, Discussion on M/D			
6	3/12	Wen	National Holiday：Data Compilation				
7	3/13	Thu		Discussion on M/D			
8	3/14	Fri	Signing M/D Report to JICA Zambia Report to Embassy of Japan				
9	3/15	Sat		13:10 Lusaka⇒15:15 Johannesburg 17:15 Johannesburg⇒		Meeting with Local Consultants 21:40 Lusaka⇒	
10	3/16	Sun		⇒12:15 Hong Kong 14:25 Hong Kong⇒19:15 Tokyo		06:50 Dubai	
11	3/17	Mon				02:55 Dubai⇒17:20 Tokyo	

APPENDIX-3

LIST OF PARTIES CONCERNED IN THE RECIPIENT COUNTRY

Appendix-3 List of Parties Concerned in the Recipient Country

Embassy of Japan

Mr. Akio Egawa	Ambassador (at field survey)
Mr. Kiyoshi Koinuma	Ambassador (at Draft Report Explanation)
Mr. Takashi Kato	Second Secretary (at field survey)
Mr. Hiroyasu Kirioka	Second Secretary (at Draft Report Explanation)

JICA Zambia Office

Mr. Yoshihide Teranishi	Chief Representative
Mr. Atsushi Nakagawa	Deputy Resident Representative (at Draft Report Explanation)
Ms. Miku Okada	Assistant Resident Representative (at field survey)
Mr. Kazuki Kaiya	Assistant Resident Representative (at Draft Report Explanation)
Ms. Mwewa Katongo	National Staff
Ms. Bertha Miyanda	National Staff

Ministry of Local Government and Housing (MLGH)

Dr. Chileshe L. Mulenga	Permanent Secretary

Department of Housing and Infrastructure Development (DHID)

Mr. Misheck Lungu	Director
Mr. Cledwin Mulambo	Acting Director
Mr. Oswel Katooka	Acting Assistant Director
Mr. Lwenga Mwape	Principal RWSS Officer
Mr. Vernon Ngulube	Senior RWSS Officer
Mr. Noel Bwalya Kunda	Senior RWSS O/M Officer
Mr. Ulanda Nyirenda	Senior RWSS Officer-Rural
Mr. John Akayombokwa	Senior Engineer-Muchinga
Mr. Alex Nonde	Principal Engineer-Muchinga
Mr. Brian Siakabeya	Principal Waste Management Officer
Mr. Henry Manzi	Technical Advisor-Rural Water
Ms. Selenia Matimelo	Principal Community Development Officer

Sustainable Operation and Maintenance Project for Rural Water Supply (SOMAP3)

Mr. Naoki Mori	Japan Techno Co., Ltd.
Ms. Mikiko Azuma	Japan Techno Co., Ltd.
Mr. Shouiti Yokogi	Japan Techno Co., Ltd.
Ms. Fumika Okane	Japan Techno Co., Ltd.
Mr. Nobert Gandize	Local Assistant

National Water Supply and Sanitation Council (NWASCO)

Mr. Kelvin Chitumbo	Director
Mr. Peter Mutale	Chief Inspector
Mrs. Chola Kasoma Mbilima	Commercial and Financial Inspector

Devolution Trust Fund（DTF)

Mr. Victor N Muyeba	Socio-Economist

Office of the Vice President, Disaster Management and Mitigation Unit

Mr. Evans M. Kapekele	Principal Research and Planning Officer

Ministry of Lands, National Resources and Environmental Protection (MLNREP)

Mr. Lungu M. Richard	Department of Environment and Natural Resources Management
Mr. Ignatius Makumba	Chief Natural Resources Management Officer
Ms. Sara Mulwanda-Chanda	Principal Legal Officer
Mr. Jackson Mukosha	Forestry Department

Zambia Environmental Management Authority (ZEMA)

Mr. Kalunga	Senior Inspector
Mr. Kambili Chilufya	Inspector-EIA
Mr. Rodwell Chandipo	

National Heritage Conservation Commission (NHCC)

Mr. Myumbwa Ndiyoi	Chief Natural Heritage Officer
Mr. Kelvin Chanda	Senior Commission Officer, Northern Region

Zambia Wildlife Authority (ZAWA)

Mr. Zook Muleya	
Mr. Edward K. Chilufya	Senior Projects Officer

DHID Western Provincial Office

Mr. Anderson MBEWE	Principal Engineer
Mr. Joshua TUBA	Water and Sanitation Coordinator

Luapula Province (Provincial Office)

Ms. Joyce Bwacha Nsamba	Deputy Permanent Secretary

Luapula Province (Provincial Local Government Office)

Mr. Vincent Chabala	Acting Provincial Local Government Officer

DHID Luapula Provincial Office

Mr. Clifford Chilenje	Principal Engineer
Mr. Evans Bwalya	Senior Engineer, Rural Water and Sanitation
Mr. Sidney Simute	Senior Engineer, Rural Water and Sanitation

DHID Northern Provincial Office

Mr. James Musonda	Principal Engineer

Nchelenge District

Mr. Danny Chibinda	District Planning Officer
Mr. Tight Chilima	Works Foreman

Mwense District

Mr. Patrick Chishimba	Director of Works
Mr. Manda Misheck	Focal Point Person-RWSSU
Mr. Mbulwe Kalama	DWASHE- DWA
Mr. Nelson Katandula	Area Councillor, Nkanga Ward

Mansa District

Mr. Innocent Lungu	Focal Point Person- RWSSU
Mr. Swala Mumba	Assistant RWSS Officer/ Ass. FPP

Milenge District

Ms. Caroline Mphande	Council Secretary
Mr. Malala Libombela	Focal Point Person, Rural Water Supply and Sanitation Unit
Mr. Stanley Mwanza	District Treasurer
Mr. Nathan Namatama	Town Planner

Kaoma District

Mr. Nelson MFUNE	Assistant Focal Point Person

Monze District

Mr. Chizela MODNGA	Rural Water Supply and Sanitation Coordinator, District Council

Luapula Water and Sewage Company Limited (LuaWSC)

Mr. Sebastian Chilekwa	Managing Director
Mr. Alicu Mwale	Director, Engineering
Mr. Chisala Chipunka	Support Service Officer

Luapula Water and Sewage Company Mwense office

Mr. James Nasiyongo	Customer Service Assistant

Luapula Water and Sewage Company Nchelenge office

Mr. Chipyoka Mweni	District Manager

Lusaka Water and Sewage Company Limited (LWSC)

Mr. Sandy Musole	Engineer
Ms. Yvonne Mwandu Siyeni	Manager Peri-Urban

Southern Water and Sewage Company Limited (SWSC)

Ms. Eustakia Hamuchente	Community Relations Officer
Ms. Bridget MULUBWA	Electrician

Cooperating Partners

Mr. Joseph Pupe	Water Aid	Operation Manager
Mr. Lyton Kanowa	Water Aid	Technical Support Manager
Mr. Moses Mumba	Water Aid	Provincial Projects Manager、Luapula
Mr. Sebastian Kunda	World Vision	WASH Manager
Mr. Paulos S. Workneh	UNICEF	Water & Environmental Sanitation Specialist
Mr. Douglas Abuuru	UNICEF	WASH Specialist
Ms. Lotte Mindedal	DANIDA	Counsellor - Development
Mr. Moffat S. Mwanza	DANIDA	Program Officer

AfDB	: African Development Bank
DANIDA	: Danish International Development Agency
DHID	: Department of Housing and Infrastructure Development, MLGH
DWA	: Department of Water Affairs, MEWD
D-WASHE	: District Water Sanitation and Hygiene Education
EIA	: Environmental Impact Assessment
FPP	: Focal Point Person
MEWD	: Ministry of Energy and Water Development
MLGH	: Ministry of Local Government and Housing
PST	: Programme Support Team
RWSSU	: Rural Water Supply and Sanitation Unit
UNICEF	: United Nation Children's Fund
WASHE	: Water Sanitation and Hygiene Education
WSS	: Water Supply and Sanitation

APPENDIX-4

MINUTES OF DISCUSSION

MINUTES OF DISCUSSIONS
ON THE PREPARATORY SURVEY
ON THE PROJECT
FOR GROUNDWATER DEVELOPMENT IN LUAPULA PROVINCE PHASE 3
IN THE REPUBLIC OF ZAMBIA

In response to a request from the Government of the Republic of Zambia (hereinafter referred to as "Zambia"), the Government of Japan decided to conduct a Preparatory Survey on the Project for Groundwater Development in Luapula Province Phase 3 (hereinafter referred to as "the Project") and entrusted the survey to the Japan International Cooperation Agency (hereinafter referred to as "JICA").

JICA sent to Zambia the Preparatory Survey Team (hereinafter referred to as "the Team"), which is headed by Mr. Yoshihide Teranishi, Chief Representative, JICA Zambia Office, and is scheduled to stay in the country from 6 June 2013 to 21 June 2013.

The Team held a series of discussions with the officials concerned of the Government of Zambia and conducted a field survey in the Project area.

In the course of discussions and field survey, both parties confirmed the main items described in the attached sheets. The Team will proceed to further work and prepare the Preparatory Survey Report.

Lusaka, 19 June 2013

Mr. Yoshihide Teranishi
Leader
Preparatory Survey Team
Japan International Cooperation Agency
Japan

Dr. Chileshe L. Mulenga
Permanent Secretary
Ministry of Local Government and Housing
Republic of Zambia

ATTACHMENT

1. Objective of the Project

The objective of the Project is to improve the access to safe water in Luapula Province through the construction of water supply facilities.

2. Project area

The project area is located in 4 districts, namely Nchelenge, Mwense, Mansa and Milenge in Luapula Province as shown in Annex-1.

3. Responsible and implementing organization

The responsible organization is Ministry of Local Government and Housing (hereinafter referred to as "MLGH"). The implementing organization is Department of Housing and Infrastructure Development (hereinafter referred to as "DHID"), MLGH. The organization chart of MLGH and DHID is shown in Annex-2.

4. Items requested by the Government of Zambia

After discussions with the Team, the items written below were finally requested by the Government of Zambia;

(1) Construction of 320 boreholes with hand pump
(2) Construction of 8 piped water schemes with solar power system
(3) Soft component programme (community mobilisation and sensitisation, including promotion of sanitation)

The list of the requested sites is shown in Annex-3.

JICA will assess the appropriateness of the request through further survey and will recommend to the Government of Japan for approval. The final project sites will be determined in the course of the survey.

5. Japan's Grant Aid Scheme

5-1. The Zambian side understood the Japan's Grant Aid Scheme explained by the Team as described in Annex-4.

5-2. The Zambian side will take necessary measures as described in Annex-5 for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented.

5-3. JICA will report to the Zambian side if there are any other undertakings based on the result of this survey.

5-4. The Team explained that implementation of the preparatory survey is not a commitment of the approval of the Project.

6. Schedule of the Survey

6-1. The consultant members in the Team will proceed to further surveys in Zambia until September 2013.

6-2. JICA will prepare the draft report of the Survey in English and dispatch a mission to Zambia in order to explain its contents in December 2013.

6-3. In case the contents of the draft report are accepted in principle by the Government of Zambia, JICA will complete the final report and send it to the Government of Zambia around May 2014.

6-4. The Zambian side requested early commencement of implementation of the Project to the Team

7. Other relevant issues

7-1. Construction of boreholes with hand pumps

(1) Design per capita consumption

Both sides agreed to adopt 30 litre per capita per day as a per capita consumption for a basis of designing a facility with a hand pump.

(2) Criteria for the project site selection

Both sides confirmed that the Project sites for boreholes with hand pump will be determined through the criteria described as below.

a) Demand of safe and stable water supply
b) Accessibility to the site (including security for working)
c) Hydro-geological condition (possibility to provide water with standard quality in Zambia)
d) Situation of existing water supply facilities
e) Water quality
f) No duplication of project sites with other cooperating partners (CPs)
g) Possibility to establish a water management committee (V-WAASHE and Water Committee)
h) Community's willingness to pay for water tariff to cover operation and maintenance cost

(3) Specification of the water supply facilities

Both sides agreed that the specification of the borehole will be basically based on the specification of "the Project for Groundwater Development in Luapula Province Phase 2" (hereinafter referred to as "Phase 2") and the National Guidelines for Sustainable Operation and Maintenance of Handpumps in Rural Areas, and will be

finally determined in the course of the survey.

Related to the type of hand pumps adopted in the Project, both sides also agreed that Afridev hand pump will be fitted to those boreholes with dynamic water level shallower than 35 meters in order to mitigate iron content of groundwater. If dynamic water level is deeper than 35 meters, India Mark II will be adopted and necessary measures will be discussed according to water quality (pH and iron content) and friendliness to operation and maintenance by the community.

(4) Water quality value for iron and pH

Both sides confirmed that the value for iron and pH will be decided after further survey on the existing facilities in the area.

(5) Iron Removal Plant

Considering the effectiveness of the Iron Removal Plant (hereinafter referred to as "IRP") in high concentration of iron in the groundwater, the Zambian side understood the possibility of applying IRP in the Project. The type of IRP will be decided based on the evaluation on operation and maintenance of the current IRPs installed in Phase 2 and previous project. Both sides agreed to consider application of IRP based on pH and iron content.

7-2. Construction of piped water scheme

(1) Design per capita consumption

Both sides agreed to adopt 30 litre per person per day as a per capita consumption for a basis of designing piped water scheme..

(2) Justification of application of piped water scheme in rural areas

With reference to Vision 2030, the Zambian side explained it is necessary to adopt appropriate technologies in rural areas in order to provide safe drinking water to rural communities. Especially for those communities which are growth centres with business and social infrastructures may require piped water scheme to cover the growing population. Besides piped water scheme may be cost effective to provide safe water for wider areas. And the Zambian side also explained that rural electrification and decentralisation process help District Council and rural communities to properly manage piped water scheme.

(3) Criteria for the selection of site for piped water scheme

Both sides confirmed that the Project sites for piped water scheme will be determined based on the criteria described as below.

a) Operation and Maintenance
   - Establishment of Water Users Committee (consolidation of V-WASHEs)
   - Possibility of regular salary payment for pump operator of water supply scheme
   - Possibility of allowances payment for tap attendants
   - Possibility of consignment contract with Commercial Utility on management of water scheme
   - Willingness to pay for water tariff to cover operation and maintenance cost of the scheme, including regular salary for a pump operator and tap attendants
   - Affordability to pay for water tariff among expected users of the scheme
   - Availability of after services, spare parts and chlorine

b) Demand of safe and stable water supply
   - Demand of safe and stable water supply
   - Population of the community is large enough for piped scheme
   - Demand of public taps

c) Accessibility to the site (including security for working) as well as securing land to build a pump house, plot for solar panel, elevated water tank and so on

d) Situation of existing water supply facilities

e) No duplication of project sites with other CPs,

f) Hydro-geological condition allows to provide water with standard quality in Zambia with optimum yield based on water demand

g) Power supply

The most appropriate power supply shall be selected according to the results of the Survey. Options are national grid, solar power and gravity fed system. In case of solar power system, the followings are criteria for adoption.

- Availability of suppliers of qualified solar panels and pumps with a standardized quality
- Enough hours of daylight for operating solar system during rainy season

(4) Utilization of existing water source

Both sides discussed the possibility of utilization of existing water sources, such as boreholes and spring. If existing water sources are not good enough to provide necessary amount of safe drinking water to the community, the Team will consider of drilling test boreholes. The Team also explained that it is to be discussed with the Government of Japan if it is approved to make use of existing boreholes constructed by previous Japanese Grant Aid as a source of piped water scheme.

(5) Test borehole drilling

The Team explained that the purpose of test borehole drilling is to confirm groundwater availability for the development of piped water scheme in the target site. Those boreholes which are confirmed with sufficient yield and drinkable water quality will be converted to the production wells in the construction stage. Successful boreholes would be properly protected by the Zambian side until the commencement of the construction stage of the Project.

Necessary number of test boreholes may differ from site to site according to water demand. However, maximum number of test boreholes is fixed at 10 based on survey duration as well as amount of budget.

If any test borehole is dry or has insufficient yield, the Team will consult with MLGH for their advice on measures to be taken with these boreholes, whether to abandon or install a casing and conduct pumping test, etc. for future use.

(6) Specification of piped water scheme

The Team requested the Zambian side to provide information of any related regulation and standard specification of construction of piped water scheme with the Team in order to design the facility to meet standard specification in Zambia.

7-3. Alignment to National Rural Water Supply and Sanitation Programme and application of SOMAP O&M model

Regarding to the Soft Component activities for the operation and maintenance of water supply facilities in the Project, both sides confirmed that the Project is to apply SOMAP O&M model of National Rural Water Supply and Sanitation Programme (hereinafter referred to as "NRWSSP").

7-4. Demarcation with other cooperation partners (CPs)

The Zambian side confirmed that there is no duplication among CPs on the sites of the Project, and agreed to be responsible for coordination among CPs.

7-5. Submission of questionnaire response

The Team requested the Zambian side to prepare written response to the questionnaire and to submit to JICA Zambia office by 28 June, 2013 in order to conduct survey as scheduled.

7-6. Technical note

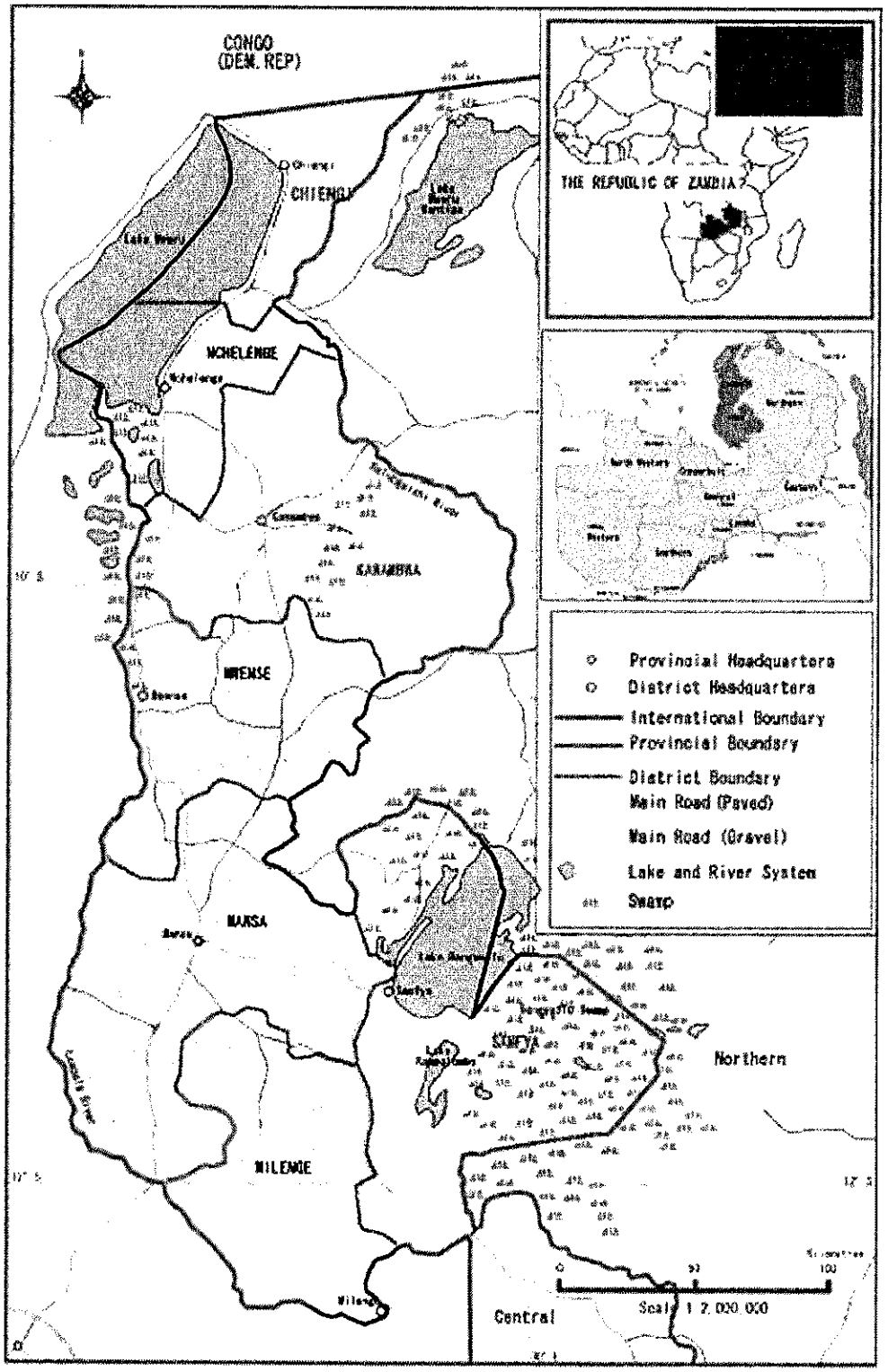
Both sides agreed to share the progress of the Survey by sharing technical note whenever it is necessary. However, both sides confirmed that final components of the Project will be examined during analysis in Japan after the Survey.

7-7. Custom clearance and issue of Letter of Purchase Order

The Japanese side requested the Zambian side to support smooth custom clearance of the equipment and materials of the Project and prompt issuance of the Letter of Purchase Order. The Zambian side understood the request and shall take appropriate measures for the smooth implementation of the Project.

Annex

1. Project Area Map
2. Organization Chart
3. List of Requested Sites
4. Japan's Grant Aid
5. Major Undertakings to be taken by Each Government

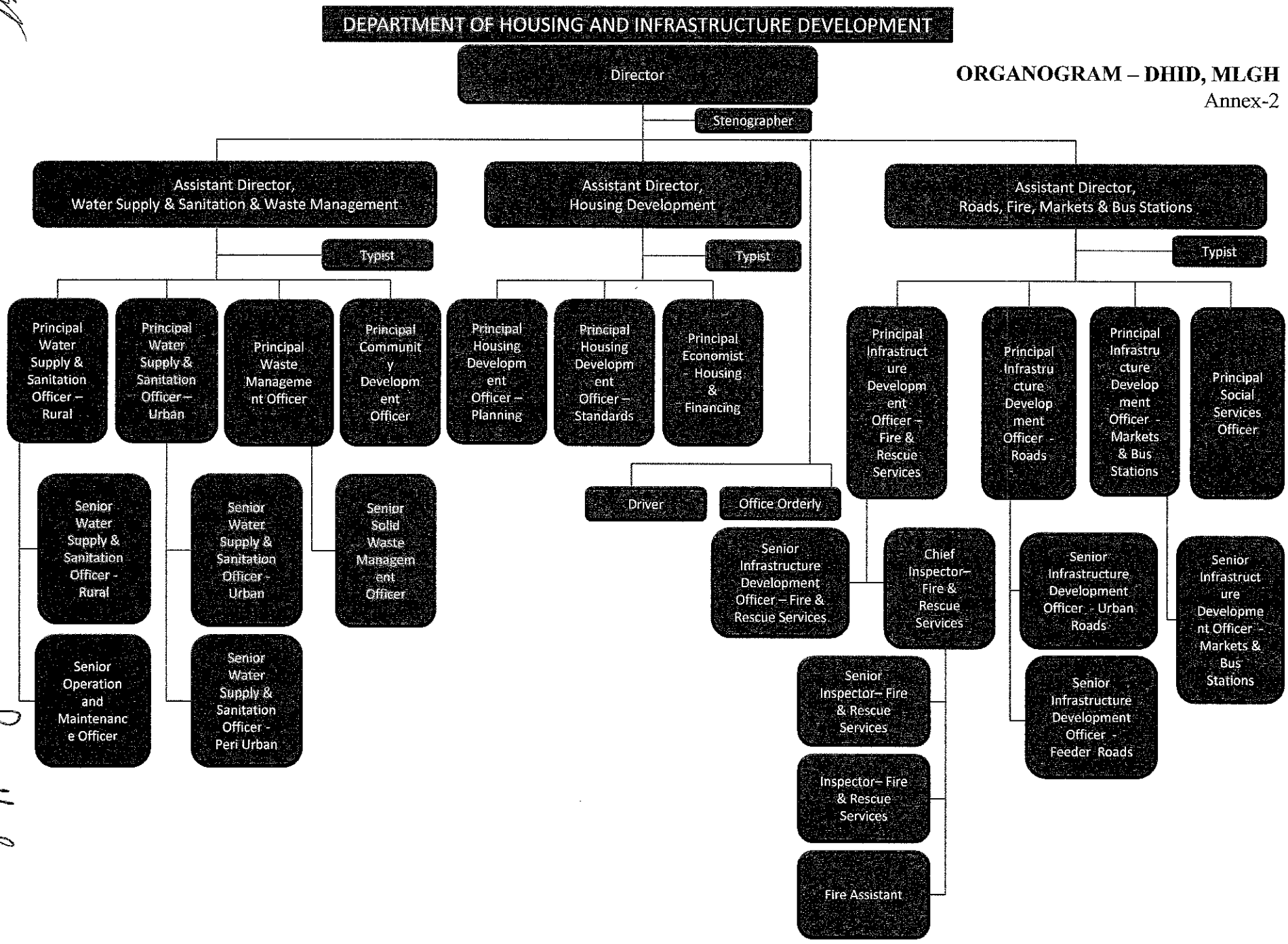


PROJECT AREA MAP

DEPARTMENT OF HOUSING AND INFRASTRUCTURE DEVELOPMENT

ORGANOGRAM – DHID, MLGH

Annex-2



Annex-3

LIST OF REQUESTED SITES (Borehole with hand pump)

	Nchelenge	Ward
1	Mutwaname	Kasamba
2	Mukumbwa	Kasamba
3	Katuta	Kasamba
4	Sekateni	Kasamba
5	Buleya	Kasamba
6	Chikange	Kasamba
7	Chapita	Kasamba
8	Kasekeli	Kasamba
9	Mushili	Kasamba
10	Katipe	Shabo
11	Chipulumushi	Shabo
12	Chablikila Section 1	Shabo
13	Chablikila Section 2	Shabo
14	Mutete	Shabo
15	Labi	Shabo
16	Chonoho	Shabo
17	Mukanso	Shabo
18	Kapambwe section 1	Shabo
19	Chomba	Shabo
20	Chinyanta	Mulwe
21	Museelu	Mulwe
22	Chipayeni	Mulwe
23	Chipeklia	Mulwe
24	Mulwe	Mulwe
25	Nalukoji	Mulwe
26	Sweba	Mulwe
27	Mukange	Mulwe
28	Kampampi	Mulwe
29	Mateyo	Mulwe
30	Mfundawula	Mofwe
31	Chifungula	Mofwe
32	Nakafwaya	Mofwe
33	Katele	Mofwe
34	Kanguluma	Mofwe
35	Chisushi	Mofwe
36	Nakafwaya Central	Mofwe
37	Lukokesha	Mofwe
38	Kanyemba East	Mofwe
39	Mubanga	Mofwe
40	Chandwe	Kashikishi
41	Kabulo	Kashikishi
42	Eliyabu	Kashikishi
43	Delson	Kashikishi
44	Mutono 1	Kashikishi
45	Mutono 2	Kashikishi
46	Mweru Primary	Kashikishi
47	Katuna	Kashikishi
48	Yanga	Kashikishi
49	Mubamba A	Nchelenge
50	Mubamba B	Nchelenge
51	Kaseka B (Lakeside)	Nchelenge
52	Kasonkomona	Nchelenge
53	Shindoni	Nchelenge
54	Kanwa	Mwatishi
55	Block 4	Mwatishi
56	block 6	Mwatishi
57	Kafwala	Mwatishi
58	Chofwe kabila	Mwatishi
59	Labani	Mwatishi
60	Chimpulumba	Mwatishi
61	Miyemba	Mwatishi
62	Lembati	Mwatishi
63	Belu	Mwatishi
64	Kasheta	Mwatishi
65	Lupili	Mwatishi
66	Mutabwe	Mwatishi
67	Kambwali Local Court	Kasamba
68	Mulonda	Mwatishi
69	Block 3	Mwatishi
70	Shimpundu	Mwatishi
71	Chibi	Mwatishi
72	Matete	Mwatishi
73	Chimpulumba	Mwatishi
74	Pingwila	Chilongo
75	Mutepuka - Filubo section	Chilongo
76	Mutepuka main	Chilongo
77	Chansa Fisali	Chilongo
78	Lumbanama	Chilongo
79	Kalubuli	Kabuta
80	Shichishipula	Kabuta
81	Kaputo	Kabuta
82	Kabuta east	Kabuta
83	Chula	Kabuta
84	Samashi	Kabuta
85	Chishima	Kabuta
86	Sekeleti	Kabuta
87	Chafuma	Kabuta
88	Siseli	Kabuta
89	Chishima	Kabuta
90	Musafili	Munkombwe

	Mansa	Ward
1	Chabwe-2	Lukangaba
2	Fibobola	Lukangaba
3	David Chilamba	Lukangaba
4	Sambe	Lukangaba
5	Kalikeka	Lukangaba
6	Matenda	Lukengeba
7	Matipa	Mutuna
8	Chiputa	Mutuna
9	Katanga	Mutuna
10	Mpota	Mutuna
11	Sakeni	Mutuna
12	Chalwa	Mutuna
13	Lukupwa	Mutuna
14	Mbulwe	Mutuna
15	Kasaka	Misakalala
16	Chikoyi	Misakalala
17	Obedi	Misakalala
18	Kabengela	Misakalala
19	Sande Facite	Misakalala
20	Mulala	Misakalala
21	Kalala	Lukola
22	Chipense	Lukola
23	Kasanga-1	Lukola
24	Lusaya	Lukola
25	Chambo	Lukola
26	Mumbwe	Lukola
27	Chimoto	Chibeleka
28	Kafusha	Chibeleka
29	Nshenda	Chilyepa
30	Mapesa	MULENSHI
31	Fiyongoli Primary School	Mansa
32	Maunga	Chansunsu
33	Lukali	Chansunsu
34	Langi	Chansunsu
35	Chibenda	Chansunsu
36	Kansepula	Chansunsu
37	Mashatini	Chansunsu
38	Kasongolola	Chansunsu
39	Jim	Chansunsu
40	Mpembesa	Chansunsu
41	Katangwe A	Chansunsu
42	Katagwe B	Chansunsu
43	Yasakwa Lay By	Chansunsu
44	Sunday	Chilyepa
45	Chapote	Chilyepa
46	Chite Com School	Chilyepa
47	Fibobe Com School	Chilyepa
48	Mwela	Chilyepa
49	Lole	Chilyepa
50	Chimpala	Chilyepa
51	Mofat I	Chilyapa
52	Matipa	Chilyepa
53	Musenga Primary School	Chilyepa
54	Kolota	Chilyapa
55	Maikeneke Market	MUCHINKA
56	Lemmy	MULENSHI
57	Sumbu A	MULENSHI
58	Sumbu B	MULENSHI
59	Chikuwe 2	MULENSHI
60	Kasheshe	MULENSHI

	Milenge	Ward
1	Lwela Secondary School	Itemba
2	Bene Kund	Itemba
3	Mpile	Itemba
4	Nkumbula	Itemba
5	Pollen	Itemba
6	Milomo	Itemba
7	Goliat	Chiswishi
8	Chituta	Chiswishi
9	Muluka	Chiswishi
10	Chilimabwe	Chiswishi
11	Chengo	Chiswishi
12	Helena Musonda	Mikula
13	Kasepa	Mikula
14	Loyi Mwape	Mikula
15	Milenge Secondary School	Mikula
16	John Nkumba	Mikula
17	Chipundu	Fibalala
18	Kampemba	Fibalala
19	Fikombo	Fibalala
20	Ng'anda fmo	Fibalala
21	Mpanse	Nsunga
22	Lumfilwa	Nsunga
23	Chungu	Nsunga
24	Chisengelo	Nsunga
25	Mulala	Nsunga
26	Kabesa	Nsunga
27	Lupiya ※	Nsunga
28	Salmoni	Nsunga
29	Thomas	Nsunga
30	Chimesa	Nsunga
31	Lungo Mukuta ※	Nsunga
32	Tali Meke	Nsunga
33	Kabola	Nsunga
34	Mukonkani	Nsunga
35	Mogani Mulelema	Nsunga
36	Ponga-Ponga ※	Nsunga
37	Kashila	Nsunga
38	Sando	Nsunga
39	Sakeni	Mulumbi
40	Kabunda	Mulumbi
41	Museleng a	Mulumbi
42	Chansanga	Milambo
43	Stephano	Milambo
44	Pwele	Milambo
45	Kanyesha	Milambo
46	Mumbotuta Primary School	Mumbotuta
47	Changwe-Lungo Primary School	Mumbotuta
48	Allen Senga	Mumbotuta
49	Changwe Village	Mumbotuta
50	Shit Ambuli Primary School	Mumbotuta
51	Fitiko	Nsaka
52	Ng'omba	Nsaka
53	James	Nsaka
54	Kokonshelo	Kapalala
55	Katoko	Kapalala
56	Katena	Kapalala
57	Lesa Mukall	Kapalala
58	Masheto	Chipundu
59	Sailas	Chipundu
60	Kapu	Chipundu
61	Mwangula	Lusumbwe
62	Musumali	Lusumbwe
63	Kalali	Lusumbwe
64	Kalamba	Sokontwe
65	Thomas	Sokontwe
66	Chilufy Kabinda	Sokontwe
67	Mashika	Sokontwe

※ Number of bohoele with handpump : 2
Milenge total: 70

	Mwense	Ward
1	Chomba	Chachacha
2	Chilengwe	Chachacha
3	Musangati	Chachacha
4	Mubuka	Chachacha
5	Shikabila	Chachacha
6	Chifuba	Chachacha
7	Namfumu Wakatindi	Chachacha
8	Kalumba	Chachacha
9	Chibwe Kabuta	Chachacha
10	Chimbini	Chachacha
11	Kusengu	Chachacha
12	Mwenso	Mambilima
13	Lunchumuna	Mambilima
14	Nandwe	Mambilima
15	Kampamba	Mambilima
16	Mutoto	Mambilima
17	Twaba A	Mambilima
18	Twaba B	Mambilima
19	Kabangwe	Mambilima
20	Mukopa A	Mambilima
21	Mukopa B	Mambilima
22	Muyemba	Mambilima
23	Tonde	Mambilima
24	Mutamba	Mambilima
25	Chisonga	Pebekabesa
26	Kapena	Pebekabesa
27	Kaswika	Pebekabesa
28	mumpolokoso	Pebekabesa
29	Chikonkolo	Pebekabesa
30	Kasanda	Pebekabesa
31	kashingwa	Pebekabesa
32	Mailtini	Kalanga
33	Shichilenge	Kalanga
34	Kambo	Kalanga
35	Shichema East	Kalanga
36	Kateule South	Kalanga
37	Shingwe	Kalanga
38	Chakwa	Kalanga
39	Motondo	Musonda
40	Kabila	Musonda
41	Chibundu	Musonda
42	Keteule	Musonda
43	Black	Musonda
44	Rosa Mukuntu	Musonda
45	Muchinga Community School	Musonda
46	Chatukwa	Nsofi
47	Halland	Nsofi
48	Chilongoshi	Nsofi
49	Ndebe	Nsofi
50	Lubamba	Nsofi
51	Matente	Nsofi
52	Mushashi	Nsofi
53	Poleni	Mpasa
54	Mutenti	Mpasa
55	Nabashila	Mpasa
56	Chisokolwe	Mpasa
57	Kapesha	Mpasa
58	Benard	Mpasa
59	Tangwe	Mpasa
60	Kayanike	Mpasa
61	Kanchinshi	Mpasa
62	Chibondo Primary School	Chibembe
63	Losa Mukunkutu	Chibembe
64	Mwashi	Chibembe
65	Sitwala	Chibembe
66	Jacobo	Chibembe
67	Punaya	Chibembe
68	Musalula	Chibembe
69	Kawama B	Nkanga
70	Chiwasha	Nkanga
71	Kapala	Nkanga
72	Mofati	Nkanga
73	Chibamba	Nkanga
74	Muchleha	Nkanga
75	Tondo	Nkanga
76	Kapotwe	Lundashi
77	Chalwe West	Lundashi
78	Chalwe East	Lundashi
79	Chiburnbu North	Lundashi
80	Chikumbi	Kasangu
81	Kapakala East	Kasangu
82	Kapakala West	Kasangu
83	Simaria B	Kasangu
84	Chakwangasha	Kasangu
85	Fisaka	Luche
86	Chelekubi	Luche
87	Sitima	Luche
88	Kapondo	Luche
89	Kabuta	Luche
90	Bundebunde	Kaombe
91	Lukumani	Kaombe
92	Kalasa	Kaombe
93	Chitasu	Kaombe
94	Ponga	Kaombe
95	Maisa	Kaombe
96	Chitupi	Kaombe
97	Kabusha South	Kaliti
98	Kantondi	Kaliti
99	Chibende	Kaliti
100	Kambule	Kaliti

Annex-3

LIST OF REQUESTED SITES (Piped water scheme)

	District	Site
1	Nchelenge	Kabuta
2	Nchelenge	Kanyembo
3	Nchelenge	Muatishi
4	Mwense	Kapala
5	Mwense	Musangu Filling Station
6	Mwense	Kapakala
7	Mwense	Shichama
8	Milenge	Milenge

Annex-4

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on the law and the decision of the Government of Japan (hereinafter referred to as "the GOJ"), JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

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

1. Grant Aid Procedures

The Japanese Grant Aid is conducted as follows-

- Preparatory Survey (hereinafter referred to as "the Survey")
  - The Survey conducted by JICA
- Appraisal &Approval
  - -Appraisal by The GOJ and JICA, and Approval by the Japanese Cabinet
- Determination of Implementation
  - -The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - -Agreement concluded between JICA and a recipient country
- Implementation
  - -Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide a basic document necessary for the appraisal of the Project by JICA and the GOJ. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and

also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.

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

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

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

(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of

Notes(hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a plead for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

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

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

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

(8) Banking Arrangements (B/A)

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

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

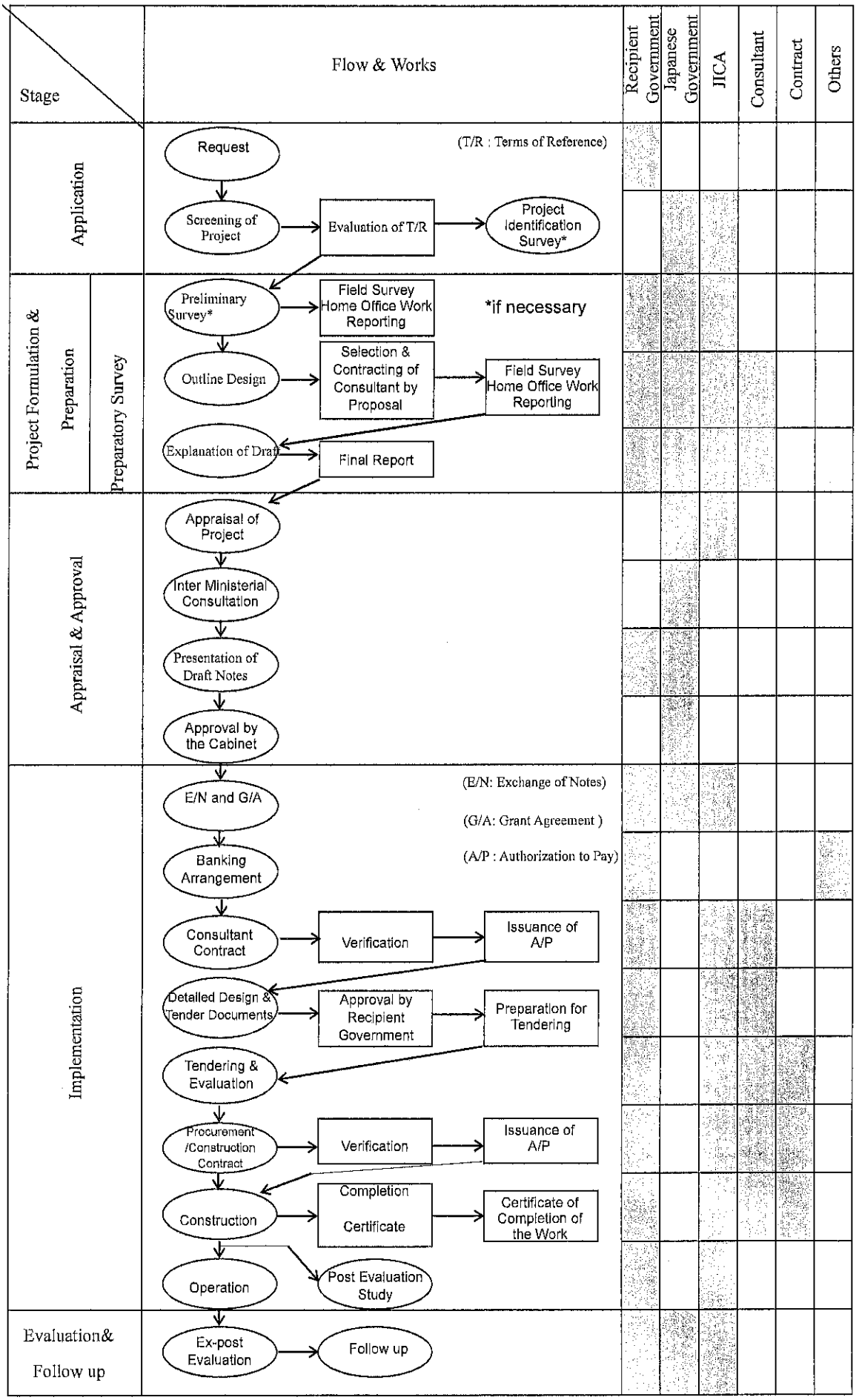
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA socio-environmental guideline.

(End)

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES



Annex-5

MAJOR UNDERTAKINGS TO BE TAKEN BY EACH GOVERNMENT

(Construction)

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure [a lot] /[lots] of land necessary for the implementation of the Project and to clear the [site]/[sites];		•
2	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the Products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site	•	
3	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted		•
4	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
5	To ensure that [the Facilities and the products]/[the Facilities]/ [the products] be maintained and used properly and effectively for the implementation of the Project		•
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		•
7	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
8	To give due environmental and social consideration in the implementation of the Project.		•

(B/A: Banking Arrangement, A/P: Authorization to pay)

Minutes of Discussions
on
Preparatory Survey
For
The Project for Groundwater Development
in Luapula Province Phase 3
in the Republic of Zambia
(Explanation of Draft Report)

In June 2013, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched a Preparatory Survey Team on the Project for Groundwater Development in Luapula Province Phase 3 in the Republic of Zambia (hereinafter referred to as "the Project") to the Republic of Zambia (hereinafter referred to as "Zambia") and through discussion, field survey, and technical examination of the results in Japan, JICA prepared a draft report of the study.

JICA dispatched to Zambia the Draft Report Explanation Team (hereinafter referred to as " the Team "), which was headed by Mr. Yoshihide Teranishi, Chief Representative, JICA Zambia Office, from March 7th-15th, 2014 to consult the Zambia authorities on the components of the draft report.

As a result of discussions, both parties confirmed the main items described on the attached sheets.

Lusaka, 14 March, 2014

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ATTACHMENT

1. Components of the Draft Report

The Zambia side agreed and accepted in principle the components of the draft outline design explained by the Team.

2. Japan's Grant Aid scheme

2-1 The Zambian side understood the Japan's Grant Aid Scheme as described in Annex-1.

2-2 The Zambian side agreed to take the necessary measures for smooth implementation of the Project, as a condition for the Japan's Grant Aid to be implemented, as described in Annex-2

3. Responsible and Implementing Organization

3-1 The responsible organization is Ministry of Local Government and Housing (hereinafter referred to as "MLGH").

3-2 The implementing organization is Department of Housing and Infrastructure Development (hereinafter referred to as "DHID"), MLGH.

4. Schedule of the Study

JICA will complete the final report in accordance with the confirmed items and send it to Zambia by the end of May, 2014.

5. Other Relevant Issues

5-1 Project Cost Estimate

The Team explained to the Zambian side the project cost estimate as attached in Annex-3. Both sides confirmed that this cost estimate is provisional and will be examined further by the Government of Japan for its approval as the Grant. Furthermore, both sides agreed that this project cost estimate should never be duplicated in any form nor released to any other parties until the relevant contracts are awarded by MLGH. This embargo is for securing fairness of tender procedure.

5-2 Necessary Budget to be covered by the Zambian Side

The Japanese side explained necessary project cost to be covered by the Zambian side and necessary operation and maintenance cost as attached in Annex-4.

Both sides agreed the Zambian side to timely allocate the necessary amount of budget (Annex-4) for smooth implementation of the Project, to assign counterpart personnel during the implementation of the Project.

5-3 Project Sites

The original request from Zambia to Japan included boreholes fitted with hand pumps at three hundred and twenty (320) sites and piped water supply schemes at eight (8) sites. However, due to restrictions in project scale as a grant aid project and construction period of one year, the target for this project became respectively, two hundred (200) sites for successful boreholes with hand pump and five (5) sites for piped water supply schemes. The social condition survey was conducted at

all requested sites according to the criteria agreed with Zambian side.

For boreholes with hand pumps, based on their detailed site survey, sixty six (66) sites were excluded. Then the remaining two hundred fifty four (254) sites were prioritized and the top two hundred (200) sites were selected as the project target sites shown in Annex-5. The fifty four (54) sites with lower priorities were retained as alternative sites in case drillings become unsuccessful. There will not be third drilling after two trials are concluded as unsuccessful in terms of water quantity and quality at the same site.

For piped water supply schemes, five (5) sites were also selected as the project target sites shown in Annex-6. Test drillings were conducted in four (4) sited out of five (5) sites during the preparatory survey, consequently were successful with enough discharge for piped water supply scheme.

5-4 Soft Component Program

1) The sphere of responsibilities of the Soft Component Activities for the sites for construction of boreholes fitted with hand pumps are as below;

Responsibilities of the Japanese side:

Japanese consultant will provide following activities

a. Orientation for District Local Authorities (hereinafter referred to as "DLAs"), Ward Development Committees (hereinafter referred to as "WDCs"), Area Pump Menders (hereinafter referred to as "APMs"), local traditional leaders and communities
b. Selection of candidate sites for facilities with the community members
c. Formation of V-WASHEs and
d. Operation and Maintenance (hereinafter referred to as "O&M") training for sites installed with iron removal plants.

Responsibility of the Zambia side:

a. Provision of trainings on O&M structure for V-WASHEs
b. Provision of trainings on O&M structure for caretakers, and
c. Provision of hygiene sanitation and hygiene promotion activities.

2) Including the above, the Zambian side shall bear funding and other resources necessary to conduct ALL of the Soft Component activities planned under the Project, whether or not it is supported by the Japanese side. Forms of responsibility include but not limited to the below items;

a. Allowances necessary for the Provincial DHID officials, D-WASHE members and WDC members to conduct soft component activities
b. Provision of transport for D-WASHE members to conduct soft component activities
c. Provision of transport allowance for WASHE facilitators
d. Provision of transport and fuel for D-WASHE members to conduct monitoring activities
e. Provision of funds for workshops, stationaries, and report preparation for the activities listed as the responsibility of the Zambia side in 5-3. 1) above.

5-5 O&M Cost for Water Supply Facilities to be constructed under the Project

MLGH should be responsible for O&M of the facilities to ensure sustainability of the water supply facilities such as both boreholes with hand pumps and piped water supply schemes to be constructed under the Project.

WDCs and DLAs in district and village level shall function for proper O&M of the completed water supply facilities.

MLGH assured the allocation of the O&M cost in the following manner;

(1) O&M cost for Boreholes with Hand Pump

The beneficiary residents in the Project sites shall cover entire costs for operation and maintenance of the completed water supply facilities, receiving the support of the WDCs and the DLAs.

(2) O&M cost for Piped Water Supply Schemes

The community in the Project sites shall cover costs for operation, management, minor repairs and routine inspections of schemes while the government shall bear the cost for provision of facilities rehabilitations/replacements, and employment of the guard for solar powered water supply scheme in Milenge, stipulated in the Draft Report.

5-6 Monitoring

DLAs shall bear the cost for regular monitoring on O&M status and necessary technical assistance, and accumulate data for future projects of similar nature. In addition, MLGH assured that the Luapula Water and Sewerage Company should provide quarterly monitoring under instruction and funding of the government. The monitoring includes evaluation of the standard of the repair/rehabilitation service provided by the contracted private company, and water quality inspection.

5-7 Land Use

The Zambia side confirmed that land to be used for construction of facilities including intake facilities, pump houses, distribution tanks, pipelines and public tap stands will not require any involuntary resettlement of inhabitants and land expropriations.

5-8 Undertakings of the Zambian Side

The Zambian side agreed to take the following necessary measures;

1) To allocate a Project Manager to assist the smooth implementation of the Project.
2) To allocate D-WASHE members from the target districts during the Project period, to participate in inspection of construction and the Soft Component Program conducted by a local consultant, and to bear the expenses for the D-WASHE members.
3) The Zambia side assured to undertake environmental screening and if necessary, the environmental impact assessment in relation to the Project and to obtain the formal approval from relevant authorities according to the Zambian laws and regulations. Based on the preliminary design to be provided by the Team, MLGH shall ensure that the formalities relating to EIA are undertaken by implementation of the Project.
4) To secure land necessary to construct the water supply facilities, and to clear, to level and to reclaim the land prior to commencement of the construction.
5) To prepare access routes necessary for the construction of water supply facilities.
6) To secure land necessary for the base camp and stockyard in the target districts during construction.

7) To exempt Japanese nationals from customs duties, internal taxes and other fiscal levies which will be imposed in Zambia with respect to the supply of the products, materials and services under the Project.
8) To ensure prompt customs clearance and internal transportation of distributed equipments and materials under the Grant Aid, according to the master list prepared by Japanese contractor
9) To operate and maintain the facilities constructed under the Grant Aid properly and effectively, and to appoint necessary staff for this O&M.
10) To bear all the expenses other than those covered by the Grant Aid.
11) To conduct sensitisation activities to the community members and to collect the community contributions of amount of ZMW1,500 obliged according to National Rural Water Supply and Sanitation Programme. Furthermore the full cash contribution by the community shall not be the condition of the commencement of the construction of the water facilities in the site.
12) To facilitate community members to establish a fence around a borehole.

5-9 Demarcation with Other Cooperating Partners

Zambian side agreed that they will be responsible for coordinating the Cooperating Partners in order to avoid duplication among Cooperating Partners on the sites of the Project.

(END)

Annex:

Annex-1 Japan's Grant Aid Scheme
Annex-2 Major Undertakings to be taken by Each Government
Annex-3 Project Cost Estimate
Annex-4 Necessary Budget to be covered by the Zambian Side
Annex-5 Project Sites List
Annex-6 Number of Projects Site in Each District

JAPAN'S GRANT AID

The Government of Japan (hereinafter referred to as "the GOJ") is implementing the organizational reforms to improve the quality of ODA operations, and as a part of this realignment, a new JICA law was entered into effect on October 1, 2008. Based on the law and the decision of the Government of Japan (hereinafter referred to as "the GOJ"), JICA has become the executing agency of the Grant Aid for General Projects, for Fisheries and for Cultural Cooperation, etc.

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

1. Grant Aid Procedures

The Japanese Grant Aid is conducted as follows-

- Preparatory Survey (hereinafter referred to as "the Survey")
  - The Survey conducted by JICA
- Appraisal &Approval
  - -Appraisal by The GOJ and JICA, and Approval by the Japanese Cabinet
- Determination of Implementation
  - -The Notes exchanged between the GOJ and a recipient country
- Grant Agreement (hereinafter referred to as "the G/A")
  - -Agreement concluded between JICA and a recipient country
- Implementation
  - -Implementation of the Project on the basis of the G/A

2. Preparatory Survey

(1) Contents of the Survey

The aim of the Survey is to provide a basic document necessary for the appraisal of

the Project by JICA and the GOJ. The contents of the Survey are as follows:

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of agencies concerned of the recipient country necessary for the implementation of the Project.
- Evaluation of the appropriateness of the Project to be implemented under the Grant Aid Scheme from a technical, financial, social and economic point of view.
- Confirmation of items agreed on by both parties concerning the basic concept of the Project.
- Preparation of a basic design of the Project.
- Estimation of costs of the Project.

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

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

(2) Selection of Consultants

For smooth implementation of the Survey, JICA uses (a) registered consulting firm(s). JICA selects (a) firm(s) based on proposals submitted by interested firms.

(3) Result of the Survey

The Report on the Survey is reviewed by JICA, and after the appropriateness of the Project is confirmed, JICA recommends the GOJ to appraise the implementation of the Project.

3. Japan's Grant Aid Scheme

(1) The E/N and the G/A

After the Project is approved by the Cabinet of Japan, the Exchange of Notes(hereinafter referred to as "the E/N") will be singed between the GOJ and the Government of the recipient country to make a plead for assistance, which is followed by the conclusion of the G/A between JICA and the Government of the recipient country to define the necessary articles to implement the Project, such as payment conditions, responsibilities of the Government of the recipient country, and procurement conditions.

(2) Selection of Consultants

The consultant firm(s) used for the Survey will be recommended by JICA to the recipient country to also work on the Project's implementation after the E/N and the G/A, in order to maintain technical consistency.

(3) Eligible source country

Under the Japanese Grant Aid, in principle, Japanese products and services including transport or those of the recipient country are to be purchased. When JICA and the Government of the recipient country or its designated authority deem it necessary, the Grant Aid may be used for the purchase of the products or services of a third country. However, the prime contractors, namely, constructing and procurement firms, and the prime consulting firm are limited to "Japanese nationals".

(4) Necessity of "Verification"

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

(5) Major undertakings to be taken by the Government of the Recipient Country

In the implementation of the Grant Aid Project, the recipient country is required to undertake such necessary measures as Annex.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use the facilities constructed and the equipment purchased under the Grant Aid properly and effectively and to assign staff necessary for this operation and maintenance as well as to bear all the expenses other than those covered by the Grant Aid.

(7) "Export and Re-export"

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

(8) Banking Arrangements (B/A)

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

b) The payments will be made when payment requests are presented by the Bank to JICA under an Authorization to Pay (A/P) issued by the Government of the recipient country or its designated authority.

(9) Authorization to Pay (A/P)

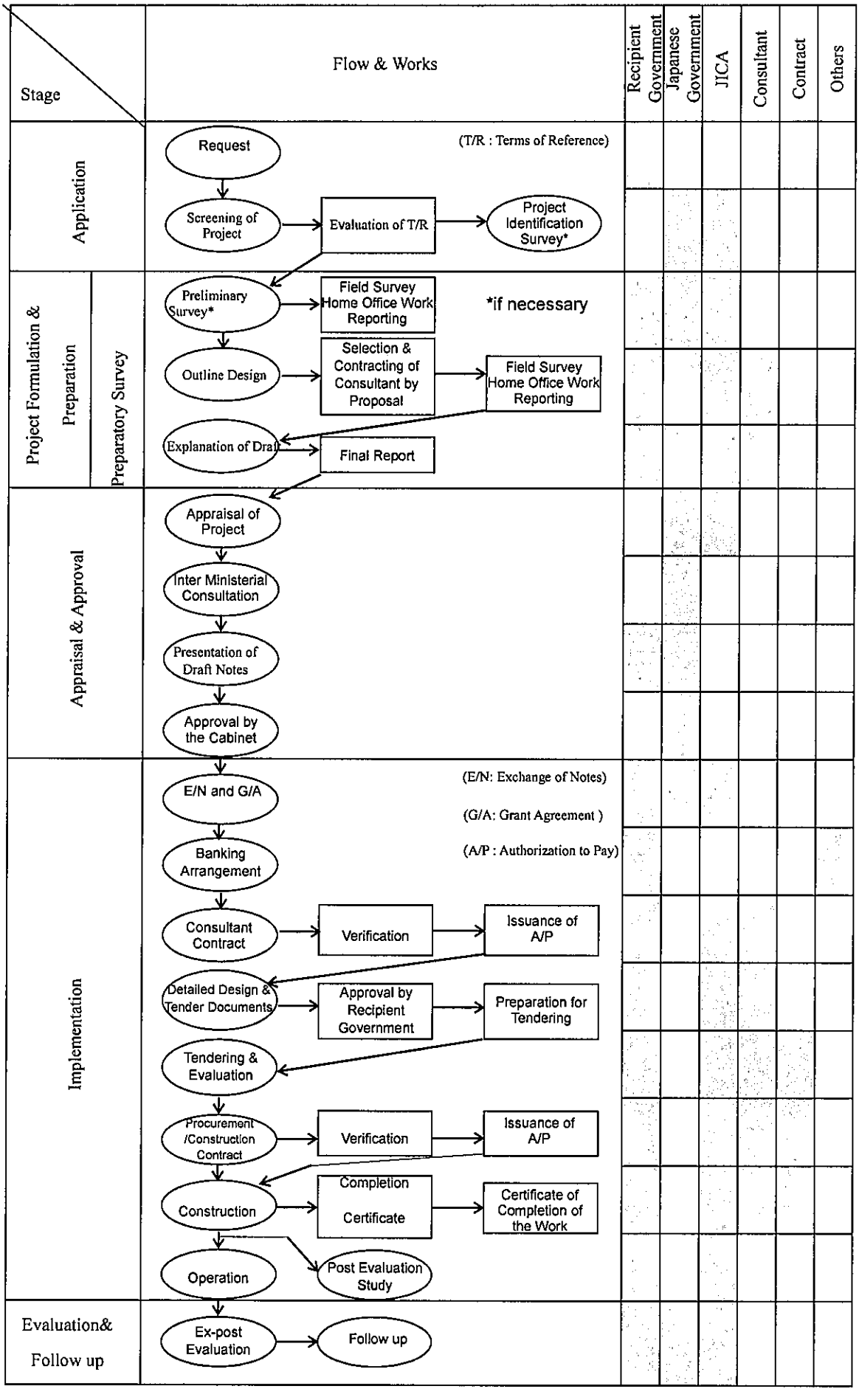
The Government of the recipient country should bear an advising commission of an Authorization to Pay and payment commissions to the Bank.

(10) Social and Environmental Considerations

A recipient country must ensure the social and environmental considerations for the Project and must follow the environmental regulation of the recipient country and JICA socio-environmental guideline.

(End)

FLOW CHART OF JAPAN'S GRANT AID PROCEDURES



MAJOR UNDERTAKINGS TO BE TAKEN BY EACH GOVERNMENT

(Construction)

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	to secure [a lot] /[lots] of land necessary for the implementation of the Project and to clear the [site]/[sites];		•
2	To ensure prompt unloading and customs clearance of the products at ports of disembarkation in the recipient country and to assist internal transportation of the products		
	1) Marine (Air) transportation of the Products from Japan to the recipient country	•	
	2) Tax exemption and custom clearance of the Products at the port of disembarkation		•
	3) Internal transportation from the port of disembarkation to the project site	•	
3	To ensure that customs duties, internal taxes and other fiscal levies which may be imposed in the recipient country with respect to the purchase of the products and the services be exempted		•
4	To accord Japanese nationals whose services may be required in connection with the supply of the products and the services such facilities as may be necessary for their entry into the recipient country and stay therein for the performance of their work		•
5	To ensure that [the Facilities and the products]/[the Facilities]/ [the products] be maintained and used properly and effectively for the implementation of the Project		•
6	To bear all the expenses, other than those covered by the Grant, necessary for the implementation of the Project		•
7	To bear the following commissions paid to the Japanese bank for banking services based upon the B/A		
	1) Advising commission of A/P		•
	2) Payment commission		•
8	To give due environmental and social consideration in the implementation of the Project.		•

(B/A: Banking Arrangement, A/P: Authorization to pay)

Necessary Budget to be covered by the Zambian Side

Total: ZMW 287,430

Cost Item	Total	Calculation	Remarks
Personnel cost for siting (project sites) during detailed design	ZMW3,350	MLA: 67days×1pers×ZMW50/day/person	D-WASHE member will join hydrogeological teams
Personnel cost for siting (alternative sites) during detailed design	ZMW350	MLA: 7days×1pers×ZMW50/day/person	D-WASHE member will participate in site transfer
Personnel cost during geophysical survey	ZMW5,000	MLA: 50days×2pers×ZMW50/day/person	D-WASHE members will participate in geophysical survey
Personnel cost during site transfer (borehole with hand pump)	ZMW2,500	MLA: 25days×2pers×ZMW50/day/person	D-WASHE and PST members will participate in site transfer
Personnel cost during site transfer (piped water scheme)	ZMW500	MLA: 5days×2pers×ZMW50/day/person	D-WASHE and PST members will participate in site transfer
Personnel cost during additional geophysical survey	ZMW1,000	MLA: 20days×1pers×ZMW50/day/person	D-WASHE member will participate in geophysical survey
Personnel cost during inspection before handover (borehole with hand pump)	ZMW4,000	MLA: 200sites/5sites/day×2pers×ZMW50	D-WASHE and PST members will participate in facilities construction handover
Personnel cost during inspection before handover (piped water supply scheme)	ZMW500	MLA: 5sites×1day×2pers×ZMW50	D-WASHE and PST members will participate in facilities construction handover
Costs during soft component activities	ZMW246,001		D-WASHE members, WDC, fuel, vehicle, etc.
Advising Commission for Authorisation to Pay (A/P)	ZMW1,093	Agreement/Contract : ZMW319.15×2times Amendment: ZMW212.8×2times	Opening of A/P: JY6,000/time A/P amendment : JY4,000/time
Payment commission to the bank	ZMW23,136		
Total	ZMW287,430		

N.B.: MLA: Missing Lunch Allowance, PST: Programme Support Team, WDC: Ward Development Committee

List of Project Sites

1. List of Project Target Sites for Nchelenge District

Site Code	Site Name	Population	Priority	Result
NCIII-02	Mukumbwa	1,850	1	Project
NCIII-46	Mweru Primary School	150	2	Project
NCIII-88	Siseli	7,750	3	Project
NCIII-87	Chafuma	6,222	4	Project
NCIII-17	Mukanso	5,750	5	Project
NCIII-66	Mutabwa	3,250	6	Project
NCIII-57	Kafwala	3,200	7	Project
NCIII-51	Kaseka B (Lakeside)	3,028	8	Project
NCIII-43	Daison	2,750	9	Project
NCIII-80	Shichishipula	2,750	10	Project
NCIII-47	Katuna	2,505	11	Project
NCIII-27	Mukange	2,500	12	Project
NCIII-41	Kabulo	2,500	13	Project
NCIII-42	Elyabu	2,500	14	Project
NCIII-48	Yanga	2,500	15	Project
NCIII-64	Kasheta	2,500	16	Project
NCIII-24	Mulwe	2,450	17	Project
NCIII-70	Shimpundu	2,327	18	Project
NCIII-04	Seketeni	2,319	19	Project
NCIII-68	Mulonda	2,250	20	Project
NCIII-07	Chapita	2,000	21	Project
NCIII-22	Chipayeni	2,000	22	Project
NCIII-23	Chipakila	1,750	23	Project
NCIII-60	Chimpulumba	1,750	24	Project
NCIII-67	Kambwali Local Court	1,550	25	Project
NCIII-20	Chinyanta	1,500	26	Project
NCIII-44	Mutono 1	1,500	27	Project
NCIII-53	Shindoni	1,500	28	Project
NCIII-84	Samashi	1,500	29	Project
NCIII-45	Mutono 2	1,450	30	Project
NCIII-36	Nakafwaya Central	1,425	31	Project
NCIII-86	Sekeleti	1,350	32	Project
NCIII-09	Mushili	1,250	33	Project
NCIII-58	Chofwe Kabila	1,200	34	Project
NCIII-06	Chikange	1,100	35	Project
NCIII-08	Kaeketi	1,100	36	Project
NCIII-11	Chipulumushi	1,000	37	Project
NCIII-79	Kalubuli	1,000	38	Project
NCIII-89	Chishima	1,000	39	Project
NCIII-54	Kanwa	950	40	Project
NCIII-72	Matete	950	41	Project
NCIII-63	Belu	900	42	Project
NCIII-30	Mfundawula	876	43	Project
NCIII-39	Mubanga	750	44	Project
NCIII-50	Mubamba B	700	45	Project
NCIII-52	Kasonkomona	700	46	Project
NCIII-76	Mutepuka Main	700	47	Project
NCIII-71	Chibi	637	48	Project
NCIII-03	Katuta	600	49	Project
NCIII-81	Kaputo	550	50	Project
NCIII-61	Miyemba	500	51	Project
NCIII-14	Mutete	470	52	Project
NCIII-65	Lupili	450	53	Project
NCIII-21	Museluu	422	54	Project
NCIII-16	Choncho	400	55	Project
NCIII-59	Labani	350	56	Project
NCIII-83	Chula	350	57	Alternative
NCIII-10	Kalipe	285	58	Alternative
NCIII-15	Labi	220	59	Alternative
NCIII-01	Mutiwanama	200	60	Alternative
NCIII-73	Chimpulumba	170	61	Alternative
NCIII-75	Mutepuka-Filubo Section	160	62	Alternative
NCIII-25	Nalukoji	150	63	Alternative
NCIII-34	Kanguluma	140	64	Alternative
NCIII-05	Bulaya	100	65	Alternative
NCIII-19	Chomba	70	66	Alternative
NCIII-35	Chisushi	70	67	Alternative
NCIII-29	Mateyo	60	68	Alternative
NCIII-37	Lukokesha	50	69	Alternative
NCIII-26	Swaba	49	70	Alternative
NCIII-33	Katele	Inaccessible		Cancelled
NCIII-18	Kapambwe Section 1	Inaccessible		Cancelled
NCIII-82	Kabuta East	Inaccessible		Cancelled
NCIII-77	Chansa Fisali	Project overlap		Cancelled
NCIII-28	Kampampi	Project overlap		Cancelled
NCIII-85	Chishima	For piped scheme		Cancelled
NCIII-49	Mubamba Primary School	Project overlap		Cancelled
NCIII-38	Kanyembo East	Inaccessible		Cancelled
NCIII-74	Pingwila	Inaccessible		Cancelled
NCIII-56	Block 6	Inaccessible		Cancelled
NCIII-55	Block 4	Inaccessible		Cancelled
NCIII-90	Musafili	Inaccessible		Cancelled
NCIII-31	Chifungula	Inaccessible		Cancelled
NCIII-69	Block 3	Inaccessible		Cancelled
NCIII-32	Nakafwaya	Low demand		Cancelled
NCIII-62	Lembati	Low demand		Cancelled
NCIII-13	Chabilikila Section 2	Low demand		Cancelled
NCIII-78	Lumbanama	Low demand		Cancelled
NCIII-40	Chandwe	Low demand		Cancelled
NCIII-12	Chabilikila Section 1	Low demand		Cancelled

2. List of Project Target Sites for Mwense District

Site Code	Site Name	Population	Priority	Result
MWIII-61	Kanchinshi Community School	720	1	Project
MWIII-62	Chibondo Primary School	450	2	Project
MWIII-45	Muchinga Community School	141	3	Project
MWIII-02	Chiengwe	6,500	4	Project
MWIII-90	Bundebunde	5,392	5	Project
MWIII-77	Chalwe West	4,600	6	Project
MWIII-84	Chakwangasha	2,983	7	Project
MWIII-26	Kapena	2,495	8	Project
MWIII-27	Kaswika	2,400	9	Project
MWIII-28	Mumpolokoso	2,090	10	Project
MWIII-37	Shingwe	1,250	11	Project
MWIII-78	Chalwe East	1,183	12	Project
MWIII-97	Kabusha South	1,160	13	Project
MWIII-100	Kambule	950	14	Project
MWIII-99	Chibende	850	15	Project
MWIII-17	Twaba A	807	16	Project
MWIII-18	Twaba B	807	17	Project
MWIII-63	Losa Mukunkutu	720	18	Project
MWIII-31	Kashingwa	580	19	Project
MWIII-67	Punaya	574	20	Project
MWIII-16	Mutoto	568	21	Project
MWIII-79	Chibumbu North	530	22	Project
MWIII-22	Muyembe	517	23	Project
MWIII-01	Chombe	500	24	Project
MWIII-20	Mukopa A	500	25	Project
MWIII-70	Chiwasha	500	26	Project
MWIII-14	Nandwe	495	27	Project
MWIII-29	Chikonkolo	490	28	Project
MWIII-46	Chatukwa	490	29	Project
MWIII-93	Chitasu	490	30	Project
MWIII-50	Lubamba	480	31	Project
MWIII-41	Chibundu	456	32	Project
MWIII-15	Kampamba	410	33	Project
MWIII-35	Shichama East	400	34	Project
MWIII-12	Mwenso	389	35	Project
MWIII-49	Ndebe	375	36	Project
MWIII-13	Lundumuna	370	37	Project
MWIII-52	Mushashi	365	38	Project
MWIII-68	Musalula	360	39	Project
MWIII-94	Ponga	360	40	Project
MWIII-72	Mofati	350	41	Project
MWIII-32	Malitini	315	42	Project
MWIII-21	Mukopa B	300	43	Project
MWIII-56	Chisokobwe	300	44	Project
MWIII-36	Kateule South	287	45	Project
MWIII-25	Chisonge	280	46	Project
MWIII-57	Kapesha	261	47	Project
MWIII-51	Matente	258	48	Project
MWIII-74	Muchisha	256	49	Project
MWIII-54	Mutanti	252	50	Project
MWIII-34	Kambo	250	51	Project
MWIII-55	Nabashila	250	52	Project
MWIII-80	Chikumbi	250	53	Project
MWIII-91	Lukumani	250	54	Project
MWIII-40	Kabila	240	55	Project
MWIII-73	Chibamba	240	56	Project
MWIII-64	Mweshi	239	57	Project
MWIII-07	Namfumu Wakatindi	200	58	Project
MWIII-11	Kusengu	200	59	Project
MWIII-23	Tonde	200	60	Project
MWIII-42	Kateule	200	61	Project
MWIII-44	Rosa Mukuntu	200	62	Project
MWIII-58	Benard	200	63	Project
MWIII-85	Fisaka	200	64	Alternative
MWIII-76	Kapotwe	192	65	Alternative
MWIII-39	Motondo	189	66	Alternative
MWIII-33	Shichilenge	174	67	Alternative
MWIII-96	Chitupi	172	68	Alternative
MWIII-08	Kalumba	170	69	Alternative
MWIII-19	Kabangwe	170	70	Alternative
MWIII-30	Kasanda	160	71	Alternative
MWIII-98	Kantondi	160	72	Alternative
MWIII-03	Musangati	150	73	Alternative
MWIII-38	Chakwa	150	74	Alternative
MWIII-75	Tondo	146	75	Alternative
MWIII-65	Sitwala	138	76	Alternative
MWIII-53	Poleni	137	77	Alternative
MWIII-89	Kabuta	135	78	Alternative
MWIII-48	Chilongoshi	130	79	Alternative
MWIII-83	Simaria B	130	80	Alternative
MWIII-87	Sitima	114	81	Alternative
MWIII-43	Black	104	82	Alternative
MWIII-06	Chifuba	100	83	Alternative
MWIII-59	Tangwe	100	84	Alternative
MWIII-95	Maisa	100	85	Alternative
MWIII-86	Chelekubi	80	86	Alternative
MWIII-10	Chimbini	68	87	Alternative
MWIII-47	Halland	68	88	Alternative
MWIII-66	Jacobo	60	89	Alternative
MWIII-05	Shikabila	32	90	Alternative
MWIII-60	Kayanike	Inaccessible		Cancelled
MWIII-71	Kapala	For piped scheme		Cancelled
MWIII-81	Kapakala East	For piped scheme		Cancelled
MWIII-04	Mubuka	Low demand		Cancelled
MWIII-24	Mutamba	Low demand		Cancelled
MWIII-09	Chibwe Kabuta	Low demand		Cancelled
MWIII-88	Kapondo	Low demand		Cancelled
MWIII-92	Kalasa	Low demand		Cancelled
MWIII-82	Kapakala West	Low demand		Cancelled
MWIII-69	Kawama B	Low demand		Cancelled

3. List of Project Target Sites for Mansa District

Site Code	Site Name	Population	Priority	Result
MAIII-20	Mulala Primary School	2,608	1	Project
MAIII-48	Mwela Primary School	380	2	Project
MAIII-47	Fibobo Community School	310	3	Project
MAIII-31	Fiyongoli Primary School	220	4	Project
MAIII-46	Chile Community School	100	5	Project
MAIII-23	Kasanga-1 Health Post	1,331	6	Project
MAIII-24	Lusaya	4,806	7	Project
MAIII-22	Chipense	3,857	8	Project
MAIII-58	Sumbu B	3,500	9	Project
MAIII-26	Mumbwe	2,700	10	Project
MAIII-59	Chikuwe 2	2,570	11	Project
MAIII-60	Kasheshe	2,280	12	Project
MAIII-08	Chiputa	2,000	13	Project
MAIII-14	Mbulwa	1,876	14	Project
MAIII-18	Kabengele	1,850	15	Project
MAIII-16	Chikoyi	1,704	16	Project
MAIII-32	Mounga Village	1,600	17	Project
MAIII-55	Maikeneke Market	1,250	18	Project
MAIII-19	Sande Facite	840	19	Project
MAIII-25	Chambo	770	20	Project
MAIII-36	Kansapule	683	21	Project
MAIII-29	Nshenda	602	22	Project
MAIII-50	Chimpala	544	23	Project
MAIII-09	Katanga	542	24	Project
MAIII-04	Sambe	516	25	Project
MAIII-21	Kaisala	480	26	Project
MAIII-06	Matenda	450	27	Project
MAIII-54	Kolota	450	28	Project
MAIII-13	Lukupwa	420	29	Project
MAIII-17	Obedi	420	30	Project
MAIII-56	Lemmy	379	31	Project
MAIII-33	Lukali	360	32	Project
MAIII-37	Mashatini	354	33	Project
MAIII-34	Langi	352	34	Project
MAIII-03	David Chilambe	350	35	Project
MAIII-30	Mapesa	350	36	Project
MAIII-49	Lole	312	37	Project
MAIII-02	Fitobola	300	38	Project
MAIII-07	Matipa	300	39	Alternative
MAIII-43	Yasakwa Lay By	300	40	Alternative
MAIII-45	Chopote	270	41	Alternative
MAIII-15	Kasaka	259	42	Alternative
MAIII-57	Sumbu A	240	43	Alternative
MAIII-11	Sakeni	222	44	Alternative
MAIII-05	Kalikeka	220	45	Alternative
MAIII-12	Chaiwa	200	46	Alternative
MAIII-35	Chbende	170	47	Alternative
MAIII-44	Sunday	160	48	Alternative
MAIII-52	Matipa	150	49	Alternative
MAIII-40	Mpembea	105	50	Alternative
MAIII-10	Mpota	102	51	Alternative
MAIII-41	Katangwe A	Inaccessible		Cancelled
MAIII-51	Mofat 1	Inaccessible		Cancelled
MAIII-01	Chabwe 2	Project overlap		Cancelled
MAIII-28	Kafusha	Inaccessible		Cancelled
MAIII-53	Musenga Primary School	Inaccessible		Cancelled
MAIII-38	Kasongolole	Inaccessible		Cancelled
MAIII-27	Chimoto	Inaccessible		Cancelled
MAIII-42	Katangwe B	Inaccessible		Cancelled
MAIII-39	Jim	Inaccessible		Cancelled

4. List of Project Target Sites for Milenge District

Site Code	Site Name	Population	Priority	Result
MLIII-01	Lwela Secondary School	650	1	Project
MLIII-53	Shitambuli Primary School	300	2	Project
MLIII-49	Mumbotuta Primary School	260	3	Project
MLIII-50	Changwe-Lungo Primary Schoo	250	4	Project
MLIII-48	Kanyesha	5,500	5	Project
MLIII-17	Chipundu	5,400	6	Project
MLIII-59	Katena	3,579	7	Project
MLIII-20	Ng'Anda Imo	1,800	8	Project
MLIII-12	Helena Musonda	1,200	9	Project
MLIII-29	Saimoni	850	10	Project
MLIII-60	Lesa Mukali	786	11	Project
MLIII-70	Mashika	750	12	Project
MLIII-16	John Nkumba	691	13	Project
MLIII-05	Pollen	680	14	Project
MLIII-19	Fikombo	680	15	Project
MLIII-44	Muselenga	680	16	Project
MLIII-04	Nkumbula	665	17	Project
MLIII-06	Milomo	640	18	Project
MLIII-03	Mpite	630	19	Project
MLIII-35	Kabola	630	20	Project
MLIII-62	Sailas	482	21	Project
MLIII-11	Chengo	480	22	Project
MLIII-31	Chimese	480	23	Project
MLIII-10	Chilimabwe	478	24	Project
MLIII-43	Kabunda	460	25	Project
MLIII-09	Muluka	455	26	Project
MLIII-02	Bene Kund	430	27	Project
MLIII-47	Pwele	400	28	Project
MLIII-61	Masheto	400	29	Project
MLIII-45	Chansange	380	30	Project
MLIII-52	Changwe Village	380	31	Project
MLIII-69	Chilufy Kabinda	380	32	Project
MLIII-46	Stephano	350	33	Project
MLIII-07	Goliat	340	34	Project
MLIII-30	Thomas	330	35	Project

Site Code	Site Name	Population	Priority	Result
MLIII-13	Kasepa	307	36	Project
MLIII-08	Chituta	300	37	Project
MLIII-42	Sakeni	230	38	Project
MLIII-66	Kalali	132	39	Project
MLIII-58	Kaloko	110	40	Project
MLIII-18	Kampemba	80	41	Project
MLIII-36	Mukonkani	54	42	Project
MLIII-14	Loyi Mwape	30	43	Project
MLIII-41	Sando	Inaccessible		Cancelled
MLIII-15	Milenge Secondary School	Project overlap		Cancelled
MLIII-40	Kashila	Inaccessible		Cancelled
MLIII-37	Mogani Mulelema	Inaccessible		Cancelled
MLIII-39	Ponga-Ponga 2	Inaccessible		Cancelled
MLIII-26	Kabesa	Inaccessible		Cancelled
MLIII-34	Tali Meke	Inaccessible		Cancelled
MLIII-38	Ponga-Ponga	Inaccessible		Cancelled
MLIII-51	Allan Senga	Inaccessible		Cancelled
MCIII-54	FitikoO	Inaccessible		Cancelled
MCIII-55	Ng'Omba	Low demand		Cancelled
MCIII-65	Musumali	Low demand		Cancelled
MCIII-64	Mwangula	Low demand		Cancelled
MCIII-67	Kalamba	Low demand		Cancelled
MCIII-57	Kokonsholo	Low demand		Cancelled
MCIII-56	James	Low demand		Cancelled
MLIII-63	Kapu	Low demand		Cancelled
MLIII-68	Thomas	Low demand		Cancelled
MLIII-21	Mpanse	Inaccessible		Cancelled
MLIII-22	Lumfilwa	Inaccessible		Cancelled
MLIII-23	Chungu	Inaccessible		Cancelled
MLIII-24	Chisengele	Inaccessible		Cancelled
MLIII-25	Mulala	Inaccessible		Cancelled
MLIII-27	Lupiya	Inaccessible		Cancelled
MLIII-28	Lupiya 2	Inaccessible		Cancelled
MLIII-32	Lungo Mukuta	Inaccessible		Cancelled
MLIII-33	Lungo Mukuta 2	Inaccessible		Cancelled

Number of Project Sites in Each District

I. Construction of Boreholes with Hand Pump

District	Requested Number	Suitable Number by Screening	Proportional Target Sites	Alternative Sites	Cancelled Number by Screening
Nchelenge	90	70	56	14	20
Mwense	100	90	63	27	10
Mansa	60	51	38	13	9
Milenge	70	43	43	0	27
Total	320	254	**200**	54	66

II. Construction of Small Scale Piped Water Supply Scheme

District	Site	Design Population	Supply Rate (m^3/day)	Water Source	Power Source	Number of Tap Stand	
						House-holds	Institu-tions
Nchelenge	Kabuta	3,267	120.3	Spring	Gravity	7	2
Mwense	Kapala	4,493	145.5	Groundwater	Grid	9	0
	Musangu	11,541	364.7	Groundwater	Grid	23	3
	Kapakala	11,257	342.6	Groundwater	Grid	22	1
Milenge	Milenge	1,233	42.0	Groundwater	Solar Power	3	6
Total	5	31,791	1,015.1	-	-	64	12

APPENDIX-5

TECHNICAL NOTES

Appendix-5 Technical Notes

(1) Selection of five candidate sites for piped water supply scheme
(8 July, 2013)

(2) Necessary yield of the borehole for piped scheme and
Judgment of the drilling result
(11 July, 2013)

(3) Status of the coverage of the 320 candidate sites and
Allocation of the number of hand pumps
(24 July, 2013)

(4) Operation and maintenance structure of the piped water supply schemes
(24 July, 2013)

(5) Result of test drilling of the piped water supply scheme
(29 August, 2013)

(1) Selection of five candidate sites for piped water supply scheme
(8 July, 2013)

TECHNICAL NOTES
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT IN LUAPULA PROVINCE PHASE 3 IN THE REPUBLIC OF ZAMBIA

The Government of Zambia has been requesting the construction of piped water scheme at 8 sites in the official request. The Preparatory Survey Team and the officials concerned of the Government of Zambia had a discussion on the candidate sites and finally agreed that 5 sites mentioned below were selected as the candidate sites for further survey.

No	District	Site Name	Water Source
1	Nchelenge	Kabuta	Existing Spring
2	Mwense	Kapala	New Borehole Drilling
3	Mwense	Musangu Filling Station	New Borehole Drilling
4	Mwense	Kapakala	New Borehole Drilling
5	Milenge	Milenge (Boma)	New Borehole Drilling

Lusaka, 8 July, 2013

Tetsuo Yabe
Chief Consultant
Japan Techno Co., LTD
JICA Survey Team

Cledwin Mulambo
Acting Director
Department of Housing and Infrastructure Development (DHID)
Ministry of Local Government and Housing (MLGH)

(2) Necessary yield of the borehole for piped scheme and
Judgment of the drilling result (11 July, 2013)

TECHNICAL NOTES
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT
IN LUAPULA PROVINCE PHASE 3
IN THE REPUBLIC OF ZAMBIA

1. Necessary Yield of the borehole for piped scheme

Design Period of the piped scheme : 2013- 2020

Village	Populatuion Year 2013	Number of existing borehole	Target population Year 2013	Water demand (l/p/d)	Daily water demand (2013) (m^3/d)	Annual population growth rate (%)	Target population Year 2020	Peak Factor	Daily water demand (2020) (m^3/d)	Houly water demand (2020) (m^3/hr)	Operation hour (hr)	Power source
Kapala	4,333	1	4,083	30	122.49	1.1%	4,408	1.2	158.7	9.92	16	Grid
Musang	11,000	2	10,500	30	315.00	1.1%	11,336	1.2	408.1	25.51	16	Grid
Kapakala	10,512	1	10,262	30	307.86	1.1%	11,079	1.2	398.8	24.93	16	Grid
Milonge	3,000	2	2,500	30	75.00	4.2%	3,334	1.2	120.0	24.01	5	PV system

- Number of existing borehole: Number of existing borehole under JICA project, 1 borehole serves 250 population
- Annual population growth rate : 2010 Census of population and housing Zambia
- PV system: Photovolutaic system

2. Judgment of the Drilling Result

First borehole satisfy necessary yield YES → End
NO ↓
Second borehole satisfy necessary yield YES → End
NO ↓
First+Second borehole satisfy necessary yield YES → End
NO ↓
Discussion with MLGH
→ to design piped water scheme in accordance with two borehole yield
→ to introduce hand pump in case two borehole yield is small
→ to implement Third borehole drilling

Lusaka, 11 July, 2013

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JICA Survey Team

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Ministry of Local Government and
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(3) Status of the coverage of the 320 candidate sites and
Allocation of the number of hand pumps (24 July, 2013)

TECHNICAL NOTES
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT
IN LUAPULA PROVINCE PHASE 3
IN THE REPUBLIC OF ZAMBIA

The Preparatory Survey Team and the officials concerned of the Government of Zambia had a discussion over the list of the 320 candidate sites for the construction of hand pumps and agreed that selection of the sites will be carried out with the sites covered by the Socio-Economic Survey, excluding those sites that were found to be either inaccessible or non-existent during the survey.

1. Status of the coverage of the 320 Candidate sites for construction of hand pumps in the Socio-Economic Survey as of 22 July 2013;

District	Number of sites requested	Number of sites not covered in the survey	Total Number of sites covered in the survey	Remarks
Mansa	60	0	60	N/A
Milenge	70	9	61	9 sites resulted inaccessible by road 1. Mpase MLIII-21 2. Lunfilwa MLIII-22 3. Chungu MLIII-23 4. Chisengele I-MLIII-24 5. Mulala MLIII-25 6. Lupiya MLIII-27 (Lupiya 1) 7. Lupiya MLIII-27 (Lupiya 2) 8. Lungomukuta MLIII-31 (Lungomukuta 1) 9. Lungomukuta MLIII-31 (Lungomukuta 2)
Mwense	100	6	94	3 sites resulted inaccessible by road 1. Mubuka MWIII-04 2. Kayanike MWIII-60 3. Kanchinchi MWIII-61 3 sites with other reasons 4. Losa Mukunkutu MWIII-63(Site does not exist) 5. Punaya MWIII-67 (Site does not exist) 6. Fitwala/Sitwala MWIII-65 (only 2 housing units in the village)
Nchelenge	90	0	90	N/A
Total	320	15	305	-

* The table above shows the current status of sites that were covered by the Socio-Economic Survey, however the survey is still on-going and the number of sites covered may change according to the findings and conditions on the ground found.

2. Allocation of the number of hand pumps in each District will be in the same ratio as to the actual number of sites requested, as described below.

*Note that the method of selection used is the same as the one used in the "Project for groundwater development in Luapula province phase 2 in the Republic of Zambia"

District	Number of sites requested	Percentage of the site to the total number of sites	Total number of allocated sites in the same percentage
Mansa	60	18.8%	38
Milenge	70	21.9%	44
Mwense	100	31.3%	62
Nchelenge	90	28.1%	56
Total	320	100%	200

Lusaka, 24 July, 2013

Tetsuo Yabe
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JICA Survey Team

Cledwin Mulambo
Acting Director
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Ministry of Local Government and
Housing (MLGH)

(4) Operation and maintenance structure of the piped water supply schemes
(24 July, 2013)

TECHNICAL NOTES
ON
THE PREPARATORY SURVEY
ON
THE PROJECTFOR GROUNDWATER DEVELOPMENT
IN LUAPULA PROVINCE PHASE 3
IN THE REPUBLIC OF ZAMBIA

The Preparatory Survey Team and the officials concerned of the Government of Zambia had a discussion over the Operation and Maintenance structure of the proposed piped water schemes in rural areas and, although the details of the structure are yet to be determined, agreed as a general concept that the daily maintenance and operation, including quotidian inspection of the facilities, cleaning of the surroundings, collection of water fees, record keeping, minor repairs of taps and pipes, and reporting of the malfunctioning of the facilities, should be the responsibilities of the community based entities to be established through capacity development, if necessary, carried out by the soft-component of the Project, while any matters beyond the capacity of the communities, such as replacement of facilities, major rehabilitation work, saving of the collected fees, and monitoring should be carried out by the Commercial Utilities present in the District, using their technical and financial resources.

In areas where Commercial Utilities are not operating, the Preparatory Survey Team and the officials concerned of the Government of Zambia agreed that the major work beyond the capacity of the community to be the responsibility of the District's relevant department until a Commercial Utility is fully established and functional in the area, and in such a case the roles and responsibilities born by the District will be gradually handed over to the Commercial Utility established.

Lusaka, 24 July, 2013

Tetsuo Yabe
Chief Consultant
Japan Techno Co., LTD
JICA Survey Team

Cledwin Mulambo
Acting Director
Department of Housing and
Infrastructure Development (DHID)
Ministry of Local Government and
Housing (MLGH)

(5) Result of test drilling of the piped water supply scheme
(29 August, 2013)

TECHNICAL NOTE (No.5)
ON
THE RESULT OF TEST DRILLING
FOR
THE PREPARATORY SURVEY
ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT IN LUAPULA PROVINCE PHASE 3 IN THE REPUBLIC OF ZAMBIA

AGREED UPON BETWEEN

DEPARTMENT OF HUSING AND INFRASTRUCTURE DEVELOPMENT
MINISTRY OF LOCAL GOVERNMENTAND HOUSING
AND
JAPAN INTERNATIONAL COOPERATION AGENCY

Department of Housing and Infrastructure Development (hereinafter referred to as "DHID") and JICA Survey Team (hereinafter referred to as "the Survey Team") had a discussion on the result of test drilling for the preparatory survey on the Project for Groundwater Development in Luapula Province Phase 3 in the Republic of Zambia. Agenda discussed was presented on attachment.

Lusaka, 29 August, 2013

Hiroshi Ishii

for Tetsuo Yabe
Chief Consultant
Japan Techno Co., LTD
JICA Survey Team

Cledwin Mulambo
Acting Director
Department of Housing and Infrastructure Development (DHID)
Ministry of Local Government and Housing (MLGH)

1

Attachment

The following points were mutually confirmed.

1. Test Drilling conducted at Milenge and Mwense District in Luapula Province from the 12th of July. The result of Test Drilling is summarized in the table below; 4 boreholes were successful out of 11 boreholes. Consequently one successful borehole was secured in each target site. Therefore piped water supply systems will be constructed at four target sites in the project.

2. In case of Milenge, actual yield was smaller than expected yield, so that the target population to be covered will be reduced. The borehole No.3 in Milenge District was kept for the installation of a hand pump by the Zambian sice.

3. In addition, a piped water supply system at Kabuta, in Nchelenge District of Luapula Province will be constructed using the existing natural spring source, aiming to supply water to around three thousand people by gravity.

4. Initially the test drilling was designed with a 6 inch PVC casing with more than 150mm internal diameter but as it turned out, only PVC casing of 145mm internal diameter was available for procurement. Because casings of 150mm internal diameter or more is required for installation of a large capacity submersible water motor pump and to conduct appropriate yield test, casing specification has been altered to 8 inch PVC casing, which is available for procurement in Zambia.

5. The expected yield of Kapala No.4 was 500 ℓ/min. However, tentative design yield of this site is estimated 165 ℓ/min in accordance with the population of around 4,000. The discharge rate of 165 ℓ/min will be applicable for 4" submersible motor pump from the technical point of view both required discharge rate and discharge head. Therefore, it was decided that pumping test with 6 inch casing and screen would be conducted as initial plan without reaming borehole diameter with 8" casing applicable for 6" submersible motor pump.

To #

M.S

District	Site	No. of Borehole	Depth of borehole (m)	Yield (ℓ/min)	Final Status	Remarks
Milenge	Milenge	No.1	106	140	6" Casing	construction of piped system
		No.2	106	(25)	Refilled (abandon)	
		No.3	106	25	6" Casing	available for hand pump
Mwense	Kapala	No.1	102	0	Refilled (abandon)	
		No.2	102	0	Refilled (abandon)	
		No.3	92	0	Refilled (abandon)	
		No.4	128	(513)	6" Casing	construction of piped system
Mwense	Musangu	N0.1	102	(5)	Refilled (abandon)	
		No.2	135	(513)	8" Casing	construction of piped system
Mwense	Kapakala	No.1	111	(5)	Refilled (abandon)	
		No.2	97	(420)	8" Casing	construction of piped system

No. of Borehole : ☐ Successful borehole

Yield : ( ) Blown yield during drilling (might be analyzed through pumping test)

To#

M.S

APPENDIX-6

SOFTWARE COMPONENT

(TECHNICAL ASSISTANCE) PLAN

Appendix-6 Software Component (Technical Asssistance) Plan

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List of Figures, Tables and Appendices

1. Background

Aiming to improve the safe water access rate in Luapula province, “The Project for Groundwater Development in Luapula Province Phase 3” (hereafter referred to as “the Project”) will construct boreholes fitted with hand pumps and piped water supply schemes and provide assistance for establishment of the Operation and Maintenance (O&M) structure for the constructed facilities and strengthening of the capacity of the stakeholders for the facility O&M. Upon formulating the Software Component plan, issues on the O&M for the boreholes fitted with hand pumps and piped water supply facilities at target sites are examined as below.

1-1. Boreholes fitted with Hand Pumps

1-1-1. Basic Policy on the Operation and Maintenance structure for boreholes fitted with hand pumps

Under the National Rural Water Supply and Sanitation Programme (NRWSSP, 2006-2015), the Ministry of Local Government and Housing (MLGH), the ministry responsible for Water Supply Sector, promotes construction of boreholes fitted with hand pumps. Simultaneously, under the Programme the Ministry makes an effort on the 1) Formulation of policies regarding the establishment of facility O&M structure, 2) Establishment of guidelines and manuals for the O&M, 3) Capacity development of the Provincial and District personnel, and 4) Coordination between various actors within the Sector. As a part of the effort, “RWSS O&M implementation Manual and User Guide (2010)” (hereafter referred to as “the O&M manual”), was created. The O&M manual explains procedures and methodologies needed for the establishment of the O&M structure for boreholes fitted with hand pumps, and states that following five mechanisms to be established.

1. Community Contribution Mechanism (Establishment of community based O&M structure)
2. Repair Mechanism (establishment of repair system at community level)
3. Toolkit management Mechanism (establishment of toolkit management structure at community level)
4. Spare Parts Supply Chain Mechanism (Establishment of supply chain for the spare parts of the facilities)
5. Monitoring Mechanism (strengthening of the monitoring structure)

The O&M structure promoted under the Programme comprises of V-WASHE, who maintains and operates the facility and collects user fee towards the facility maintenance, the establishment of the spare parts supply chain and toolkit management system within district level, and placement of the APMs (Area Pump Menders) at sub-district level.

1-1-2. Achievement in establishment of the O&M structure at the target districts

In the Project's target districts, sites targeted under Grant Aid projects "Project for Groundwater Development in Luapula Province" (hereinafter, referred to as "Phase I Project") and "Project for Groundwater Development in Luapula Province, Phase 2" (hereinafter, referred to as "Phase II Project") received assistance on the establishment of the O&M structure. Furthermore, technical cooperation project "Project for Support in National Roll-out of Sustainable Operation and Maintenance Programme (SOMAP3)" is currently providing assistance to establish the above mentioned five mechanisms in the Project's target districts.

Table 1 Achievement of the past Japanese projects on the establishment of the O&M structure at the target districts

Project	"Phase I Project"	"Phase II Project"	SOMAP3
Target area	231 sites of 7 districts (Chiengi, Nchelenge, Kawambwa, Mwense, Mansa, Samfya and Milenge)	216sites of 4 districts (Nchelenge, Mwense, Mansa and Milenge)	4 districts (Nchelenge, Mwense, Mansa, and Milenge)
Activities Implemented	• ToT (Training of the trainers) for training of APMs, targeting D-WASHE (District Water, Sanitation, and Health Education Committee) members (22 participants) • Training of WASHE Facilitators (84 participants) • APM training (92 participants) • Formation of V-WASHEs in target sites (231 sites)	• Refresher trainings targeting D-WASHE members (11 participants) • Refresher trainings for WASHE facilitators (50 participants) • APM Training/refresher trainings (57 participants) • Formation of V-WASHEs in target sites (216 sites)	• Capacity development of the D-WASHE members/District officials on formulation and implementation of the O&M activity plan • Establishment of Spare parts supply chain • APM trainings/ orientation on SOMAP O&M mechanisms • Refresher trainings for WDCs, orientation on SOMAP O&M mechanisms • Establishment of toolkit management structure (allocation of toolkits to the designated toolkit centres within each ward) • Strengthening of the community capacity on O&M of the boreholes fitted with hand pumps • Establishment of the monitoring structure for the O&M activities

In order to determine the sphere to be covered under the Software Component activities under the Project, the above mentioned achievement and capacity of the stakeholders such as district officials, WDC and APMs will be considered.

1-1-3. Issues on O&M in the target area

Following describes issues identified through the Survey and appropriate counter approach for these issues.

(1) Promoting community's ownership and responsibilities for the facility O&M

Sites without boreholes fitted with hand pumps do not have V-WASHEs formed and therefore formulation of V-WASHE and provision of capacity development is required.

Software Component activities for the borehole facility will utilise these trained human resources within the district (district officials, other D-WASHE members, WASHE facilitators, and APMs) effectively, and minimise the Software Component activity to the absolutely necessary activities for the establishment of the O&M structure at each site.

Specifically, Software Component Activity supported by Japan will include 1) orientation targeting the districts, WDCs (WASHE facilitators), APMs, representatives from the community, and the community members, 2) selection of candidate site for facility construction, 3) formation/refresher training of V-WASHE, and 4) O&M training for the Iron Removal Plant (IRP).

On the other hand, provision of trainings to V-WASHEs and the care takers of the borehole on the facility O&M, and hygiene promotion targeting the community will be under the responsibility of the government, implemented by WASHE facilitators and APMs under the supervision of the district officials.

Once V-WASHE is formed, trainings on topics such as leadership, issues and needs analysis, formulation of an action plan to solve the issues, reaching agreement with the community, organisational management, setting of the O&M cost and reserving of the collected fees, accounting, maintenance of the facility, management of repair, and monitoring of the O&M activities shall be provided by the government.

(2) Promotion of hygiene practices

Majority of the households in the target sites obtains domestic water from unprotected sources such as river and unprotected dug wells. When asked for the diseases that affect the household most, diarrhoea, dysentery and cholera were second most answered diseases (70.7% of the surveyed household), after Malaria (82.8%), suggesting presence of unhygienic environment. On understanding of the causes of diarrhoea, 82.6% of the households surveyed pointed out drinking of contaminated water, however, lack of hand washing and other causes were far less identified. To improve living condition through safe water supply, dissemination on the appropriate use and handling of safe water is necessary. Further, by improving hygiene awareness, participation to the O&M will improve, and understanding towards the importance of the water fee collection will increase as well. For these reasons, promotion of hygiene practices is

important.

1-2. Piped water supply schemes

1-2-1. Basic Policy on the Operation and Maintenance structure for piped water supply schemes

The national policy states that selection of water supply technology is determined by administrative boundaries. Boreholes fitted with hand pumps are adopted for the area defined as 'Rural', whereas for 'Urban' areas including 'Peri-Urban' area, piped water supply schemes are applied. The O&M system with V-WASHE as the principally responsible body is applied to the former, while for the latter, the 11 Commercial Utilities (CUs), under the licence issued by National Water Supply and Sanitation Council (NWASCO), run the water supply services. The CU is established and contracted by the District Local Authorities (DLAs) to provide water supply and sanitation services in the relevant area. Construction of piped water supply schemes in rural areas is request under the Project, however, for the demarcation policy stated above, policy for the O&M structure for the piped water supply schemes in rural areas is not established. With such background, the roles and responsibilities and capacity of the stakeholders were assessed with an objective to determine the most appropriate O&M structure based on the situation on the district and the Luapula province.

(1) District Local Authority (DLA)

In Luapula province, all seven DLAs in the province gathered their asset together and established Luapula Water and Sewerage Company Limited (LuaWSC) in 2009 with the DLAs being main shareholders. With this arrangement, all the piped water supply schemes and equipment formerly belonged to DLAs were transferred to LuaWSC. Currently, Rural Water Supply and Sanitation Officer (RWSS Officer) is the only staff in charge of the Water Supply and Sanitation project at each DLA, who formulates and manages the implementation of the district rural water supply and sanitation development plan. In the urban water supply sector, the involvement of the DLAs is as the members of Board of Directors[1] of LuaWSC.

(2) Luapula Water and Sewerage Company Limited (LuaWSC)

LuaWSC is the sole organisation who has the structure and experience of the O&M of piped water supply schemes in Luapula province. However, the area of operation is limited to urban and surrounding areas and it has no experience in running rural piped water supply schemes. LuaWSC also has no experience of O&M of water supply schemes using solar system, as planned in the Project.

(3) Private Company

Though there is no company specialised in O&M of water supply facilities, there are

[1] Member of the Board of Directors consists of entrepreneurs, small business owners, DLA representatives, etc.

companies that has experiences in repair of the water motor pumps and solar pump systems, and that deal with the spare parts. Thus these companies could potentially take a part in the O&M structure.

(4) Community

The community can play a role in daily O&M operation (such as operation of water motor pumps, management of the taps, collection of water fees), as well as the role as the recipients of the water supply services. Further, the local human resources could be strengthened through provision of trainings to take over financial management, or small scale facility repair. On the other hand, major facility repair which require specialised skills and knowledge needs to be delegated to other entities, such as the private company or LuaWSC.

1-2-2. O&M structure of the constructed piped water supply schemes

In the Project, capacity and roles and responsibilities of the stakeholders in the target area regarding rural piped waters supply scheme O&M were analysed and following five options of the O&M structure was examined. Through the examination, the O&M option 1, where the V-WASHE will take the main responsibility was determined to be the most realistic.

Option 1.	Main responsible body is V-WASHE :	The Community carries out daily operation/management and small scale repair, whereas the private company is responsible for major repair/rehabilitation.
Option 2.	Main responsible body is V-WASHE :	The Community carries out daily operation/management and small scale repair, whereas LuaWSC is responsible for major repair/rehabilitation.
Option 3.	Main responsible body is V-WASHE :	The Community carries out daily operation/management, whereas LuaWSC is responsible for small scale repair and major repair/rehabilitation.
Option 4.	Main responsible body is V-WASHE :	Delegate overall O&M activities to LuaWSC from the community. LuaWSC reports to the community and the community pays the service provision fee to LuaWSC.
Option 5.	Main responsible body is LuaWSC :	LuaWSC takes overall responsibilities of the water supply facility as part of their schemes. Involvement of the community is limited to the role of tap attendant and so forth.

Since LuaWSC expresses little interest in participating only partially to the O&M of the facilities, option 2 to 4 are considered difficult. For the option 5, the O&M costs estimated will be an extra burden on LuaWSC's current financial status, where the O&M costs are not fully recovered from the water fee collected. Evaluating from the financial perspective, expansion of its business to rural area is unjustifiable for its operation.

Meanwhile, the Project confirmed presence of private companies who have experience in facility repair and rehabilitation in cities such as Lusaka and Kitwe. As a result of the above evaluation, the Project determined that the option 1, where the V-WASHE and the community implement daily facility O&M, as the most realistic O&M structure. As both districts and the community lack experience in O&M of piped water supply schemes, LuaWSC will conduct quarterly monitoring under MLGH's management to ensure the O&M standard.

Further, if the financial performance of LuaWSC improves and LuaWSC is able to substitute the O&M cost of the rural piped water supply schemes from revenue from other sectors, it can provide stable O&M for the constructed facilities and thereofore, possibility to transfer the responsibility and the scheme to LuaWSC in the future should be maintained.

1-2-3. Issues of O&M activities

The following are the issues identified for sustainable use and O&M of the facilities, and issues to take in consideration in the Software Component Programme.

(1) Establishment of O&M structure in target areas

Since the Project could not discern already done example of repair service contract signed between community and private company, Software Component support to promote understanding of roles and responsibilities of the stakeholders including MLGH, province, district and community on the O&M structure, to promote coordination with private sector, and to provide capacity development is required.

(2) Establishment of O&M support and management structure for piped water supply schemes at DLA

DLA is the entity responsible for the water supply and sanitation project in its jurisdiction and is a member of LuaWSC's Board of Directors. DLAs are expected play roles in monitoring of O&M activities and supervisor of repair service provision in the piped water supply schemes' O&M structure. However, the DLAs do not possess necessary knowledge and experience in management of the O&M structure of the piped water supply facilities, and thus trainings to establish O&M management structure at DLA is required.

(3) Capacity development of the community on facility O&M

The National Water Policy 1994 defines the community to be the responsible body for raising the O&M cost of the facility they use. Formation of the V-WASHE, the community based organisation, and its capacity development on daily operation including water fee collection is vital for sustainable use of the constructed facility. The government promote formation and utilisation of V-WASHE as the main responsible body of the O&M of water supply facilities. The O&M structure under the Project also will adapt this WASHE approach and recognise

V-WASHE to be the main responsible body for the O&M structure of both boreholes fitted with hand pumps and piped water supply facilities.

Member composition of V-WASHE differs between facility types; for borehole fitted with hand pumps, it consists of the board member, such as chairperson, vice-chairperson, secretary, and accountant, and apart from the board member, caretakers. For piped water supply schemes, under the board member, there are facility operators, tap attendants and plumbers. In addition, for the facility using solar energy, there will also be a guard.

Setting of the O&M fee (water fee) will be done through Software Component activities, which supports district officials to explain the items and cost of the O&M, and importance of the O&M fee collection to the community, and to reach agreement with the community on the collection of O&M fees. As there is no established structure of the fee collection, the district officials, through support of the Software Component Programme, introduces different methodologies, such as prepaid collection per container, monthly fixed fee, monthly fee according to the water use, etc. and its pros and cons at community meeting, and determine the most effective method with the community.

It is important to support formation and capacity development of the V-WASHE, who will take be in charge of the financial management, daily operation, facility small scale repair, or organizational management of the facility O&M. Especially, skills such as preparation and implementation of the facility O&M action plan, and coordination with the user community, district, and the private company should be strengthened. This is because the water supply are expands to the whole village except where existing water facilities are, and because the skills necessary to carry out the O&M of the facility is higher than that of boreholes fitted with hand pumps.

The piped water supply schemes has different types of power sources, such as gravity, electricity grid, and solar system, therefore O&M trainings will take this difference in account when providing technical trainings. Facility with solar system requires training items such as operation of the pumping facility, cleaning of the solar panels, preventative measures against breaking. Facility with electricity grid needs training items such as recording and checking of the voltages, and facility with gravity requires items such as water condition of the spring source. Other common themes include measures against leakage, replacement of the facility, operation of chlorinator, procurement of chlorine, etc. As stated above, the structure intends to involve a private professional company for major repair and rehabilitation of the facility beyond capacity of the community. The service provision and O&M status is supervised and monitored by the DLA and LuaWSC.

The O&M structure for both boreholes fitted with hand pumps and piped water supply schemes are shown below in Figure 1.

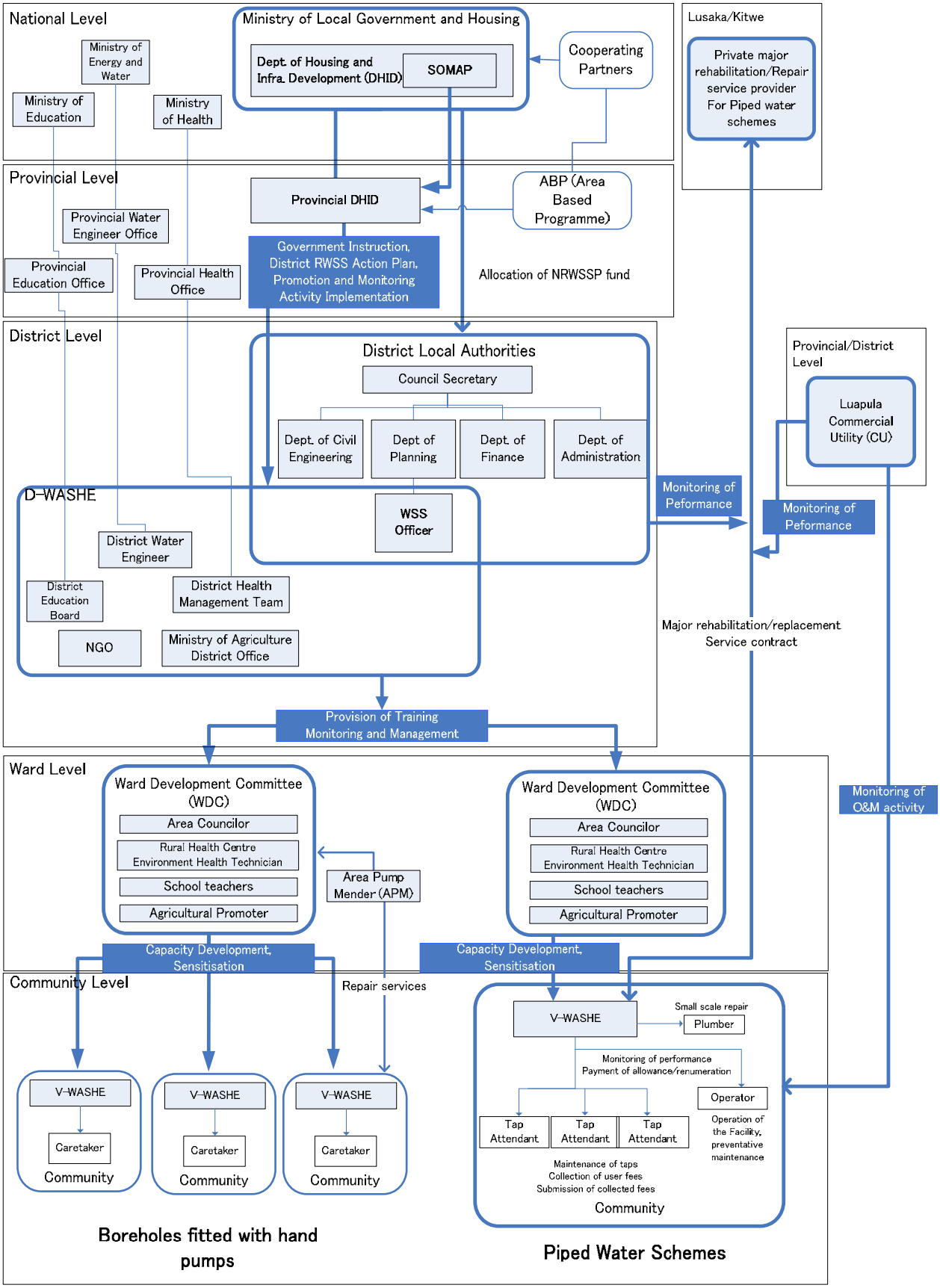


Figure 1　O&M structure of the water supply facilities

(4) O&M cost of constructed facilities

For the O&M cost of the piped water supply schemes, attention should be paid to the fact that the O&M cost borne by households will be higher than the water fee currently paid by households in the target sites if major rehabilitation/replacement cost and personnel expenses such as salary of the tap attendants, accountants, security guards (in the case of Milenge) were included in the O&M cost. Therefore, it is posing challenges to sustainability of O&M fee collection. As a counter measure, the Project held a discussion with the government of Zambia and reached an agreement on the structure where the government covers part of the O&M costs, namely the facility rehabilitation / replacement costs and provision of salary for the guard (in the case of Milenge), while tap attendants and accountants work on a voluntary basis.

(5) Promotion of community Water and Hygiene awareness

Finding from the Socio-economic Survey conducted under the Project suggests that the communities lack understanding on the cause of diarrhoea and its preventative measures. To increase the effect of the safe water supply and to promote use of the facility, as well as to increase the O&M fee collection rate, promotion of hygiene will be conducted.

2. Objectives of the Software Component Programme

To achieve the Project objective "Safe water access rate in the target area is increased", and to secure sustainability of the Project effect, Software Component Programme will be implemented to provide necessary support for establishment of the community based O&M structure.

3. Output of Software Component Programme

3-1. Borehole fitted with hand pumps

Output1. Community based O&M structure is established in the target sites.

Output2. Communities' understandings on the safe and appropriate use of the water supplied from the constructed facility is increased.

3-2. Piped water supply schemes

Output1. Community based O&M structure is established in the target sites.

Output2. Communities' understandings on the safe and appropriate use of the water supplied from the constructed facility is increased.

Output3. DLA support structure for the piped water supply facility O&M in rural areas is established.

Output4. Understanding of the stakeholders such as DLAs, community, and LuaWSC on the O&M structure is promoted.

4. Means of Verification of Achievement of the Outputs

4-1. Borehole fitted with hand pumps

Output1. Community based O&M structure is established in the target sites.

【Indicator】 V-WASHEs in all target sites acquire knowledge and skills necessary for the O&M activities

【Documents】 Contract of Operation of V-WASHE, O&M action plan, Memorandum of Understanding (MoU) on facility O&M, at least one month long O&M activity and financial record from sites where the facility including Iron Removal Plant (IRP) is completed at the time of January 2016.

The skills necessary for V-WASHEs are largely divided into the technical items and organisational management side. Former involves daily preventative measures and inspection, small scale repair, conservation of surrounding areas. Latter includes O&M action plan, instruction of community members on appropriate use of the facility, collection of O&M fees and financial management, coordination with district and private entities to solicit support on the O&M. The Contract, O&M action plan, and MoU will be checked to see if these items are indicated in them. Coordination with private entities (APMs), record of O&M activities and finance is also examined.

Output2. Communities' understandings on the safe and appropriate use of the water supplied from the constructed facility is increased.

【Indicator】 V-WASHE acquires hygiene promotion method and provide hygiene trainings to the community.

【Documents】 Monitoring Report prepared by DLAs

Through monitoring, examine if training on participatory hygiene promotion method was provided to V-WASHE, and the V-WASHE provided/is providing community trainings in coordination with the health workers in the area from the facility construction phase of the Project. Methodologies such as Community Lead total Sanitation (CLTS) will be adopted to promote hygiene practice at each individual, household, and community level. In sites where livestock are present, inspect the existence of fences around the facility.

4-2. Piped water supply schemes

Output1. Community based O&M structure is established in the target sites.

【Indicator】 V-WASHEs in all target sites acquire knowledge and skills necessary for the O&M activities

【Documents】 Contract of Operation of V-WASHE, O&M action plan, Memorandum of Understanding(MoU) on facility O&M, at least one month long O&M activity and financial record from sites where the facility is completed at the time of January 2016.

The skills necessary for V-WASHEs are largely divided into the technical items and organisational management side. Former involves daily preventative measures and inspection, small scale repair, conservation of surrounding areas. Latter includes O&M action plan, instruction of community members on appropriate use of the facility, collection of O&M fees and financial management, coordination with district and private entities to solicit support on the O&M. The Contract, O&M action plan, and MoU will be checked to see if these items are indicated in them. Coordination with private entities (Contracted Company), record of O&M activities and finance is also examined.

Output2. Communities' understandings on the safe and appropriate use of the water supplied from the constructed facility is increased.

【Indicator】 V-WASHE acquires hygiene promotion method and provide hygiene trainings to the community.

【Documents】 Monitoring Report prepared by DLAs

Through monitoring, examine if training on participatory hygiene promotion method was provided to V-WASHE, and the V-WASHE provided/is providing community trainings in coordination with the health workers in the area from the facility construction phase of the Project. Methodologies such as Community Lead total Sanitation (CLTS) will be adopted to promote hygiene practice at each individual, household, and community level. In sites where livestock are present, inspect the existence of fences around the facility.

Output3. DLA support structure for the piped water supply facility O&M in rural areas is established.

【Indicator】 DLAs conduct regular monitoring on the O&M situation of piped water supply schemes

【Documents】 Monitoring Report prepared by DLAs

Using the check list prepared with the monitoring and evaluation plan under the Software Component activity, confirm if each activity is conducted appropriately, and if they are achieving the Outputs. The result shall be compiled into a report and used

as documents for Activity Review and Evaluation. In the sites where the use of the facility has been commenced, the DLA monitors on the status of the facility use and O&M activities. As the Japanese side does not follow-up on the status after the facility hand over, regular monitoring by the government is strongly desired.

Output4. Understanding of the stakeholders such as DLAs, community, and LuaWSC on the O&M structure is promoted.

【Indicator】 The stakeholders, such as DLAs, Community, and LuaWSC understands the roles and responsibilities of each other in the O&M structure of the piped water supply schemes.

【Documents】 Software Component Report prepared by Local Consultant (record of activities indicated under Output 4 in page 15.)

5. Software Component Activities (Appendix 1. Details of the Software Component activity plan)

Activities for each Output are described below. The details of each activity are described in Appendix 1, "Detailed Software Component Activity Plan" attached at the end of the document.

5-1. Borehole fitted with hand pumps

Output1. Community based O&M structure is established in the target sites.

- Project orientation and preparation of detail implementation plan of activities at the district level【Activity 1】
- Refresher Training of WASHE facilitators and APMs at sub-district level in facilitation of participatory operation and maintenance of water supply facility and hygiene promotion activities 【Activity 2】
- Sensitising the community leaders in the roles and responsibilities in the rural water supply and sanitation projects and briefing of the project【Activity 3】
- Project orientation at village level【Activity 4】
- Situation analysis on present water supply & sanitation environment for the planed water supply facility【Activity 5】
- Formation/ re-activation of V-WASHE and signing a memorandum of understanding regarding project implementation【Activity 6】
- Training of V-WASHEs on their roles and responsibilities and implementation of hygiene promotion activities 【Activity 7】(Cost Borne by Zambian Side)
- Training of caretakers in daily operation and maintenance of hand pumps 【Cost Borne by Zambian Side】【Activity 9】(Cost Borne by Zambian Side)
- Training of V-WASHEs (including caretakers) in maintenance methods of Iron Removal Plant【Activity 10】
- Monitoring of Software Component Programme activities【Activity 18】(Cost Borne

by Zambian Side)

- Review on progress of activities, evaluation of results of outputs and establishing the action plan on maintenance【Activity 19】(Cost Borne by Zambian Side)

Output2. Communities' understandings on the safe and appropriate use of the water supplied from the constructed facility is increased.

- Situation analysis on present water supply & sanitation environment and pre-sitting for the planed water supply facility【Activity 5】
- Training of V-WASHEs on their roles and responsibilities and implementation of hygiene promotion activities 【Activity 7】(Cost Borne by Zambian Side)
- Training of caretakers in management of hygiene conditions of the water points (conducted with Activity 9)【Activity 8】(Cost Borne by Zambian Side)

In formulation of the activities, following points are considered.

(1) Compatibility with the plan of the National Rural Water Supply and Sanitation Sector

The O&M structure of borehole fitted with hand pumps to be supported under the Programme confirms to the O&M of the structure promoted under the NRWSSP and its O&M manual. The training of the V-WASHEs shall confirm to the manual and its guidelines. Also the past project of the "Phase I Project" and "Phase II Project" as well as 'SOMAP3' is referred in formulation of the activities.

(2) Coordination with the Technical Cooperation Programme

The Software Component activities for boreholes fitted with hand pumps will utilise already trained human resources, namely the district officials, WDC members, and APMs to formulate V-WASHEs and provide O&M trainings. The Project also utilise spare parts shop established by the SOMAP3 project to promote communities' access to spare parts of the constructed facilities. Through utilisation of existing human resources, the Programme intends to increase its effectiveness.

5-2. Piped water supply schemes

Output1. Community based O&M structure is established in the target sites.

- Project orientation and preparation of detail implementation plan of activities at the district level【Activity 1】
- Refresher Training of WASHE facilitators and APMs at sub-district level in facilitation of participatory operation and maintenance of water supply facility and hygiene promotion activities【Activity 2】
- Sensitising the community leaders in the roles and responsibilities in the rural water supply and sanitation projects and briefing of the project【Activity 3】
- Project orientation at village level【Activity 13】
- Formation/ re-activation of V-WASHE and signing a memorandum of understanding regarding project implementation【Activity 14】

- Training of V-WASHEs (including tap attendants and operators) on their roles and responsibilities of O&M activities and implementation of hygiene promotion activities【Activity 15】
- Assisting contract signing between community and a private company【Activity 16】
- Follow-up Training of V-WASHEs (including tap attendants and operators) on their roles and responsibilities of O&M activities and implementation of hygiene promotion activities【Activity 17】
- Monitoring of Software Component Programme activities【Activity 18】(Cost Borne by Zambian Side)
- Review on progress of activities, evaluation of results of outputs and establishing the action plan on maintenance【Activity 19】(Cost Borne by Zambian Side)

Output2. Communities' understandings on the safe and appropriate use of the water supplied from the constructed facility is increased.

- Training of V-WASHEs (including tap attendants and operators) on their roles and responsibilities of O&M activities and implementation of hygiene promotion activities【Activity 15】
- Follow-up Training of V-WASHEs (including tap attendants and operators) on their roles and responsibilities of O&M activities and implementation of hygiene promotion activities【Activity 17】

Output3. DLA support structure for the piped water supply facility O&M in rural areas is established.

- Creation of manuals on Operation and Maintenance of the small scale piped water supply schemes in rural areas【Activity 11】
- Training of Provincial and District Trainers for capacity building of V-WASHEs on O&M of the piped water supply facilities【Activity 12】
- Assisting contract signing between community and a private company【Activity 16】

Output4. Understanding of the stakeholders such as DLAs, community, and LuaWSC on the O&M structure is promoted.

- Project orientation and preparation of detail implementation plan of activities at the Ministry level【Activity 0】
- Project orientation and preparation of detail implementation plan of activities at the district level including LuaWSC representatives【Activity 1】
- Refresher Training of WASHE facilitators and APMs at sub-district level in facilitation of participatory operation and maintenance of water supply facility and hygiene promotion activities【Activity 2】
- Sensitising the community leaders in the roles and responsibilities in the rural water supply and sanitation projects and briefing of the project【Activity 3】
- Project orientation at village level【Activity 13】

6. Procurement of resources for Software Component Programme implementation

Details of personnel to be allocated for the programme implementation are shown below.

(1) Japanese Consultant: 1 person (O&M planning/Public Hygiene)
Formulates Software Component Plan, and manages the entire Project implementation process, and provides technical instruction to the Implementing Agency and Local consultants /NGO. S/he also coordinates with and reports to the Zambian and Japanese related bodies of Software Component Activities. The person should have experiences in social development field.

(2)Local consultants / NGO Project Director/Social Development 1person :
Manages the overall work delegated from the Japanese Consultant, supervises the activity input, methodology used, output and overall progress, and reports to the Japanese Consultant and the Implementing Agency. S/he is in charge of formulation of the field manuals on capacity development/ hygiene promotion, based on WASHE concept, under the instruction and management of the Japanese Consultant. S/he also is in charge of instructing WASHE facilitators. The person should have experiences as a Project Director in similar projects, be familiar with participatory planning/ monitoring and evaluation, participatory hygiene promotion, and Organisational management and Financial Management of community based organisations.

(3)Local consultants / NGO Facilitators for target sites for Boreholes fitted with hand pumps: 4 people
Manages progress of activities regarding community sensitisation, pre-siting for the planned water supply facility, formation/re-activation of V-WASHEs, and provides technical assistance. The Facilitators also provide trainings of V-WASHEs in O&M of IRP. The Facilitators should have experiences in O&M trainings of the boreholes fitted with hand pumps.

(4)Local consultants / NGO Facilitators for target sites for Small Scale Piped Water Supply Schemes: 1 person
Assisting Project Director, conducts activity to formulate field manuals, and provides trainings and orientation targeting DLA staffs. S/he also conducts capacity development trainings and workshop for community on the facility O&M, and assists repair service contract signing between community and private company. The Facilitator should have experiences in community capacity development or establishment of participatory O&M structure in water supply project(s). The person should also have experiences in pipe installation and repair of concrete structures.

(5)Implementing Agency Project Manager: 1 person
Allocated by the Implementing Agency as the Counter Part, s/he manages activities in coordination with Japanese consultant and Local consultant /NGO.

(6) DLA　RWSS Officer: 1 person

Coordinates the Project at district level. This is the responsibility of the district RWSS Officer.

(7)　WASHE facilitator/APM:　1 person each/Ward

Implement community level activities in coordination with Local consultants /NGO

7.　Implementation plan of the Software Component Programme

Implementation plan of the Software Component Programme is listed as Appendix 2.

8.　Output Products of the Software Component Programme

Main output products are as described in the Appendix 1. "Details of the Sofwaret Component activity plan". Apart from the Software Component Completion Report to be prepared by Local Consultant/NGO and submitted to the Implementing Agency and Japan, the main products include Training Manual for V-WASHE on piped water supply schemes O&M, activity reports prepared by Local consultants / NGO, WASHE facilitators, and APMs, MoU, and Contract of V-WASHE. The progress of Activity implementation and achievement level of outputs are evaluated through them.

9.　Responsibility of the Implementation of the Programme

The responsibility of both Japan and the Zambian government is shown as below. As there is a limit to DLAs' budget, the Implementing Agency should utilise basket fund to effectively secure and allocate funding required for activity implementation.

- Responsibility of the Implementation of the Programme

【Japanese Side】

Labour cost and transport cost of Local consultants /NGO, transport cost of D-WASHE members, workshop hosting cost, stationaries, document preparation cost, allowance of APMs to implement activity 1 to 6 and 10 to 17

【Zambian Side】

Monitoring and Activity implementation cost for the whole activities (1 to19). Namely allowances for provincial officials, D-WASHE members, and WASHE facilitators, allocation of vehicles for activity implementation by D-WASHE and WASHE facilitators and its fuel

cost. For activity 19, Review on progress of activities, evaluation of results of outputs and establishing the action plan on maintenance, in addition to the above items, workshop hosting cost, stationaries and report preparation cost should be calculated.

- Implementation of activity 3 to 6 in alternative sites

When borehole drilling becomes unsuccessful at target site and the project decides to transfer the borehole drilling to one of the alternative sites, DLAs shall take responsibility in provision of project orientation to the communities of the alternative sites, formation of V-WASHEs, and cost sharing necessary for implementation of training.

Appendix 1: Detailed Software Component Activity Plan

Facility Type	No.	Activities	Objective	Target Group	Methodology and required equipment	Days/Activity	Responsible organisation	Location	Output
Activities for boreholes fitted with hand pumps and piped water supply schemes	**Stage1: Pre-Planning**								
	0	Project orientation and preparation of detail implementation plan of activities at the Ministry level - Log frame of the Project, Activity implementation plan, Approach for Software Component Project - Roles and responsibilities of the stakeholders on O&M and the Project implementation - Determination of Output indices, baseline, and Evaluation plan - Administrative procedures and coordination for the Project implementation	- Reach agreement with MLGH on the Project and Software Component activities implementation plan	MLGH	Meeting with MLGH · Vehicle for Japanese Consultant	1day/Meeting	Japanese Consultant	Lusaka	- Minutes of the Meeting
	1	Project orientation and preparation of detail implementation plan of activities at the district level - Understanding of O&M issues of after the handover of facilities in “Phase I Project” and “Phase II Project”, examination of point of improvement in the current Project, refining of existing manuals, translation of them into local languages - Orientation on Log-frame, Activity implementation plan and Softwareware Component approach of the Project - Roles and responsibilitieSoftwarehe stakeholders in O&M and implementation of the Project - Determination of Output indices, preparation of Monitoring and Evaluation plan, and determination of baseline - Administrative procedures and coordination for the Project implementation	- Reach agreement with the implementing agency on the Project and Softwareware Component Activities - Identify and analyse issues from the previous Softwareware Component activities - Based on the analysis, each district prepares Monitoring and Evaluation activity plan	Representative of the target 4 Districts' D-WASHE(incl. WSSO) 【2 people/D-WASHE: 8 people total】 Representative of the Luapula LuaWSC(for the first day only) 【2 people】	Workshop for representatives of D-WASHE of 4 districts · Vehicle for Japanese Consultant · Vehicle for Local Consultant	2days/Workshop	MLGH Provincial Office, Japanese Consultant, Local Consultant/ NGO 【Cost Borne by Japanese side】	Mansa	- Monitoring and Evaluation Plan for Softwareware Component Activities agreed with districts - Action Plan of each district - Workshop Report
	2	Refresher Training of WASHE facilitators and APMs at sub-district level in facilitation of participatory operation and maintenance of water supply facility and hygiene promotion activities - Explanation of the Project - Preparation of Activity plan for formation/reformation of V-WASHEs, their capacity building trainings, and hygiene promotion activities - Establishment of Activity monitoring, reporting methodology - Establishment of Coordination and reporting structure for the activity implementation	- Prepare activity implementation plan at each site	WASHE facilitator(EHT, school members, members of WDC, etc.), and APMs in wards where target sites belong 【2 people/Ward: 90 people total】	Workshop · Vehicle for Japanese Consultant · Vehicle for Local Consultant · Monitoring and Evaluation plan made in Activity 1	2days/District (8days)	Japanese Consultant Local Consultant/ NGO, D-WASHE representatives from Activity 1 【Cost Borne by Japanese side】	District Administrative Centre	- Workshop Report - Implementation Plan of activities prepared by the participants

	Stage 2: Participatory-Planning								
	3	Sensitising the community leaders in the roles and responsibilities in the rural water supply and sanitation projects and briefing of the project	- Promote understandings of the community leaders on the objective of the Project and implementation plan - Form agreement on the roles and responsibilities of the community leaders - Promote understanding of the community leaders to encourage participation of women - Establish cooperative relationship with the community leaders	Representative of the target site (Village head, Village development committee member, etc.), traditional leader, area councillor	Meeting · Vehicle for Local Consultant · Vehicle for D-WASHE · Activity reporting form	1day/Ward (45days)	Local Consultant/ NGO Facilitator from Activity 2【 Cost Borne by Japanese side】	Centre of the Ward located in the middle of the target sites	- Field report prepared by WASHE facilitators
Activities for boreholes fitted with hand pumps	4	Project orientation at village level - Outline of the Project - Correlation between use of safe water and water borne diseases - Roles and responsibilities of stakeholders - Responsibilities of the community (collection of O&M cost, formation of V-WASHE, participation in Software Component activities, cooperating the construction (participate in siting, securing access of construction vehicle, storing the construction materials, providing labour)	- Promote understanding of the Project objective and implementation plan, and responsibilities of the community	Community	Targeted the whole community members. Promote understanding of the community members with use of visual tools. Participation of the community members are also encouraged even for the boreholes to be constructed for schools and RHCs. · Vehicle for Local Consultant · Vehicle for D-WASHE · Activity reporting form	0.5day/Site (100days)	As above	Target sites	As above
	5	Situation analysis on present water supply & sanitation environment for the planned water supply facility - Analysis of current water supply and sanitation status - Identification of issues and points of improvement - Identification of location pertinent/unsuited as water points and its reasons	- Collect information of the community on the suitable location for water points - Provide capacity development activity to V-WASHE on identification of water related issues and solutions, as well as reaching consensus	Community	Field survey and workshop using group works and discussions · Vehicle for Local Consultant · Vehicle for D-WASHE · Activity reporting form	1day/Site (200days)	As above	As above	- Field report prepared by WASHE facilitators - Community map describing current water supply and sanitation situation and candidate water point locations

6	Formation/ re-activation of V-WASHE and signing a memorandum of understanding regarding project implementation - Intention to accept the project and to confirm the community responsibilities explained in activity 4 - Agreement on the roles and responsibilities of the V-WASHE, and Contract of Operation of V-WASHE - Selection of V-WASHE members (if it already exists, examine need for re-selection) - Signing of Memorandum of Understanding on the facility O&M between the community and DLA - Confirmation of list of items to be prepared by the community prior to the construction initiation	- V-WASHE is formed/re-activated at sites where the agreement on the community responsibilities explained in activity 4 was reached - Reach agreement on roles and responsibilities of the community leader explained in activity 4	Community	Meeting targeting the whole community · Vehicle for Local Consultant · Vehicle for D-WASHE · Activity reporting form	0.5day/Site (100days)	As above	As above	- Field report prepared by WASHE facilitators - V-WASHE member list - Contract of Operation of V-WASHE - Memorandum of understanding on facility O&M signed by the target communities
7	Training of V-WASHEs on their roles and responsibilities and implementation of hygiene promotion activities - Understanding on functions of V-WASHE, roles and responsibilities of each member, and roles of other stakeholders - Conflict resolution and leadership skills - Accounting and management of collected funds (cash or in kind, how to collect the fee, frequency of collection, methodology of funds storing, financial accounting report, etc.), access to the spare parts - Measures to include vulnerable groups and considerations towards gender equality in water facility use and O&M activity - Promotion of use of safe water, improvement of hygiene practice, participatory method of hygiene improvement - Cooperation with NHC and TBA, implementation plan of hygiene promotion activity - Activity Monitoring - Formulation of V-WASHE O&M action plan 【Cost Borne by Zambian Side】	- Promote understanding on functions of the V-WASHE, roles and responsibilities of each member, and other O&M considerations - Training of methodologies for hygiene sensitisation - Promote cooperation with Neighbourhood Health Committee (NHC), and Traditional Birth Attendants (TBA), who work in the target area - Formulate V-WASHE O&M action plan	V-WASHE(incl. care taker) of target sites【approx. 10 people/committee】	Workshop(1.5days) targeting V-WASHE using group works and discussions Meeting targeting the whole community (0.5days): Explanation and Approval of the Action Plan prepared by the V-WASHE · Vehicle for Local Consultant · Vehicle for D-WASHE · Activity reporting form · Accounting Recording form	2days/Site (400days)	DLA/D-WASHE【Cost Borne by Zambian Side】	As above	- Field report prepared by WASHE facilitators - V-WASHE O&M Action Plan
Stage3: Construction/Implementation								
8	Training of caretakers in management of hygiene conditions of the water points(conducted with Activity 9) - Conservation of water source (importance and benefit of using safe water, prevention of water waste, user sensitisation) - Conservation and improvement of environmental hygiene (installation of fences, promotion of cleaning surrounding area) 【Cost Borne by Zambian Side】	- Promote understanding of caretakers on promotion of environmental hygiene of the surrounding area - Obtain skills to sensitise community on appropriate use of the facility	Caretaker of target sites【2 people/Site】	Orientations, discussions and field works using the maintenance manual · Vehicle for Local Consultant · Activity reporting form · Maintenance manual for care takers	1day/Ward (45days)	As above	Centre of the Ward located in the middle of the target sites	- Field report prepared by WASHE facilitators

	9	Training of caretakers in daily operation and maintenance of hand pumps - Daily O&M activity of boreholes fitted with hand pumps - Use and storage of O&M toolkit - Procedures for facility malfunction and cooperation with APMs upon facility malfunction - Facility inspection and repair record taking 【Cost Borne by Zambian Side】	- Training for caretakers on preventative measures of the facility (for Afridev facility, training on installation and repair as well)	Caretaker of target sites【2 people/Site】	Orientations, discussions and field works using the maintenance manual · Maintenance manual · Repair toolkit, Spare parts · Activity reporting form · Support Vehicle for WASHE Activities · Vehicle for Local Consultant	1day/Ward (45days)	As above	Centre of the Ward located in the middle of the target sites	- Field report prepared by APMs
	10	Training of V-WASHEs(including caretakers) in maintenance methods of Iron Removal Plant - Correlation between use of safe water and water borne diseases; impact of iron contents on human body and on the water supply facility - Structure and function of the Iron Removal Plant - Benefit of the Water Supply Facility and Iron Removal Plant - O&M activities needed (especially on cleansing of the filter) - Determination of cleaning frequency, place to store tools and people in charge	- Promote understanding of the community on correlation between use of safe water and water borne diseases and prevention of them - Promotion of understanding of the community on function and benefit of the Plant - Training of O&M of the Plant (especially on filter cleaning)	Caretaker and V-WASHE of target sites, Community	Field practice on site: 2days · Vehicle for Local Consultant · Maintenance Manual prepared in Activity 1 · Activity reporting form	2days/Site (16days)	Local Consultant/ NGO, APM from each Ward【Cost Borne by Japanese side】	Sites where Iron Removal Plant is installed	- Field report prepared by APMs
Activities for piped water supply schemes	**Stage1: Pre-Planning**								
	11	Creation of manuals on Operation and Maintenance of the small scale piped water supply schemes in rural areas Contents; Leadership, Financial management, facility O&M and preventative measures, trainings on small scale repair, participatory Monitoring and Evaluation	- Create V-WASHE training manuals and guidelines on piped water supply facility O&M	MLGH, DLA, D-WASHE, V-WASHE of target 3 districts	Discussion with implementation agency, identification of needs, creation of the manuals, submission of the manuals	20days	Japanese Consultant Local Consultant/ NGO	Lusaka	-Field training manuals
	12	Training of Provincial and District Trainers for capacity building of V-WASHEs on O&M of the piped water supply facilities Contents; Leadership, Financial management, facility O&M and preventative measures, trainings on small scale repair, participatory Monitoring and Evaluation	- Training of trainers on V-WASHE training on O&M of piped water supply facilities using manuals of activity 11 - Gain understanding on O&M operation for the facilities, monitoring over violation of the repair service contract, signed between community and a private company.	MLGH Provincial Office D-WASHE of target 3 districts【5 people/District: 15 people total (DLA, DoW, DPO, WSSO, etc.)】	Workshop	5days	Japanese Consultant Local Consultant/ NGO	Mansa	- Training Report - Monitoring Plan

Stage2: Participatory-Planning								
13	Project orientation at village level - Outline of the Project - Correlation between use of safe water and water borne diseases - Roles and responsibilities of stakeholders - Responsibilities of the community (collection of O&M cost, formation of V-WASHE, participation in Software Component activities, cooperating the construction (participate in siting, securing access of construction vehicle, storing the construction materials, providing labour)	- Promote understanding of the Project objective and implementation plan, and responsibilities of the community	Community	Meeting targeting the whole community	3days/Site(5 site)(15days)	Japanese Consultant Local Consultant/ NGO DLA/ WASHE Facilitator	Target sites	- Community Orientation Report - Minutes of Agreement on the facility O&M structure
14	Formation/ re-activation of V-WASHE and signing a memorandum of understanding regarding project implementation - Intention to accept the project and to confirm the community responsibilities explained in activity 13 - Agreement on the roles and responsibilities of the V-WASHE, and Contract of Operation of V-WASHE - Selection of V-WASHE members (if it already exists, examine need for re-selection) - Signing of Memorandum of Understanding on the facility O&M between the community and DLA - Confirmation of list of items to be prepared by the community prior to the construction initiation	- V-WASHE is formed/re-activated at sites where the agreement on the community responsibilities explained in activity 13 was reached - Reach agreement on roles and responsibilities of the community leader explained in activity 13	Community	Meeting targeting the whole community	3days/Site(5 site)(15days)	Japanese Consultant Local Consultant/ NGO	Target sites	-V-WASHE member list - Contract of Operation of V-WASHE
Stage3: Construction/Implementation								
15	Training of V-WASHEs(including tap attendants and operators) on their roles and responsibilities of O&M activities and implementation of hygiene promotion activities 1. Financial management 2. Repair skills 3. Organisational management (selection of tap attendants, leadership) 4. Daily operation and preventative maintenance 5. Hygiene promotion/sensitisation	- Trainings on the facility O&M to community using the O&M manuals and guidelines	V-WASHE, Operator, tap attendant	Participatory Field Workshop	3days/theme (3days x5themes =15days/Site (5site) = 75days	Japanese Consultant Local Consultant/ NGO DLA	As above	- Training Report - V-WASHE O&M action plan
16	Assisting contract signing between community and a private company	- Promote understanding of the community on service contract content for repair service contract - Establish and reach agreement on district support structure and intermediating measures in case the contract was violated	V-WASHE	Meeting	1days/Site(5 sites)(5days)	Japanese Consultant Local Consultant/ NGO DLA	As above	- Contract of service provision

Stage4: Monitoring and Follow-up								
17	Follow-up Training of V-WASHEs(including tap attendants and operators) on their roles and responsibilities of O&M activities and implementation of hygiene promotion activities 1. Financial management 2. Repair skills 3. Organisational management (selection of tap attendants, leadership) 4. Daily operation and preventative maintenance 5. Hygiene promotion/sensitisation	- Through field and OJT, using the manuals, provide trainings on unclear issues and weak points - Trainings on the facility O&M to community using the O&M manuals and guidelines	V-WASHE, Operator, tap attendant	Participatory Field Workshop	3days/Site(5 sites)(15days)	As above	As above	- Training Report
18※	Monitoring of Software Component Programme activities - Verify the progress of the Software Component activities at village level and acquirement of skills 【Cost Borne by Zambian Side】	- Monitor water supply facility construction - Monitor status of O&M activity carried out by V-WASHEs at the target sites where the use of the facility has commenced	WASHE facilitator of target 4 district, APM, V-WASHE	Interview (with WASHE facilitators, APMs, V-WASHEs, caretakers and the community members), direct observation of WASHE activities and sites of water supply : 2days/month/District · Vehicle for D-WASHE · Monitoring form		D-WASHE of target 4District【Cost Borne by Zambian Side】		- Monitoring report to be prepared by D-WASHE members
19※	Review on progress of activities, evaluation of results of outputs and establishing the action plan on maintenance - Progress of each activity - Issues in activity implementation and solution - Evaluation of achievement of the outputs - As a result of the evaluation, identification of necessary follow-up topics, and incorporation of them into the next annual plan 【Cost Borne by Zambian Side】	- Based on the monitoring done in activity 18, examine progress of activity implementation and its achievement, and provide suggestion for improving activity implementation - Incorporate necessary follow-up items into the WASHE O&M action plan		Annual Review meeting by each district: 2days/month/District		DLA/D-WASHE【Cost Borne by Zambian Side】		- Annual O&M action plan of each district

* Monitoring/Follow-up activity is conducted as a part of O&M action plan (on regular monitoring and review meeting) prepared by each DLA.

Annex 2 : Implementation Schedule of Software Component Programme

	Item		Month	2014 5	6	7	8	9	10	11	12	2015 1	2	3	4	5	6	7	8	9	10	11	12	2016 1	2	3	4	5	6
Contract	Approval by the Cabinet			▼																								
	Exchange of Note, Grant Agreement				▼																							
	Consultant Agreement					▲																						
Detailed Design	Field Survey: Soft Component Activity: V-WASHE formation, Orientation, etc.						■	■	■	■																		
	Hydrogeological, Geophysical Survey							■	■	■	■																	
	Verification, Detailed Design								■	■	■																	
	Comparison between B/D and D/D								■	■																		
	Preparation of Tender Documents									■	■																	
	Confirmation of Tender Documents										■																	
Implementation	Tender Notice, Evaluation of P/Q										■																	
	Distribution and Explanation of Tender Document										■																	
	Tendering											▲																
	Evaluation of Tendering											■																
	Contract (Construction)												▲															
	Verification of Construction Contract by JICA												▲															
Construction Schedule (Provinces fitted with hand pumps)	Preparation Work												■	■														
	Team 1: (8 boreholes/Month*9)	Construction of 67 boreholes												■	■	■	■	■	■	■	■	■	■					
		Construction of 67 aprons													■	■	■	■	■	■	■	■	■					
		Construction of 8 Iron Removal Plants																				■	■	■	■	■	■	■
	Team 2: (8 boreholes/Month*9)	Construction of 67 boreholes													■	■	■	■	■	■	■	■	■					
		Construction of 67 aprons														■	■	■	■	■	■	■	■					
	Team 3: (8 boreholes/Month*9)	Construction of 66 boreholes													■	■	■	■	■	■	■	■	■					
		Construction of 66 aprons														■	■	■	■	■	■	■	■					
	Demobilisation																							■	■			
Construction Schedule (Piped Water Supply Schemes)	Preparation Work													■	■													
	Milenge	Construction of reservoir and plumbing													■	■	■	■	■	■	■	■	■					
	Musangu	Construction of reservoir and plumbing														■	■	■	■	■	■	■	■	■	■	■	■	■
	Kapala	Construction of reservoir and plumbing														■	■	■	■	■	■	■	■					
	Kapakala	Construction of reservoir and plumbing															■	■	■	■	■	■	■					
	Kabuta	Construction of reservoir and plumbing																						■	■	■	■	■
			Day/Activity	Total																								
Soft Component — Activities for boreholes fitted with hand pumps and piped water schemes	Stage1: Pre-Planning																											
	0 Project orientation and preparation of detail implementation plan of activities at the Ministry level	1 day/ meeting	1																									
	1 Project orientation and preparation of detail implementation plan of activities at the district level	2 days/workshop	2																									
	2 Refresher Training of WASHE facilitators and APMs at sub-district level in facilitation of participatory operation and maintenance of water supply facility and hygiene promotion activities	2 days/district	8																									
	Stage2: Participatory-Planning																											
	3 Sensitising the community leaders in the roles and responsibilities in the rural water supply and sanitation projects and briefing of the project	1 day/ward	45																									
	4 Project orientation at village level	0.5 day/site	100																									
	5 Situation analysis on present water supply & sanitation environment for the planned water supply facility	1 day/site	200																									
	6 Formation/ re-activation of V-WASHE and signing a memorandum of understanding regarding project implementation	0.5 day/site	100																									
	7 Training of V-WASHEs on their roles and responsibilities and implementation of hygiene promotion activities 【Cost Borne by Zambian Side】	2 days/site	-																									
	Stage3: Construction/Implementation																											
	8 Training of caretakers in management of hygiene conditions of the water points 【Cost Borne by Zambian Side】	1 day/ward	-																									
	9 Training of caretakers in daily operation and maintenance of hand pump 【Cost Borne by Zambian Side】	1 day/ward	-																									
	10 Training of V-WASHEs (including caretakers) in maintenance methods of Iron Removal Plant	2 days/site	16																									
Activities for piped water schemes	Stage1: Pre-Planning																											
	11 Creation of manuals on Operation and Maintenance of the small scale piped water supply schemes in rural areas	20 days	20																									
	12 Training of Provincial and District Trainers for capacity building of V-WASHEs on O&M of the piped water supply facilities	5 days	5																									
	Stage2 : Participatory-Planning																											
	13 Project orientation at village level	3 days/site (5 sites)	15						Kabuta Kapala Musangu Kapakala Milenge																			
	14 Formation/ re-activation of V-WASHE and signing a memorandum of understanding regarding project implementation	3 days/site (5 sites)	15						Kabuta Kapala Musangu Kapakala Milenge																			
	Stage3: Construction/Implementation																											
	15 Training of V-WASHEs (including tap attendants and operators) on their roles and responsibilities of O&M activities and implementation of hygiene promotion activities	3days/theme (5 themes)/site (5 sites)	75															Milenge Kapala				Musangu Kapakala						
	16 Assisting contract signing between community and a private company	1 days/site(5 sites)	5																					Kabuta Milenge Kapala Musangu Kapakala Kabuta				
	Stage4: Monitoring and Follow-up																											
	17 Follow-up Training of V-WASHEs (including tap attendants and operators) on their roles and responsibilities of O&M activities and implementation of hygiene promotion activities	3 days/site (5 sites)	15															Milenge Kapala					Kapakala			Musangu Kabuta		
Activities for boreholes fitted with hand pumps	18 Monitoring of Software-Component Programme activities 【Cost Borne by Zambian Side】	2 days/ district/month	-																									
	19 Review on progress of activities, evaluation of results of outputs and establishing the action plan on maintenance 【Cost Borne by Zambian Side】	1time /district/year (2 days/time)	-																									
		Total	621																									
Staffs	Japanese Consultant	MM	Day																									
	Operation and Maintenance Planning/Public Health	4.63	139				2.73 MM								0.9 MM												1.0 MM	
	Local Consultant	MM	Day																									
	Project Director/Social Development	3.70	111.0																									
	Facilitators for target sites for Boreholes fitted with hand pumps (1)	4.50	135.0																									
	Facilitators for target sites for Boreholes fitted with hand pumps (2)	3.82	114.5																									
	Facilitators for target sites for Boreholes fitted with hand pumps (3)	4.17	125.0																									
	Facilitators for target sites for Boreholes fitted with hand pumps (4)	3.88	116.5																									
	Facilitators for target sites for Piped Water Supply Schemes (1)	6.57	197.0																									

Remarks

- Construction (Boreholes with hand pumps)
- Construction (Piped Water Schemes)
- Consultant
- Work (Japan)

Activities of Local Consultant

Activities for boreholes fitted with hand pumps
- Nchelenge
- Mwense
- Mansa
- Milenge

Activities for piped water schemes
- 5 sites

Activities of Zambian Government

APPENDIX-7

REFERENCES

Appendix-7 References

No.	Title	Type	Original / Copy	Organization / Publisher	Year
1	National Rural Water Supply and Sanitation Programme 2006-2015	Print	Copy	MLGH	2007
2	National Guidelines for Sustainable Operation and Maintenance of Hand Pumps in Rural Areas	Print	Copy	MLGH	2007
3	Supply Chain Management Manual for Rural Water Supply	Print	Copy	MLGH	2008
4	RWSS O&M Implementation Manual & User Guide、1st Edition	Print	Copy	MLGH	2010
5	District Rural Water Supply and Sanitation Programme 2008-2015 (Nchelenge)	Print	Copy	MLGH Nchelenge District Council	2008
6	District Situational Analysis (DSA), Mansa	Print	Copy	MLGH Mansa District	2005
7	Zambia 2000 Census of Population and Housing, Volume Four Luapula Province, Analytical Report	Print	Original	Central Statistical Office	2004
8	Living Conditions Monitoring Survey Report 2006	CD	Copy	Central Statistical Office	2006
9	Micro-Level Estimates of Poverty in Zambia	Print	Original	Central Statistical Office	2007
10	Statistical Fact Sheet	Print	Original	Central Statistical Office	2007
11	Labour force Survey Report 2005	Print	Original	Central Statistical Office	2007
12	Consumer Price Index	Print	Copy	Central Statistical Office	2009
13	Formal Sector Employment and Earnings Inquiry Report	Print	Original	Central Statistical Office	2006
14	Demographic Health Survey	Print	Original	Central Statistical Office	2009
15	Sixth National Development Programme (Water Sector), Draft	Print	Copy	Government of the Republic of Zambia	2010
16	Topographical Map, 1:250,000, Mwense, Mansa, Milenge	Map	Original	Surveyor General	1982
17	Topographical Map, 1:500,000, Luapula Province	Map	Original	Surveyor General	1982
18	Estimates of Revenue and Expenditure (Activity Based Budget), January/2009 - December/2009	Print	Original	Ministry of Finance and National Planning	2009
19	Estimates of Revenue and Expenditure (Activity Based Budget), January/2010 - December/2010	Print	Original	Ministry of Finance and National Planning	2010
20	The Sustainable Operation and Maintenance Project for Rural Water Supply (SOMAP) 2, Joint Evaluation Report	Print	Copy	MLGH、JICA	2010

No.	Title	Type	Original / Copy	Organization / Publisher	Year
21	National Water Policy、2010	Print	Copy	Ministry of Energy and Water Development	2010/Feb
22	Toolkit for Peri-Urban Water Supply Version 1.0	CD	Copy	Devolution Trust Fund (DTF)	2006
23	Milenge Development Plan 1:5,000	Map	Original	MLGH Department of Pysical Planning and Housing	2010
24	Luapula Water Supply and Sewage Company Monthly Operations Management Information System Report 2012	Data	Copy	Luapula Water Supply and Sewage Company	2013
25	Meteorogical data （Mansa, Kawamba Station)	Data	Copy	Meteorological Department	2013
26	Draft National Water Supply and Sanitation Policy (Second Draft) June 2013	Print	Copy	MLGH	2013
27	2010 Census of Population and Housing Preliminary Population Figures Feb/2011	Data	Copy	Central Statistical Office	2011
28	Water for the Urban Poor in Zambia, Water kiosks in peri-urban and low-cost areas	Data	Copy	German Technical Cooperation (GIZ)/DTF	2005
29	National Urban Water Supply and Sanitation Programme 2011-2030	Print	Original	MLGH	2011
30	Guidelines on Water Supply for Peri-Urban areas	Print	Copy	National Water Supply and Sanitation Council (NWASCO)	2002
31	The Water Supply and Sanitation Act 1997	Data	Copy	Government of the Republic of Zambia	1997
32	Vision 2030	Data	Copy	Government of the Republic of Zambia	2006
33	Luapula Water Supply and Sewage Company Business and Investment plan 2011 to 2013	Data	Copy	Luapula Water Supply and Sewage Company	2011
34	Urban and peri-urban water supply and sanitation sector report 2011/12	Data	Copy	National Water Supply and Sanitation Council (NWASCO)	2012
35	NWASCO Strategic Plan 2013-2015	Data	Copy	National Water Supply and Sanitation Council (NWASCO)	2013
36	NWASCO 10 Years of Regulating	Data	Copy	National Water Supply and Sanitation Council (NWASCO)	unknown
37	Water Sector Reform in Zambia	Data	Copy	National Water Supply and Sanitation Council (NWASCO)	2004
38	The National Decentralisation Policy	Data	Copy	Government of the Republic of Zambia	2003

APPENDIX-8

OTHER RELEVANT DATA

Appendix 8-1 Screening List of Boreholes with Hand Pumps

Result of Screening ○：Possible for borehole construction、×：Inappropriate for borehole construction

Population *1：Total Population、*2：*1－250×(no. of existing boreholes)

Nchelenge District						
Site Code	Site Name	Result of Screening	Result of Observation / Remarks	Pop.(*1)	Pop.(*2)	Category
NCIII-01	Mutiwanama	○	Existing 2 BH	700	200	Village
NCIII-02	Mukumbwa Primary School	○	Existing 3 BH	2,600	1850	School
NCIII-03	Katuta	○		600	600	Village
NCIII-04	Seketeni	○	Existing 2 BH	2,819	2319	Village
NCIII-05	Bulaya	○	Existing 2 BH	600	100	Village
NCIII-06	Chikange	○	Existing 2 BH	1,600	1100	Village
NCIII-07	Chipita	○	Existing 2 BH	2,500	2000	Village
NCIII-08	Kaseketi	○	Existing 2 BH	1,600	1100	Village
NCIII-09	Mushili	○	Existing 1 BH	1,500	1250	Village
NCIII-10	Kalipese	○		285	285	Village
NCIII-11	Chipulumushi	○		1,000	1000	Village
NCIII-12	Chabilikila Section 1	×	Water Demand satisfied	110	-640	Village
NCIII-13	Chabilikila Section 2	×	Water Demand satisfied	100	-150	Village
NCIII-14	Mutete	○		470	470	Village
NCIII-15	Labi	○		220	220	Village
NCIII-16	Choncho	○		400	400	Village
NCIII-17	Mukanso	○	Existing 1 BH	6,000	5750	Village
NCIII-18	Kapambwe section 1	×	No Access	4,800	4300	Village
NCIII-19	Chomba	○	Existing 2 BH	570	70	Village
NCIII-20	Chinyanta	○	Existing 2 BH	2,000	1500	Village
NCIII-21	Muselu	○	Existing 1 BH	672	422	Village
NCIII-22	Chipayeni	○	Existing 2 BH	2,500	2000	Village
NCIII-23	Chipakila	○	Existing 1 BH	2,000	1750	Village
NCIII-24	Mulwe	○	Existing 3 BH	3,200	2450	Village
NCIII-25	Nalukoshi	○		150	150	Village
NCIII-26	Swaba	○		49	49	Village
NCIII-27	Mukange	○	Existing 2 BH	3,000	2500	Village
NCIII-28	Kampampi	×	Duplication	2,800	2050	-
NCIII-29	Mateyo	○		60	60	Village
NCIII-30	Mfundawula	○		876	876	Village
NCIII-31	Chifungula	×	No Access	49	49	Village
NCIII-32	Nakafwaya	×	Water Demand satisfied	250	0	Village
NCIII-33	Katele	×	No Access	8,000	8000	Village
NCIII-34	Kanguluma	○	Existing 1 BH	390	140	Village
NCIII-35	Chisushi	○		70	70	Village
NCIII-36	Nakafwaya Central	○		1,426	1426	Village
NCIII-37	Lukokesha	○	Existing 1 BH	300	50	Village
NCIII-38	Kanyembo East	×	No Access	530	530	Village
NCIII-39	Mubanga	○		750	750	Village
NCIII-40	Chandwe East Section 3	×	Water Demand satisfied	1,000	-250	Village
NCIII-41	Kabulo	○	Existing 2 BH	3,000	2500	Village
NCIII-42	Elyabu	○	Existing 2 BH	3,000	2500	Village
NCIII-43	Daison	○	Existing 1 BH	3,000	2750	Village
NCIII-44	Mutono 1	○	Existing 2 BH	2,000	1500	Village
NCIII-45	Mutono 2	○	Existing 3 BH	2,200	1450	Village

Nchelenge District						
Site Code	Site Name	Result of Screening	Result of Observation / Remarks	Pop.(*1)	Pop.(*2)	Category
NCIII-46	Mweru Primary School	○		150	150	School
NCIII-47	Katuna	○	Existing 2 BH	3,005	2505	Village
NCIII-48	Yenga	○	Existing 2 BH	3,000	2500	Village
NCIII-49	Mubamba Primary School	×	Duplication	700	700	School
NCIII-50	Mubamba B	○		700	700	Village
NCIII-51	Kaseka B (Lakeside)	○	Existing 3 BH	3,778	3028	Village
NCIII-52	Kasonkomona	○	Existing 2 BH	1,200	700	Village
NCIII-53	Shimutambala	○	Existing 2 BH	2,000	1500	Village
NCIII-54	Kanwa	○	Existing 1 BH	1,200	950	Village
NCIII-55	Block 4	×	No Access	150	150	Village
NCIII-56	Block 6	×	No Access	200	200	Village
NCIII-57	Kafwala	○	Existing 2 BH	3,700	3200	Village
NCIII-58	Chofwe kabila	○		1,200	1200	Village
NCIII-59	Labani	○		350	350	Village
NCIII-60	Chimpulumba	○	Existing 1 BH	2,000	1750	Village
NCIII-61	Miyemba	○		500	500	Village
NCIII-62	Lembati	×	Water Demand satisfied	120	-130	Village
NCIII-63	Belu	○	Existing 2 BH	1,400	900	Village
NCIII-64	Kasheta	○	Existing 2 BH	3,000	2500	Village
NCIII-65	Lupili	○	Existing 3 BH	1,200	450	Village
NCIII-66	Mutabwa	○	Existing 3 BH	4,000	3250	Village
NCIII-67	Kambwali Local Court	○	Existing 1 BH	1,800	1550	Village
NCIII-68	Mulonda	○	Existing 3 BH	3,000	2250	Village
NCIII-69	Block 3	×	No Access	275	25	Village
NCIII-70	Shimpundu	○	Existing 1 BH	2,577	2327	Village
NCIII-71	Chibi	○	Existing 1 BH	887	637	Village
NCIII-72	Matete	○	Existing 1 BH	1,200	950	Village
NCIII-73	Kasheta	○	Existing 1 BH	420	170	Village
NCIII-74	Pingwila	×	No Access	586	336	Village
NCIII-75	Mutepuka - Filubo section	○		160	160	Village
NCIII-76	Mutepuka main	○		700	700	Village
NCIII-77	Chansa Fisali	×	Duplication	3,016	2516	Village
NCIII-78	Lumbanama	×	Water Demand satisfied	25	-225	Village
NCIII-79	Kalubuli	○		1,000	1000	Village
NCIII-80	Shichishipula	○	Existing 1 BH	3,000	2750	Village
NCIII-81	Kaputo	○		550	550	Village
NCIII-82	Kabuta east	×	No Access	3,600	2850	Village
NCIII-83	Chula	○	Existing 3 BH	1,100	350	Village
NCIII-84	Samashi	○	Existing 2 BH	2,000	1500	Village
NCIII-85	Chishima 1	×	Covered by piped water scheme	1,200	950	Village
NCIII-86	Sekeleti	○	Existing 1 BH	1,600	1350	Village
NCIII-87	Chafuma	○	Existing 1 BH	6,472	6222	Village
NCIII-88	Siseli	○	Existing 1 BH	8,000	7750	Village
NCIII-89	Chishima 2	○		1,000	1000	Village
NCIII-90	Musafili	×	No Access	50	50	Village

Mwense District						
Site Code	Site Name	Result of Screening	Result of Observation / Remarks	Pop.(*1)	Pop.(*2)	Category
MWIII-01	Sombe	○		500	500	Village
MWIII-02	Chilengwe	○	Existing 2 BH	7,000	6500	Village
MWIII-03	Musangati	○		150	150	Village
MWIII-04	Muluka	×	Low water demand	4	4	Village
MWIII-05	Shikabila	○		32	32	Village
MWIII-06	Chifuba	○		100	100	Village
MWIII-07	Namfumu Wakatinti	○		200	200	Village
MWIII-08	Kalumba	○		170	170	Village
MWIII-09	Chibwe Kabuta	×	Water Demand satisfied	438	-62	Village
MWIII-10	Chimbini	○		68	68	Village
MWIII-11	Kusengu	○		200	200	Village
MWIII-12	Mwenso	○		389	389	Village
MWIII-13	Lundumuna	○		370	370	Village
MWIII-14	Ng'andwe	○		495	495	Village
MWIII-15	Kampamba	○		410	410	Village
MWIII-16	Mutoto	○		568	568	Village
MWIII-17	Swaba A	○		807	807	Village
MWIII-18	Swaba B	○		807	807	Village
MWIII-19	Kabangwe	○		170	170	Village
MWIII-20	Mukopa A	○		500	500	Village
MWIII-21	Mukopa B	○		300	300	Village
MWIII-22	Muyembe	○		517	517	Village
MWIII-23	Chonde	○		200	200	Village
MWIII-24	Mutamba	×	Water Demand satisfied	240	-10	Village
MWIII-25	Chisonge	○		280	280	Village
MWIII-26	Kapena	○	Existing 2 BH	2,995	2495	Village
MWIII-27	Kaswika	○		2,400	2400	Village
MWIII-28	mumpolokoso	○	Existing 1 BH	2,340	2090	Village
MWIII-29	Chikonkolo	○		490	490	Village
MWIII-30	Kasanda	○		160	160	Village
MWIII-31	kashingwa	○	Existing 1 BH	830	580	Village
MWIII-32	Malitini	○		315	315	Village
MWIII-33	Shichilenge	○		174	174	Village
MWIII-34	Kamboo	○		250	250	Village
MWIII-35	Shichama East	○	Existing 2 BH	900	400	Village
MWIII-36	Kateule South	○		287	287	Village
MWIII-37	Shingwe	○	Existing 1 BH	1,500	1250	Village
MWIII-38	Chakwa	○		150	150	Village
MWIII-39	Mutondo	○		189	189	Village
MWIII-40	Kabila	○	Existing 1 BH	490	240	Village
MWIII-41	Chibumbu	○		456	456	Village
MWIII-42	Katebula	○		200	200	Village
MWIII-43	Black	○		104	104	Village
MWIII-44	Rosa Mukuntu	○		200	200	Village
MWIII-45	Muchinga Community School	○		141	141	School
MWIII-46	Chatukwa	○		490	490	Village
MWIII-47	Holland	○		68	68	Village
MWIII-48	Chilongoshi	○		130	130	Village
MWIII-49	Ndebe	○		375	375	Village
MWIII-50	Lubamba	○		480	480	Village
MWIII-51	Matente	○		258	258	Village

Mwense District						
Site Code	Site Name	Result of Screening	Result of Observation / Remarks	Pop.(*1)	Pop.(*2)	Category
MWIII-52	Mushashi	○		365	365	Village
MWIII-53	Poleni	○		137	137	Village
MWIII-54	Mutanti	○		252	252	Village
MWIII-55	Nabashila	○		250	250	Village
MWIII-56	Chisokobwe	○		300	300	Village
MWIII-57	Kapesha	○		261	261	Village
MWIII-58	Benard	○		200	200	Village
MWIII-59	Tangwa	○	Existing 1 BH	350	100	Village
MWIII-60	Kayanike	×	No Access	2,250	2250	Village
MWIII-61	Kanchinchi Community School	○		720	720	School
MWIII-62	Chibondo Primary School	○		450	450	School
MWIII-63	Losa Mukunkutu	○		720	720	Village
MWIII-64	Kasengula/Mwenshi	○		239	239	Village
MWIII-65	Sitwala	○		138	138	Village
MWIII-66	chakopo	○	Existing 1 BH	310	60	Village
MWIII-67	Punga	○		574	574	Village
MWIII-68	Musalula	○		360	360	Village
MWIII-69	Kawama B	×	Water Demand satisfied	250	-750	Village
MWIII-70	Chiwasha	○	Existing 1 BH	750	500	Village
MWIII-71	Kapala	×	Covered by piped water scheme	2,426	2176	Village
MWIII-72	Mofati	○		350	350	Village
MWIII-73	Chibamba	○	Existing 1 BH	490	240	Village
MWIII-74	Mushisha	○		256	256	Village
MWIII-75	Tondo	○		146	146	Village
MWIII-76	Kapotwe	○	Existing 1 BH	442	192	Village
MWIII-77	Chalwe West	○		4,600	4600	Village
MWIII-78	Chalwe East	○		1,183	1183	Village
MWIII-79	Chibumbu North	○		530	530	Village
MWIII-80	Chikumbi	○		250	250	Village
MWIII-81	Kapakala East	×	Covered by piped water scheme	1,100	850	Village
MWIII-82	Kapakala West	×	Water Demand satisfied	350	-150	Village
MWIII-83	Shimaria B	○	Existing 1 BH	380	130	Village
MWIII-84	Chakwangasha	○	Existing 1 BH	3,233	2983	Village
MWIII-85	Fisaka	○		200	200	Village
MWIII-86	Chelekumbi	○		80	80	Village
MWIII-87	Sitima	○	Existing 1 BH	364	114	Village
MWIII-88	Kapondo	×	Water Demand satisfied	180	-70	Village
MWIII-89	Kabuta	○		135	135	Village
MWIII-90	Bundebunde	○	Existing 2 BH	5,892	5392	Village
MWIII-91	Lukumani	○		250	250	Village
MWIII-92	Kalasa	×	Water Demand satisfied	166	-84	Village
MWIII-93	Chitasu	○		490	490	Village
MWIII-94	Ponga	○		360	360	Village
MWIII-95	Mainsa	○		100	100	Village
MWIII-96	Chitupi	○		172	172	Village
MWIII-97	Kabosha South	○	Existing 2 BH	1,660	1160	Village
MWIII-98	Kantondi	○		160	160	Village
MWIII-99	Chibende	○		850	850	Village
MWIII-100	Kambule	○	Existing 1 BH	1,200	950	Village

Mansa District						
Site Code	Site Name	Result of Screening	Result of Observation / Remarks	Pop.(*1)	Pop.(*2)	Category
MAIII-01	Chabwe2	×	Duplication	1,000	500	Village
MAIII-02	Fitobola	○		300	300	Village
MAIII-03	David Chilambe	○		350	350	Village
MAIII-04	Sambe	○		516	516	Village
MAIII-05	Kalikeka	○		220	220	Village
MAIII-06	Matenda	○		450	450	Village
MAIII-07	Matipa village	○		300	300	Village
MAIII-08	Chiputa	○		2,000	2000	Village
MAIII-09	Katanga	○		542	542	Village
MAIII-10	Mpota	○		102	102	Village
MAIII-11	Sakeni	○		222	222	Village
MAIII-12	Chaiwa	○		200	200	Village
MAIII-13	Lukupwa	○		420	420	Village
MAIII-14	Mbulwa	○		1,876	1876	Village
MAIII-15	Kasaka	○		259	259	Village
MAIII-16	Chikoyi village	○		1704	1704	Village
MAIII-17	Obedi village	○		420	420	Village
MAIII-18	Kabengele	○		1,850	1850	Village
MAIII-19	Sande Facite	○		840	840	Village
MAIII-20	Mulala Primary School	○		2,608	2608	School
MAIII-21	Kaisala	○		480	480	Village
MAIII-22	Chipense vilage	○		3,857	3857	Village
MAIII-23	Kasanga- Health Post	○		1,331	1331	RHC
MAIII-24	Lusaya village	○	Existing 1 BH	5,056	4806	Village
MAIII-25	Chambo	○	Existing 1 BH	1,020	770	Village
MAIII-26	Mumbwe	○		2,700	2700	Village
MAIII-27	Chimoto	×	No Access	243	243	Village
MAIII-28	Kafusha	×	No Access	421	421	Village
MAIII-29	Nshenda	○		602	602	Village
MAIII-30	Mapesa	○		350	350	Village
MAIII-31	Fiyongoli Primary School	○		220	220	School
MAIII-32	Mounga Village	○		1,600	1600	Village
MAIII-33	Lukali	○		360	360	Village
MAIII-34	Langi	○		352	352	Village
MAIII-35	Chbende	○	Existing 1 BH	420	170	Village
MAIII-36	Kansapule	○		683	683	Village
MAIII-37	Mashatini	○		354	354	Village
MAIII-38	Kasongolole	×	No Access	300	300	Village
MAIII-39	Jim	×	No Access	150	150	Village
MAIII-40	Mpembea	○		105	105	Village
MAIII-41	Katangwe A	×	No Access	980	730	Village
MAIII-42	Katangwe B	×	No Access	200	200	Village
MAIII-43	Yasakwa Lay By	○		300	300	Village
MAIII-44	Sunday	○		160	160	Village
MAIII-45	Chopote	○		270	270	Village
MAIII-46	Chile Com School	○		100	100	School
MAIII-47	Fibobo Com School	○		310	310	School
MAIII-48	Mwela Primary School	○		380	380	School
MAIII-49	Lole	○		312	312	Village
MAIII-50	Chimpala Village	○	Existing 1 BH	794	544	Village
MAIII-51	Mofat I	×	No Access	562	562	Village

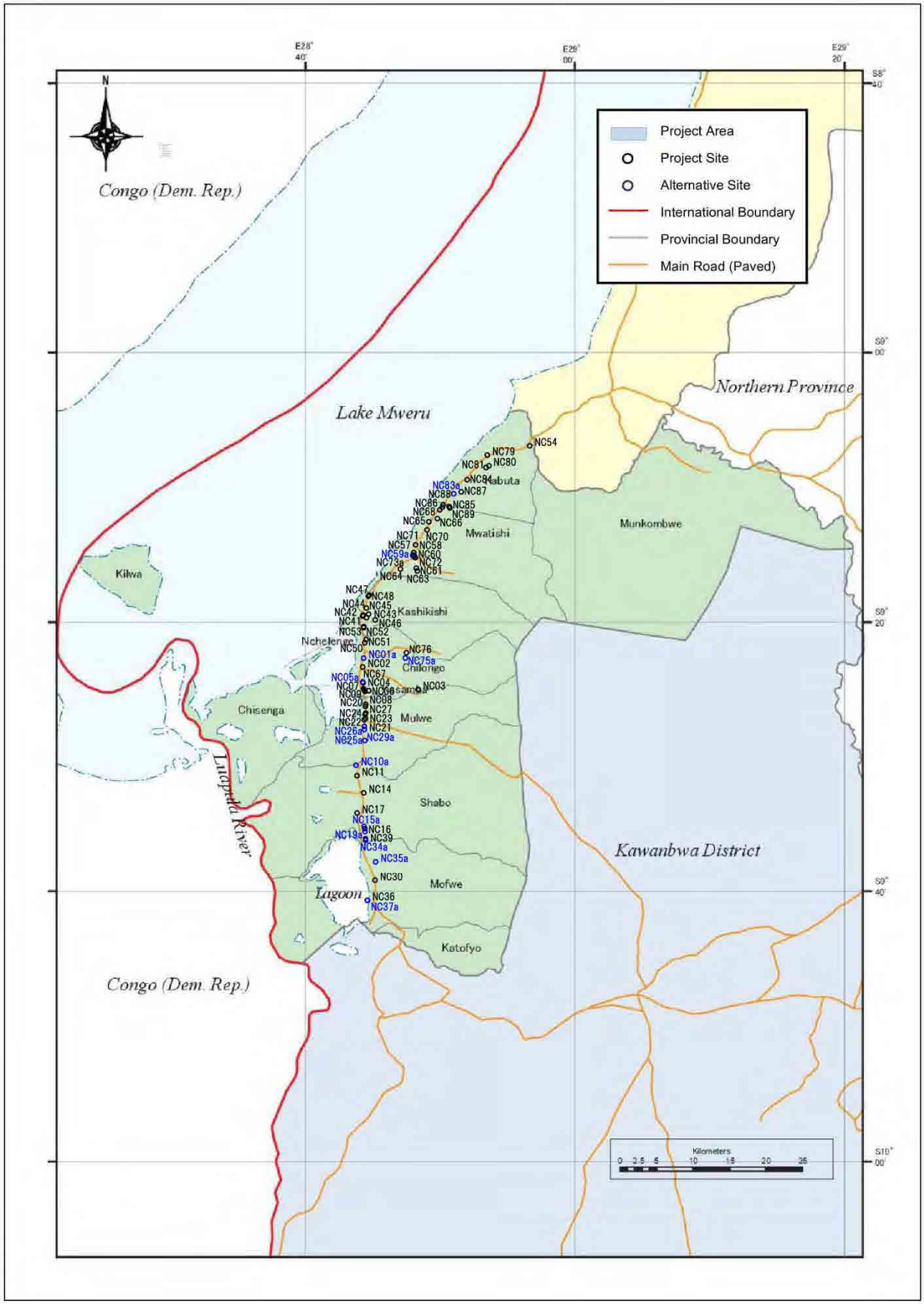
Mansa District						
Site Code	Site Name	Result of Screening	Result of Observation / Remarks	Pop.(*1)	Pop.(*2)	Category
MAIII-52	Matipa	○		150	150	Village
MAIII-53	Musenga Primary School	×	No Access	400	400	School
MAIII-54	Kolota	○		450	450	Village
MAIII-55	Maikeneke Market	○		1,250	1250	Village
MAIII-56	Lemmy	○		379	379	Village
MAIII-57	Sumbu A	○		240	240	Village
MAIII-58	Sumbu B	○		3,500	3500	Village
MAIII-59	Chikuwe 2	○	Existing 1 BH	2,820	2570	Village
MAIII-60	Kasheshe	○		2,280	2280	Village

Milenge District						
Site Code	Site Name	Result of Screening	Result of Observation / Remarks	Pop.(*1)	Pop.(*2)	Category
MLIII-01	Lwela Secondary School	○	Existing 1 BH	900	650	School
MLIII-02	Bene Kund	○		430	430	Village
MLIII-03	Mpite	○		630	630	Village
MLIII-04	Nkumbula	○		665	665	Village
MLIII-05	Pollen	○		680	680	Village
MLIII-06	Milomo	○		640	640	Village
MLIII-07	Goliat	○		340	340	Village
MLIII-08	Chituta	○		300	300	Village
MLIII-09	Muluka	○		455	455	Village
MLIII-10	Chilimabwe	○	Existing 1 BH	728	478	Village
MLIII-11	Chengo	○		480	480	Village
MLIII-12	Helena Musonda	○		1,200	1200	Village
MLIII-13	Kasepa	○		307	307	Village
MLIII-14	Loyi Mwape	○	Existing 1 BH	280	30	Village
MLIII-15	Milenge Secondary School	×	Duplication	613	613	School
MLIII-16	John Nkumba	○		691	691	Village
MLIII-17	Chipundu	○		5,400	5400	Village
MLIII-18	Kampemba	○		80	80	Village
MLIII-19	Fikombo	○		680	680	Village
MLIII-20	Ng'Anda Imo	○		1,800	1800	Village
MLIII-21	Mpanse	×	No Access			Village
MLIII-22	Lumfilwa	×	No Access			Village
MLIII-23	Chungu	×	No Access			Village
MLIII-24	Chisengele	×	No Access			Village
MLIII-25	Mulala	×	No Access			Village
MLIII-26	Kabesa	×	No Access	259	259	Village
MLIII-27	Lupiya	×	No Access			Village
MLIII-28	Lupiya2	×	No Access			Village
MLIII-29	Saimoni	○		850	850	Village
MLIII-30	Thomas	○		330	330	Village
MLIII-31	Chimese	○		480	480	Village
MLIII-32	Lungo Mukuta	×	No Access			Village
MLIII-33	Lungo Mukuta2	×	No Access			Village
MLIII-34	Tali Meke	×	No Access	250	250	Village
MLIII-35	Kabola	○		630	630	Village
MLIII-36	Mukonkani	○	Existing 1 BH	304	54	Village
MLIII-37	Mogani Mulelema	×	No Access	350	350	Village
MLIII-38	Ponga-Ponga	×	No Access	240	240	Village
MLIII-39	Ponga-Ponga2	×	No Access	350	350	Village
MLIII-40	Kashila	×	No Access	460	460	Village
MLIII-41	Sando	×	No Access	1,950	1950	Village
MLIII-42	Sakeni	○		230	230	Village
MLIII-43	Kabunda	○		460	460	Village
MLIII-44	Muselenga	○		680	680	Village
MLIII-45	Chansange	○		380	380	Village
MLIII-46	Stephano	○		350	350	Village
MLIII-47	Pwele	○		400	400	Village
MLIII-48	Kanyesha	○		5,500	5500	Village
MLIII-49	Mumbotuta Primary School	○		260	260	School
MLIII-50	Changwe-Lungo Primary School	○		250	250	School
MLIII-51	Allan Senga	×	No Access	200	200	Village

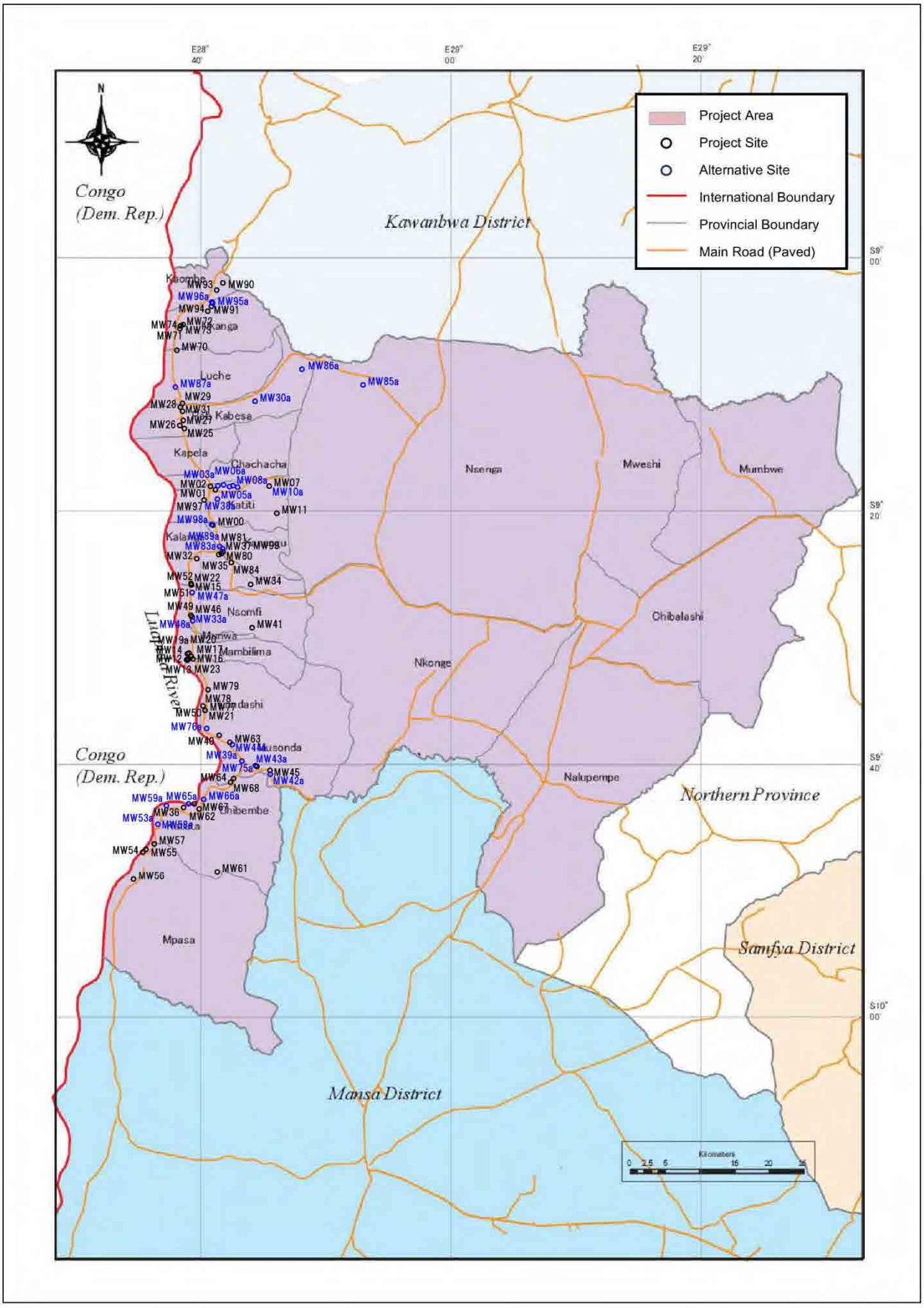
Milenge District						
Site Code	Site Name	Result of Screening	Result of Observation / Remarks	Pop.(*1)	Pop.(*2)	Category
MLIII-52	Changwe Village	○		380	380	Village
MLIII-53	Shitambuli Primary School	○		300	300	School
MLIII-54	Fitiko	×	No Access	300	50	Village
MLIII-55	Ng'Omba	×	Existing BH/Low water demand	273	23	Village
MLIII-56	James	×	Water Demand satisfied	350	-150	Village
MLIII-57	Kokonsholo	×	Water Demand satisfied	157	-93	Village
MLIII-58	Kaloko	○	Existing 1 BH	360	110	Village
MLIII-59	Katena	○	Existing 1 BH	3,829	3579	Village
MLIII-60	Lesa Mukali	○		786	786	Village
MLIII-61	Masheto	○		400	400	Village
MLIII-62	Sailas	○	Existing 1 BH	732	482	Village
MLIII-63	Kapu	×	Water Demand satisfied	258	-242	Village
MLIII-64	Mwangula	×	Water Demand satisfied	210	-40	Village
MLIII-65	Musumali	×	Existing BH/Low water demand	260	10	Village
MLIII-66	Kalali	○	Existing 1 BH	382	132	Village
MLIII-67	Kalamba	×	Water Demand satisfied	430	-70	Village
MLIII-68	Thomas	×	Water Demand satisfied	238	-262	Village
MLIII-69	Chilufy Kabinda	○	Existing 1 BH	630	380	Village
MLIII-70	Mashika	○		750	750	Village

Appendix 8-2　Location Map of Boreholes with Hand Pumps

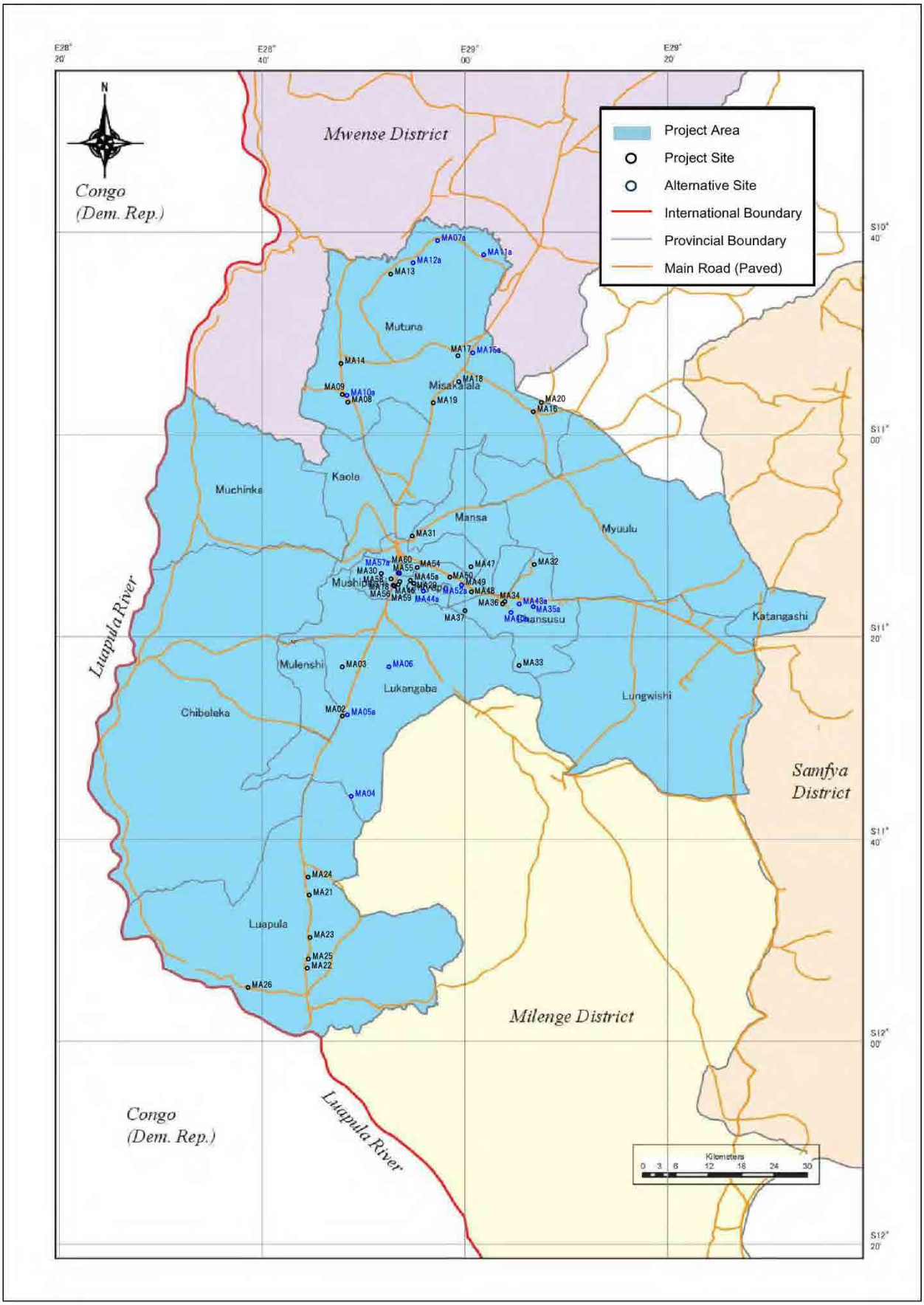
〔Nchelenge District〕



〔Mwense District〕



〔Mansa District〕



〔Milenge District〕

Appendix 8-3 pH and Fe Monitoring of "Phase ll Project"

Nchelenge District

BH No	Site Name	Construction				Monitoring		
		pH (site)	Fe (site)	Fe (labo)	Handpump	pH (site)	Fe (site)	IRP
NCII-01	Mangamu Basic Sch.	5	2	<0.01	Afridev	4.92	<0.2	
NCII-02	Mutono Basic School	4.88	<0.2	0.02	Afridev	5.03	<0.2	
NCII-03	Miba Community Sch.	6.7	<0.2	0.08	Afridev	6.34	<0.2	
NCII-06	Kafutuma clinic	6.91	<0.2	<0.01	Afridev	6.96	<0.2	
NCII-08	Mutono Village (1)	5.52	<0.2	<0.01	Afridev	5.44	<0.2	
NCII-12	Chilongoshi (B)	5.05	<0.2	<0.01	Afridev	5.22	<0.2	
NCII-13	Kasalaulo Village	5.2	1	0.06	Afridev	5.42	<0.2	
NCII-14	Mutampula Village	6.99	<0.2	0.34	Afridev	7.14	<0.2	
NCII-15	Bulu Village	5.11	<0.2	0.11	Afridev	5.26	<0.2	
NCII-16	Kasonso Village	4.4	0.5	0.13	Afridev	4.51	<0.2	
NCII-17	Seketeni Village	5.02	0.2	0.1	Afridev	5.23	<0.2	
NCII-19	St. Paul Hospital	5.12	<0.2	<0.01	Afridev	5.55	<0.2	
NCII-20	Chishipula Village	6.3	<0.2	0.09	Afridev	6.23	<0.2	
NCII-21	Chipanta Village	6.51	<0.2	0.25	Afridev	6.48	<0.2	
NCII-22	Luswili Village	5.24	0.2	<0.01	Afridev	5.15	<0.2	
NCII-24	Shimutambala Village	6.85	<0.2	<0.01	Afridev	6.44	<0.2	
NCII-26	Chokolo Village	4.8	<0.2	<0.01	Afridev	5.03	<0.2	
NCII-27	Holland Village	4.89	1	<0.01	Afridev	5.34	<0.2	
NCII-28	Kapambwe Village	5.31	0.5	<0.01	Afridev	5.63	<0.2	
NCII-30	Mwanamwishi Village	6.97	<0.2	<0.01	Afridev	7.12	<0.2	
NCII-31	Nshoka Village	5.5	<0.2	<0.01	Afridev	5.44	<0.2	
NCII-32	Shimalita	6.7	<0.2	<0.01	Afridev	6.93	<0.2	
NCII-33	Mukeya Village	7.42	<0.2	0.29	India Mark-II	6.84	1	
NCII-34	Kaseka Vill. (near Rd)	5.72	<0.2	0.26	Afridev	5.92	<0.2	
NCII-35	Kasamba B. School	4.85	0.5	0.04	Afridev	5.1	<0.2	
NCII-36	Kanengwa B. School	5.62	0.2	0.12	Afridev	5.44	<0.2	
NCII-37	Chofwe Mulenga Village	7.37	<0.2	<0.01	India Mark-II	6.98	<0.2	
NCII-40	Shikapambwe	4.7	<0.2	<0.01	Afridev	4.97	<0.2	
NCII-41	Pingwila Village	5.13	<1	0.58	Afridev	5.46	<0.2	
NCII-42	Kabeke Village	7.55	<0.2	0.08	India Mark-II	7.76	0.5	
NCII-44	Shanyemba Village	5.55	0.2	<0.01	Afridev	5.76	<0.2	
NCII-45	Chibwili	5.64	2	<0.01	Afridev	5.92	0.5	
NCII-46	Mushingo Village	7.76	<0.2	0.06	India Mark-II	7.22	<0.2	
NCII-47	Sela Village	6.29	10	2.88	Afridev	5.94	10	IRP
NCII-50	Mutepuka Village	5	5	0.19	Afridev	5.36	<0.2	
NCII-51	Kalweo Community Sch	7.29	<0.2	0.55	India Mark-II	7.02	<0.2	
NCII-52	Kaseketi Village	4.54	<0.2	<0.01	Afridev	4.71	<0.2	
NCII-53	Mushili Village	5.03	0.5	<0.01	Afridev	5.28	<0.2	
NCII-54	Chapita Village	4.66	<0.2	<0.01	Afridev	4.9	<0.2	
NCII-57	Chinkobwe Village	6.17	<0.2	<0.01	Afridev	5.94	<0.2	
NCII-58	Chimba Village	7.51	<0.2	1.06	India Mark-II	7.3	<0.2	
NCII-59	Mutabwa Village	6.94	<0.2	<0.01	Afridev	6.82	<0.2	
NCII-63	Kaputo Village	7.36	<0.2	0.11	India Mark-II	6.94	0.5	
NCII-65	Felushi Village	7.45	<0.5	1.83	India Mark-II	6.87	1	
NCII-66	Chomba Village	6.95	<0.2	0.1	Afridev	6.92	<0.2	
NCII-67	Diamond Village	6.74	<0.2	0.23	Afridev	6.48	<0.2	
NCII-70	Katuna Village	5.47	<0.2	0.08	Afridev	5.63	<0.2	
NCII-72	Mutono Village (2)	5.24	<0.2	<0.01	Afridev	5.36	<0.2	
NCII-73	Toka Village	4.88	2	<0.01	Afridev	5.02	0.5	
NCII-74	Chabilikila Village	4.9	1	<0.01	Afridev	5.2	<0.2	
NCII-75	Mulonda B. School	5.54	<0.2	0.15	Afridev	5.82	<0.2	
NCII-76	Mofwe B. School	5.11	<0.2	<0.01	Afridev	5.31	<0.2	
NCII-77	Kambwali clinic	5.18	<0.2	<0.01	Afridev	5.26	<0.2	
NCII-78	Lukokesha Basic Sch.	5.04	1	0.1	Afridev	5.24	<0.2	
NCII-79	Kapepele Village	5.22	<1	<0.01	Afridev	5.43	<0.2	

NCII-82	Chikuni Village	6.98	<0.2	0.04	Afridev	7.15	<0.2	
NCII-83	Shimpundu Village	6.9	<0.2	0.59	Afridev	6.97	<0.2	
NCII-85	Shinjoni Village	6.83	<0.2	0.08	Afridev	6.36	1	
NCII-87	Kanyembo Basic Sch.	4.75	0.02	<0.01	Afridev	4.93	<0.2	
NCII-88	Kasheta Village	6.98	<0.2	0.2	Afridev	6.85	<0.2	
NCII-89	Mukanda Village	6.65	<0.2	0.1	Afridev	6.37	<0.2	
NCII-92	Chile	6.82	<0.2	0.15	Afridev	6.94	<0.2	
NCII-93	Kabosha Village	7.39	<0.2	0,11	India Mark-II	6.97	<0.2	
NCII-94	Shindoni Village	5.13	<0.2	<0.01	Afridev	5.4	<0.2	

Mwense District

BH No	Site Name	Construction				Monitoring		
		pH (site)	Fe (site)	Fe (labo)	Handpump	pH (site)	Fe (site)	IRP
MWII-02	Kabengele	6.06	<0.2	0.07	Afridev	5.72	<0.2	
MWII-03	Chililo	7.19	0.5	0.26	India Mark-II	6.21	0.2	
MWII-04	Polo Kankomba Vill.	7.01	<0.2	0,08	India Mark-II	6.56	0.5	
MWII-05	Lubunda Basic School	5.03	<0.2	0.07	Afridev	5.23	<0.2	
MWII-06	Kanama Village	7.4	0.2	0.34	India Mark-II	6.33	0.5	
MWII-07	Luamfwe Village	4.46	<0.2	0.11	Afridev	5.37	<0.2	
MWII-09	Shimaria	6.51	<0.2	0.15	India Mark-II	5.94	<0.2	
MWII-10	Mutonto	5	<0.2	0.11	Afridev	5.12	<0.2	
MWII-11	Kapamba Basic School	6.51	0.2	0.12	Afridev	6.07	<0.2	
MWII-12	Mumpolokoso Vill.	6.85	<0.2	0.08	Afridev	6.24	<0.2	
MWII-13	Chibele East	7	1	0.12	Afridev	6.18	1	
MWII-15	Kangomba Comm. Sch	7.14	1	0.1	India Mark-II	6.25	1	
MWII-16	Kakusa B. Village	5.9	<0.2	0.22	Afridev	5.73	<0.2	
MWII-17	Nyengele	6.15	<0.2	0.2	Afridev	5.87	<0.2	
MWII-18	Anas	5.21	2	<0.01	Afridev	5.15	<0.2	
MWII-19	Chembe Comm. Sch.	7.2	<0.2	0,02	India Mark-II	6.42	<0.2	
MWII-20	Chilumbi	6.41	0.5	0.13	Afridev	6.3	<0.2	
MWII-21	Kalasa	5.59	0.2	0.1	Afridev	5.36	<0.2	
MWII-22	Chansa Village	7.24	<0.2	<0.01	India Mark-II	5.99	1	
MWII-23	James Chiwasha	7.33	0.5	0.05	India Mark-II	6.39	0.8	
MWII-24	Chisulo	7.4	1	0.08	India Mark-II	6.53	0.5	
MWII-27	Sichama Comm. Sch.	6.13	<0.2	0.13	Afridev	5.92	<0.2	
MWII-30	Chibunse	6.85	0.2	0.13	Afridev	6.31	0.2	
MWII-34	Munkupa	7.03	<0.2	0.13	India Mark-II	6.37	<0.2	
MWII-35	Chisheta	5.36	<0.2	0.13	Afridev	5.25	<0.2	
MWII-36	Mutanti	7.01	<0.2	0.12	India Mark-II	6.22	0.2	
MWII-40	Kaoma	7.62	<0.2	0.1	India Mark-II	6.7	0.2	
MWII-43	Sepe	6.72	0.2	0.13	Afridev	6.81	0.5	
MWII-44	Mwense East Farm	7.25	<0.2	0.05	India Mark-II	5.89	0.5	
MWII-46	Chibwe Village	4.52	<0.2	<0.01	Afridev	4.61	<0.2	
MWII-47	Kamami Village	7.48	<0.2	<0.01	India Mark-II	6.68	0.2	
MWII-51	Mutipula B. School	6.87	<0.2	<0.01	Afridev	6.66	<0.2	
MWII-53	Pibelibe	5.56	<0.2	<0.01	Afridev	4.77	<0.2	
MWII-54	Mulunda B. School	6.08	<0.2	0.08	Afridev	6.01	<0.2	
MWII-55	Longa Vill. (Longa)	7.78	0.2	<0.01	India Mark-II	7.2	<0.2	
MWII-56	Bunda Chunsu Basic Sch	6.78	<0.2	<0.01	Afridev	5.92	<0.2	
MWII-57	Kapalaula	4.36	<0.2	<0.01	Afridev	4.4	0.2	
MWII-58	Chifuntwe	5.96	<0.2	0.06	Afridev	5.94	<0.2	
MWII-59	Chililo	6.59	7	2.48	Afridev	6.23	1	
MWII-60	Kane	5.33	<0.2	<0.01	Afridev	5.8	<0.2	
MWII-62	Tambalala	6.65	2	0.02	Afridev	6.44	<0.2	
MWII-63	Bunde	5.94	<0.2	<0.01	Afridev	6.02	<0.2	
MWII-64	Leo	6.67	<0.2	<0.01	Afridev	6.41	<0.2	
MWII-65	Musalango	6.77	<0.2	<0.01	Afridev	5.38	<0.2	

Mansa District

BH No	Site Name	Construction				Monitoring		
		pH (site)	Fe (site)	Fe (labo)	Handpump	pH (site)	Fe (site)	IRP
MAII-01	Chitamba Basic Sch	6.49	<0.2	0.02	Afridev	6.13	<0.2	
MAII-02	Lukakula	6.47	<0.2	<0.01	Afridev	6.29	<0.2	
MAII-03	Mantumbusa Basic Sch	7.16	<0.2	<0.01	Afridev	6.74	<0.2	
MAII-06	Milima/Sepe	6.95	<0.2	0.03	Afridev	6.66	<0.2	
MAII-07	Mutiti	6.62	<0.2	<0.01	Afridev	6.26	<0.2	
MAII-08	Kasongo	6.33	<0.2	<0.01	Afridev	6.08	<0.2	
MAII-09	Chikuwe	6.25	<0.2	<0.01	Afridev	6.27	<0.2	
MAII-13	Kunda Ndomi	6.54	<0.2	<0.01	Afridev	6.13	<0.2	
MAII-16	Chitakwa	7.52	<0.2	<0.01	India Mark-II	7.16	<0.2	
MAII-17	Mwanachama	6.21	<0.2	<0.01	Afridev	5.86	<0.2	
MAII-19	Kalaba	6.61	0.5	0.03	Afridev	6.2	<0.2	
MAII-21	Chofwe	7.29	<0.2	<0.01	India Mark-II	6.88	<0.2	
MAII-22	Chakaba	6.83	<0.2	<0.01	Afridev	6.22	<0.2	
MAII-23	Kambalikila	5.02	<0.2	<0.01	Afridev	5.88	<0.2	
MAII-24	Musaila Rural Health Centre	6	<0.2	<0.01	Afridev	5.72	<0.2	
MAII-26	Shamende	6.44	<0.2	<0.01	Afridev	6.69	<0.2	
MAII-28	Temfwe	6.12	<0.2	0.04	Afridev	5.95	<0.2	
MAII-29	Kapu	6.55	<0.2	<0.01	Afridev	6.17	<0.2	
MAII-30	Fipatauko	6.31	<0.2	0.02	Afridev	6.13	<0.2	
MAII-31	Kalaba	6.41	<0.2	<0.01	Afridev	6.5	<0.2	
MAII-32	Chabala	6.78	<0.2	<0.01	Afridev	6.33	<0.2	
MAII-33	Shoti (Chansunsu Comm. Sch)	6.88	<0.2	<0.01	Afridev	6.43	<0.2	
MAII-34	Kapapa Community Sch	6.69	<0.2	<0.01	Afridev	6.35	<0.2	
MAII-35	Chiwele Comm. Sch	6.54	0.5	<0.01	Afridev	6.22	2	IRP
MAII-36	Kombaniya	6.67	<0.2	<0.01	Afridev	6.32	<0.2	
MAII-37	Sendapu	5.69	<0.2	<0.01	Afridev	5.81	<0.2	
MAII-38	Chansa (Kalukusha Area)	7.34	0.2	0.02	India Mark-II	6.77	<0.2	
MAII-42	Kasoma	6.17	<0.2	<0.01	Afridev	5.85	<0.2	
MAII-43	Kachepeshi	6.23	<0.2	<0.01	Afridev	5.88	<0.2	
MAII-45	Matipa	5.91	0.5	<0.01	Afridev	5.77	<0.2	
MAII-46	Kosamu	6.13	<0.2	<0.01	Afridev	6.27	<0.2	
MAII-47	Makunka	6.78	<0.2	0.11	Afridev	6.48	<0.2	
MAII-48	Musela	6.67	<0.2	0.03	Afridev	6.38	<0.2	
MAII-49	Kalasakando Basic Sch	7.71	<0.2	<0.01	India Mark-II	7.02	<0.2	
MAII-51	Fibale Basic School	6.25	<0.2	<0.01	Afridev	6.1	<0.2	
MAII-52	Mupofwe Comm. Sch	5.95	<0.2	<0.01	Afridev	5.75	<0.2	
MAII-53	Chisukulo	7.4	0.5	<0.01	Afridev	6.78	<0.2	
MAII-54	Eshon and Banda Area	6.79	<0.2	0.03	Afridev	6.55	<0.2	
MAII-57	Sanofi	6.62	<0.2	<0.01	Afridev	6.48	<0.2	
MAII-58	Kapompole	6.74	<0.2	<0.01	Afridev	6.53	<0.2	
MAII-60	Kabulaya Musesha (Comm. Sch)	7.53	<0.2	0.09	India Mark-II	6.82	<0.2	
MAII-61	Yasakwa (Bena Section)	7.68	<0.2	<0.01	India Mark-II	6.73	<0.2	
MAII-62	Chitungula	7.49	<0.2	0.04	India Mark-II	6.99	<0.2	
MAII-63	Mashikolo	6.41	<0.2	<0.01	Afridev	6.26	<0.2	
MAII-64	Chipungu	6.68	<0.2	<0.01	Afridev	6.42	<0.2	
MAII-65	Kamipundu Comm. Sch	7.31	0.5	0.02	Afridev	6.63	<0.2	
MAII-66	Chisumbu	6.58	10	3.45	Afridev	6.19	1	
MAII-67	Chief Mabumba's Palace	6.72	<0.2	<0.01	Afridev	6.37	<0.2	
MAII-68	Mushitu Comm.Sch	6.85	<0.2	<0.01	Afridev	6.51	<0.2	
MAII-71	Mabumba Market	5.55	<0.2	<0.01	Afridev	5.49	<0.2	
MAII-73	Chibale Kalaliki	6.52	0.5	<0.01	Afridev	6.26	<0.2	
MAII-74	Tubi	6.23	<0.2	<0.01	Afridev	5.98	<0.2	
MAII-75	Saili	6.98	0.2	<0.01	Afridev	6.62	<0.2	
MAII-76	Lofoyi	7.33	<0.2	<0.01	India Mark-II	6.87	<0.2	
MAII-78	Chimese Local Court	7.4	0.2	<0.01	Afridev	7.01	<0.2	

MAII-83	Senseleni	6.55	<0.2	0.04	Afridev	6.63	<0.2	
MAII-85	Motoka	6.81	<0.2	<0.01	Afridev	6.42	<0.2	
MAII-87	Kapaipi	6.8	<0.2	<0.01	Afridev	6.51	5	IRP
MAII-88	Mungulube	6.78	0.7	0.08	Afridev	6.34	0.5	
MAII-89	Chabwe	6.57	<0.2	<0.01	Afridev	6.37	<0.2	
MAII-90	Kale (Musenga)	6.91	<0.2	<0.01	Afridev	6.61	<0.2	

Milenge District

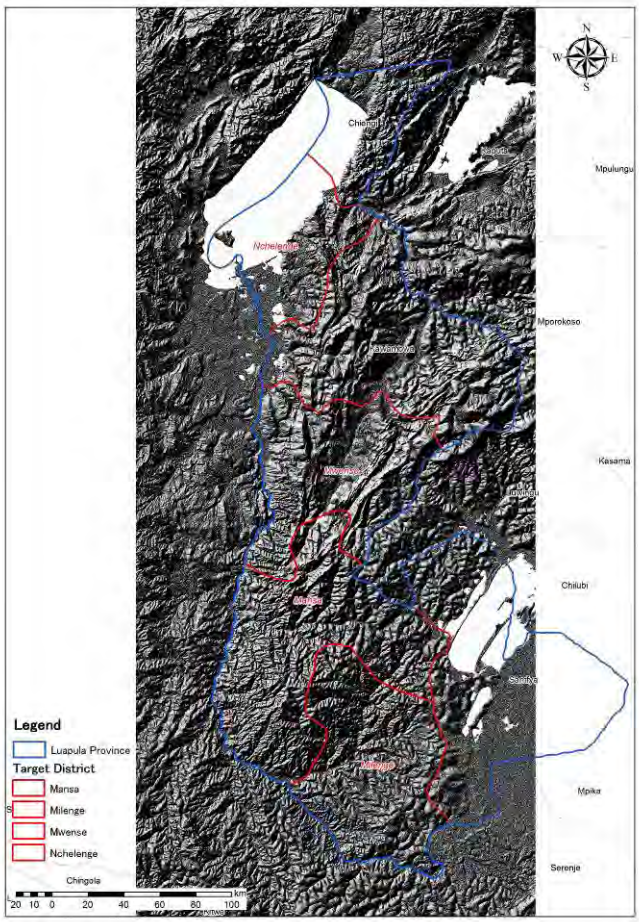
BH No	Site Name	Construction				Monitoring		
		pH (site)	Fe (site)	Fe (labo)	Handpump	pH (site)	Fe (site)	IRP
MLII-01	Garden (A)	5.81	1	<0.01	Afridev	6.04	<0.2	
MLII-01.2	Garden (A)2	7.12	<0.2	<0.01	India Mark-II	6.65	1	
MLII-02	Garden (B)	6.48	0.2	<0.01	Afridev	6.97	0.5	
MLII-03	Munushi Compound	6.15	1	<0.01	Afridev	6.66	1	
MLII-04	Kamupapa	5.69	<0.2	<0.01	Afridev	6.13	<0.2	
MLII-05	Kalotoli	6.35	<0.2	<0.01	Afridev	5.72	<0.2	
MLII-06	Chisensa	7.56	<0.2	<0.01	India Mark-II	7.38	<0.2	
MLII-07	Sokontwe New	7.15	<0.2	<0.01	India Mark-II	6.41	0.5	
MLII-08	Sokontwe Old	6.34	0.2	<0.01	Afridev	6.61	<0.2	
MLII-09	Riverside Comm. School	6.57	0.5	<0.01	Afridev	6.01	1	
MLII-10	Musongo Mwewa	6.49	<0.2	<0.01	Afridev	5.78	<0.2	
MLII-12	Chilufya Yamwela	5.46	<0.2	<0.01	Afridev	5.88	<0.2	
MLII-13	Chipundu (A) (Kupu) Vill	7.5	<0.2	<0.01	India Mark-II	6.59	<0.2	
MLII-14	Chipundu (B) (Makole) Village	7.12	<0.2	<0.01	India Mark-II	7.06	<0.2	
MLII-25	Miyambo Village	7.8	<0.2	<0.01	India Mark-II	6.41	1	
MLII-29	Buyantanshi Vill	7.82	0.2	<0.01	India Mark-II	7.4	<0.2	
MLII-30	Mulungushi Basic Sch.	6.86	<0.2	0.02	Afridev	6.79	<0.2	
MLII-31	Tande Basic Sch.	7.62	<0.2	0.4	India Mark-II	7.03	<0.2	
MLII-32	Milulu health Post	6.2	<0.2	<0.01	Afridev	6.97	0.5	
MLII-33	Musumali	6.83	<0.2	<0.01	Afridev	7.07	1	
MLII-34	Mote	6.13	<0.2	<0.01	Afridev	5.97	<0.2	
MLII-35	Kalali	6.9	<0.2	0.02	Afridev	7.06	<0.2	
MLII-37	Kabongo (A)	5.68	<0.2	<0.01	Afridev	6.23	<0.2	
MLII-38	Kabongo (B)	6.39	0.5	<0.01	Afridev	6.26	<0.2	
MLII-39	Chenga (A)	5.36	<0.2	0.09	Afridev	5.86	<0.2	
MLII-40	Chenga (B)	6.57	<0.2	0.11	Afridev	6.14	<0.2	
MLII-41	Muyayi	7.48	<0.2	0.08	India Mark-II	6.86	1	
MLII-43	Vincent	7.71	<0.2	0.15	India Mark-II	6.54	<0.2	
MLII-45	Alas	6.62	1	0.04	Afridev	6.85	<0.2	
MLII-46	N'gomba	6.32	0.2	<0.01	Afridev	6.44	<0.2	
MLII-49	Mulumbi (A)	7.35	<0.2	2.11	Afridev	6.96	<0.2	
MLII-51	Kachenge (A)	7.91	<0.2	0.41	India Mark-II	7.33	<0.2	
MLII-52	Kachenge (B)	7.45	0.5	0.44	India Mark-II	7.02	<0.2	
MLII-53	Scheme (A)	6.81	<0.2	0.06	Afridev	6.86	<0.2	
MLII-56	Chandika	6.87	<0.2	<0.01	Afridev	6.44	<0.2	
MLII-59	Kabange	6.91	<0.2	<0.01	Afridev	6.38	<0.2	
MLII-59.2	Kabange(B)	5.78	0.5	<0.01	Afridev	5.56	<0.2	
MLII-60	Itemba	6.77	<0.2	<0.01	Afridev	6.4	<0.2	
MLII-61	Kabayi	6.83	<0.2	2.28	Afridev	6.52	<0.2	
MLII-62	Chifwalo	6.59	<0.2	<0.01	Afridev	6.28	<0.2	
MLII-63	Kakasu	6.32	<0.2	<0.01	Afridev	6.38	<0.2	
MLII-64	Itemba Local Court	6.94	<0.2	<0.01	Afridev	6.61	<0.2	
MLII-65	Kalubini	6.44	0.5	<0.01	Afridev	6.14	<0.2	
MLII-66	Chabuka Baushi Basic Sch.	6.6	<0.2	0.02	Afridev	6.31	<0.2	
MLII-67	Kapalamuna	6.9	0.5	<0.01	Afridev	6.51	<0.2	
MLII-69	Chibende	6.79	<0.2	0,04	Afridev	6.43	<0.2	
MLII-70	Kalaba Shitembeye Com. Sch.	6.33	<0.2	<0.01	Afridev	6.18	<0.2	

Appendix 8-4　Lineament Analysis

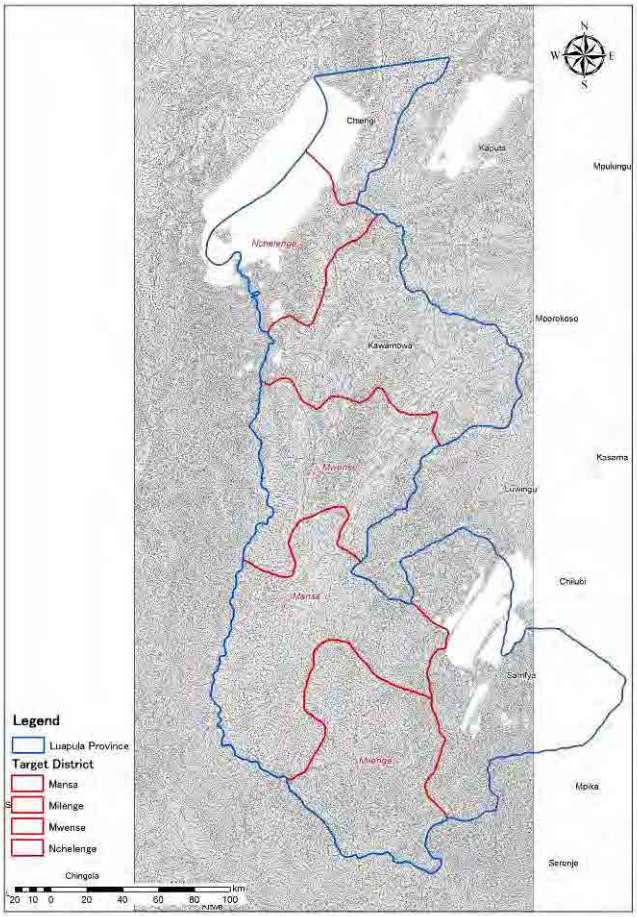
In the 4 districts of the Luapula province, a possibility that groundwater exists in fractured basement rock is high. In order to grasp the distribution of the fractured zones, lineament analysis in the 4 districts was conducted as advance-preparations work.

The lineament extraction was carried out using Digital elevation model (DEM) which can be obtained from the Internet.

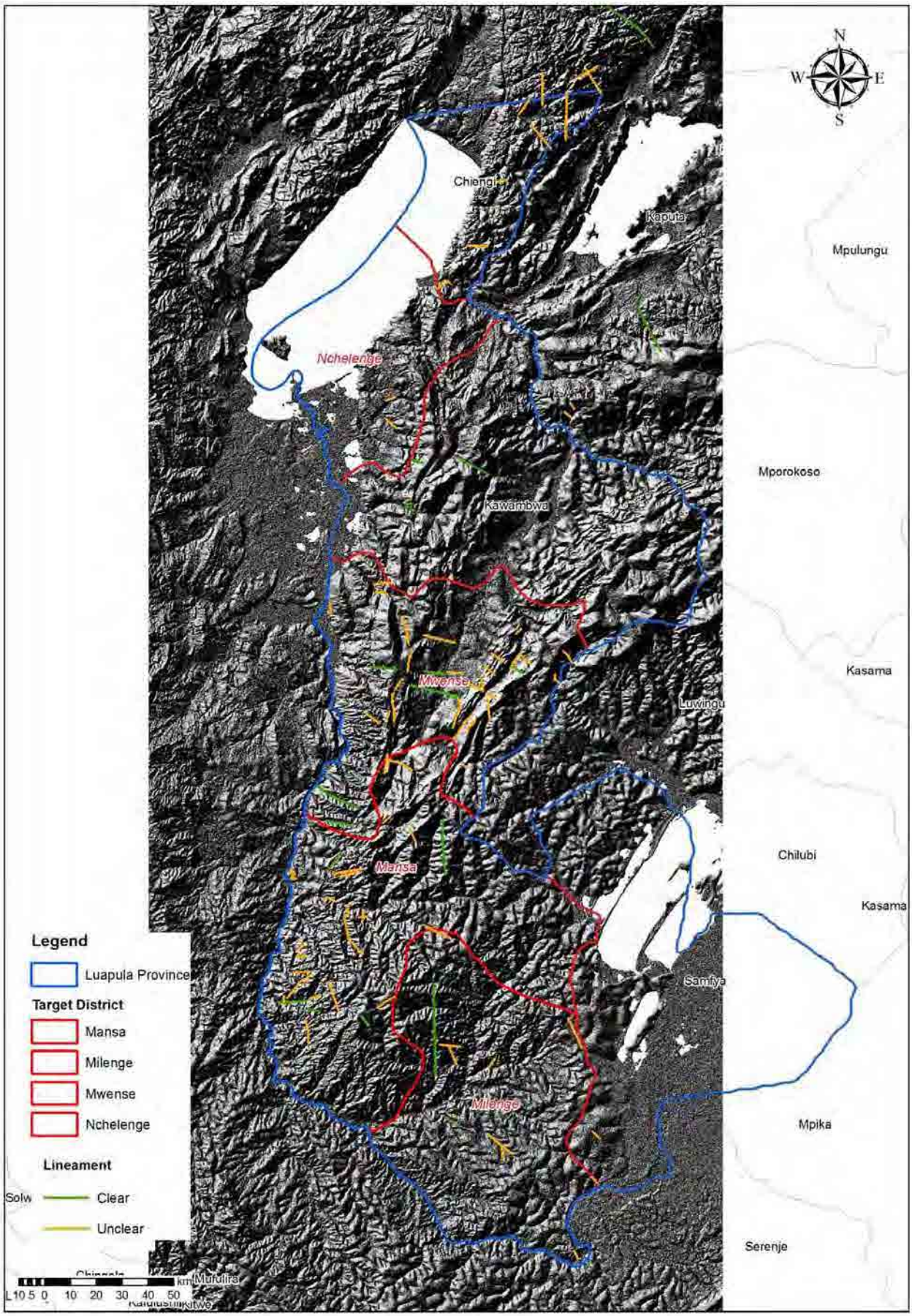
- Digital elevation model (DEM)：SRTM3-version 2
- Analysis method：Creation of shaded-relief map, aperture analysis



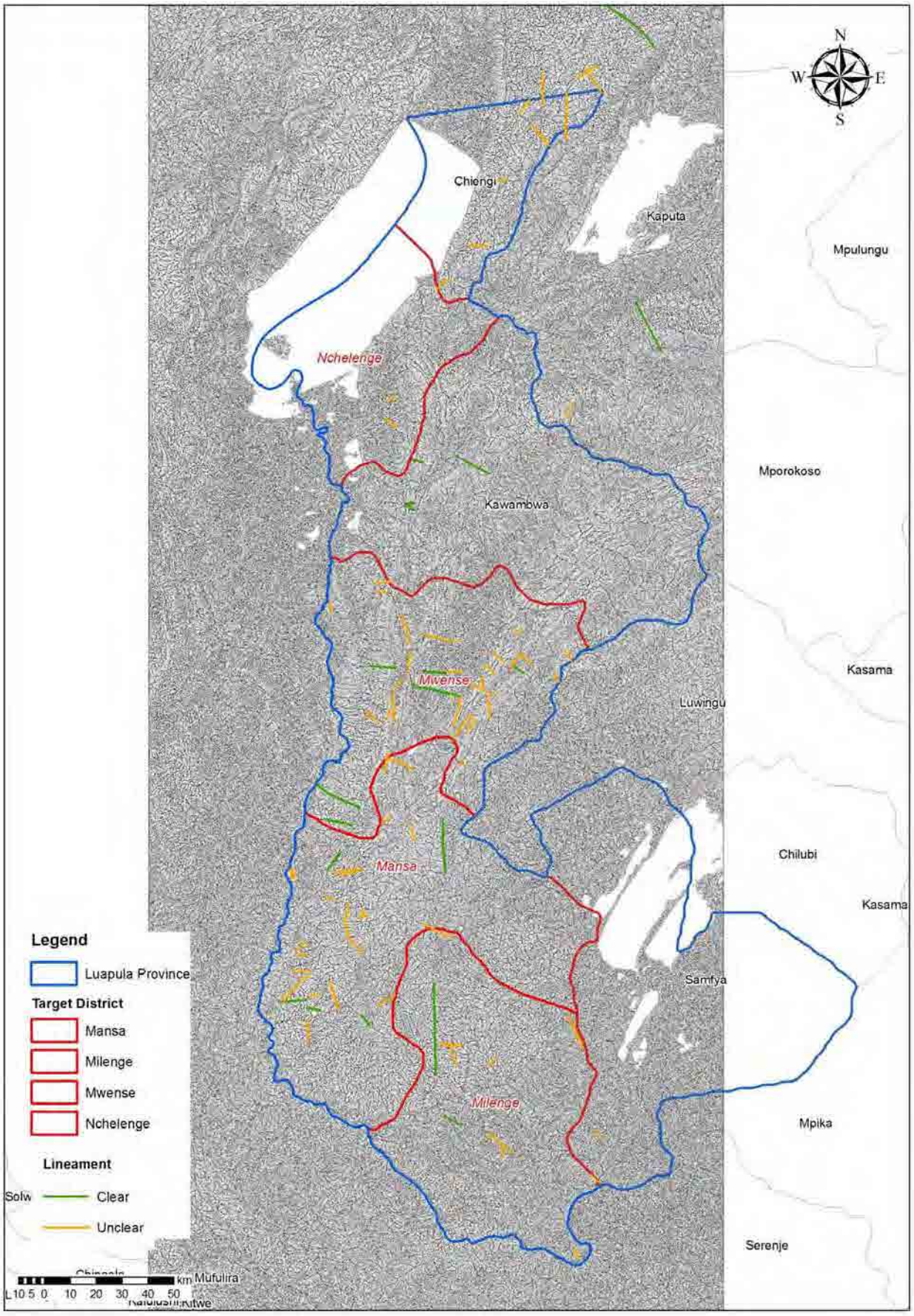
Shaded-relief map



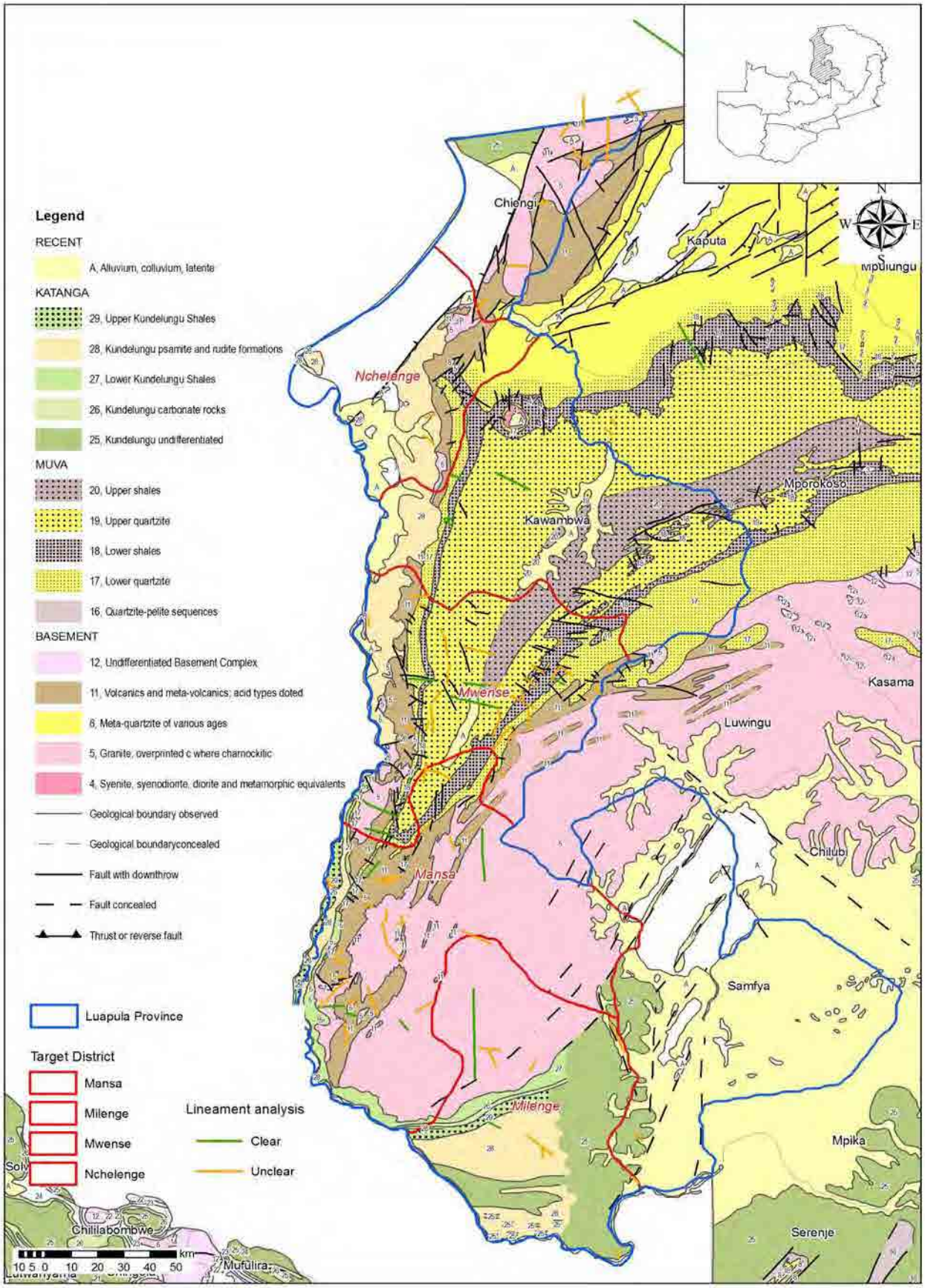
Aperture map



Lineament extraction result figure (Shaded relief map)



Lineament extraction result figure (Aperture map)



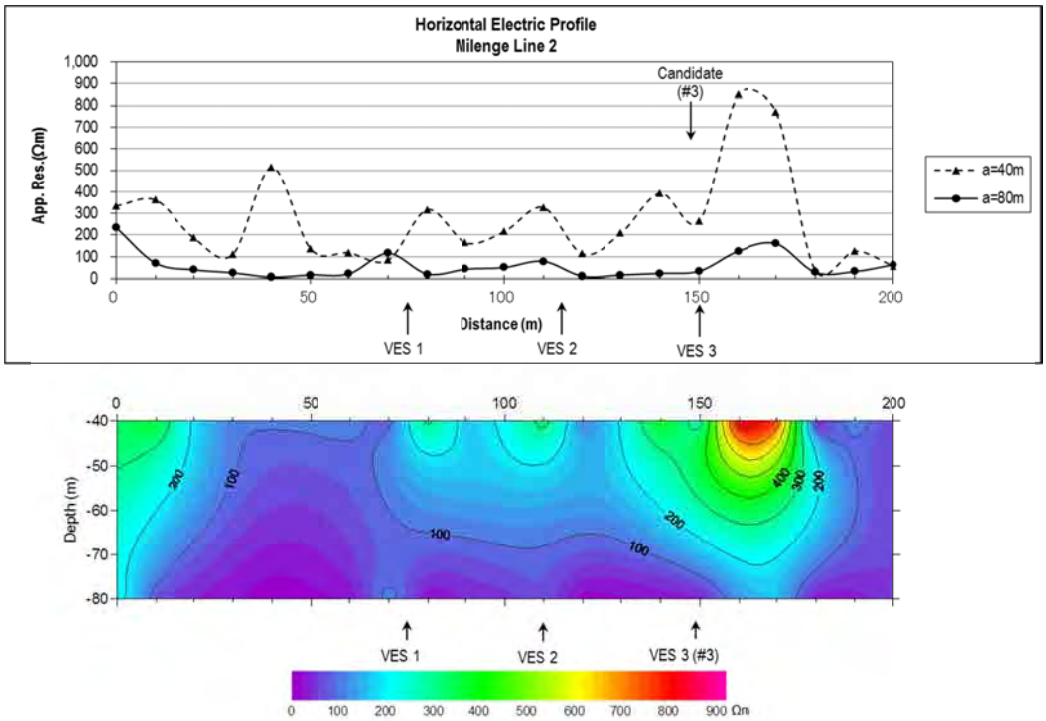
Source：Geological Map of Zambia, Geological Survey Department, 1994

Lineament extraction result figure (Superposed by the existing geological map)

Appendix 8-5 Geophysical Survey

1) Results of the Horizontal Electric Profile (HEP)

- Milenge Line 2（West-East）



i) Milenge, Milenge District

The target area is located approximately 900m to the south-southwest from Milenge District Headquarter and the Luapula River is flowing in the north side. This area is an area where Katanga Supergroup consisted of deposits layers from the Neoproterozoic to early Paleozoic era, mainly composed by sand stone and mud stone, is distributed.

As a result of the execution of 4 survey lines of HEP (total length of 800m), this area showed a resistivity between 10Ωm to 900Ωm and places showing a low resistivity anomaly was observed. 9 points were selected to carry out VES.

ii) Kapala, Mwense District

The target area is located along the main road, approximately 35km to the north from Mwense District Headquarter and the Luapula river is flowing in the west side. This area is an area where Katanga Supergroup consisted of deposits layers from Neoproterozoic to early Paleozoic era, mainly composed by sand stone and mud stone, is distributed.

As a result of the execution of 4 survey lines of HEP (total length of 800m), this area showed a resistivity between 100Ωm to 800 Ωm and places showing a low resistivity anomaly was observed.

8 points were selected to carry out VES.

The test drilling was carried out in 3 places selected from the results of the 8 VES points described above. As a result, it was not possible to confirm the presence of groundwater in these places and it was carried out 2 survey lines of HEP (total length of 400m) as additional survey. It was observed a resistivity between 130Ωm to 600Ωm and places showing low resistivity anomalies. 4 points were selected to carry out VES.

iii) Musangu Filling Station, Mwense District

The target area is located along the main road, approximately 15km to the north from Mwense District Headquarter and the Luapula river is flowing in the west side. This area is an area where Katanga Supergroup consisted of deposits layers from Neoproterozoic to early Paleozoic era, mainly composed by sand stone and mud stone, is distributed.

As a result of the execution of 4 survey lines of HEP (total length of 900m), this area showed a relatively higher resistivity between 200Ωm to 4,000Ωm and places showing a low resistivity anomaly was observed. 9 points were selected to carry out VES.

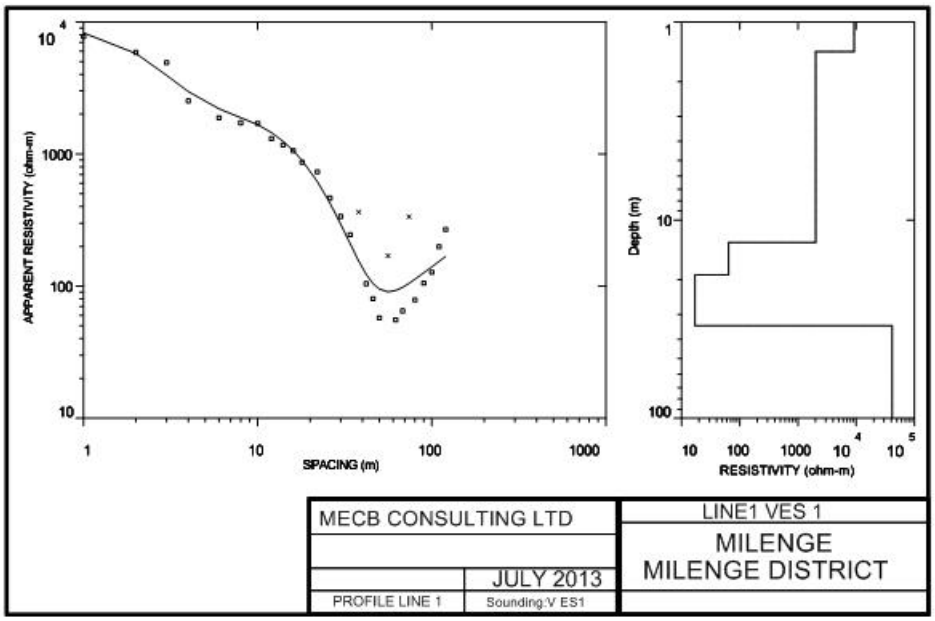
iv) Kapakala, Mwense District

The target area is located along the main road, approximately 1.5km to the north from Mwense District Headquarter. This area is an area where the Basement rock composed by granite, volcanic rocks and metamorphic rocks from the Archean to Paleoproterozoic era and Katanga Supergroup consisted of deposits layers from Neoproterozoic to early Paleozoic era, mainly composed by sand stone and conglomerate, is distributed.

As a result of the execution of 5 survey lines of HEP (total length of 900m), this area showed a resistivity between 430Ωm to 1,700Ωm and places showing a low resistivity anomaly was observed. 9 points were selected to carry out VES.

2) Results of Vertical Electrical Sounding (VES)

Vertical electrical sounding was carried out based in the above HEP results and candidate test drilling places were selected.



i) Milenge, Milenge District

From the surface to G.L- 15m, the resistivity varies significantly from 900Ωm to 6,000Ωm due to the difference in the grade of saturation and the composition of the surface layer. Generally, in deeper depth, the resistivity shows a high value of 1,500Ωm or more and it is supposed the existence of fresh rocks distributed in this area. However it was confirmed layers with low resistivity values varying from tens of Ωm to hundreds of Ωm.

ii) Kapala, Mwense District

From G.L. -10m to G.L -20m of the surface layer of 4 surveyed lines (Line 1 to Line 4), the soil is a dry soil not saturated and due to the difference in the grade of saturation and its composition, the resistivity values varying from 1,000Ωm to 7,000Ωm was observed. Under this layer was observed a layer with approximately 20m thickness with a low resistivity between tens of Ωm to hundreds of Ωm. In deeper depth, it is supposed that fresh rock is distributed in this area with resistivity values between 1,500Ωm to 6,000 Ωm with places showing the resistivity between 200Ωm to 500 Ωm.

In the additional survey, the result of VES can be divided in 2 categories. In Line A1, the surface layer, from G.L - 20m to G.L - 30m showed a high resistivity varying from 1,300Ωm to 4,300Ωm and under this layer it was observed a resistivity of hundreds of Ωm. In deeper depth, resistivity of approximately 5,000Ωm was observed, supposing the distribution of fresh rocks in this area.

In Line A2, from surface to around G.L. -8m, it was observed a high resistivity of 3,000Ωm, and

below, up to G.L. -30m the resistivity observed was around 400Ωm to 600Ωm. The resistivity observed from G.L.-30m to G.L. -70m was around 100Ωm and below, up to G.L. -120m, the resistivity observed was between 800Ωm to 1,000Ωm.

iii) Musangu Filling Station, Mwense District

Form the surface to G.L. -5m, the surface soil; due to a difference of the grade of saturation and its composition, it was observed a high resistivity between 3,000Ωm to 7,000Ωm. Under this layer is distributed a layer of hundreds of Ωm with inter-bedded places showing resistivity of tens of Ωm and thousands of Ωm.

iv) Kapakala, Mwense District

It is an area that indicates a relatively higher resistivity values, indicating a resistivity between 750Ωm to 2,000Ωm. Partially in the surface area, indicates a high resistivity between 4,000Ωm to 6,000Ωm. There are places where a resistivity of hundreds of Ωm were observed at different depths.

List of test drilling candidate places

District	Village	VES No.	Lat. S	Long. E	Candidate	Observation
Milenge	Milenge	L3-VES 2	12°24′38.67″	29°29′43.68″	1	Groundwater was confirmed
		L4-VES 2	12°24′41.41″	29°29′43.44″	2	
		L2-VES 3	12°24′38.78″	29°29′35.59″	3	
Mwense	Kapala	L2-VES 3	10°05′00.54″	28°38′40.37″	1	
		L4-VES 2	10°05′00.94″	28°38′33.93″	2	
		L3-VES 1	10°05′05.01″	28°38′34.87″	3	
		A1-VES 1	28.638070	10°04′36.94″	1	Groundwater was confirmed (additional survey)
		A2-VES 2	10°04′52.60″	28°38′24.25″	2	(additional survey)
	Musangu Filling Station	L1-VES 1	10°14′25.41″	28°39′22.95″	1	
		L4-VES 1	10°14′21.68″	28°39′32.12″	2	Groundwater was confirmed
		L3-VES 1	10°14′10.20″	28°39′22.91″	3	
	Kapakala	L4-VES 2	10°22′38.80″	28°41′53.10″	1	
		L5-VES 1	10°22′42.33″	28°41′43.06″	2	Groundwater was confirmed
		L3-VES 2	10°22′35.26″	28°42′01.55″	3	

Groundwater was confirmed: Places where sufficient quantity of water was confirmed in the test drilling and can be used as a source for the piped water supply schemes.

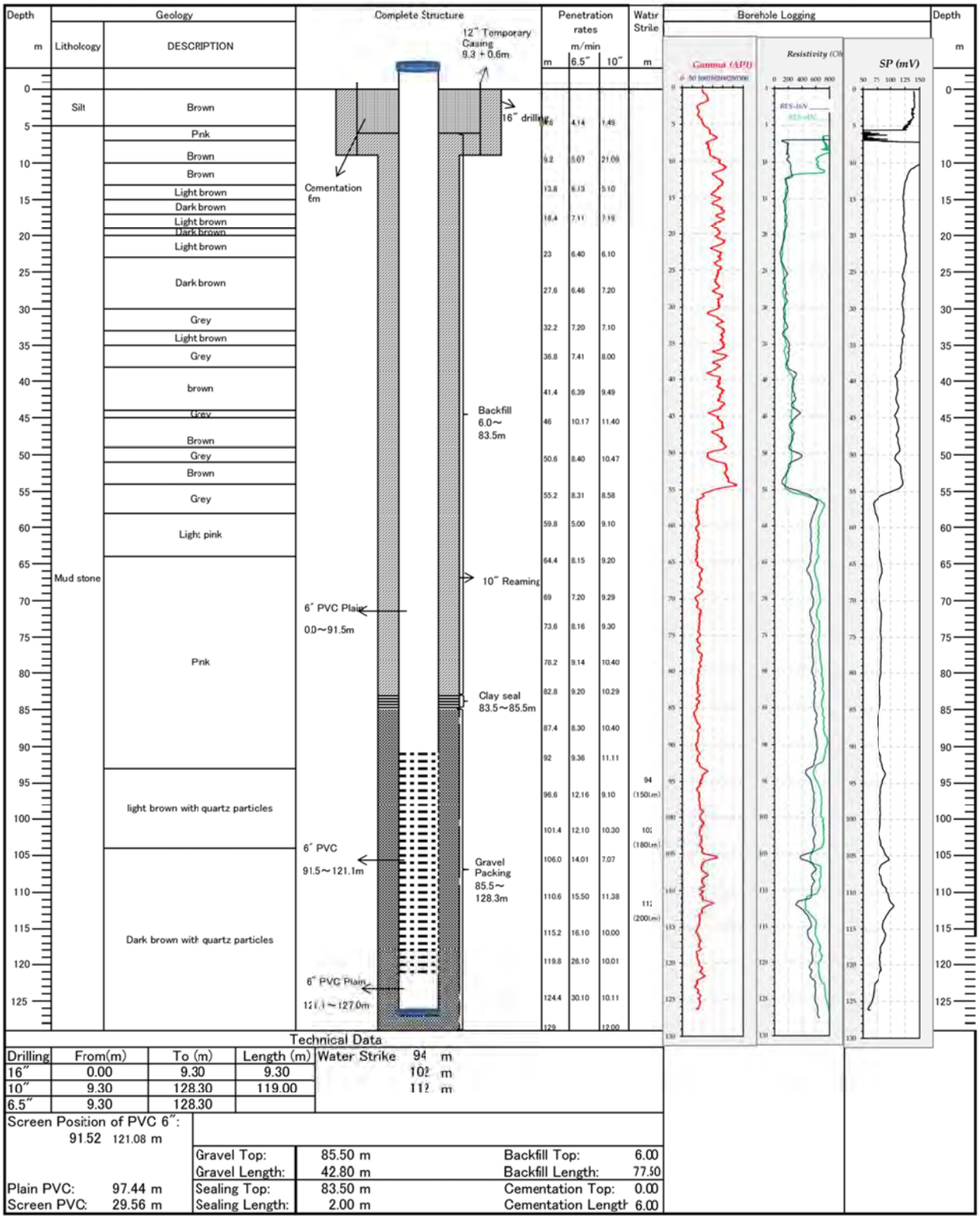
Appendix 8-6 Test Drilling

1. Kapala, Mwense District

The Project for Groundwater Development in Luapula Province Phase 3
Form of Quality Control

Drilling Work
Form Name: Drilling Report
Coordinates:
E : 28° 53' 626" S : 11° 12' 143"

Borehole No. Kapala
District Mwense
Site name Kapala 4
Date of Com 15-Aug-2013
Date of Com 29-Aug-2013
Contractor Zambezi Drilling & Exploration Ltd



Technical Data

Drilling	From(m)	To (m)	Length (m)
16"	0.00	9.30	9.30
10"	9.30	128.30	119.00
6.5"	9.30	128.30	

Water Strike 94 m
102 m
112 m

Screen Position of PVC 6":
91.52 121.08 m

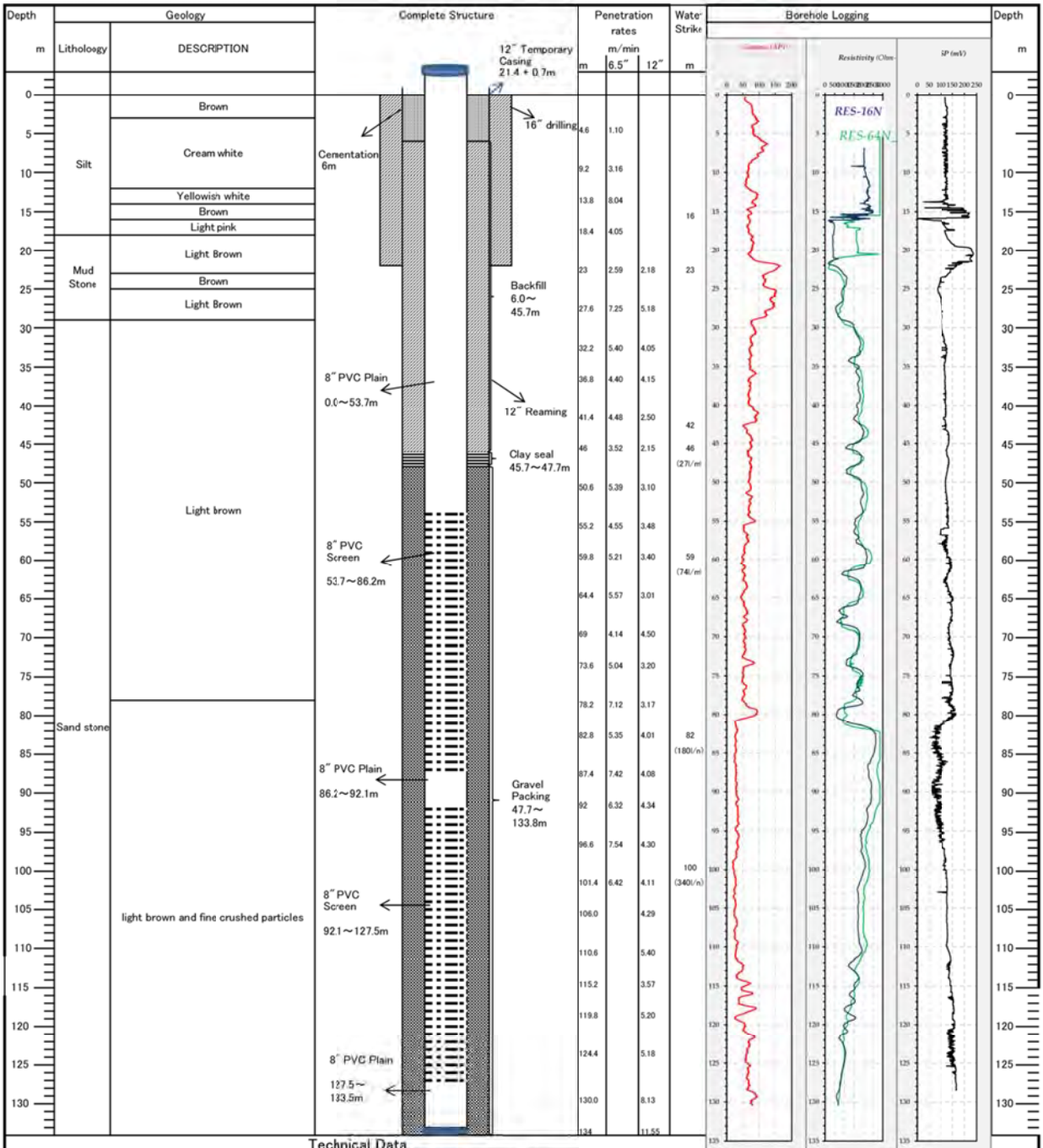
		Gravel Top:	85.50 m	Backfill Top:	6.00
		Gravel Length:	42.80 m	Backfill Length:	77.50
Plain PVC:	97.44 m	Sealing Top:	83.50 m	Cementation Top:	0.00
Screen PVC:	29.56 m	Sealing Length:	2.00 m	Cementation Length	6.00

2. Musangu, Mwense District

The Project for Groundwater Development in Luapula Province Phase 3
Form of Quality Control

Drilling Work
Form Name: Drilling Report
Coordinates:
E : 28° 39' 538" S : 10° 14' 363"

Borehole No. Musangu 2
District Mwense
Site name Musangu 2
Date of Com 27-Jul-2013
Date of Com 2-Sep-2013
Contractor Zambezi Drilling & Exploration Ltd



Technical Data

Drilling	From(m)	To (m)	Length (m)
16″	0.00	21.40	21.40
10″	21.40	133.80	112.40
6.5″	0.00	101.00	

Water Strike: 16 m, 59 m; 23 m, 82 m; 42 m, 100 m; 46 m

Screen Position of PVC 6″:
53.74 86.21 m
92.12 127.49 m

Plain PVC: 65.66 m
Screen PVC: 67.84 m

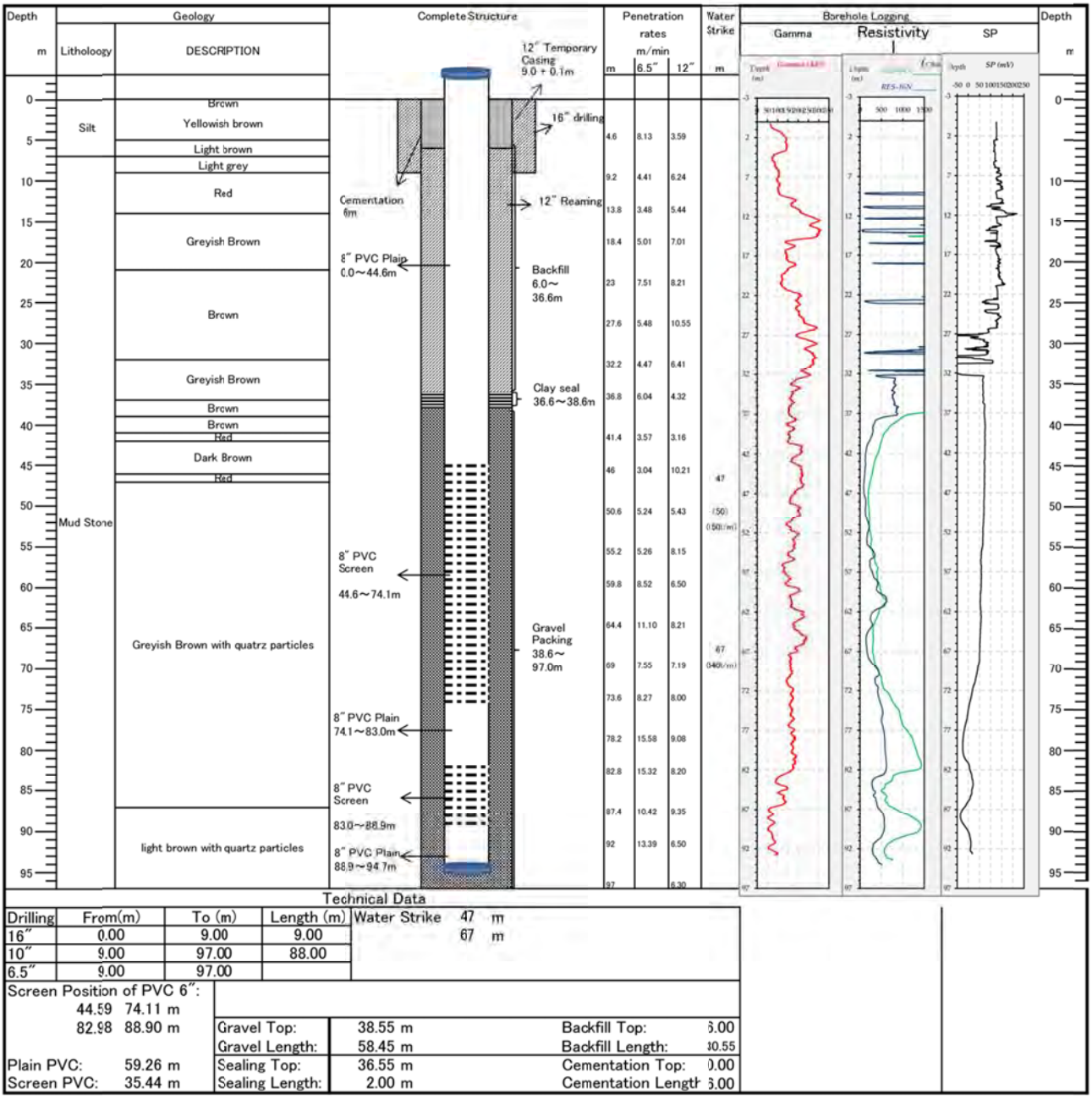
Gravel Top:	47.70 m	Backfil Top:	6.00
Gravel Length:	86.10 m	Backfil Length:	39.70
Sealing Top:	45.70 m	Cementation Top:	0.00
Sealing Length:	2.00 m	Cementation Length	6.00

3. Kapakala, Mwense District

The Project for Groundwater Development in Luapula Province Phase 3
Form of Quality Control

Drilling Work
Form Name: Drilling Report
Coordinates:
E : 28^0 41' 718" S : 10^0 22' 707"

Borehole No. Kapakala 2
District Mwense
Site name Kapakala 2
Date of Com 29-Jul-2013
Date of Com 6-Sep-2013
Contractor Zambezi Drilling & Exploration Ltd



Technical Data

Drilling	From(m)	To (m)	Length (m)	Water Strike	47 m
16"	0.00	9.00	9.00		67 m
10"	9.00	97.00	88.00		
6.5"	9.00	97.00			

Screen Position of PVC 6":
44.59 74.11 m
82.98 88.90 m

Plain PVC: 59.26 m
Screen PVC: 35.44 m

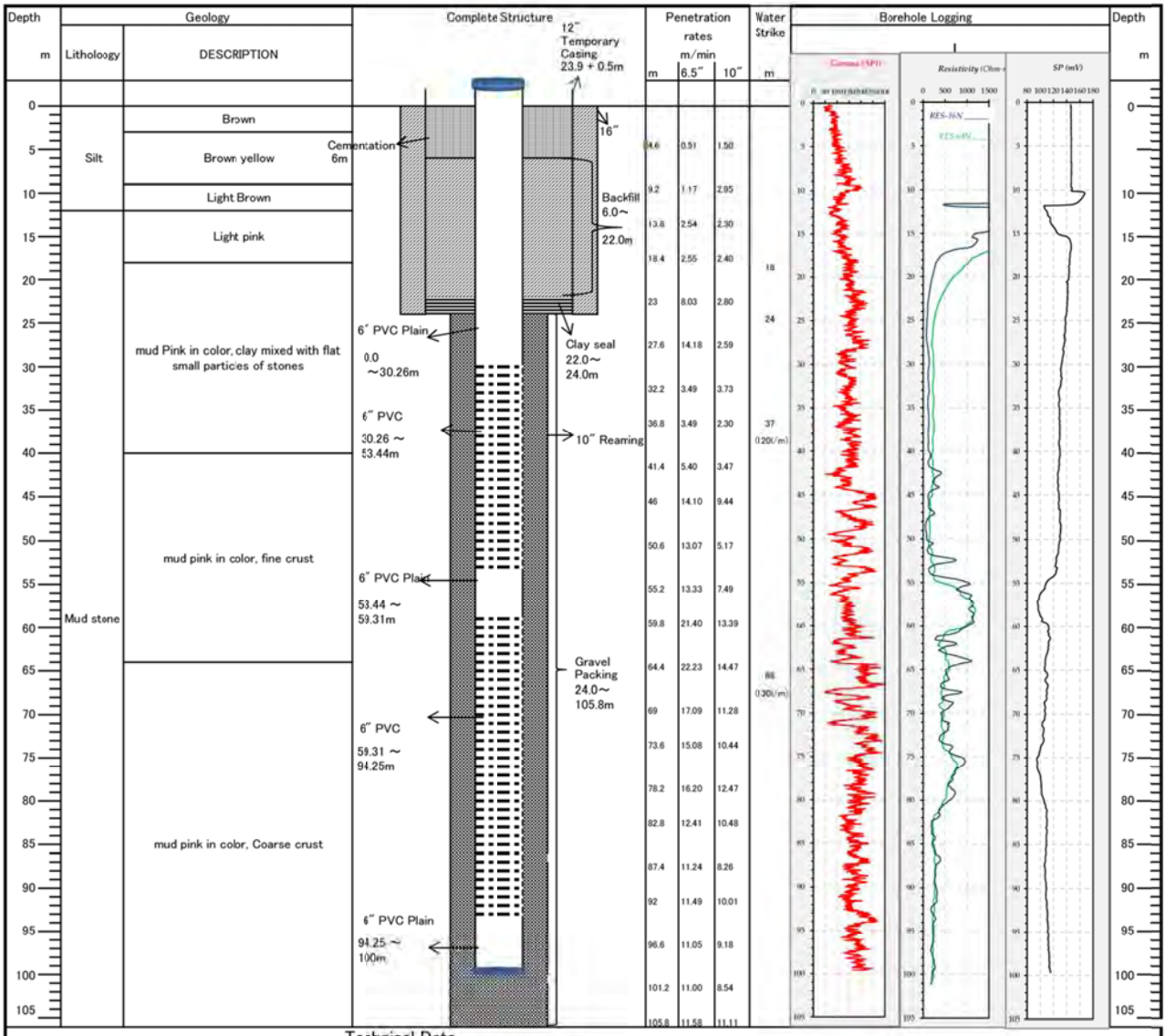
Gravel Top:	38.55 m	Backfill Top:	5.00
Gravel Length:	58.45 m	Backfill Length:	30.55
Sealing Top:	36.55 m	Cementation Top:	0.00
Sealing Length:	2.00 m	Cementation Length	5.00

4. Milenge, Milenge District

The Project for Groundwater Development in Luapula Province Phase 3

Drilling Work
Form Name: Drilling Report
Coordinates:
E : 28° 53' 626" S : 11° 12' 143"

Borehole No. Milenge 1
District Milenge
Site name Milenge 1
Date of Com 12-Jul-2013
Date of Com 23-Jul-2013
Contractor Zambezi Drilling & Exploration Ltd



Technical Data

Drilling	From(m)	To (m)	Length (m)
16"	0.00	23.90	23.90
10"	23.90	105.80	81.90
6.5"	0.00	105.80	

Water Strike 18 m
24 m
37 m

Screen Position of PVC 6":
30.26 53.44 m
59.31 94.25 m

Plain PVC: 41.88 m
Screen PVC: 58.12 m

Gravel Top:	24.00 m	Backfill Top:	0.00
Gravel Length:	81.80 m	Backfill Length:	6.00
Sealing Top:	22.00 m	Cementation Top:	0.00
Sealing Length:	2.00 m	Cementation Length	6.00

Appendix 8-7 Geological Survey

1. Kabuta, Nchelenge District

RECORD OF SUBSURFACE INVESTIGATION

TYPE OF BORING:	STANDARD PENETRATION TEST (S.P.T)	**DATE OF BORING:**	8 August 2013
LOCATION:	KABUTA SITE, NCHELENGE DISTRICT	**BORING NUMBER:**	4
OPERATOR:	NOSIDE SOIL LABORATORY	**EQUIPMENT TYPE:**	ARCHWAY SPT RIG

Description	Profile	Depth (m)	Blows	N	Wc	y	Remarks
Top Soil (0-0.95m) overlying a hard igneous rock 0.95		1	8	>50			 - No penetration could be registered by the S.P.T spoon Early Refusal at 0.95m
		2					
		3					
		4					
		5					
		6					
		7					
		8					
		9					
		10					

GROUND LEVEL		BULK SAMPLE	B
WATER LEVEL		UNDISTURBED SAMPLE	D
S.P.T		UNDISTURBED SAMPLE	U
		WATER SAMPLE	W

Client:	Project Title:	Consultant:
JAPAN TECHNO CO., LTD	Geological Survey for the Preparatory Survey on the Project for Groundwater development in Luapula Province, Phase 3 in The Republic of Zambia	WRC Consultants Ltd

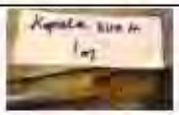
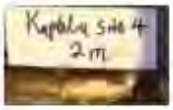
2. Kapala, Mwense District

RECORD OF SUBSURFACE INVESTIGATION

TYPE OF BORING: STANDARD PENETRATION TEST (S.P.T) **DATE OF BORING:** 9 August 2013

LOCATION: KAPALA SITE, MWENSE DISTRICT **BORING NUMBER:** 5

OPERATOR: NOSIDE SOIL LABORATORY **EQUIPMENT TYPE:** ARCHWAY SPT RIG

Description	Profile	Depth (m)	Blows	N	Wc	γ	Remarks
Slightly moist dark brownish clayey lateritic gravel		1	3 2 3	5			
Slightly moist brownish clayey sand overlying hard rock		2	6 27 24	51			 Early Refusal at 1.75m - No penetration registered after more than 5 blows
		3					
		4					
		5					
		6					
		7					
		8					
		9					
		10					

GROUND LEVEL ↓

WATER LEVEL ▽

S.P.T ↓

BULK SAMPLE ● B

UNDISTURBED SAMPLE ■ D

UNDISTURBED SAMPLE ■ U

WATER SAMPLE ● W

Logged by Lawrence Ridaston Drawn by Clifford Mwelwa

Client:	Project Title:	Consultant:
JAPAN TECHNO CO., LTD	Geological Survey for the Preparatory Survey on the Project for Groundwater development in Luapula Province, Phase 3 in The Republic of Zambia	WRC Consultants Ltd

3. Musangu, Mwense District

RECORD OF SUBSURFACE INVESTIGATION

TYPE OF BORING:	STANDARD PENETRATION TEST (S.P.T)	**DATE OF BORING:**	7 August 2013
LOCATION:	MUSANGU SITE, MWENSE DISTRICT	**BORING NUMBER:**	3
OPERATOR:	NOSIDE SOIL LABORATORY	**EQUIPMENT TYPE:**	ARCHWAY SPT RIG

Description	Depth (m)	Blows	N	Wc	γ
Slightly moist brownish clay with laterites stones (0–1)	1	3, 4, 4	8		
Slightly moist light brown clayey sand (1–2)	2	2, 3, 4	7		
Slightly moist reddish brown clayey sand (2–8)	3	2, 3, 4	7		
	4	2, 3, 3	6		
	5	5, 6, 7	13		
	6	8, 10, 11	21		
	7	10, 13, 14	27		
	8	9, 12, 15	27		
Slightly moist speckled yellowish silty sand (8–10)	9	11, 12, 15	27		
	10	10, 17, 15	32		

Remarks:

GROUND LEVEL	⊥	BULK SAMPLE	● B
WATER LEVEL	▽	UNDISTURBED SAMPLE	▮ D
S.P.T	↓	UNDISTURBED SAMPLE	▮ U
		WATER SAMPLE	● W

Logged by Lawrence Kalaba — Drawn by Clifford Mutibuka

Client:	Project Title:	Consultant:
JAPAN TECHNO CO., LTD	Geological Survey for the Preparatory Survey on the Project for Groundwater development in Luapula Province, Phase 3 in The Republic of Zambia	WRC Consultants Ltd

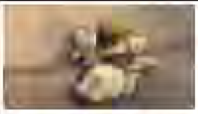
4. Kapakala, Mwense District

RECORD OF SUBSURFACE INVESTIGATION

TYPE OF BORING: STANDARD PENETRATION TEST (S.P.T) **DATE OF BORING:** 7 August 2013

LOCATION: KAPAKALA SITE, MWENSE DISTRICT **BORING NUMBER:** 2

OPERATOR: NOSIDE SOIL LABORATORY **EQUIPMENT TYPE:** ARCHWAY SPT RIG

Description	Profile	Depth (m)	Blows	N	Wc	γ	Remarks
Thin layer of top soil overlying a hard igneous rock 0.1			16				 Early Refusal at 0.1m
Igneous rock		1	↓	>50			- The sampler only went in 10 centimetres and got damaged by the hard rock. - No Samples were collected in the sampler
		2					
		3					
		4					
		5					
		6					
		7					
		8					
		9					
		10					

GROUND LEVEL	⊥	BULK SAMPLE	● B
WATER LEVEL	▽	UNDISTURBED SAMPLE	■ D
S.P.T	↓	UNDISTURBED SAMPLE	■ U
		WATER SAMPLE	● W

Logged by [illegible] Drawn by Clifford [illegible]

Client:	Project Title:	Consultant:
JAPAN TECHNO CO., LTD	Geological Survey for the Preparatory Survey on the Project for Groundwater development in Luapula Province, Phase 3 in The Republic of Zambia	WRC Consultants Ltd

5. Milenge, Milenge District

RECORD OF SUBSURFACE INVESTIGATION

TYPE OF BORING: STANDARD PENETRATION TEST (S.P.T) **DATE OF BORING:** 1 August 2013

LOCATION: MILENGE SITE, MILENGE DISTRICT **BORING NUMBER:** 1

OPERATOR: NOSIDE SOIL LABORATORY **EQUIPMENT TYPE:** ARCHWAY SPT RIG

Description	Profile	Depth (m)	Blows	N	Wc	y	Remarks
Slightly moist dark brownish clayey sand		1	4, 6, 7	13			
Slightly moist reddish brown clayey sand		2	2, 4, 3	7			
		3	2, 2, 4	6			
		4	2, 3, 3	6			
		5	2, 3, 3	6			
		6	2, 3, 3	6			
Slightly moist light brown clayey sand		7	3, 4, 10	14			
Slightly moist reddish brown silty sand with traces of yellowish znest		8	8, 13, 15	28			
Slightly moist yellowish silty sand - **Saprolite** (completely weathered)		9	9, 20, 20	40			
Slightly moist purplish silty sand **Saprolite** (completely weathered)		10		>50			Refusal at 10m

GROUND LEVEL		BULK SAMPLE	B
WATER LEVEL		UNDISTURBED SAMPLE	D
S.P.T		UNDISTURBED SAMPLE	U
		WATER SAMPLE	W

Logged by Lawrence Rolobo

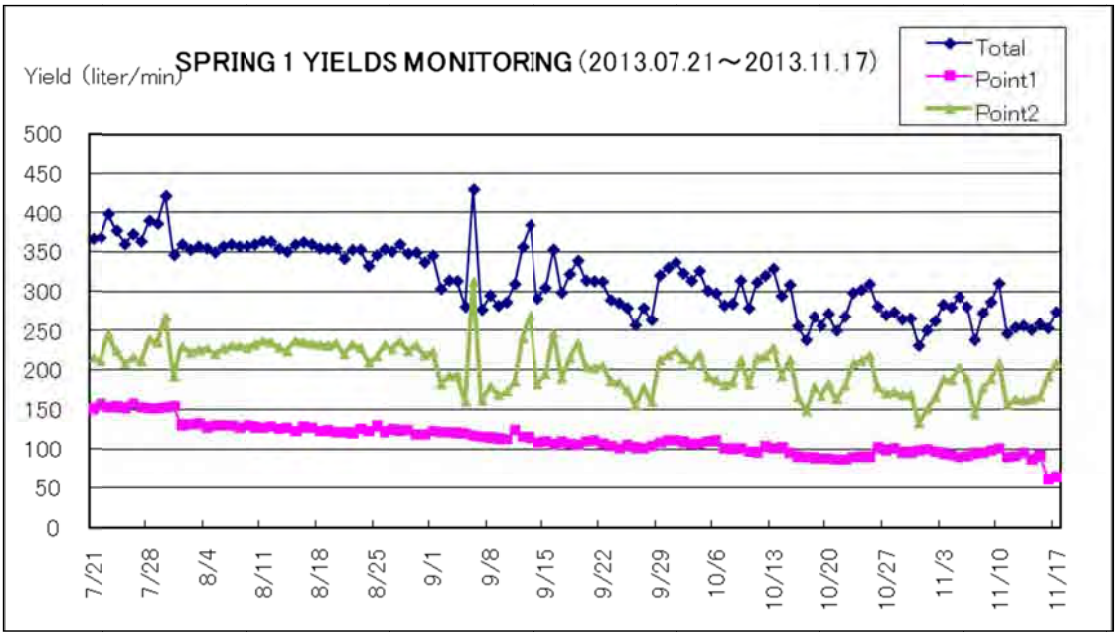
Drawn by Clifford Mositiwa

Client:	Project Title:	Consultant:
JAPAN TECHNO CO., LTD	Geological Survey for the Preparatory Survey on the Project for Groundwater development in Luapula Province, Phase 3 in The Republic of Zambia	WRC Consultants Ltd

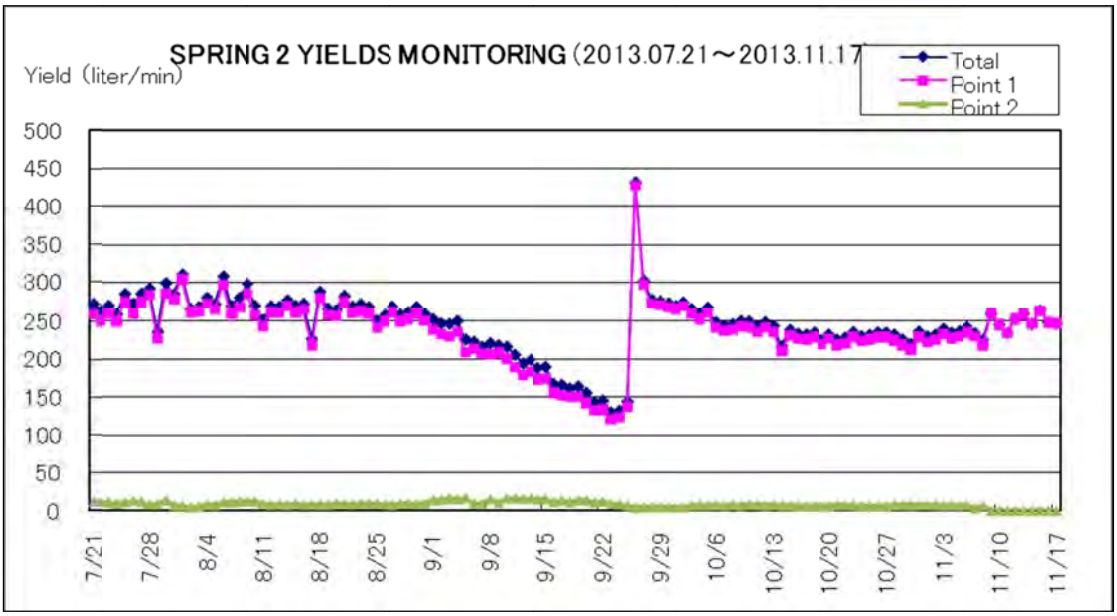
Appendix 8-8　Spring Monitoring Survey（Kabuta, Nchelenge）

①Yields Monitoring

Spring Point 1



Spring Point 2



② Water Quality Analysis

Date	Water Quality Indicators																										
	Temperature	Turbidity	pH	EC	TS	Colour	Odour	Taste	Nitrate	Nitrite	Iron	Copper	Chloride	Alkalinity	Calcium Hardness	Total Hardnes	Calcium	Cadmium	Magnesium	Manganese	Lead	Fluoride	Boron	Ammonia	Arsenic	Total Coliform	Faecal Coliform
	°C	NTU	-	µs/cm	mg/l	TCU	-	-	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	No/100ml	No/100ml
Guideline Value	NS	NS	6.5-8.0	NS	NS	<15	Normal	Normal	<10	<1.0	<1.0	<1.0	<250	NS	NS	<500	<200	<0.005	<150	<0.1	<0.01	<1.5	NS	<1.5	<0.05	0	0
Spring 1																											
08/29/13	25.9	0.68	5.95	96.10	60.00	7.00	Normal	Normal	0.18	0.003	0.09	<0.003	10.0	90.0	72	92.0	28.8	<0.0002	4.8	<0.01	<0.01	0.05	<0.3	<0.01	<0.0002	44	14
09/29/13	27.0	0.64	6.20	93.90	60.00	10.00	Normal	Normal	0.09	0.002	0.28	<0.003	18.0	78.0	30	82.0	26.2	<0.0002	12.5	<0.01	<0.01	0.04	<0.3	<0.01	<0.0002	15	8
10/31/13	27.8	0.65	5.76	95.00	65.00	8.00	Normal	Normal	0.12	0.003	0.15	<0.003	21.0	82.0	48	88.0	24.7	<0.0002	8.5	<0.01	<0.01	0.05	<0.3	<0.01	<0.0002	30	9
11/17/13	27.8	0.70	5.85	90.60	62.00	8.50	Normal	Normal	0.15	0.003	0.12	<0.003	15.0	88.0	58	90.0	30.2	<0.0003	8.5	<0.01	<0.01	0.04	<0.3	<0.01	<0.0003	74	32
Spring 2																											
08/29/13	25.6	0.49	5.73	86.50	62.00	7.00	Normal	Normal	0.22	0.010	0.11	<0.003	10.0	140.0	78	146.0	31.2	<0.0002	11.5	<0.01	<0.01	0.04	<0.3	<0.01	<0.0002	17	2
09/29/13	26.0	0.89	5.77	85.45	58.00	7.00	Normal	Normal	0.09	0.000	0.09	<0.003	20.0	76.0	28	80.0	28.4	<0.0002	12.5	<0.01	<0.01	0.04	<0.3	<0.01	<0.0002	20	10
10/31/13	26.5	0.55	5.68	100.30	52.00	6.00	Normal	Normal	0.12	0.010	0.15	<0.003	18.0	88.0	38	98.0	35.5	<0.0002	13.2	<0.01	<0.01	0.03	<0.3	<0.01	<0.0002	28	1
11/17/13	26.5	0.75	6.03	97.90	60.00	7.00	Normal	Normal	0.18	0.010	0.13	<0.003	17.0	92.0	35	110.0	30.2	<0.0003	12.9	<0.01	<0.01	0.03	<0.3	<0.01	<0.0002	120	80

Appendix-8-9 Socio-Economic Survey

1. Background

In the Republic of Zambia, National Water Policy was revised in February 2010. Concerning rural water supply and sanitation, the National Rural Water Supply and Sanitation Programme (2006-2015) was officially announced in November 2007 with aims to improve the rural water accessibility rate to 75% by 2015 in line with the MDGs. This objective is also raised in the Sixth National Development Programme 2011-2015 (SNDP). Furthermore, Vision 2030 (December 2006) stipulates that the national coverage rate for safe water of 63% in 2010 is to be increased to 80% in 2015 and eventually become 100% in 2030.

In order to contribute in achieving the above goals, in 2004, the Zambian government requested to the Japanese Government a Grant Aid for the "Project for Groundwater Development in Luapula Province" (hereinafter, referred to as "Phase I Project") targeting all 7 districts of Luapula Province which had the lowest access rate to safe water among the 9 provinces in Zambia, and "Project for Ground Water Development in Luapula Province Phase II" (hereinafter referred as "Phase II Project") in 2009. In succession to "Phase I Project" and "Phase II Project", with aims to further increase the access rate to safe and stable water in Luapula Province, in August 2011, the "Phase III Project" as Grant Aid Project was requested to the Japanese Government. This project, as a result of construction of 200 boreholes fitted with hand pumps and 5 piped water supply schemes at 4 target districts (Nchelenge, Mwense, Mansa and Milenge) of Luapula Province, aims to increase the number of beneficiary population.

The Socio economic survey was conducted as a part of Preparatory Survey of the Project to confirm validity of the Project, to design appropriate Grant Aid Project plan, and to calculate the cost of the Project, and aims to examine sustainability of the Project and demands for improved water supply facilities.

2. Socio-Economic Survey Data

1) Objectives of the Survey

Aimed the followings, socio-economic survey was conducted in a) 320 sites for construction of boreholes fitted with hand pumps, and b) 8 sites for construction of piped water supply schemes, which were requested by implementing agency.

1. To assemble basic information on socio-economic conditions
2. To grasp the communities' willingness and capacity to improve living conditions, ability to contribute, and their assessment of current situation and needs related to water and sanitation
3. To extract social conditions to take in account for the planning of the Project
4. To collect baseline data of indicators for impact evaluation of the project

2) Contents and method of the Survey

2-1) Boreholes fitted with hand pumps

Items	1. Interview with the site representatives	2. Household Survey
Survey target sites	320 candidate sites for construction of boreholes fitted with hand pumps (Nchelenge 90, Mwense 100 Mansa 60 Milenge 70)※1	
Number of Sample	320 samples (1 sample × 320 sites)	1,920 samples (6 household samples × 320 sites)※1
Contents of the Survey	Basic information of the sites Demographic information (household population, immigration, etc.) Situation of Infrastructure Water supply situation (types of existing water facilities, operational status, Operation and Maintenance (O&M) activity status, etc.) Needs and demands for water supply	Basic household information Household economic situation Water supply situation (sources of water collected, time required for water collection, frequency of water collection, distance, water fee, etc.) Health and sanitation situation (major diseases affecting household, causes of diarrhoea, etc.) Needs and demands for water supply
Respondents	Representatives of the sites such as village heads, members of school, V-WASHE, NGO, etc.	Community members randomly selected in the target 320 sites.
Survey Method	Structured interview based on questionnaires prepared by the Survey Team	

※1 In Milenge District, due to difficulty in accessing 9 sites, the Survey was conducted in 61 sites out of requested 70.

2-2) Piped Water Supply Schemes

Items	1. Participatory Rural Appraisal (PRA)	2. Household Survey
Survey target sites	8 candidate sites for construction of piped water supply schemes (Nchelenge 3, Mwense 4, Milenge 1)	
Number of Sample	8 samples (1 workshop × 8 sites)	160 samples (20 sample households × 8 sites)
Contents of the Survey	Basic information of the sites Demographic information (household population, immigration, etc.) Situation of Infrastructure Water supply situation (types of existing water facilities, operational status, O&M activity status, etc.) Needs and demands for water supply	Basic household information Household economic situation Water supply situation (sources of water collected, time required for water collection, frequency of water collection, distance, water fee, etc.) Health and sanitation situation (major diseases affecting household, causes of diarrhoea, etc.) Needs and demands for water supply
Respondents	About 20 representatives of the sites such as village heads, members of school, V-WASHE, NGO, etc.	Community members randomly selected in the target 8 sites.
Survey Method	PRA(Community mapping, Focus Group Discussion)	Structured interview based on questionnaires prepared by the Survey Team

3) Survey Data[1]

3-1) Boreholes fitted with hand pumps

3-1-1) Survey data of the Household Survey

I. Details of respondents and Household Heads

The sex ratio of the respondents was 39.9% male and 60.1% female, showing a slightly higher number of female respondents. The age distribution of respondents shows age group between 21-30 years old with 34.6%, followed by age group 31-40 at 25.8%, 41-50 years old age group with 15.8%, and 51-60 age group with 8.5%, indicating majority of them are age between 21-40 years old.

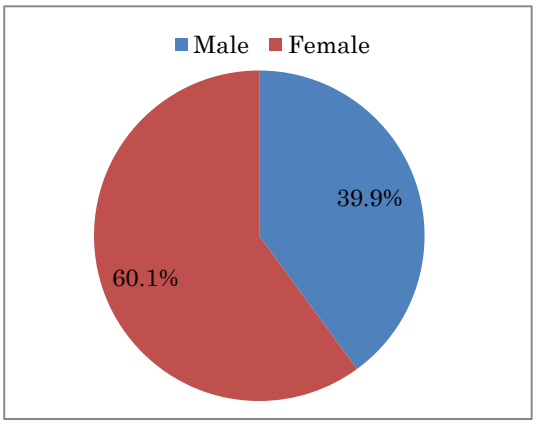


Figure 1 Sex of Respondent

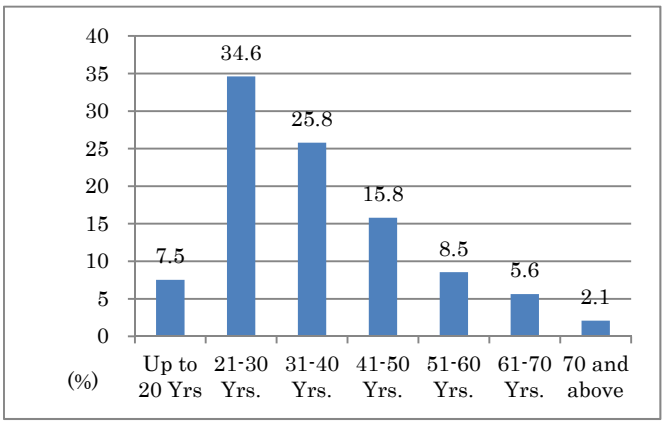


Figure 2 Age of Respondent

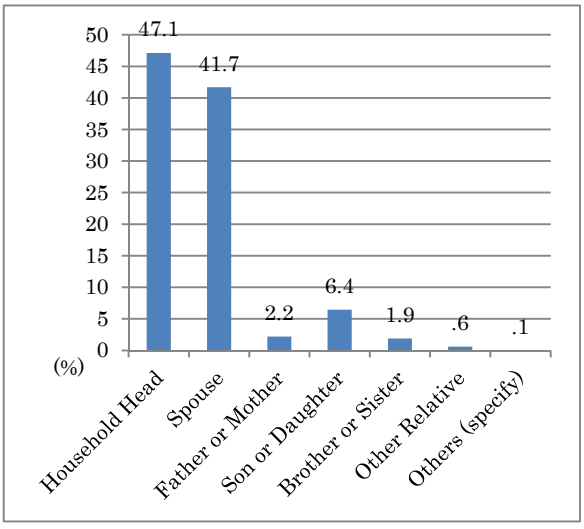


Figure3 Respondent's relationship to the household head

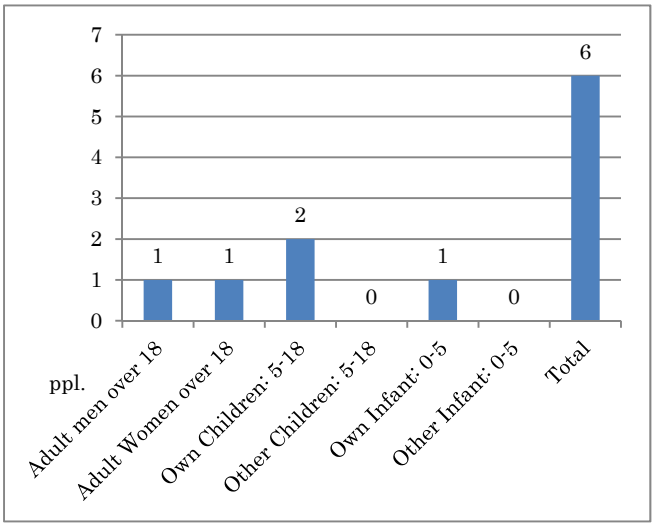


Figure 4 Household Population (Median)

[1] Description of the Survey Analysis Result: Figures are shown in percentages. The sum of figures may not add up to 100% as figures are rounded off to the nearest whole number. In cases of Multiple Answer questions, the sum may exceed 100% as the percentages are of total number of respondents.

II. Priority for improvement of living conditions

Table 1 1st priority for the household for improving living condition

District	Don't know	Improve electricity	Improve health services	Improve education	Improve water supply services	Improve sanitation /sewerage system	Improve disposal of garbage	Improve road access	Other (specify)	Improve Farming Productivity	Creation of Market place	Hammer Mill
Nchelenge	0.2%	3.3%	16.9%	2.6%	72.6%	1.5%	0.4%	2.4%	0.2%	0.0%	0.0%	0.0%
Mwense	0.5%	11.6%	10.4%	7.9%	59.7%	3.5%	0.2%	2.2%	0.8%	1.5%	1.5%	0.2%
Mansa	0.3%	6.4%	17.5%	6.9%	49.7%	4.2%	0.3%	11.7%	0.8%	0.8%	0.8%	0.6%
Milenge	0.3%	4.4%	18.9%	1.6%	58.7%	1.9%	0.0%	13.4%	0.3%	0.5%	0.0%	0.0%
Total	0.3%	6.8%	15.3%	4.9%	61.3%	2.7%	0.2%	6.3%	0.5%	0.8%	0.6%	0.2%

Table 2 2nd priority for the household for improving living condition

District	Don't know	Improve electricity	Improve health services	Improve education	Improve water supply services	Improve sanitation/ sewerage system	Improve disposal of garbage	Improve road access	Other (specify)	Improve Farming Productivity	Creation of Market place	Hammer Mill
Nchelenge	8.7%	4.6%	40.6%	4.6%	16.3%	5.7%	1.1%	9.1%	1.7%	2.4%	2.6%	2.6%
Mwense	2.4%	9.6%	17.1%	8.1%	23.0%	23.2%	0.5%	7.9%	1.3%	2.5%	3.5%	0.8%
Mansa	4.7%	8.6%	19.4%	9.2%	21.7%	13.1%	1.4%	14.4%	3.1%	0.6%	2.2%	1.7%
Milenge	2.2%	6.8%	17.5%	2.5%	23.8%	8.2%	0.0%	33.9%	1.4%	2.5%	0.5%	0.8%
Total	4.6%	7.4%	24.4%	6.2%	21.0%	13.2%	0.8%	14.6%	1.8%	2.1%	2.4%	1.5%

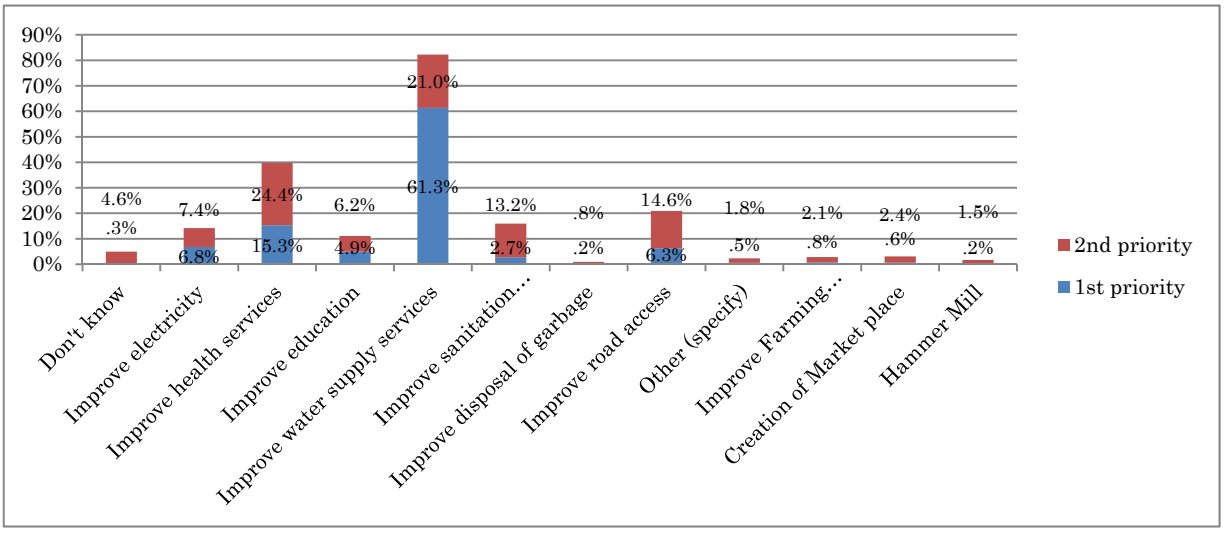


Figure 5 1st and 2nd priority for the household for improving living condition (Whole survey target sites)

III. Condition of water supply and use

Table 3 Main sources of domestic water (Dry Season)

District	Borehole with hand pump	Protected spring (point source)	Unprotected spring (point source)	Rainwater collection	Protected dug well	Unprotected dug well	Pond, river or stream	Water vendor	Public/individual Tap
Nchelenge	41.9%	.6%	.7%	.4%	10.6%	13.1%	30.2%	.2%	2.4%
Mwense	18.7%	.2%	.3%	0.0%	4.7%	11.8%	56.0%	0.0%	8.4%
Mansa	8.3%	1.4%	5.0%	.3%	18.3%	37.2%	29.2%	.3%	0.0%
Milenge	14.2%	2.2%	4.4%	0.0%	1.6%	19.1%	57.9%	0.0%	.5%
Total	22.5%	.9%	2.1%	.2%	8.4%	18.5%	43.7%	.1%	3.5%

Table 4 Main sources of domestic water (Rainy Season)

District	Borehole with hand pump	Protected spring (point source)	Unprotected spring (point source)	Rainwater collection	Protected dug well	Unprotected dug well	Pond, river or stream	Water vendor	Other (specify)
Nchelenge	41.9%	.2%	.7%	1.1%	10.6%	12.4%	31.1%	.2%	1.9%
Mwense	19.5%	0.0%	.3%	4.0%	5.0%	10.9%	51.8%	0.0%	8.4%
Mansa	6.7%	.6%	4.2%	1.1%	17.8%	45.0%	24.4%	.3%	0.0%
Milenge	12.6%	3.0%	7.9%	.8%	2.2%	27.0%	46.4%	0.0%	0.0%
Total	22.1%	.8%	2.7%	2.0%	8.5%	21.1%	39.4%	.1%	3.2%

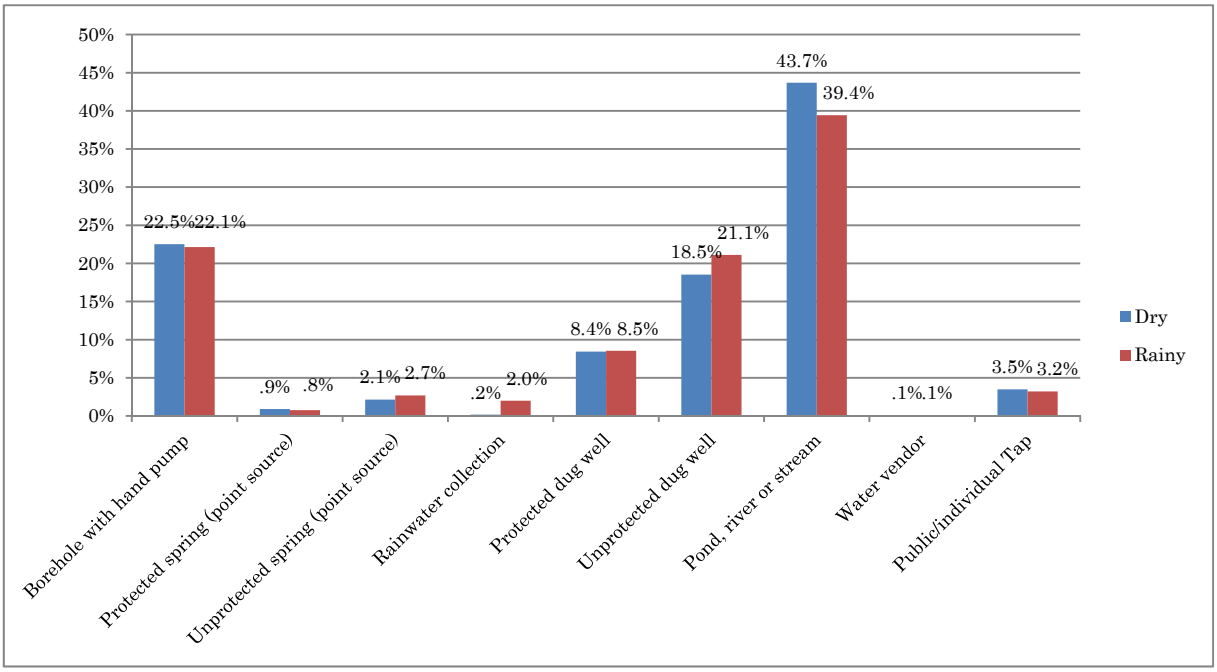


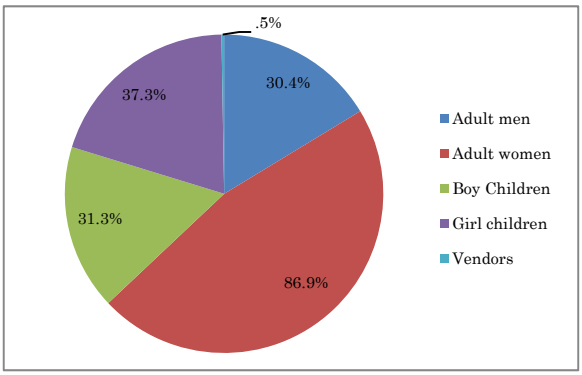
Figure 6 Main sources of domestic water (Whole survey target sites)

Table 5 Water consumption per capita/day (Litre) (Mean)

District	Dry Season	Rainy Season
Milenge	15.6	16.4
Mwense	11.7	11.6
Nchelenge	12.3	11.9
Mansa	20.1	18.4
Total	14.6	14.4

Table 6 Extra water demand per capita/ day (Litre) (Mean)

District	Dry Season	Rainy Season
Milenge	3.4	2.7
Mwense	2.5	2.2
Nchelenge	3.7	2.7
Mansa	3.6	3.1
Total	3.2	2.6



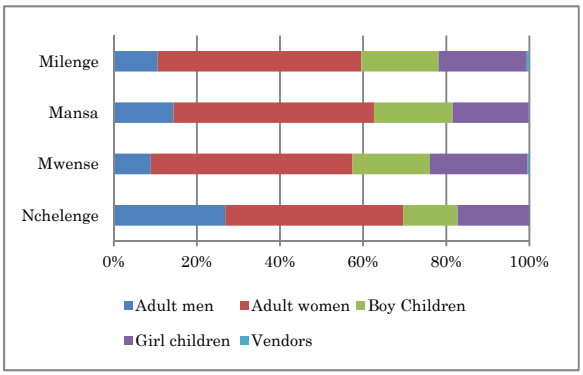


Figure 7 Responsible persons for water collection (Whole survey target sites) (Left)

Figure 8 Responsible persons for water collection (per District) (Right)

Table 7　Time required to get water (Return trip) (Minute) (Mean) (Left)

Table 8　Frequency of water collection per day per household /Day (time) (Mean) (Right)

District	Dry Season	Rainy Season
Nchelenge	11.84	11.86
Mwense	31.25	30.90
Mansa	21.95	17.12
Milenge	39.13	33.53
Total	25.37	23.23

District	Dry Season	Rainy Season
Nchelenge	2.36	2.37
Mwense	2.35	2.27
Mansa	3.21	2.69
Milenge	3.01	2.36
Total	2.65	2.40

IV.　Perception on improvement of current water supply situation

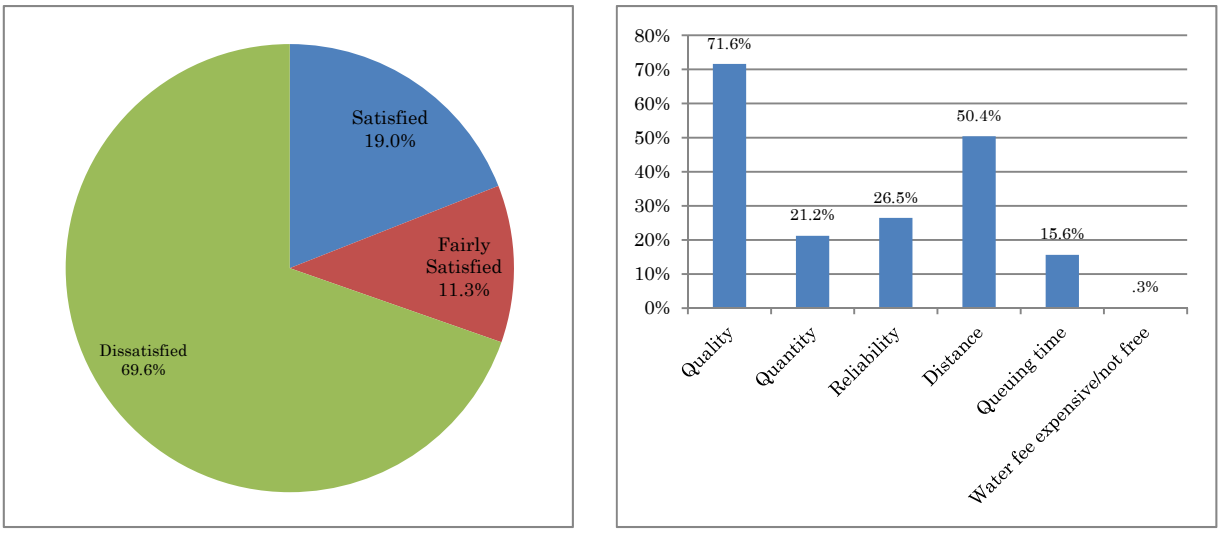


Figure 9　Perception of current water supply situation (Whole survey target sites)

Figure 10　Reasons for dissatisfaction (Whole survey target sites)

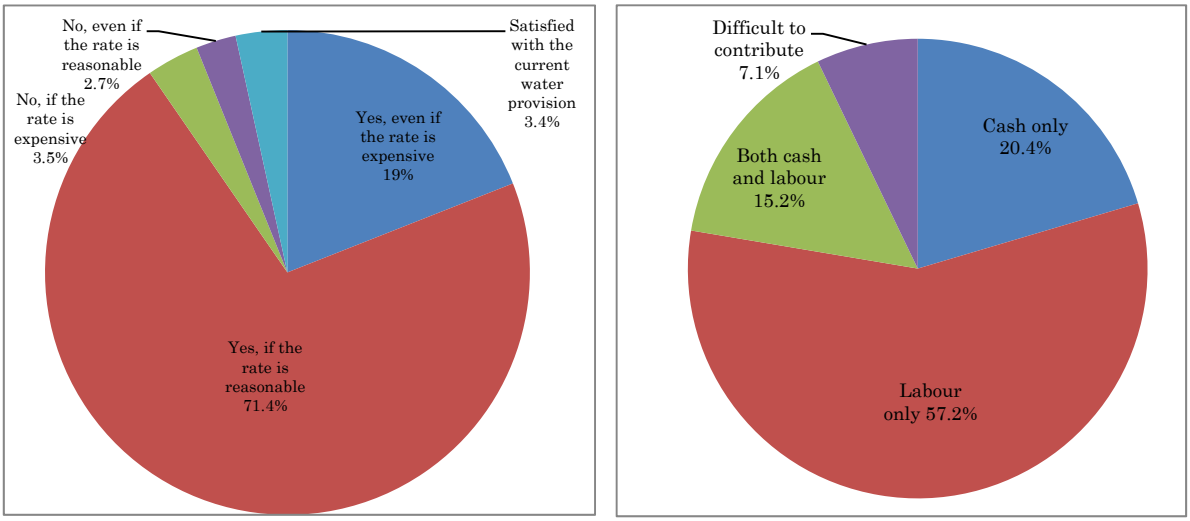
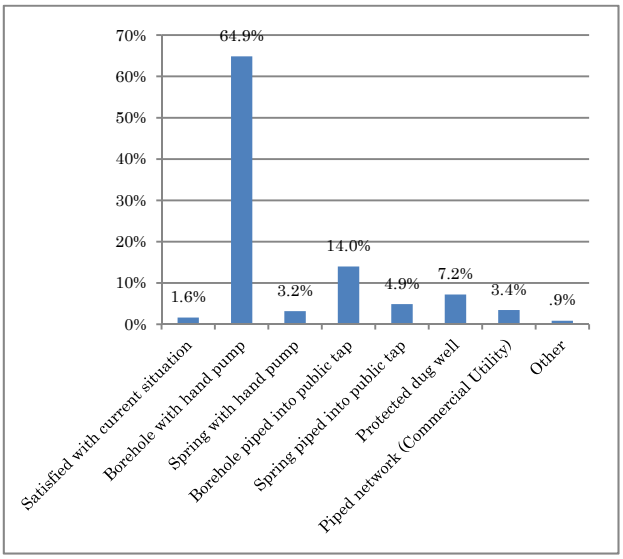


Figure 11　Willingness to pay for water fee of improved water supply facility (Whole survey target sites)

Figure 12　Types of contribution for construction of water facility (Whole survey target sites)



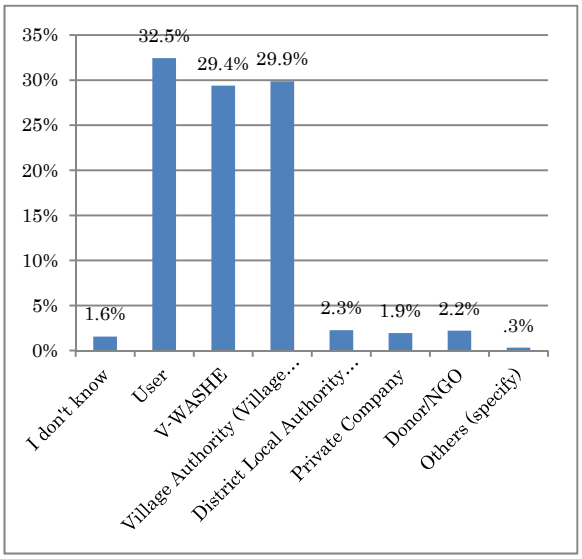
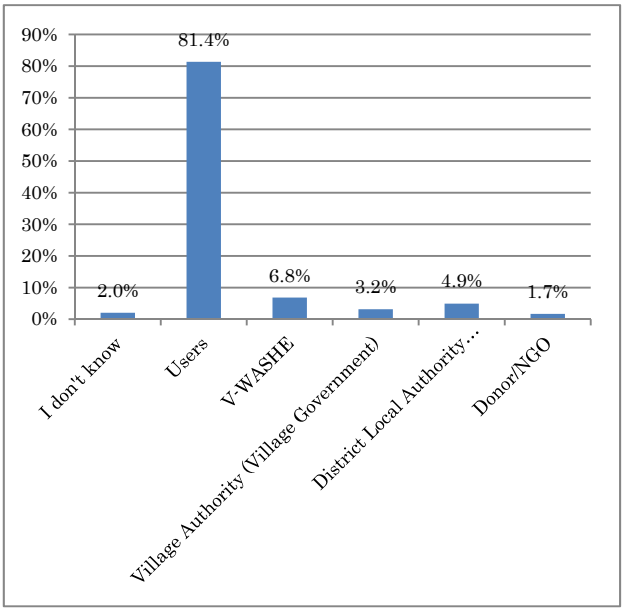


Figure 13 Preferred water supply facility type (Whole survey target sites) (Left)

Figure 14 Who should operate and maintain the facility (Whole survey target sites) (Right)



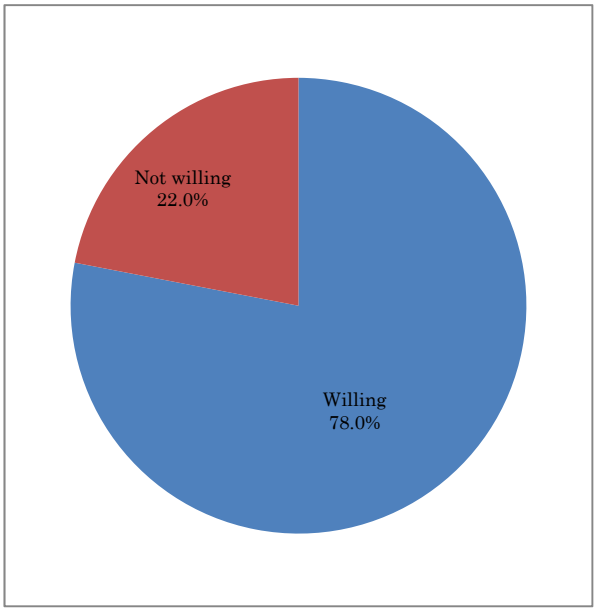


Figure 15 Who should cover the O&M cost of the facility (Whole survey target sites)

Figure 16 Willingness to pay for water obtained from the facilities (Whole survey target sites)

Table 9 Willingness to pay for the water fee (Household/20L) (Median)

District	ZMW
Nchelenge	0.03
Mwense	0.03
Mansa	0.04
Milenge	0.03

V. Health and Sanitation Conditions

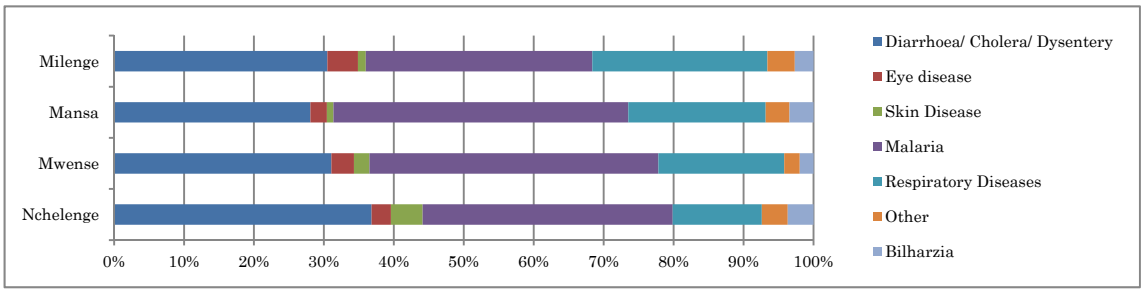


Figure 17 Major diseases affecting the household (Multiple Answer)

Table 10 Major diseases affecting the household (Multiple Answer)

District	Diarrhoea/ Cholera/ Dysentery	Eye disease	Skin Disease	Malaria	Respiratory Diseases	Other	Bilharzia
Nchelenge	88.9%	6.7%	10.9%	86.3%	30.8%	8.9%	8.9%
Mwense	58.8%	6.1%	4.2%	78.1%	34.0%	4.2%	3.7%
Mansa	59.2%	5.0%	1.9%	88.9%	41.4%	7.2%	7.2%
Milenge	74.6%	10.7%	2.7%	79.2%	61.2%	9.6%	6.6%

Table 11 Perceived practices that cause diarrhoea (Multiple Answer)

District	Not washing hands	Drinking/Using contaminated water	Handling food inappropriately	Not having hygiene toilet	Flies	Witchcraft	I don't know	Other
Nchelenge	15.4%	83.9%	57.1%	32.1%	30.4%	3.5%	3.2%	0.4%
Mwense	12.6%	78.4%	15.7%	16.9%	5.2%	0.8%	3.4%	4.4%
Mansa	15.0%	85.5%	43.5%	21.4%	9.5%	1.1%	4.5%	1.1%
Milenge	14.0%	84.7%	35.9%	11.0%	5.5%	2.2%	6.8%	0.8%
Total	14.2%	82.6%	37.1%	21.0%	13.4%	1.9%	4.2%	1.9%

VI. Household Economic Status

Table 12 Main Income Sources (Multiple Answer)

District	Farming	Livestock farming	Own Business	Salary from employer	Pension	Remittance	Casual labour	Fishing	Other
Nchelenge	81.9%	1.9%	43.9%	3.5%	0.7%	6.1%	29.3%	16.1%	1.3%
Mwense	85.5%	3.2%	15.3%	3.5%	0.5%	3.7%	9.6%	4.5%	0.3%
Mansa	83.1%	7.8%	31.1%	2.8%	0.6%	3.9%	19.7%	0.0%	1.7%
Milenge	87.9%	5.5%	4.7%	7.7%	0.5%	1.9%	4.9%	4.1%	0.8%
Total	84.5%	4.1%	24.6%	4.2%	0.6%	4.1%	16.3%	6.9%	1.0%

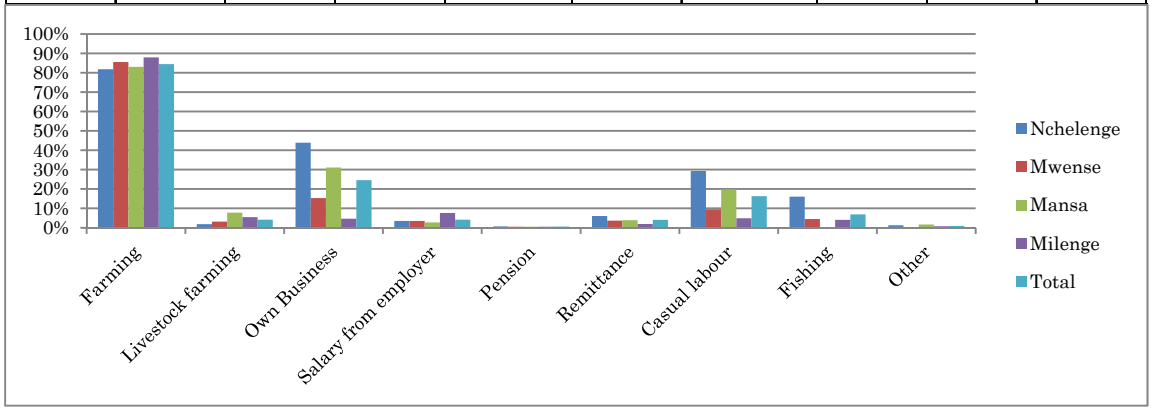


Figure 18 Main Income Sources

Table 13 Monthly expenditure per household (Median)

District	ZMW
Nchelenge	100.0
Mwense	75.0
Mansa	85.0
Milenge	80.0
Total	100.0

Table 14 Monthly income per household (Median)

District	ZMW
Nchelenge	200.0
Mwense	100.0
Mansa	150.0
Milenge	150.0
Total	150.0

Table 15 Months that bring most cash income

District	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Nchelenge	8.3%	7.6%	8.5%	10.7%	41.9%	75.4%	81.1%	65.0%	23.3%	13.3%	17.2%	14.1%
Mwense	13.8%	11.6%	14.1%	41.0%	34.6%	41.2%	30.3%	19.8%	9.9%	6.4%	16.1%	21.2%
Mansa	16.1%	5.6%	5.0%	22.8%	32.5%	58.1%	45.6%	35.8%	19.4%	17.5%	20.6%	17.2%
Milenge	6.9%	7.7%	7.1%	22.6%	50.9%	65.1%	69.4%	62.0%	41.4%	35.1%	11.4%	9.1%
Total	11.3%	8.5%	9.4%	25.1%	39.4%	59.0%	55.6%	44.2%	21.7%	16.0%	16.4%	16.0%

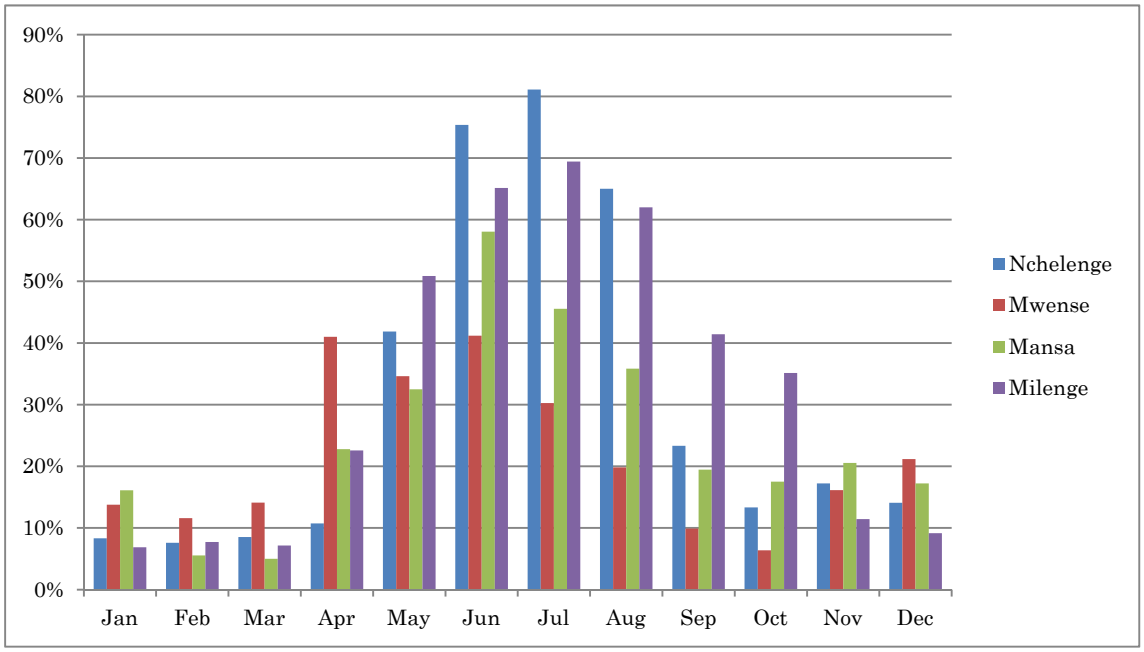


Figure 19 Distribution of months that bring most cash income (Multiple Answer)

3-1-2) Survey data of the Interview with the site representatives (Key Informant Survey)

I. Details of the Key Informants

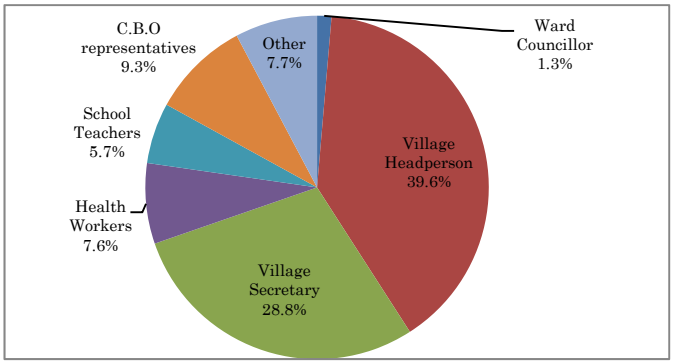


Figure 1 Occupation of the Key Informants

II. Basic Site Information

Table 1 Population of the Site

District	250 or less	251-500	501-750	751-1000	1000-1250	1251-1500	1501-2000	2001-3000	More than 3000
Nchelenge	17.8%	10.0%	13.3%	6.7%	7.8%	3.3%	11.1%	16.7%	13.3%
Mwense	39.0%	35.0%	7.0%	5.0%	3.0%	1.0%	1.0%	5.0%	4.0%
Mansa	21.7%	38.3%	8.3%	6.7%	3.3%	1.7%	8.3%	6.7%	5.0%
Milenge	14.8%	49.2%	21.3%	4.9%	1.6%	0.0%	3.3%	0.0%	4.9%
Total	24.8%	31.2%	11.9%	5.8%	4.2%	1.6%	5.8%	7.7%	7.1%

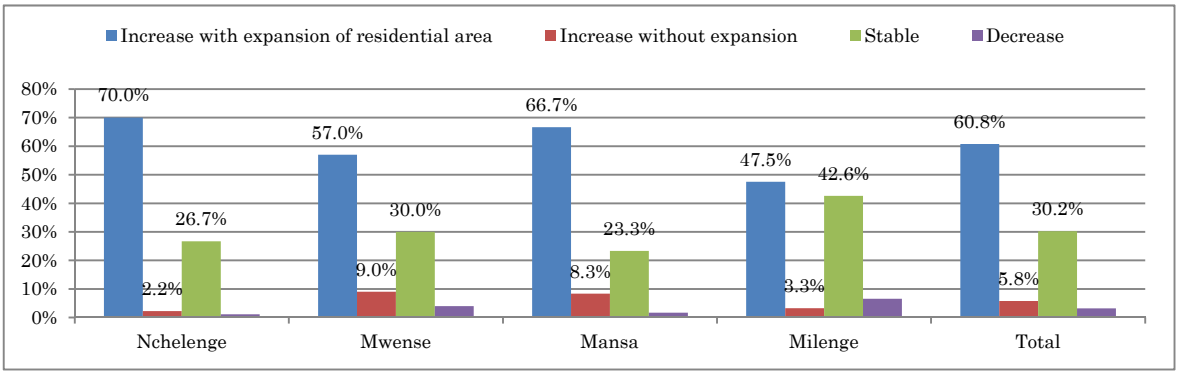


Figure 2 Growth in the village's population size

III. Access

Table 2 Means of transport to access the district centre

District	Foot	Bike	Motorbike	Public bus	Lift
Nchelenge	76.7%	100.0%	1.1%	1.1%	90.0%
Mwense	60.0%	88.0%	22.0%	11.0%	18.0%
Mansa	63.3%	83.3%	0.0%	5.0%	40.0%
Milenge	24.6%	73.8%	1.6%	1.6%	21.3%
Total	58.5%	87.8%	7.7%	5.1%	43.7%

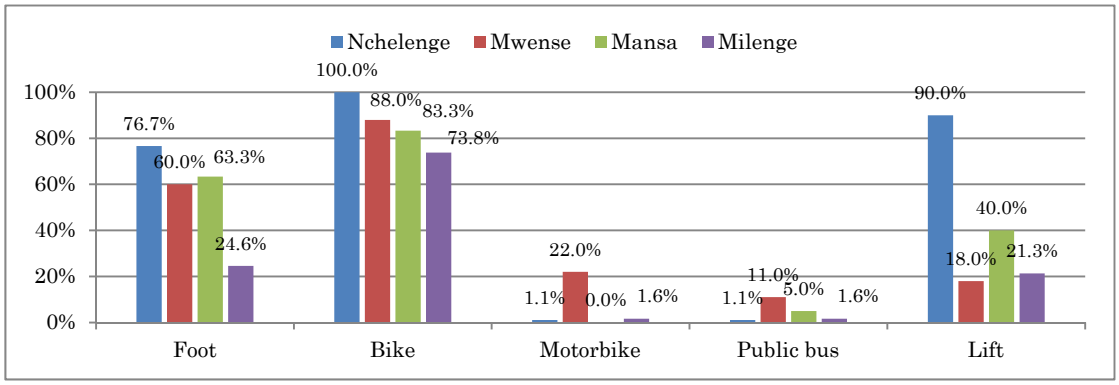


Figure 3 Means of transport to access the district centre (Multiple Answer)

Table 3 Time to get to the district centre using most common means of transport (Mean) (Hrs) (Left)

Table 4 Road condition from the village to the centre of District (Right)

District	Dry Season	Rainy Season
Nchelenge	2.8	3.6
Mwense	2.1	2.3
Mansa	2.6	3.2
Milenge	5.9	6.0
Total	3.1	3.6

District	Good throughout the year	Good only in the dry season	Bad through the year
Nchelenge	50.0%	36.7%	13.3%
Mwense	68.0%	30.0%	2.0%
Mansa	43.3%	30.0%	26.7%
Milenge	8.2%	34.4%	57.4%
Total	46.3%	32.8%	20.9%

Table 5 Access condition of heavy vehicles to the village

District	Access throughout the year	Only in Dry season	Small works necessary	Through alternative road	No
Nchelenge	65.6%	18.9%	4.4%	0.0%	11.1%
Mwense	68.0%	26.0%	5.0%	0.0%	1.0%
Mansa	50.0%	23.3%	13.3%	0.0%	13.3%
Milenge	19.7%	32.8%	19.7%	1.6%	26.2%
Total	54.3%	24.8%	9.3%	0.3%	11.3%

IV. Economic Activity

Table 6 Key industries in the village (1st)

District	Farming	Fishing	Retail	Manufacturing handcraft	Public service
Nchelenge	100.0%	0.0%	0.0%	0.0%	0.0%
Mwense	97.0%	3.0%	0.0%	0.0%	0.0%
Mansa	95.0%	0.0%	5.0%	0.0%	0.0%
Milenge	90.2%	4.9%	0.0%	1.6%	3.3%
Total	96.1%	1.9%	1.0%	0.3%	0.6%

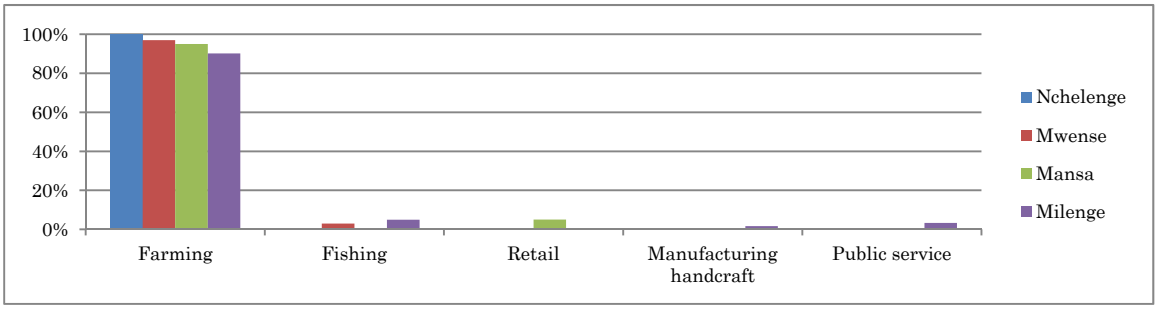


Figure 4 Key industries in the village (1st)

Table 7 Key industries in the village (2nd)

District	Farming	Fishing	Livestock rearing	Retail	Manufacturing handcraft	Public service	Work in nearby town	Other (specify)	Charcoal burning
Nchelenge	16.7%	47.8%	26.7%	1.1%	1.1%	3.3%	1.1%	0.0%	2.2%
Mwense	8.0%	44.0%	25.0%	0.0%	16.0%	1.0%	5.0%	1.0%	0.0%
Mansa	16.7%	10.0%	41.7%	15.0%	1.7%	0.0%	11.7%	0.0%	3.3%
Milenge	21.3%	34.4%	36.1%	3.3%	0.0%	1.6%	0.0%	3.3%	0.0%
Total	14.8%	36.7%	30.9%	3.9%	5.8%	1.6%	4.2%	1.0%	1.3%

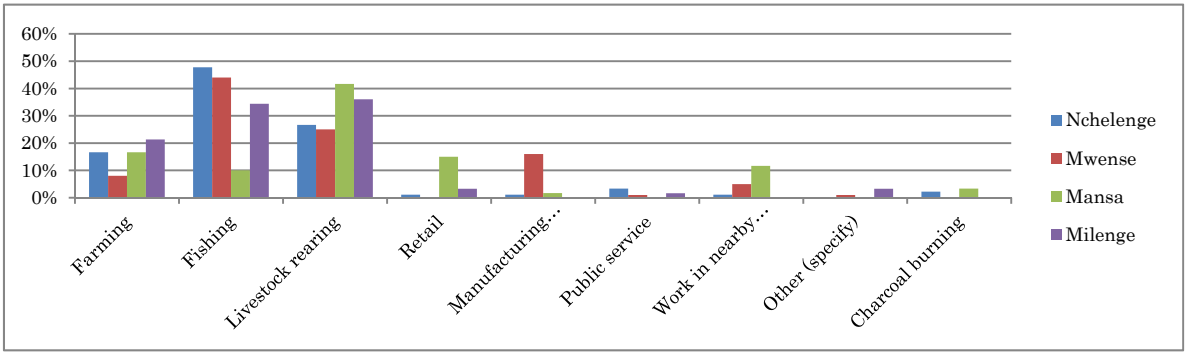
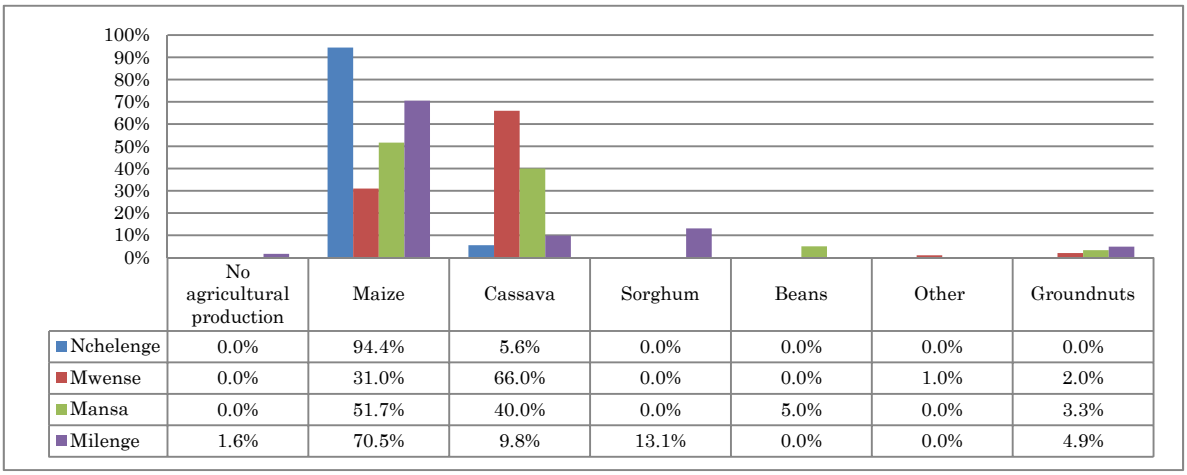


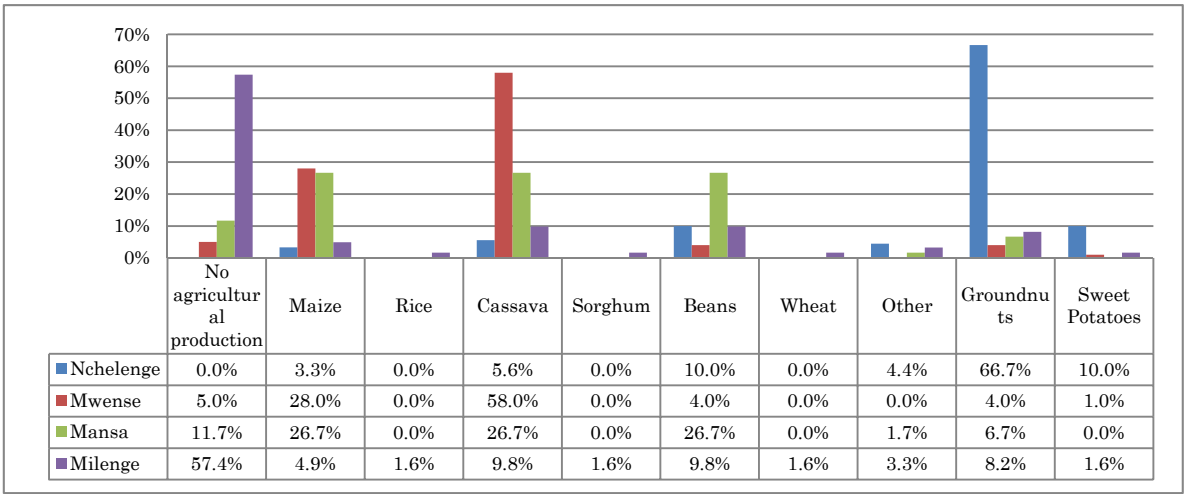
Figure 5 Key industries in the village (2nd)

Table 8 Main food crops in the village



	No agricultural production	Maize	Cassava	Sorghum	Beans	Other	Groundnuts
Nchelenge	0.0%	94.4%	5.6%	0.0%	0.0%	0.0%	0.0%
Mwense	0.0%	31.0%	66.0%	0.0%	0.0%	1.0%	2.0%
Mansa	0.0%	51.7%	40.0%	0.0%	5.0%	0.0%	3.3%
Milenge	1.6%	70.5%	9.8%	13.1%	0.0%	0.0%	4.9%

Table 9 Main cash crops in the village



	No agricultural production	Maize	Rice	Cassava	Sorghum	Beans	Wheat	Other	Groundnuts	Sweet Potatoes
Nchelenge	0.0%	3.3%	0.0%	5.6%	0.0%	10.0%	0.0%	4.4%	66.7%	10.0%
Mwense	5.0%	28.0%	0.0%	58.0%	0.0%	4.0%	0.0%	0.0%	4.0%	1.0%
Mansa	11.7%	26.7%	0.0%	26.7%	0.0%	26.7%	0.0%	1.7%	6.7%	0.0%
Milenge	57.4%	4.9%	1.6%	9.8%	1.6%	9.8%	1.6%	3.3%	8.2%	1.6%

V. Village Organisation

Table 10 Existing community based organisation

District	Farmers Org	Health Association	Women's' association	Religious org	PTA	Youth Group	V-WASHE	Other
Nchelenge	23.2%	27.5%	39.1%	4.3%	18.8%	42.0%	84.1%	0.0%
Mwense	38.0%	4.2%	28.2%	49.3%	5.6%	5.6%	43.7%	12.7%
Mansa	76.2%	23.8%	38.1%	4.8%	2.4%	21.4%	31.0%	16.7%
Milenge	62.8%	2.3%	2.3%	4.7%	9.3%	4.7%	48.8%	16.3%

Table 11 Improvement effort implemented by village organisation

District	Supply Facility	School	Irrigation	Community Hall	Road/ Bridge	Other
Nchelenge	0.0%	0.0%	0.0%	66.7%	66.7%	33.3%
Mwense	75.0%	0.0%	16.7%	0.0%	0.0%	33.3%
Mansa	57.7%	0.0%	0.0%	38.5%	38.5%	23.1%
Milenge	48.7%	2.6%	2.6%	46.2%	48.7%	0.0%

Table 12 Type of contribution made by the community members for construction/rehabilitation

District	Cash for Initial Cost	Cash for O&M	In-kind for Initial Cost	In-kind for O&M	Labour	Other	No Contribution
Nchelenge	0.0%	0.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Mwense	7.7%	0.0%	7.7%	7.7%	84.6%	7.7%	23.1%
Mansa	3.4%	3.4%	24.1%	34.5%	82.8%	31.0%	24.1%
Milenge	0.0%	0.0%	5.6%	0.0%	94.4%	0.0%	5.6%

VI. Health and Sanitation Situation

Table 13 Major diseases affecting the village (1st)

District	Diarrhoea, cholera, dysentery	Eye disease	Skin disease	Malaria	Respiratory diseases	Other
Nchelenge	33.3%	0.0%	0.0%	64.4%	2.2%	0.0%
Mwense	53.0%	1.0%	0.0%	45.0%	1.0%	0.0%
Mansa	26.7%	0.0%	6.7%	65.0%	1.7%	0.0%
Milenge	63.9%	1.6%	1.6%	23.0%	8.2%	1.6%

Table 14 Major diseases affecting the village (2nd)

District	Diarrhoea, cholera, dysentery	Eye disease	Skin disease	Malaria	Respiratory diseases	Other
Nchelenge	58.9%	0.0%	0.0%	33.3%	7.8%	0.0%
Mwense	39.0%	4.0%	2.0%	36.0%	18.0%	1.0%
Mansa	43.3%	0.0%	5.0%	23.3%	23.3%	5.0%
Milenge	23.0%	3.3%	3.3%	16.4%	54.1%	0.0%

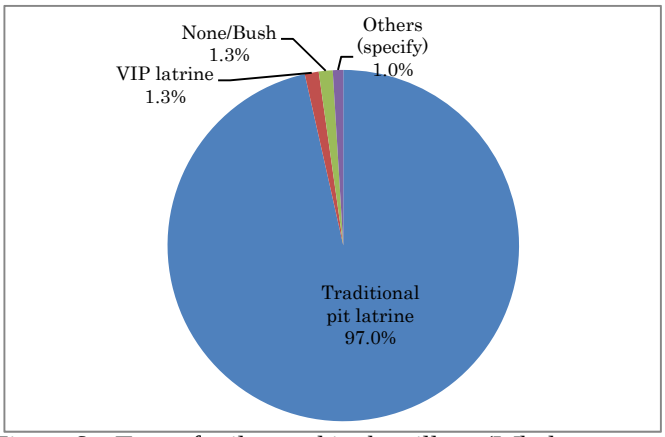


Figure 6 Type of toilet used in the village (Whole survey target sites)

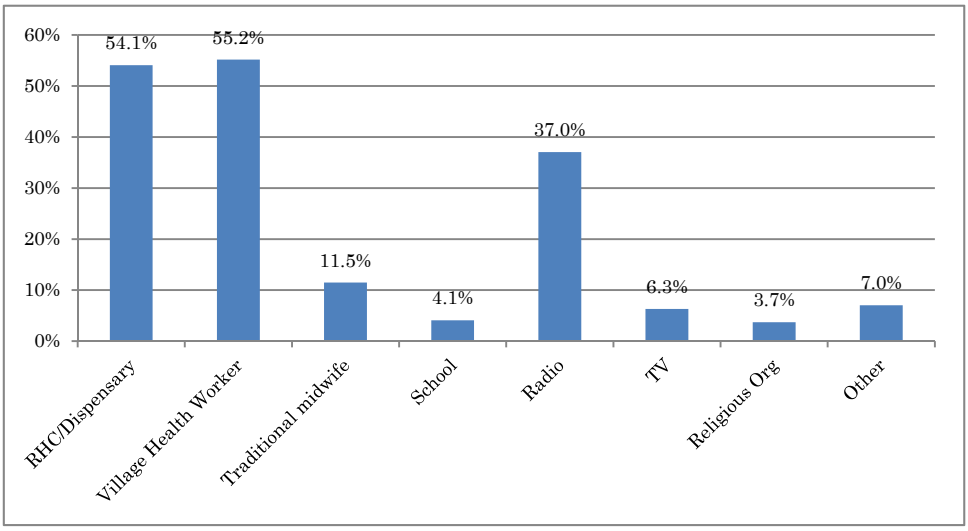


Figure 7 Source of Health and Hygiene Information for villagers (Whole survey target sites)(Multiple Answer)

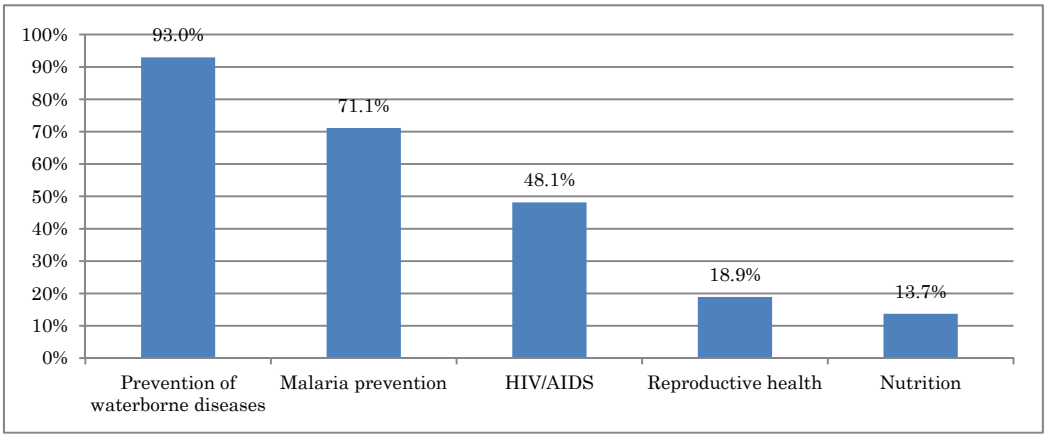


Figure 8 Contents of Health and Hygiene Information provided (Whole survey target sites) (Multiple Answer)

VII. Water Supply Situation

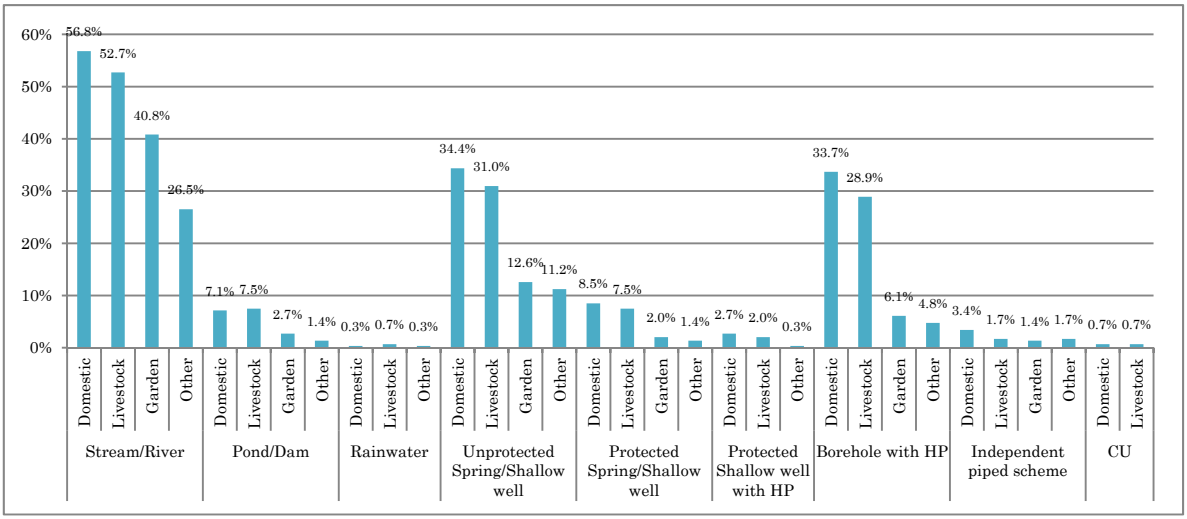


Figure 9 Sources of water used in the village (Whole survey target sites)

a) Situation of sites with existing boreholes fitted with hand pumps

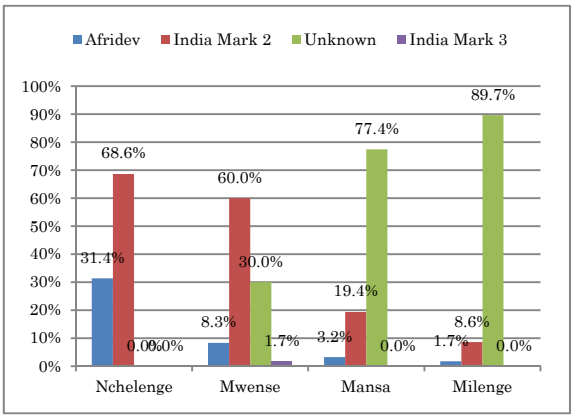


Figure10 Types of hand pump used

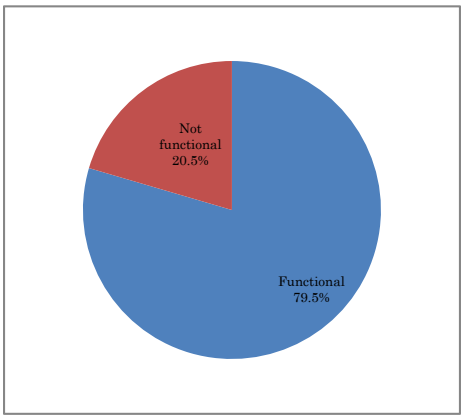
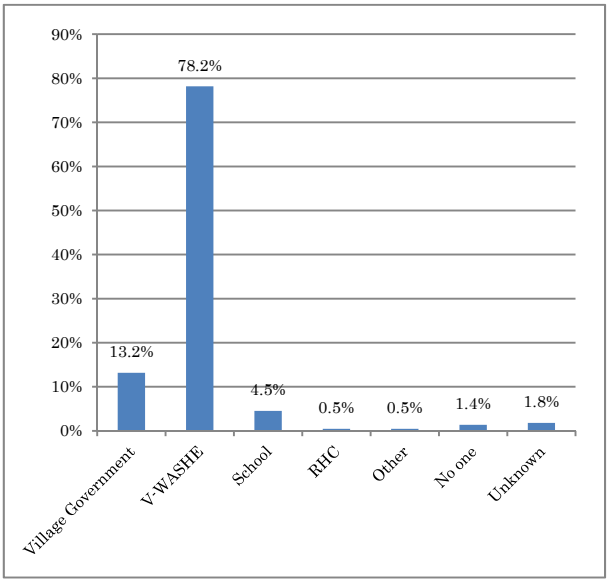


Figure 11 Operational status of hand pumps (Whole survey target sites)



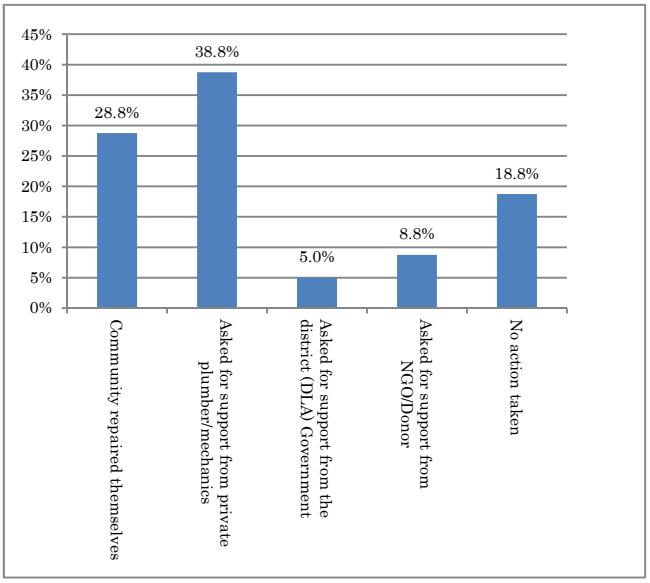


Figure12 Responsible body for O&M of the existing water supply facility (Whole survey target sites) (Left)

Figure 13 Method of hand pump repair (Whole survey target sites) (Right)

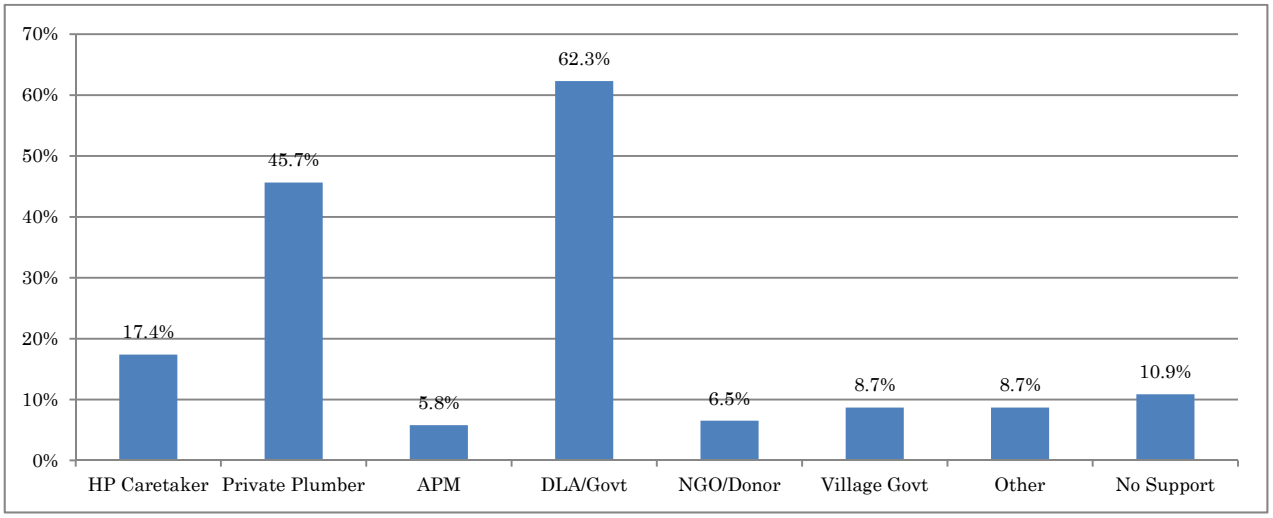


Figure 14 Whom to ask for support of the facility O&M (Whole survey target sites)（Multiple Answer)

Table 15 Status of O&M fees collection

District	No fee collected	Regularly (daily, monthly, yearly, etc...)	Fee collected only when actual repair work is needed	Contribution from well-wishers when repair is needed	Other (specify)
Nchelenge	9.7%	87.1%	0.0%	1.6%	1.6%
Mwense	38.2%	50.0%	11.8%	0.0%	0.0%
Mansa	66.7%	22.2%	5.6%	5.6%	0.0%
Milenge	79.2%	20.8%	0.0%	0.0%	0.0%

Table 16 Management of collected O&M fees

District	Kept in a bank account for the water committee	Kept in a bank account for the village government	Kept by the treasurer of the village water committee
Nchelenge	1.9%	20.4%	77.8%
Mwense	0.0%	5.3%	94.7%
Mansa	0.0%	0.0%	100.0%
Milenge	0.0%	0.0%	100.0%

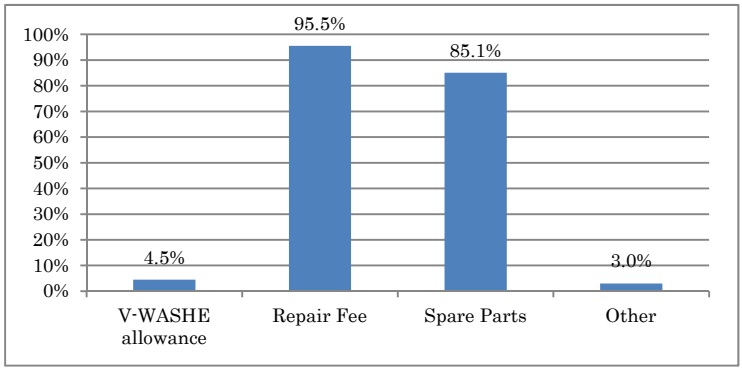


Figure 15 What the O&M fee is used for (Whole survey target sites)

Table 17 Who makes decision for candidate location for a water supply facility

District	Village Chairman/ Headman	Sub-village chairman	Village government member	Chief	District Local Authority	Ward executive officer	Other (specify)	Community
Nchelenge	77.4%	0.0%	0.0%	4.8%	1.6%	0.0%	0.0%	16.1%
Mwense	47.1%	2.9%	11.8%	0.0%	5.9%	2.9%	14.7%	14.7%
Mansa	44.4%	0.0%	11.1%	0.0%	0.0%	0.0%	33.3%	11.1%
Milenge	44.0%	24.0%	12.0%	0.0%	12.0%	0.0%	8.0%	0.0%

Table 18 Who participates in decision making of a water supply facility construction (Multiple Answer)

District	Village government members	Village elders	V-WASHE	Chief	Whole village members	Ward officers	Other
Nchelenge	0.0%	6.5%	83.9%	8.1%	90.3%	0.0%	3.2%
Mwense	14.7%	5.9%	23.5%	0.0%	58.8%	8.8%	0.0%
Mansa	27.8%	33.3%	55.6%	0.0%	72.2%	5.6%	0.0%
Milenge	4.0%	60.0%	44.0%	0.0%	60.0%	0.0%	24.0%

Table 19 Who makes decision on the construction of a water supply facility

District	Voting by whole community	By traditional leaders	By village Govt officials	By village chairman	By Ward Officials	By the Chief	Other
Nchelenge	95.2%	0.0%	0.0%	0.0%	0.0%	4.8%	0.0%
Mwense	82.4%	0.0%	5.9%	2.9%	8.8%	0.0%	0.0%
Mansa	83.3%	0.0%	5.6%	0.0%	0.0%	0.0%	11.1%
Milenge	76.0%	12.0%	8.0%	0.0%	0.0%	0.0%	4.0%

Table 20 Preferred type of improved water supply facility

District	Satisfied with current water supply conditions	Borehole with hand pump	Borehole piped into public tap	Protected dug well	Piped network (Water Supply Authority)	Other
Nchelenge	66.1%	33.9%	0.0%	0.0%	0.0%	0.0%
Mwense	0.0%	94.1%	2.9%	0.0%	2.9%	0.0%
Mansa	5.6%	66.7%	5.6%	11.1%	5.6%	5.6%
Milenge	0.0%	40.0%	36.0%	12.0%	8.0%	4.0%

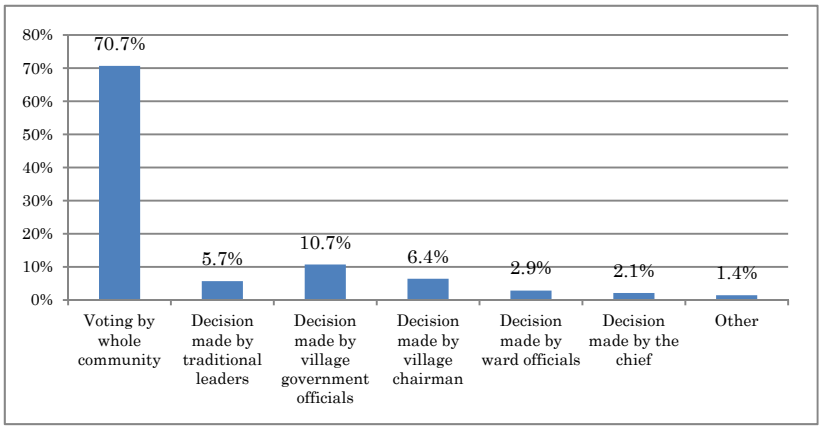


Figure 16 Decision making procedure

Table 21 Responsible body for the O&M of a constructed water supply facility

District	Users	V-WASHE/ water committee	Village Authority (Village Government)	District Local Authority (DLA)/Government	Other
Nchelenge	3.2%	96.8%	0.0%	0.0%	0.0%
Mwense	23.5%	67.6%	2.9%	5.9%	0.0%
Mansa	16.7%	77.8%	5.6%	0.0%	0.0%
Milenge	12.0%	76.0%	4.0%	0.0%	8.0%

Table 22 Responsible body for collection of O&M cost of the constructed water supply facility

District	Users	V-WASHE/water committee	Village Authority (Village Government)	District Local Authority (DLA)/Government	Other (specify)
Nchelenge	51.6%	48.4%	0.0%	0.0%	0.0%
Mwense	64.7%	32.4%	0.0%	2.9%	0.0%
Mansa	77.8%	11.1%	5.6%	5.6%	0.0%
Milenge	96.0%	0.0%	0.0%	0.0%	4.0%

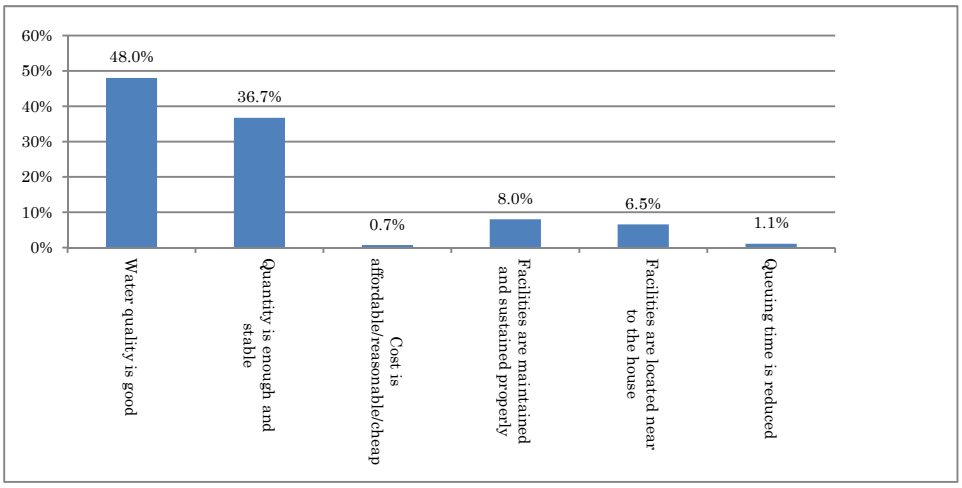


Figure 17 Expectation towards improved water supply facility (2 items selected) (Whole target sites)

b) Situation of sites without existing boreholes fitted with hand pumps

Table 23 Preferred type of improved water supply facility

District	Borehole with hand pump	Borehole piped into public tap	Protected dug well	Piped network (Water Supply Authority)	Other
Nchelenge	100.0%	0.0%	0.0%	0.0%	0.0%
Mwense	87.9%	7.6%	0.0%	1.5%	3.0%
Mansa	76.2%	14.3%	7.1%	0.0%	2.4%
Milenge	83.3%	11.1%	2.8%	2.8%	0.0%

Table 24 Responsible body for the O&M of a constructed water supply facility

District	Users	V-WASHE/water committee	Village Authority (Village Government)	Private Company	Donor/NGO	Other (specify)
Nchelenge	0.0%	92.9%	7.1%	0.0%	0.0%	0.0%
Mwense	16.7%	65.2%	10.6%	1.5%	0.0%	6.1%
Mansa	14.3%	57.1%	21.4%	0.0%	2.4%	4.8%
Milenge	13.9%	77.8%	2.8%	0.0%	0.0%	5.6%

Table 25 Responsible body for collection of O&M cost of the constructed water supply facility

District	Users	V-WASHE/water committee	Village Authority (Village Government)	District Local Authority (DLA)/Government	Other (specify)
Nchelenge	32.1%	64.3%	0.0%	3.6%	0.0%
Mwense	68.2%	30.3%	1.5%	0.0%	0.0%
Mansa	66.7%	26.2%	4.8%	0.0%	2.4%
Milenge	88.9%	2.8%	2.8%	0.0%	5.6%

Table 26 Measures to be taken when the facility breaks down

District	Community will repair by themselves	Ask for support from private plumber/mechanics	Ask for support from the district (DLA)/Government	Ask for support from NGO/Donor	Other (specify)
Nchelenge	3.6%	82.1%	14.3%	0.0%	0.0%
Mwense	60.6%	22.7%	9.1%	1.5%	6.1%
Mansa	47.6%	33.3%	7.1%	4.8%	7.1%
Milenge	44.4%	16.7%	30.6%	2.8%	5.6%

Table 27 Body to ask for support in O&M of the improved water supply facility (Multiple Answer)

District	Hand pump care taker	Private plumber/mechanics	APM	District Local Authority/Government	NGO	Village Government	Other
Nchelenge	3.6%	85.7%	0.0%	89.3%	0.0%	0.0%	0.0%
Mwense	22.7%	7.6%	4.5%	24.2%	18.2%	16.7%	10.6%
Mansa	21.4%	14.3%	9.5%	33.3%	2.4%	19.0%	4.8%
Milenge	19.4%	8.3%	8.3%	36.1%	0.0%	30.6%	0.0%

Table 28 Who makes decision for use of land in the village

District	Village Chairman	Sub-village chairman	Village government member	Chief	District Local Authority	Other (specify)
Nchelenge	0.0%	3.6%	0.0%	3.6%	0.0%	92.9%
Mwense	72.7%	1.5%	1.5%	0.0%	1.5%	22.7%
Mansa	59.5%	7.1%	16.7%	0.0%	2.4%	14.3%
Milenge	88.9%	2.8%	2.8%	0.0%	2.8%	2.8%

Table 29 Who participates in decision making process in the village (Multiple Answer)

District	Village Government Members	Village Elders	V-WASHE	Chief	Whole Village members	Ward Office	Other
Nchelenge	0.0%	39.3%	60.7%	0.0%	100.0%	3.6%	14.3%
Mwense	26.2%	23.1%	18.5%	6.2%	52.3%	4.6%	3.1%
Mansa	26.2%	21.4%	28.6%	2.4%	64.3%	2.4%	2.4%
Milenge	5.6%	83.3%	38.9%	2.8%	52.8%	5.6%	5.6%

Table 30 Decision making procedure

District	Voting by whole community	Decision made by traditional leaders	Decision made by village government officials	Decision made by village chairman	Decision made by ward officials	Decision made by the chief
Nchelenge	89.3%	3.6%	3.6%	0.0%	0.0%	3.6%
Mwense	84.8%	4.5%	4.5%	3.0%	3.0%	0.0%
Mansa	83.3%	4.8%	9.5%	0.0%	2.4%	0.0%
Milenge	58.3%	13.9%	27.8%	0.0%	0.0%	0.0%

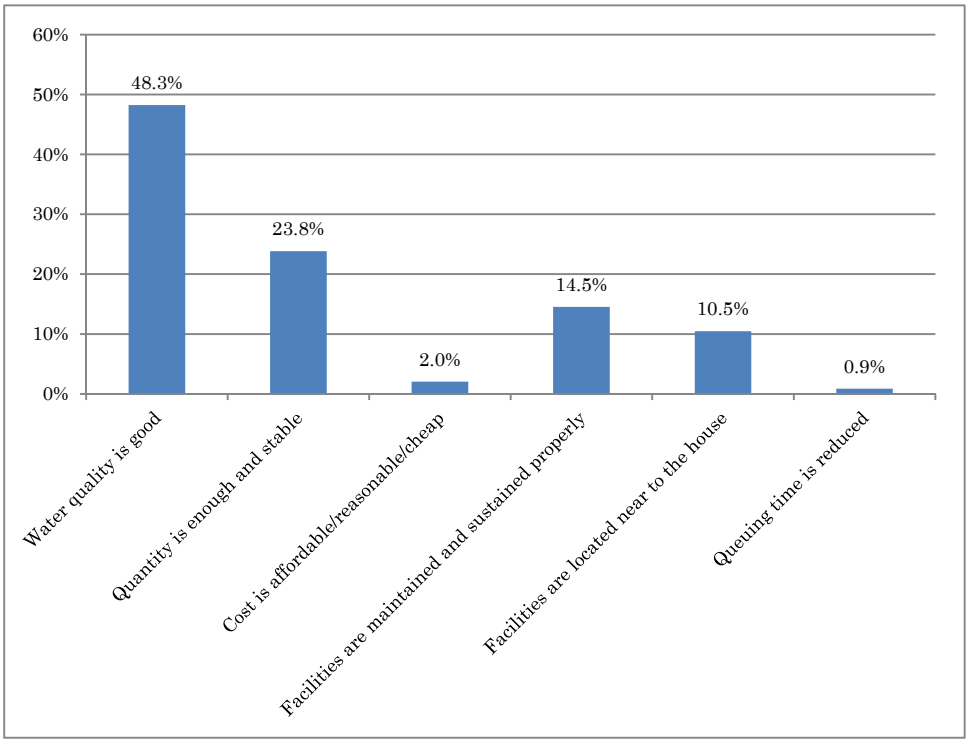


Figure 18 Expectation towards improved water supply facility (2 items selected) (Whole survey target sites)

3-2) Piped water supply schemes

3-2-1) Survey data of the Household Survey

I. Details of respondents and Household Heads

The sex ratio of the respondents was 38.8% male and 61.3% female, showing a slightly higher number of female respondents. The age distribution of respondents shows age group between 31-40 years old with 29.4%, followed by age group 41-50 at 23.8%, 21-30 years old age group with 13.8%, and 51-60 age group with 13.1%, indicating majority of them are age between 31-50 years old.

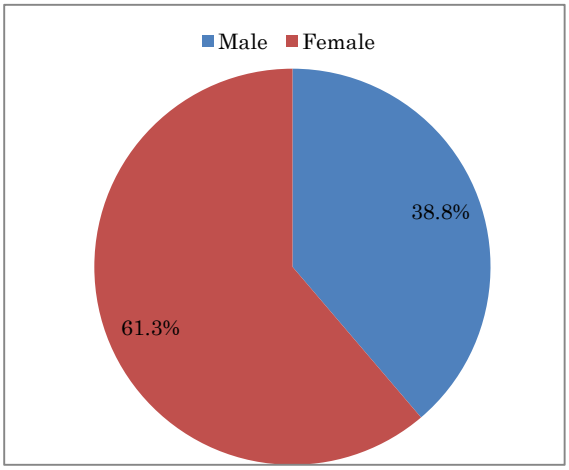


Figure 1 Sex of Respondent

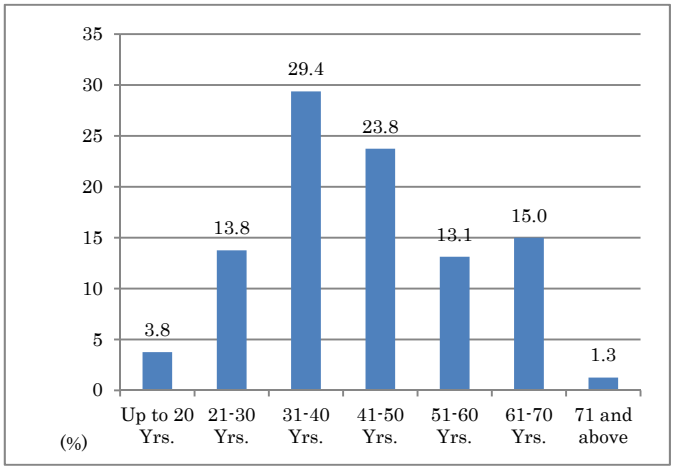


Figure 2 Age of Respondent

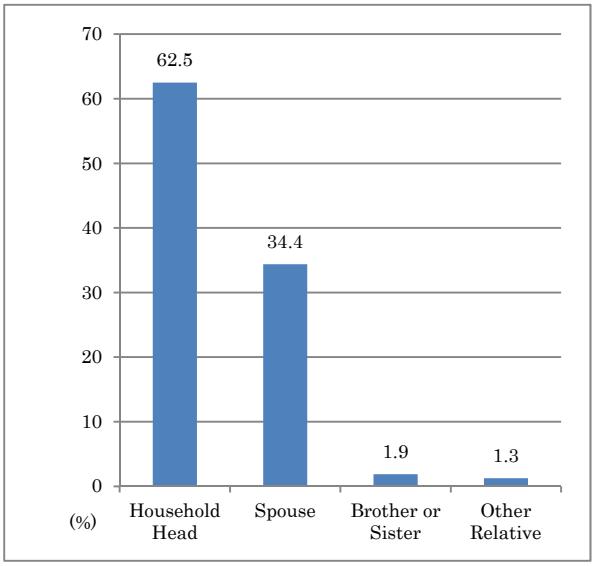


Figure 3 Respondent's relationship to the household head

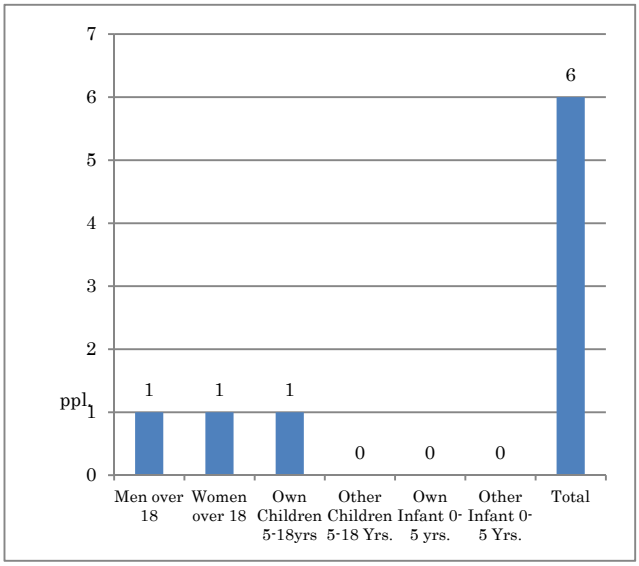


Figure 4 Household Population (Median)

II. Priority for improvement of living conditions

Table 1 1st priority for the household for improving living condition

Site Name	Improved electricity	health clinics and services	schools and education	water supply facility and	Improve access road	Other (specify)	Improve Farming
Kabuta	0.0%	20.0%	0.0%	80.0%	0.0%	0.0%	0.0%
Kanyembo	5.0%	5.0%	0.0%	90.0%	0.0%	0.0%	0.0%
Muatishi	10.0%	0.0%	0.0%	90.0%	0.0%	0.0%	0.0%
Kapala	0.0%	10.0%	0.0%	80.0%	0.0%	0.0%	10.0%
Musangu Filling Station	0.0%	5.0%	10.0%	85.0%	0.0%	0.0%	0.0%
Kapakala	0.0%	0.0%	5.0%	90.0%	0.0%	5.0%	0.0%
Shichama	10.0%	0.0%	5.0%	80.0%	0.0%	0.0%	5.0%
Milenge	25.0%	0.0%	5.0%	45.0%	25.0%	0.0%	0.0%
Total	6.3%	5.0%	3.1%	80.0%	3.1%	0.6%	1.9%

Table 2 2nd priority for the household for improving living condition

Site Name	Don't know/Not sure	Improved electricity	Improve health clinics and services	Improve schools and education	Improve water supply facility and services	Improve sanitation/sewerage system	Improve access road	Other (specify)	Improve Farming
Kabuta	20.0%	15.0%	5.0%	0.0%	20.0%	15.0%	0.0%	0.0%	25.0%
Kanyembo	25.0%	40.0%	10.0%	0.0%	5.0%	0.0%	0.0%	10.0%	10.0%
Muatishi	5.0%	55.0%	5.0%	0.0%	5.0%	0.0%	10.0%	15.0%	5.0%
Kapala	0.0%	10.0%	5.0%	5.0%	20.0%	10.0%	5.0%	10.0%	35.0%
Musangu Filling Station	15.0%	0.0%	15.0%	15.0%	10.0%	0.0%	5.0%	25.0%	15.0%
Kapakala	5.0%	30.0%	0.0%	25.0%	0.0%	0.0%	10.0%	0.0%	30.0%
Shichama	0.0%	65.0%	0.0%	5.0%	10.0%	0.0%	0.0%	20.0%	0.0%
Milenge	0.0%	40.0%	5.0%	0.0%	20.0%	0.0%	30.0%	0.0%	5.0%
Total	8.8%	31.9%	5.6%	6.3%	11.3%	3.1%	7.5%	10.0%	15.6%

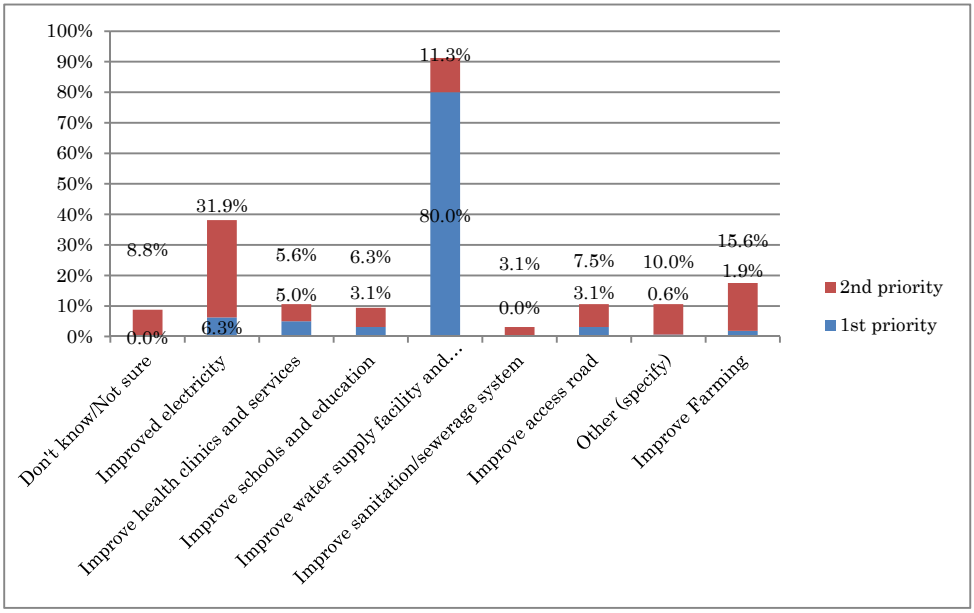


Figure 5 1st and 2nd priority for the household for improving living condition (Whole survey target sites)

III. Condition of water supply and use

Table 3 Main sources of domestic water (Dry Season)

Site Name	Borehole with hand pump	Protected spring (point source)	Unprotected dug well	Pond, river, lake or stream	Other
Kabuta	0.0%	55.0%	0.0%	45.0%	0.0%
Kanyembo	55.0%	0.0%	0.0%	40.0%	5.0%
Muatishi	85.0%	0.0%	0.0%	15.0%	0.0%
Kapala	35.0%	0.0%	15.0%	50.0%	0.0%
Musangu Filling Station	55.0%	5.0%	40.0%	0.0%	0.0%
Kapakala	5.0%	0.0%	0.0%	95.0%	0.0%
Shichama	90.0%	5.0%	5.0%	0.0%	0.0%
Milenge	75.0%	0.0%	15.0%	10.0%	0.0%
Total	50.0%	8.1%	9.4%	31.9%	0.6%

Table 4 Main sources of domestic water (Rainy Season)

Site Name	Borehole with hand pump	Protected spring (point source)	Rainwater collection	Unprotected dug well	Pond, river, lake or stream	Other
Kabuta	0.0%	55.0%	0.0%	0.0%	45.0%	0.0%
Kanyembo	45.0%	0.0%	0.0%	0.0%	50.0%	5.0%
Muatishi	55.0%	5.0%	0.0%	0.0%	40.0%	0.0%
Kapala	45.0%	0.0%	0.0%	25.0%	30.0%	0.0%
Musangu Filling Station	50.0%	5.0%	0.0%	40.0%	5.0%	0.0%
Kapakala	5.0%	0.0%	0.0%	0.0%	95.0%	0.0%
Shichama	70.0%	5.0%	0.0%	0.0%	25.0%	0.0%
Milenge	65.0%	0.0%	5.0%	15.0%	15.0%	0.0%
Total	41.9%	8.8%	0.6%	10.0%	38.1%	0.6%

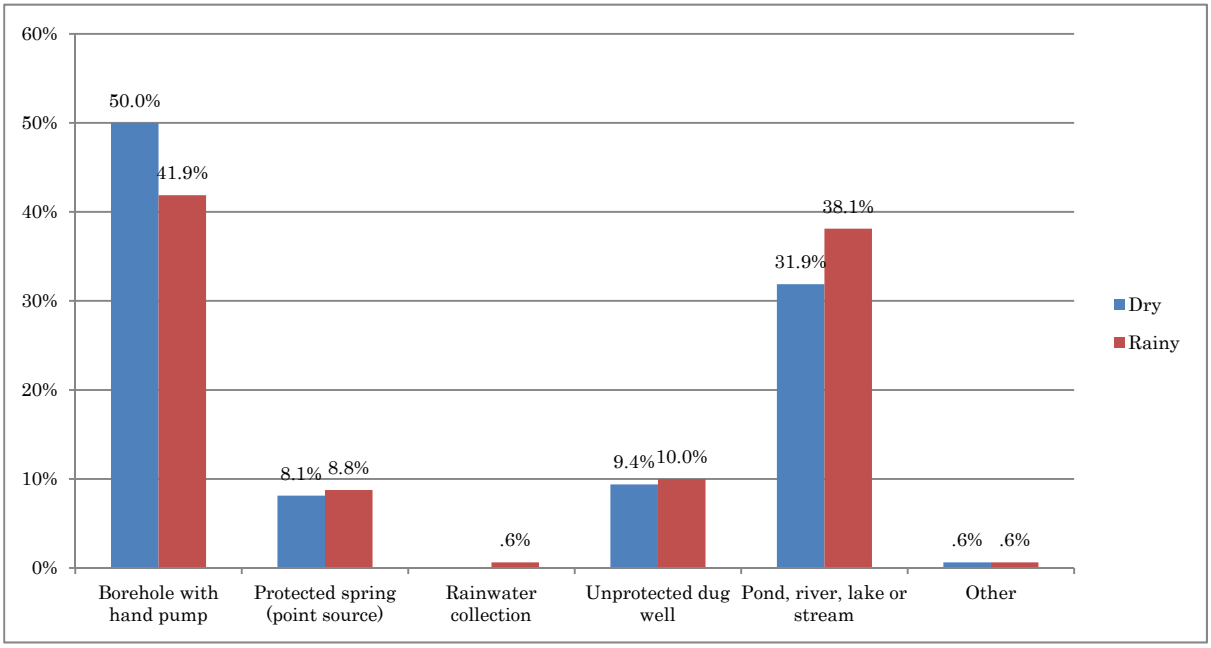


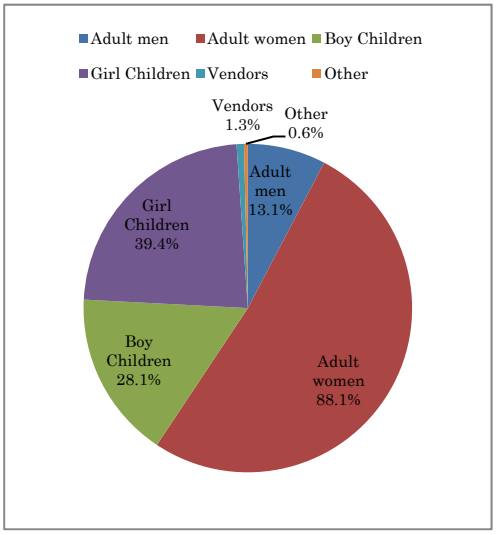
Figure 6 Main sources of domestic water (Whole survey target sites)

Table 5　Daily water consumption per capita (Litre) (Mean) (Left)

Table 6　Extra water demand per capita per day (Litre) (Mean) (Right)

Site Name	Dry Season	Rainy Season
Kabuta	16.6	16.6
Kanyembo	12.9	12.5
Muatishi	11.3	11.7
Kapala	15.2	14.4
Musangu Filling Station	20.6	20.3
Kapakala	14.8	12.5
Shichama	17.2	17.2
Milenge	12.9	12.1
Total	15.1	14.6

Site Name	Dry Season	Rainy Season
Kabuta	12.0	12.0
Kanyembo	11.7	12.3
Muatishi	8.4	8.9
Kapala	14.6	14.3
Musangu Filling Station	12.3	12.3
Kapakala	5.0	16.0
Shichama	9.0	9.0
Milenge	8.3	7.7
Total	10.8	11.6



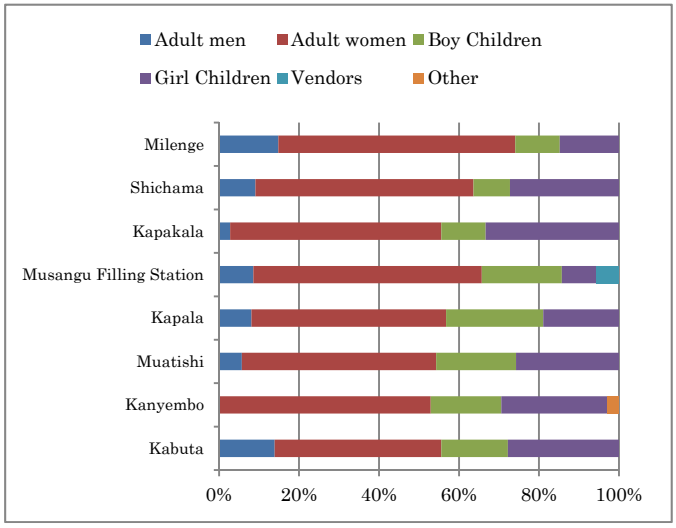


Figure 7　Responsible persons for water collection (Whole survey target sites) (Multiple Answer) (Left)

Figure 8　Responsible persons for water collection (per District) (Right)

Table 7　Time required to get water (Return trip) (minute) (Mean) (Left)

Table 8　Frequency of water collection per day per household /Day (time) (Mean) (Right)

Site Name	Dry Season	Rainy Season
Kabuta	40.75	40.75
Kanyembo	41.25	34.25
Muatishi	76.65	57.15
Kapala	33.85	33.20
Musangu Filling Station	54.80	54.80
Kapakala	21.75	21.75
Shichama	46.00	46.00
Milenge	10.05	10.05
Total	40.64	37.24

Site Name	Dry Season	Rainy Season
Kabuta	3.70	3.70
Kanyembo	1.80	1.80
Muatishi	1.65	1.60
Kapala	4.40	4.25
Musangu Filling Station	3.95	3.85
Kapakala	3.20	2.55
Shichama	1.35	1.35
Milenge	3.00	3.00
Total	2.88	2.76

Table 9　Willingness to pay for the water fee (Household/20L) (Median)

Site Name	ZMW
kabuta	0.01
kanyembo	0.01
muatishi	0.03
kapala	0.02
Musangu Filling Station	0.04
kapakal	0.05
shichama	0.05
milenge	0.01

IV. Perception on improvement of current water supply situation

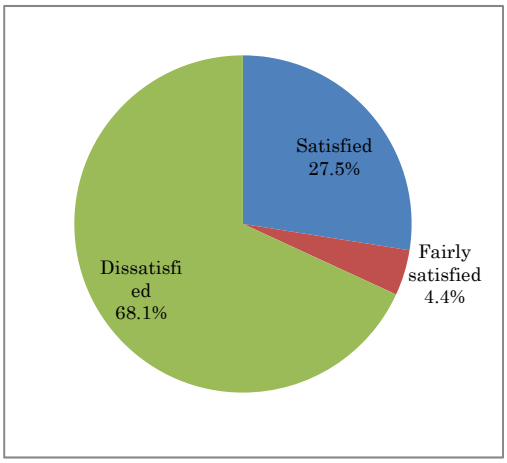


Figure 9 Perception of current water supply situation (Whole survey target sites)

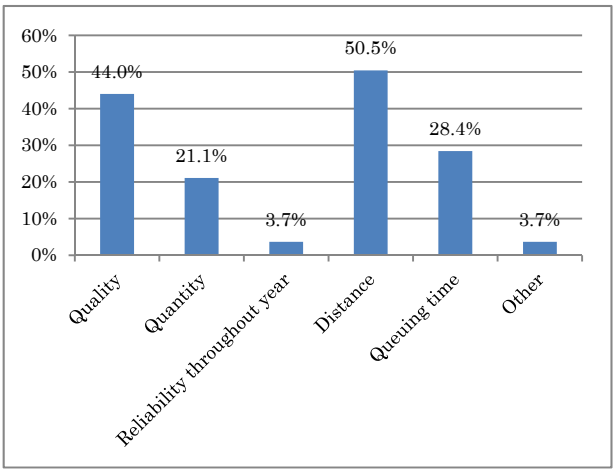


Figure 10 Reasons for dissatisfaction (Whole survey target sites)

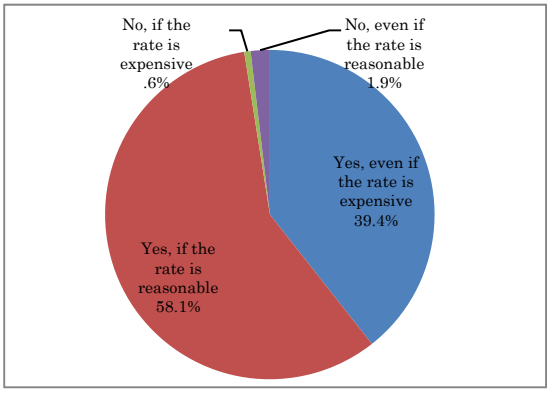


Figure 11 Willingness to pay for water fee of improved water supply facility (Left)

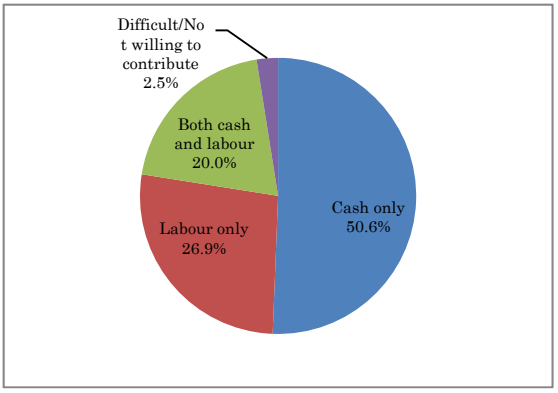


Figure 12 Types of contribution for construction of water facility (Right) (Whole survey target sites)

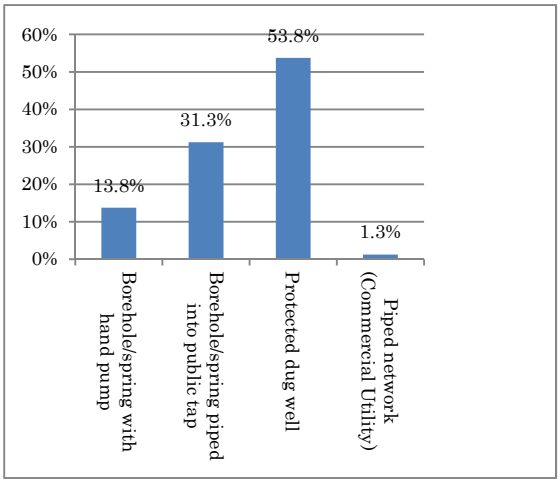


Figure13 Preferred water supply facility type (Whole survey target sites)

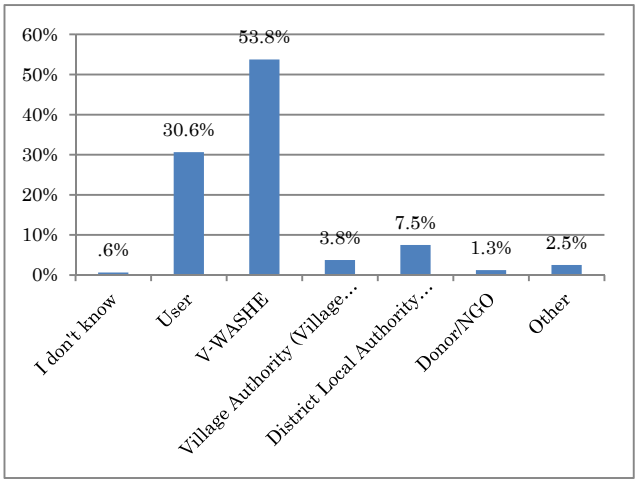
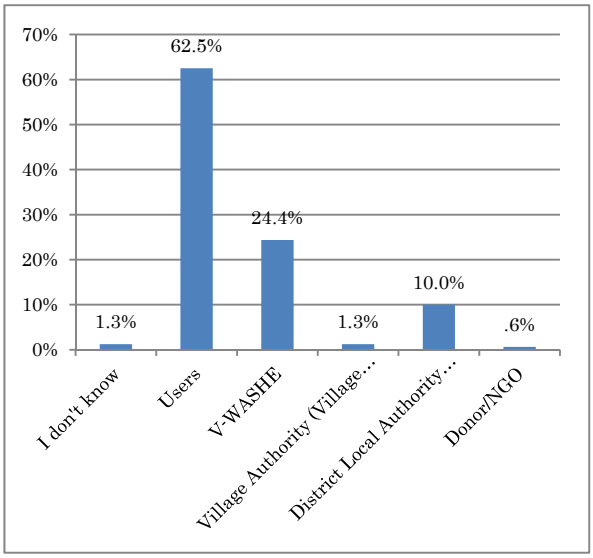


Figure14 Who should operate and maintain the facility (Whole survey target sites)



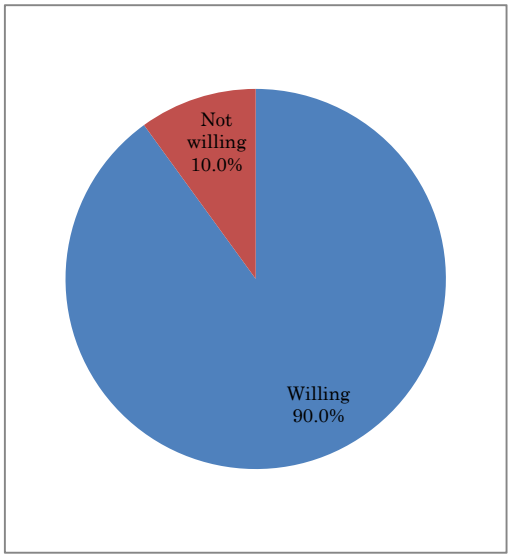


Figure 15 Who should cover the O&M cost of the facility (Whole survey target sites) (Left)

Figure 16 Willingness to pay for water obtained from the facility (Whole survey target sites) (Right)

V. Health and Sanitation Conditions

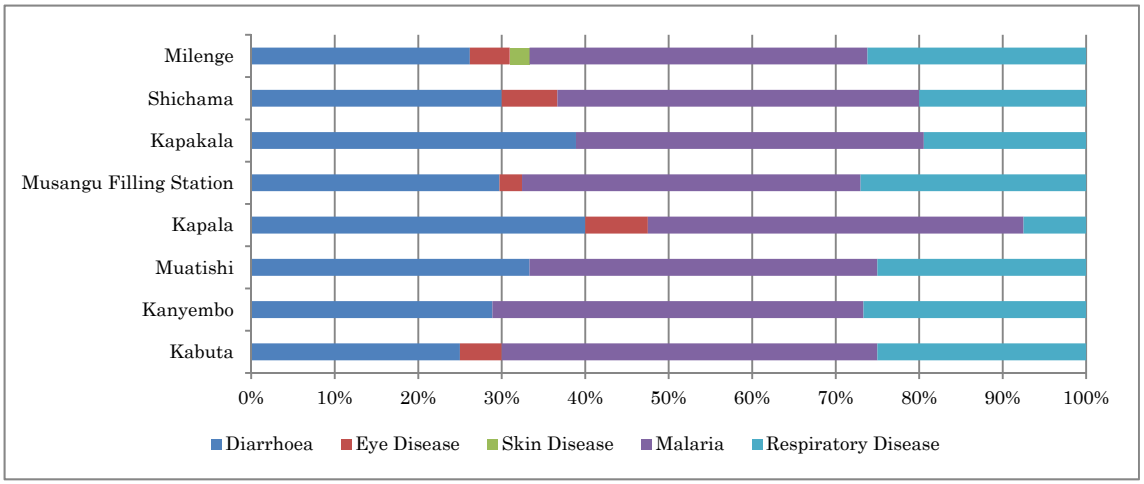


Figure 17 Major diseases affecting the household (Multiple Answer)

Table 10 Major diseases affecting the household (Multiple Answer)

Site Name	Diarrhoea	Eye Disease	Skin Disease	Malaria	Respiratory Disease
Kabuta	50.0%	10.0%	0.0%	90.0%	50.0%
Kanyembo	65.0%	0.0%	0.0%	100.0%	60.0%
Muatishi	80.0%	0.0%	0.0%	100.0%	60.0%
Kapala	80.0%	15.0%	0.0%	90.0%	15.0%
Musangu Filling Station	57.9%	5.3%	0.0%	78.9%	52.6%
Kapakala	70.0%	0.0%	0.0%	75.0%	35.0%
Shichama	45.0%	10.0%	0.0%	65.0%	30.0%
Milenge	55.0%	10.0%	5.0%	85.0%	55.0%

Table 11 Perceived practices that cause diarrhoea (Multiple Answer)

Site name	Not washing hand	Drinking/Using contaminated water	Handling food in inappropriate manner	Not having hygiene toilet	Flies	I don't know	Other
Kabuta	7.1%	100.0%	50.0%	0.0%	0.0%	0.0%	0.0%
Kanyembo	5.0%	90.0%	35.0%	5.0%	0.0%	0.0%	0.0%
Muatishi	10.5%	89.5%	36.8%	10.5%	0.0%	0.0%	10.5%
Kapala	5.0%	90.0%	40.0%	10.0%	0.0%	5.0%	5.0%
Musangu Filling Station	0.0%	95.0%	50.0%	5.0%	0.0%	0.0%	0.0%
Kapakala	10.5%	68.4%	21.1%	5.3%	21.1%	0.0%	0.0%
Shichama	0.0%	80.0%	25.0%	10.0%	5.0%	0.0%	0.0%
Milenge	0.0%	83.3%	16.7%	5.6%	0.0%	11.1%	0.0%
Total	4.7%	86.7%	34.0%	6.7%	3.3%	2.0%	2.0%

VI. Household Economic Status

Table 12 Main Income Sources (Multiple Answer)

Site Name	Farming	Livestock farming	Own business	Salary from	Pension	Remittance	Casual Labour	Fishing	Charcoal burning	Other
Kabuta	60.0%	0.0%	20.0%	0.0%	0.0%	5.0%	5.0%	30.0%	10.0%	35.0%
Kanyembo	30.0%	0.0%	15.0%	20.0%	0.0%	0.0%	5.0%	20.0%	5.0%	35.0%
Muatishi	84.2%	5.3%	5.3%	5.3%	0.0%	0.0%	10.5%	57.9%	5.3%	5.3%
Kapala	70.0%	15.0%	30.0%	5.0%	0.0%	0.0%	5.0%	35.0%	20.0%	10.0%
Musangu Filling Station	95.0%	5.0%	0.0%	0.0%	0.0%	0.0%	5.0%	20.0%	0.0%	20.0%
Kapakala	80.0%	0.0%	5.0%	0.0%	5.0%	10.0%	10.0%	0.0%	10.0%	15.0%
Shichama	90.0%	0.0%	10.0%	5.0%	0.0%	5.0%	0.0%	0.0%	10.0%	20.0%
Milenge	25.0%	0.0%	25.0%	45.0%	0.0%	0.0%	30.0%	0.0%	0.0%	0.0%
Total	66.7%	3.1%	13.8%	10.1%	0.6%	2.5%	8.8%	20.1%	7.5%	17.6%

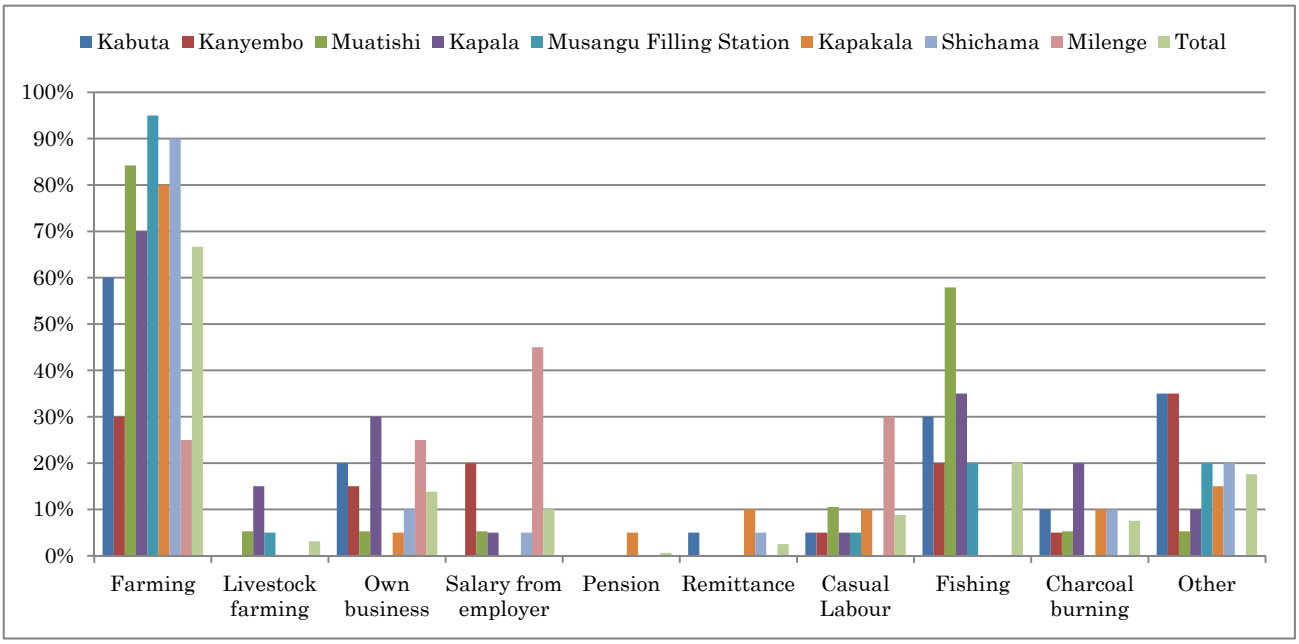


Figure 18 Main Income Sources

Table13　Monthly expenditure per household (Median) (Left)

Table14　Monthly income per household (Median) (Right)

Site Name	ZMW
Kabuta	125
Kanyembo	300
Muatishi	250
Kapala	200
Musangu Filling Station	100
Kapakala	100
Shichama	100
Milenge	375
Total	150

Site Name	ZMW
Kabuta	155
Kanyembo	300
Muatishi	300
Kapala	500
Musangu Filling Station	250
Kapakala	200
Shichama	250
Milenge	525
Total	300

Table 15　Months that bring most cash income

Site Name	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Kabuta	15.0%	15.0%	45.0%	5.0%	25.0%	50.0%	50.0%	25.0%	15.0%	15.0%	30.0%	30.0%
Kanyembo	20.0%	35.0%	30.0%	15.0%	5.0%	30.0%	45.0%	30.0%	15.0%	20.0%	30.0%	15.0%
Muatishi	5.0%	5.0%	35.0%	20.0%	15.0%	30.0%	35.0%	45.0%	20.0%	20.0%	40.0%	15.0%
Kapala	55.0%	30.0%	5.0%	5.0%	15.0%	20.0%	15.0%	5.0%	5.0%	10.0%	30.0%	45.0%
Musangu Filling Station	5.0%	0.0%	5.0%	35.0%	40.0%	30.0%	15.0%	20.0%	15.0%	5.0%	20.0%	15.0%
Kapakala	10.0%	5.0%	0.0%	5.0%	45.0%	75.0%	60.0%	25.0%	5.0%	10.0%	10.0%	5.0%
Shichama	15.0%	5.0%	0.0%	10.0%	10.0%	50.0%	35.0%	25.0%	10.0%	5.0%	5.0%	30.0%
Milenge	30.0%	30.0%	30.0%	35.0%	40.0%	80.0%	75.0%	55.0%	60.0%	55.0%	50.0%	40.0%
Total	19.4%	15.6%	18.8%	16.3%	24.4%	45.6%	41.3%	28.8%	18.1%	17.5%	26.9%	24.4%

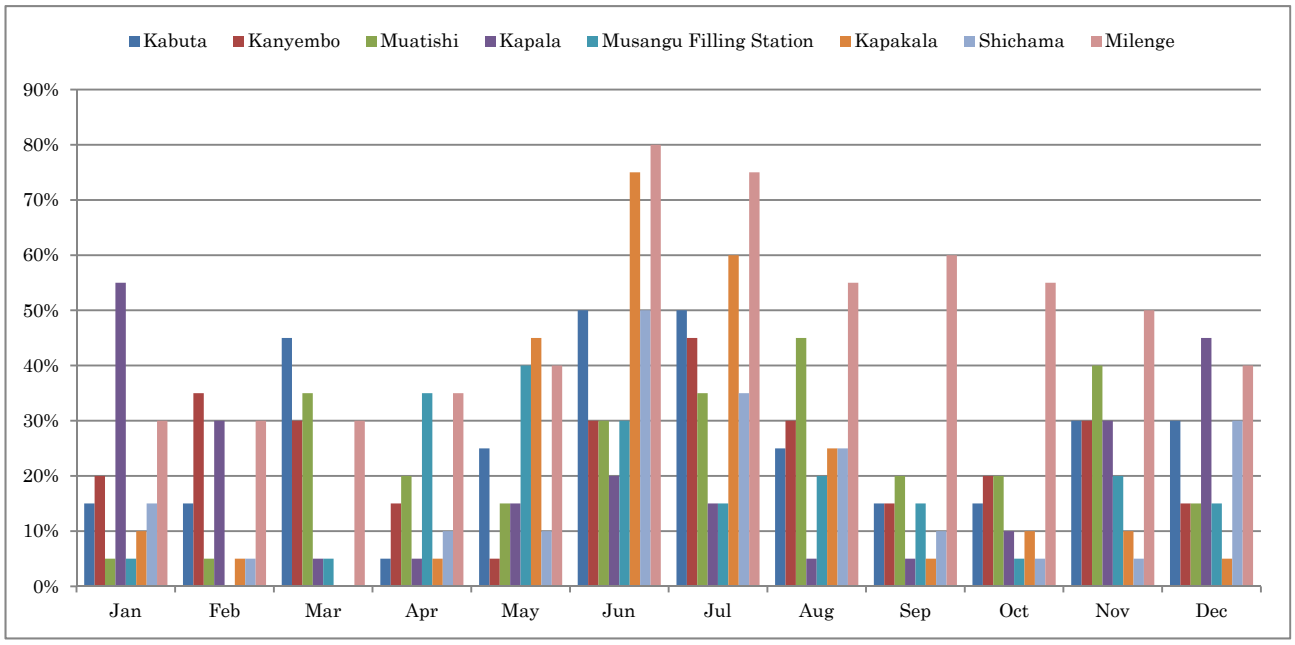


Figure 19　Distribution of months that bring most cash income (Multiple Answer)

3 Socio-Economic Survey Questionnaires

3-1 Household Survey Questionnaire

3-2 Key Informant Survey Questionnaire

HOUSEHOLD QUESTIONNAIRE

Section-A: Questionnaire Information Panel	
A1 Serial No.	A2 Day/Month/Year of Interview
A3 Name of Interviewer	A4 Village Code/ Village Name
A5 Name of Ward	A6 Name of District【Please Tick】 ☐01：Nchelenge ☐02 : Mwense ☐03：Mansa ☐04 : Milenge

Section-B: Interviewee and Household Information			
B1	Name of Respondent		
B2	Sex of Respondent	Male…….. 01 Female…….. 02	
B3	Age of Respondent		Yrs Old
B4	Relationship of Respondent to the Household Head	Household Head…….. 01 Spouse…….. 02 Father or Mother…….. 03 Son or Daughter…….. 04 Brother or Sister…….. 05 Other Relative…….. 06 Others (Specify) _____ 07	
B5	How many persons usually live in your household?	Adult Men (age 18 and above)……..	[ ]
		Adult Women (age 18 and above)……	[ ]
		Own Children (age 5 - 17)……..	[ ]
		Other Children (age 5 – 17)……	[ ]
		Own Infant (under 5)……..	[ ]
		Other Infant (under 5)……	[ ]

Section-C Priority of Improvement of Living Condition			
C1	Which of the following problems are you most concerned about <u>as the first and second priority</u> for improvement of living conditions in your village/community? ***[Don't read out the choices]***	Improved electricity…… 01 Improve health clinics and services …….. 02 Improve schools and education ……..… 03 Improve water supply facility and services……. 04 Improve sanitation/sewerage system ……. 05 Improve disposal of garbage (solid waste) …… 06 Improve access road …….. 07 Other (specify) _____ 08 Don't Know/ Not Sure ……..... -1	C1_f) 1st Priority C1_s) 2nd Priority

Section-D Water Supply and Use

D1	What is the main source of water for domestic use in the Dry and Rainy Seasons, respectively?	Borehole with hand pump………………………… Protected spring (Point Source)…………… Unprotected spring (Point Source)………… Rainwater collection…………………………… Protected dug well……………………………… Unprotected dug well…………………………… Pond, river or stream…………………………… Water vendor……………………………………… Other (specify) _____________________	01 02 03 04 05 06 07 08 09	D1_d) Dry Season D1_r) Rain Season
D2	How much water, from the main source above, does your family use per day on average in the Dry and Rainy Seasons, respectively?	D2-d) Dry Season litre/day D2_r) Rain Season litre/day		
D3	How much EXTRA water does your household require per day in the Dry and Rainy Seasons, respectively?	D3_d) Dry Season litre/day (Put "0", if no extra water is required) D3_r) Rain Season litre/day (Put "0", if no extra water is required)		
D4	Are there any water sources you pay for, in the Dry and Rainy Seasons, respectively?	Borehole with hand pump………………………… Protected spring (Point Source)…………… Unprotected spring (Point Source)………… Rainwater collection…………………………… Protected dug well……………………………… Unprotected dug well…………………………… Pond, river or stream…………………………… Water vendor……………………………………… Other (specify) _____________________ Not Applicable………………………………………	01 02 03 04 05 06 07 08 09 -1	D4_d) Dry Season If -1, go to D8 D4_r) Rainy Season If -1, go to D8
D5	How much water, from the source paid, does your family use per day on average in the Dry and Rainy Seasons, respectively?	D5_d) Dry Season (May to Oct) Not Applicable……………-1 litre/day D5_r) Rain Season (Nov to Apr) Not Applicable……………-1 litre/day		
D6	How much money do you spend on water in the Dry and Rainy Seasons, respectively?	D6_d) Dry Season Not Applicable……………-1 ZMW/month D6_r) Rain Season Not Applicable……………-1 ZMW/month		
D7	What is your perception on the amount you pay for water in the Dry and Rainy Seasons, respectively?	Very Expensive…………………………………… Expensive…………………………………………… Fair…………………………………………………… Cheap………………………………………………… Very Cheap…………………………………………… Not Applicable…………………………………………	01 02 03 04 05 -1	D7_d) Dry Season D7_r) Rain Season

D8	Who usually fetches water in your household? 【Multiple Answer】	Adult men…… Adult women…… Boy children…… Girl children…… Vendors…… Others (Specify) _____	01 02 03 04 05 06	
D9	How long does it take to go your water source, get water, and come back, in the Dry and Rainy Seasons, respectively?	Number of minutes…… Water in housing premises…… Number of minutes…… Water in housing premises……	→ 0 → 0	D9_d) Dry Season min D9_r) Rain Season min
D10	How many times does your family fetch water from the main source in a day in the Dry and Rainy Seasons, respectively?	Number of times…… Water on premises…… Number of times…… Water on premises……	→ -1 → -1	D10_d) Dry Season times/day D10_r) Rain Season times/day

Section-E: Users' Awareness and Valuation on the Improved Water Supply

E1	Are you satisfied with current water supply situation?	Yes…… Fairly…… No……	01 02 03	 If 01 or 02, go to E3
E2	What are the reasons for dissatisfaction? 【Multiple Answer】	Quality…… Quantity…… Reliability throughout year…… Distance…… Queuing time…… Others (specify) _____ Not Applicable……	01 02 03 04 05 06 -1	
E3	Do you need an improved water supply facility even if your family have to pay user fees? 【Choose from the item listed】	Yes, even if the rate is expensive…… Yes, if the rate is reasonable…… No, if the rate is expensive…… No, even if the rate is reasonable…… I am satisfied with the current water provision……	01 02 03 04 05	
E4	If the improved water supply system is constructed, in which form is your household able to contribute for construction?	Cash only…… Labour only…… Both labour and cash…… Difficult to contribute……	01 02 03 04	 If 02 or 04, go to E6
E5	If you can contribute Cash, how much are you prepared to pay?	ZMW _____ Not Applicable……	 -1	
E6	What type of improved water supply facilities do you prefer?	Borehole with hand pump…… Spring with hand pump…… Borehole piped into public tap…… Spring piped into public tap…… Protected dug well…… Piped network (Commercial Utility)..... Others (specify) _____ Not Applicable……	01 02 03 04 05 06 07 -1	
E7	Who do you think should operate and maintain the improved water supply facility mainly?	Users…… V-WASHE…… Village Authority (Village Government)…… District Local Authority(DLA)/Government... Private Company…… Donor/NGO…… Others (Specify) _____ I don't know……	01 02 03 04 05 06 07 -1	

E8	Whose money do you think should cover the cost for operation and maintenance of the improved water supply facilities?	Users……..…….. 01 V-WASHE……..……..…… 02 Village Authority (Village Government)……. 03 District Local Authority(DLA)/Government.. 04 Donor/NGO……. 05 Others (Specify) _____ 06 I don't know…….. -1	
E9	Do you think you are supposed to pay to use improved water supply facility?	Yes…….....……01 No……02	
E10	How much is affordable price per 20L container from the following improved water facilities?	Borehole with hand pump…….....……..	E10_hp) [ ] ZMW/container
		Borehole/spring piped into public tap…….	E10_pt) [ ] ZMW/container

Section-F Conditions and Awareness in Health and Sanitation

F1	What are the major diseases affecting your household? 【Multiple Answer】	Diarrhoea…… 01 Eye disease…….. 02 Skin disease…….. 03 Malaria…… 04 Respiratory diseases…… 05 Others (Specify) _____ 06	
F2	During the past 30 days, did any of your household members have diarrhoea?	Yes…….. 01 No…….. 02	
F3	What kind of practice do you think causes diarrhoea? 【Multiple Answer】 ***[Don't read out the choices]***	Not washing hand……..….. 01 Drinking/Using contaminated water…….... 02 Handling food in inappropriate manner…… 03 Not having hygiene toilet…… 04 Flies…… 05 Witchcraft…… 06 I don't know…… 07 Others (specify) _____ 08	
F4	How much money has your household spent on medical expenditures (including medicine, doctor's fees, transport) in the past 30 days		ZMW/month

Section-G Economic Status

G1	What are the main income sources of your household, which bring cash income? 【Multiple Answers】	Farming…… 01 Livestock Farming……..…….. 02 Own business…… 03 Salary from employer……..…… 04 Pension……..…… 05 Remittance from family working outside… 06 Casual Labour 07 Others (Specify) _____ 08	
G2	How much is your family expenditure per month on average?		ZMW/Month

G3	How much does your family spend for household fuel per month on average?	ZMW/Month If ZMW0, go to G5	
G4	What is your perception on the amount paid for household fuel?	Very Expensive…….. 01 Expensive…….. 02 Fair…….. 03 Cheap…….. 04 Very Cheap…… 05 Not Applicable…… -1	
G5	How much is your family income per month on average?	ZMW/Month	
G6	Which month in a year does your family have the most cash income? 【Multiple Answer】	☐Jan ☐Feb ☐Mar ☐Apr ☐May ☐Jun ☐Jul ☐Aug ☐Sep ☐Oct ☐Nov ☐Dec 【Tick the month】	

KEY INFORMANT QUESTIONNAIRE

Section-A: Questionnaire Information Panel			
A1	Serial No.	A2 Day/Month/Year of Interview	
A3	Name of Interviewer	A4 Village Code/ Village Name	
A5	Name of Ward	A6 Name of District【Please Tick】 ☐01 : Nchelenge ☐02 : Mwense ☐03 : Mansa ☐04 : Milenge	
A7	Name and Title of the Representative of Key Informants Position _____ Name _____ Contact Number _____		
A8	Who are the key informants present? **[Multiple Answer]**	Ward Councillor……01 Village Headperson……02 Village Secretary……03 Health Workers……04 School Teachers……05 C.B.O representatives……06 Other (Specify) _____...07	
A9	The centre point of the Village(location of administrative centre) in GPS coordinate data	Degrees, minutes and seconds (DDD, MM, SS)	
A10	What kind / how many public facilities do you have in the village?	RHC……	[ ]
		Dispensary……	[ ]
		Primary School……	[ ]
		(Day) Secondary School……	[ ]
		Boarding School……	[ ]
		Community School……	[ ]
		Religious building……	[ ]
		Market……	[ ]
		Cooperatives……	[ ]
		Administrative office……	[ ]
		Others (Specify)_____….	[ ]
		*If facility is not in the village, put "-1"	

A11	How many people are using the facilities?	RHC (Number of visiting patients)	[ ]
		Primary School (number of pupils).....	[ ]
		Day Secondary School (number of pupils)...	[ ]
		Boarding School (number of pupils)	[ ]
		*If facility is not in the village, put "-1"	

Section-B: Population			
B1	Population of the Village		
B2	Ratio of Male and Female	Male [ ] Female [ ] I don't know……-1	
B3	Number of Households		
B4	Average No. of Household Members		
B5	Has there been demographic change in the community in the past five years?	Drastic increase with expansion of residential area.....01 Drastic increase without expansion of the residential area of the village……02 Stable apart from natural population increase……03 Drastic decrease due to emigration……04	
B6	Is there seasonal variety in the village population?	Yes……1 No……2	If 2, go to Section C
B7	When does the community have the most people? **[Multiple Answer]**	[Tick boxes] ☐Jan ☐Feb ☐Mar ☐Apr ☐May ☐Jun ☐Jul ☐Aug ☐Sep ☐Oct ☐Nov ☐Dec Not Applicable……-1	

Section-C: Accessibility			
C1	Please indicate the combination of means of transport which community members usually rely on to access to the Municipal/District centre(boma). **[Multiple Answer]**	On foot.....01 By Bicycle.....02 By motorbike.....03 By public bus.....04 By getting a lift.....05 Others (Specify) _____.....06	

C2	How long does it take to get to the District centre from the village by the means of transport which community members usually use for the Dry and Rainy Seasons?	Dry Season	minutes
		Rainy season	minutes
C3	How is the road condition from the village to the centre of the District?	Good throughout the year.....01 Good only in the dry season.....02 Bad throughout the year.....03	
C4	Can heavy vehicles/ machines reach the centre of the village from the District boma? *[surveyors should verify the answer since they have just observed the road condition]*	Yes, they can access throughout the year.....01 Yes, but only in the dry season.....02 Yes, but small works are necessary for access.....03 Yes, if you take an alternative road, detouring.....04 No, impossible throughout the year.....05 **Please attach picture taken of the road condition (especially inaccessible points, if any)*	
C5	If C4 is 03, would the community members be willing to carry out small works for the access of the road?	Yes……01 No……02 Not Applicable……-1	

Section-D: Economic activities

D1	What are the two biggest income sources in the village?	Farming.....01 Fishing.....02 Livestock rearing.....03 Retail.....04 Manufacturing handcraft.....05 Public service.....06 Work in nearby town.....07 Other (Specify) _____.....08	1st 2nd	
D2	What are the 1st and 2nd major food and cash crops in the village?	Maize.....01 Rice.....02 Cassava.....03 Sorghum.....04 Beans.....05 Wheat.....06 Other (Specify) _____.....07 No agricultural production.....-1	Food Crops 1st / 2nd Cash Crops 1st / 2nd	

Section-E: Existing Organisations

E1	What organisations, formed voluntarily in the village by the community members, currently exist in the village? **[Multiple Answer]**	Farmers' association.....01 Health association.....02 Women's association. .....03 Religious organisation.....04 PTA.....05 Youth Group.....06 V-WASHE.....07 Other (Specify)_____.....08 No Organisation formed.....-1	

E2	If there is no V-WASHE, is there any plan to organise it in the village?	Yes.....01 No.....02 V-WASHE already exists.....-1	
E3	Has there been effort made by community for improvement of living condition? If so, what kind of effort? **[Multiple Answer]**	Construction/rehabilitation of water supply facility.....01 Construction/rehabilitation of school.....02 Construction/rehabilitation of irrigation scheme.....03 Construction/rehabilitation of community hall.....04 Construction/rehabilitation of road/bridge.....05 Other (Specify)_____ .....06 No experiences.....-1	If -1, go to E8
E4	What kind of resources did the community contribute to implement or maintain the activities? **[Multiple Answer]**	Cash for initial cost.....01 Cash for O&M cost.....02 In-Kind for initial cost.....03 In-Kind for O&M cost.....04 Provision of labour force.....05 Other (Specify)_____.....06 No contribution made.....07 Not applicable.....-1	If 03-07 or -1, go to E7

E5	If contribution was made in cash, how much was paid by each Household for initial cost? Not applicable..... -1	Water supply facility	☐ZMW/Household ☐ZMW/Person [tick the unit]	ZMW
		School	☐ZMW/Household ☐ZMW/Person [tick the unit]	ZMW
		Irrigation	☐ZMW/Household ☐ZMW/Person [tick the unit]	ZMW
		Community Hall	☐ZMW/Household ☐ZMW/Person [tick the unit]	ZMW
		Road/Bridge	☐ZMW/Household ☐ZMW/Person [tick the unit]	ZMW
		Other (Specify)_____	☐ZMW/Household ☐ZMW/Person [tick the unit]	ZMW
E6	If contribution was made in Cash, how much was paid for O&M? (Monthly)	Water supply facility	☐ZMW/Household ☐ZMW/Person [tick the unit]	ZMW

	Not applicable..... -1	School	☐ZMW/Household ☐ZMW/Person [tick the unit] ZMW
		Irrigation	☐ZMW/Household ☐ZMW/Person [tick the unit] ZMW
		Community Hall	☐ZMW/Household ☐ZMW/Person [tick the unit] ZMW
		Road/Bridge	☐ZMW/Household ☐ZMW/Person [tick the unit] ZMW
		Other (Specify)_____	☐ZMW/Household ☐ZMW/Person [tick the unit] ZMW
E7	Who were the projects funded by? Indicate name(s). * Put "Community" if no external support was received Not applicable..... -1	Water supply facility	
		School	
		Irrigation	
		Community Hall	
		Road/Bridge	
		Other (Specify)_____	
E8	Does the community presently receive any support from government/NGO/ Donor in the water supply area?	Yes.....01 No.....02	If 02, go to Section F
E9	Please indicate the names of the three main organisations.	1. 2. 3. Not Applicable……..-1	
E10	What type of support does the community receive?	Construction of boreholes with hand pumps……..01 Construction of boreholes piped into public tap……02 Rehabilitation of existing water supply facilities…03 Training on O&M activities of V-WASHE……04 Training on hand pump repair to APM……05 Provision of spare parts……06 Other (Specify) _____……07 Not Applicable……-1	

Section-F: Sanitation and Hygiene			
F1	What are the three main diseases affecting the community members in the village?	Diarrhoea.....01 Eye disease.....02 Skin disease.....03 Malaria.....04 Respiratory diseases.....05 Others (Specify) _____...06	1st 2nd 3rd
F2	Please describe the most common type of latrine used in the village.	Traditional pit latrine….....01 VIP latrine….....02 Pour flush latrine….....03 Flush to sewage system/septic tank….....04 None/Bush….....05 Others (Specify) _____...06	
F3	How many households have improved (VIP latrine, Pour flush latrine or Flush to sewage system/septic tank) toilet?		
F4	What are the percentages of owned toilet?	Owned by one household each……. Shared by several households……. I don't know……..	[ ] [ ] -1
F5	How do you receive health and hygiene information? **[Multiple Answer]**	Staff of dispensary/RHC.....01 Village Health Worker.....02 Traditional Birth Attendants.....03 School.....04 Radio.....05 TV.....06 Religious Organisations.....07 Other (Specify)_____ .....08 No health/hygiene information available.....-1	
F6	If there is, what kind of health/hygiene education programme is there in the village? **[Multiple Answer]**	On Prevention of water borne diseases……1 On Malaria prevention……2 On HIV/AIDS……3 On reproductive health……4 Nutrition……5 Other (Specify)_____……..6 No health/hygiene programme provided……-1	

Section-G: Water Supply Situation

Type of water source/facility in the village No water sources in the village…….-1	G1 Put "x" for all water use				G2 Indicate number of sources/facilities located within the village		G3 What is the reason for disuse? **[Multiple Answer]** 01. Source dried up 02. Problem with water quality 03. Breakdown of pumping device 04. Lack of funds for operation 05. Other (Specify) There is no water source of this type…….-1	G4 Unit Price of user fee specify the unit: ZMW/litre ZMW/Month ZMW/day/HH No fee charged……-2	G5 On whose property are the sources/facilities on? 01. Government 02. Village Government 03. Chief 04. A community member 05. Other (specify) There is no water source of this type…….-1
	Domestic use	Livestock use	gardening	Other	a) In use	b) Not in use			
1. Stream, river									
2. Pond, dam									
3. Rainwater									
4. Unprotected spring/shallow well									
5. Protected shallow well/Spring									
6. Protected shallow well with HP									
7. Borehole with HP									
8. Independent piped scheme					No. of water point	No. of water point			
9. Piped network (CU)					No. of water point	No. of water point			

10. Other (specify)					

G6	Do the community members buy water from water vendors?	Yes……01 No……02	If 02, go to Section H	
G7	How many vendors are there?	Handcart/bicycle vendors…… Water tanker…… Other (specify) _____…… Not Applicable……-1	[ ] [ ] [ ]	
G8	What are the sources of water sold? **[Multiple Answer]**	Stream/river……01 Dam/pond……02 Unprotected spring/shallow well……03 Protected shallow well/Spring……04 Protected shallow well/borehole with HP……05 Independent piped scheme……06 Piped network (CU)……07 Other (specify)_____……08 Not Applicable……-1		
G9	What is the average price of water sold by the vendors?	Not Applicable……-1	☐ZMW/litre ☐ZMW/month ☐ZMW/day/Household [tick the unit]	

For Communities with hand pumps, go to Section H. If Community has no hand pumps, go to Section I

Section-H: O&M of existing hand pumps (For communities with hand pump water supply facilities)							
	H( )_1	H( )_2	H( )_3	H( )_4	H( )_5	H( )_6	H( )_7
Hand Pump Number (ask about up to 5 HP)	When was the hand pump constructed? Not applicable…….-1 Unknown…….99	What is the type of the hand pump? 01. Afridev 02. India Mark II 03. India Mark III 04. Other (specify) Not applicable…-1 Unknown……99	Who provided funding for construction of the hand pump? Describe the name of the organisation Not applicable……..-1 Unknown……99	Who is responsible for daily O&M of the hand pump? 01. Village Government 02. V-WASHE 03. School 04. RHC 05. District (DLA) 06. Other (Specify) 07. No one Not applicable…-1 Unknown…….99	Is the hand pump operational? 01. Yes 02. No Not applicable..-1	Has the hand pump broken down since the construction? 01. Yes 02.No. Not applicable..-1	What kind of measures were taken to fix the hand pump? 01. community repaired themselves 02. asked for support from private plumber/mechanics 03. asked for support from the district (DLA)/Government 04. asked for support from NGO/Donor 05. No action taken 06. Hand pump has not broken down Not Applicable……-1
H1							
H2							

H3							
H4							
H5							

H6	Who can the community ask for support with O&M of the hand pump? **[Multiple Answer]**	Hand pump care taker.....01 Private Plumber/mechanics.....02 APM.....03 District Local Authority/Government.....04 NGO/Donors.....05 Village Government.....06 Other (Specify) _____.....07 No Support is provided.....08	
H7	How does the community usually collect the fee?	Regularly (daily, monthly, yearly, etc.).....01 Fee collected only when actual repair work is needed.....02 Contribution from well-wishers when repair is needed.....03 Other (Specify) _____.....04 No fee collected .....-1	If-1, go to H13
H8	Approximately how much did the repair and regular O&M work of the facility cost in the past one year?	ZMW _____ Not Applicable .....-1	
H9	How are collected water fees held?	Kept in a bank account for the water committee.....01 Kept in a bank account for the village government.....02 Kept by the treasurer of the village water committee.....03 Other (Specify) _____.....04 Not applicable.....-1	
H10	Are records kept on water user fee collection and use?	Yes.....01 No.....02 Not Applicable .....-1	If 02, go to H12
H11	What is the latest balance for the water user fee account?	ZMW _____ Not Applicable .....-1	
H12	What is the water user fee used for? **[Multiple Answer]**	To pay for allowances for V-WASHE members.....01 To pay for the repair fee.....02 To pay for the spare parts.....03 Other (Specify)_____.....04 Not Applicable .....-1	
H13	Has O&M training been provided?	Yes.....01 No.....02	If 02, go to H16
H14	When was the training?	Year/Month Not Applicable .....-1	
H15	Who funded the training?	Not Applicable .....-1	
H16	Who is in charge of decision making for the location for construction of the improved water supply facility?	**Leadership is taken by;** Village Chairman.....01 Sub-village chairman.....02 Village government member.....03 Chief.....04 District Local Authority.....05 Ward executive officer.....06 Other (Specify)_____.....07	

H17	Who participates in decision making process for construction of the improved water supply facility? **[Multiple Answer]**	**Decision making participated by;** Village government member……01 Village elders……02 V-WASHE……03 Chief……04 Whole village members……05 Ward officers……06 Other (Specify)_____……07	
H18	What is the process of decision making for construction of the improved water supply facility?	Voting by whole community ……01 Decision made by traditional leaders……02 Decision made by village government officials……03 Decision made by village chairman……04 Decision made by ward officials……05 Decision made by the chief……06 Other (specify) _____……07	
H19	Who is in charge of decision making when conflict arises in O&M of the facility?	**Leadership is taken by;** Village Chairman……01 Sub-village chairman……02 Village government member……03 Chief……04 District Local Authority……05 Ward executive officer……06 Other (Specify)_____……07	
H20	Who participates in decision making process when conflict arises in O&M of the facility? **[Multiple Answer]**	**Decision making participated by;** Village government members……01 Village elders……02 V-WASHE……03 Chief……04 Whole village members……05 Ward officers……06 Other (Specify)_____……07	
H21	What is the process of decision making when conflict arises in O&M of the facility?	Voting by whole community……01 Decision made by traditional leaders……02 Decision made by village government officials……03 Decision made by village chairman……04 Decision made by ward officials……05 Decision made by the chief……06 Other (specify) _____……07	
H22	What type of improved water supply facility would you prefer?	Borehole with hand pump.....01 Borehole piped into public tap.....02 Protected dug well.....03 Piped network (Water Supply Authority).....04 Other (Specify) _____.....05 Satisfied with current water supply conditions…..-1	
H23	Who do you think should operate and maintain the improved water supply facility?	Users.....01 V-WASHE/water committee.....02 Village Authority (Village Government).....03 District Local Authority(DLA)/Government.....04 Private Company.....05 Donor/NGO.....06 Other (Specify) _____.....07	

H24	Who should cover the cost of O&M of the improved water facility?	Users.....01 V-WASHE/water committee.....02 Village Authority (Village Government).....03 District Local Authority(DLA)/Government.....04 Private Company.....05 Donor/NGO.....06 Other (Specify) _____.....07	
H25	What is your most important expectation, from the item listed, on the improved water supply facility? **【chose 2 items from the list】**	Water quality is good.....01 Quantity is enough and stable.....02 Cost is affordable/reasonable/cheap.....03 Facilities are maintained and sustained properly.....04 Facilities are located near to the house.....05 Queuing time is reduced.....06 Other (Specify) _____.....07	

Section-I: O&M of potential water supply facilities (For communities WITHOUT existing water supply facilities)

I1	Do you need the improved water supply facility, even if community members have to pay for fee?	Yes, even if the rate is expensive……01 Yes, if the rate is reasonable……02 No, if the rate is expensive……03 No, even if the rate is reasonable……04 I am satisfied with the current water provision……05	
I2	What type of improved water supply facility would you prefer?	Borehole with hand pump.....01 Borehole piped into public tap.....02 Protected dug well.....03 Piped network (Water Supply Authority).....04 Other (Specify) _____.....05 Satisfied with current water supply conditions…….....-1	
I3	Who do you think should operate and maintain the improved water supply facility?	Users.....01 V-WASHE/water committee.....02 Village Authority (Village Government).....03 District Local Authority(DLA)/Government.....04 Private Company.....05 Donor/NGO.....06 Other (Specify) _____.....07	
I4	Who should cover the cost of O&M of the improved water facility?	Users.....01 V-WASHE/water committee.....02 Village Authority (Village Government).....03 District Local Authority(DLA)/Government.....04 Private Company.....05 Donor/NGO.....06 Other (Specify) _____.....07	
I5	What would you do if the improved water facility breaks down?	Community will repair by themselves.....01 Ask for support from private plumber/mechanics.....02 Ask for support from the district (DLA)/Government.....03 Ask for support from NGO/Donor.....04 No action.....05 Other (Specify) _____……06	

I6	Who would the community ask for support for with O&M (including repair) of the improved water facility from? [Multiple Answer]	Hand pump care taker.....01 Private Plumber/mechanics.....02 APM.....03 District Local Authority/Government.....04 NGO.....05 Village Government.....06 Other (Specify) _____.....07 No Support would be provided.....99	
I7	Who is in charge of decision making for selection and use of land, such as a site for construction of the improved water supply facility?	**Leadership is taken by;** Village Chairman.....01 Sub-village chairman.....02 Village government member.....03 Chief.....04 District Local Authority.....05 Ward executive officer.....06 Other (Specify)_____.....07	
I8	Who would participate in decision making process? **[Multiple Answer]**	**Decision making participated by;** Village government member.....01 Village elderlies.....02 V-WASHE.....03 Chief.....04 Whole village members.....05 Ward officers.....06 Other (Specify)_____.....07	
I9	What would be the process of decision making?	Voting by whole community.....01 Decision made by traditional leaders.....02 Decision made by village government officials.....03 Decision made by village chairman.....04 Decision made by ward officials.....05 Decision made by the chief.....06 Other (specify) _____.....07	
I10	What is your most important expectation, from the item listed, on the improved water supply facility? **【chose 2 items from the list】**	Water quality is good.....01 Quantity is enough and stable.....02 Cost is affordable/reasonable/cheap.....03 Facilities are maintained and sustained properly.....04 Facilities are located near to the house.....05 Queuing time is reduced.....06 Other (Specify) _____.....07	

Appendix-8-10 Format for Environmental Project Brief Report

Environmental Project Brief Report Format

EXECUTIVE SUMMARY (*Briefly describe the proposed project, alternatives considered, major impacts, and environmental management commitments*)

TABLE OF CONTENTS

1.0 INTRODUCTION
- 1.1 Give a brief project background, objectives.
- 1.2 The developer's physical address and the contact person.
- 1.3 Particulars of Shareholders and Directors
- 1.4 Track Record (Previous Experience of Enterprise)
- 1.5 Total project investment
- 1.6 state the project implementation date

2.0 DESCRIPTION OF THE PROJECT LOCATION (*Describe the project location supported by a location map drawn to an appropriate scale with a legend, direction of the True North. The location map must be printed on at least "A3" paper size for it to be clear*)

3.0 LEGAL AND POLICY FRAMEWORK (*Briefly describe the legal and policy framework and its relation to the proposed project*)

4.0 DESCRIPTION OF THE PROJECT, LIFECYCLE ACTIVITIES AND ALTERNATIVES
- 4.1 Project Description
- 4.2 Project Lifecycle Activities
  - 4.2.1 Construction Phase
  - 4.2.2 Operation Phase
  - 4.2.3 Decommissioning and Closure Phase (*Assume that this phase occurred*)
- 4.3 Project Inputs and Outputs (*State the raw materials and products*)
- 4.4 Project Alternatives (*describe alternatives for the production processes, location, raw materials and describe the "No Action" alternative*). You must give reasons for the selected alternatives.

5.0 DESCRIPTION OF THE BASELINE ENVIRONMENT
- 5.1 Ecological Resources (*flora, fauna and habitat resources*)
- 5.2 Geology and Hydrogeology
- 5.3 Drainage
- 5.4 Climate
- 5.5 Landscape and Topography
- 5.6 Land Use and Soils
- 5.7 Ground and Surface Water
- 5.8 Air quality and Noise
- 5.9 Social, Economic and Cultural Issues
- 5.10 Built Environment

6.0 ENVIRONMENTAL IMPACTS (*If possible, an impact matrix table should be included*)
- 6.1 Positive Impacts
  - 6.1.1 Socio-economic Environment
  - 6.1.2 Physical Environment
  - 6.1.3 Biological Environment
- 6.2 Negative Impacts
  - 6.2.1 Socio-economic Environment
  - 6.2.2 Physical Environment
  - 6.2.3 Biological Environment
- 6.3 Methodology of Impact Evaluation

Evaluation of impacts for significance should combine:

6.3.1 the *frequency* of occurrence
6.3.2 the *duration* of the impact
6.3.3 the *spatial extent* of the impact
6.3.4 the *sensitivity* of the element being impacted.

7.0 ENVIRONMENTAL SOCIAL MANAGEMENT PLAN (*State the Environmental Management Commitments for mitigating negative Environmental Impacts identified in Section 6.0 and measures for enhancing positive impacts.*

7.1 Environmental Monitoring Plan *(These should include environmental management cost estimates, responsible personnel and the frequency of monitoring*)

Aspect	Impact	Frequency	Mitigation measure	Time frame	Performance indicator	Monitoring and reporting	Cost

8.0 DECOMMISSIONING AND CLOSURE PLAN (*State environmental management commitments associated with the Decommissioning and Closure Phase for the project*)

9.0 Declaration of authenticity of report contents

REFERENCES (*Full references of the main documents cited in the report should be given*)

APPENDICES

- *Maps and satellite images*
- *Certificate of Incorporation*
- *Investment License*
- *Proof of Public consultation (e.g publications, minutes, comments from the public and adverts*
- *Land ownership (Title deeds or lease agreement)*
- *Any other relevant supporting documents or information that cannot be presented in the main report*

Apendix-8-11 Format for Environmental Impact Statement

Environmental Impact Statement Format

1.0 Executive Summary

- *Briefly describe the project background, objectives, location, shareholders, investment cost, relevant legislation, project description, technology, project alternatives, main findings, mitigation measures and lifespan.*
- *The executive summary should be signed by the developer* and the *study team.*

2.0 Introduction

2.1 Background of the project
2.2 Summary description of the project including project rationale
2.3 Objectives the project
2.4 Brief description of the Location
2.5 Particulars of Shareholders/Directors
2.6 The developer's physical address and the contact person.
2.7 Track Record/Previous Experience of Enterprise Elsewhere
2.8 Total Project Cost/Investment
2.9 Proposed Project Implementation Date

3.0 Policy, Legal and Institutional Framework

(cite all Policy, legal and institutional framework relevant to the project)

4.0 Project Description

4.1 Location
- *Include distances and nature of business of surrounding community*
- *Satellite images*
- *Maps*
- *Geographical coordinates*

4.2 Project description
- *Raw materials (including hazardous materials and their storage on site)*
- *products and by-products*
- *process and technology (including flow diagrams)*
- *production capacity*
- *Schedule and life time of the project*

4.3 Main activities
- Site preparation phase
- Construction phase
- Operation phase

5.0 Project Alternatives

Analyse the available alternatives such as but not limited to :

5.1 Location Alternatives
5.2 Process and technology
5.3 Raw materials
5.4 Product
5.5 Demand Alternatives *(Production Capacity)*
5.6 Justification for the selected option(s)

6.0 Environmental Baseline Study

Description of the site and the surrounding environment especially those aspects that are relevant to the project including evaluation of the sensitiveness of the environment. Baseline data should include but not limited to the following:

6.1 Topography
6.2 Climate
- *Rainfall, Temperature, Humidity, Sunshine*

6.3 Air quality
6.4 Geology
6.5 Hydrology
- *Surface water quality*
- *Groundwater quality*

6.6 Hydrogeology
6.7 Soils

6.8 Land use
6.9 Built Environment
6.10 Land tenure
6.11 Noise and vibration
6.12 Fauna
- *Field survey of animal species (Aquatic and terrestrial)*
- *Identification of rare or endangered species*

6.13 Flora
- *Terrestrial species*
- *Aquatic species*
- *Identification of rare or endangered species*

6.14 Birds
- *Field survey of bird species*
- *Identification of rare and endangered bird species*

6.15 Archaeological and cultural environment
- *Sources of raw materials for such events, or location of significant historical or archaeological features*

6.16 Social-cultural and economic set up
- *Population*
  Growth rate, population density and distribution
- *Administration*
- *Social services and amenities*
- *Market availability on various commodities*
- *Literacy levels, health and gender equity*
- *Traditional and religious practices and rites*

7.0 Impacts

7.1 Biophysical Environment
- *Positive – direct, indirect, short term, long term, reversible and irreversible*
- *Negative – direct, indirect short term, long term, reversible and irreversible*

7.2 Socio-economic and cultural
- *Positive – direct, indirect, short term, long term, reversible and irreversible*
- *Negative – direct, indirect short term, long term, reversible and irreversible*

7.3 Evaluation of impacts **significance** should combine:
- the ***frequency*** of occurrence of the impact
- the ***duration*** of the impact
- the ***spatial extent*** of the impact
- the ***sensitivity*** of the element being impacted.

8.0 Environment and Social Management Plan

(Management Commitments for mitigating negative Environmental Impacts identified and evaluated in Section 6.0 and measures for enhancing positive impacts)

8.1 Environment and Social Monitoring Plan **(***These should include environmental management cost estimates, responsible personnel and the frequency of monitoring)*

Aspect*	Impact	Mitigation measure	Frequency of Monitoring	Time frame	Performance indicator	Responsible person	Cost

***NOTE:** Aspect is an activity, service or product that is likely to cause an impact due to interaction with the environment*

9.0 Decommissioning and Rehabilitation Plan

(S*tate environmental management commitments associated with the Decommissioning and Closure Phase for the project*)

References (*Full references of the main documents cited in the report should be given*)

10.0 Appendices

- *Maps and satellite images*
- *Certificate of Incorporation*
- *Investment License*
- *Proof of Public consultation (Minutes and comments from the public during consultation and scoping) and adverts*
- *Land ownership (Title deeds or lease agreement)*
- *Specialised study Reports*
- *Any other relevant supporting documents or information that cannot be presented in the main report*

Appendix-8-12 Format for Full Resettlement Action Plan

ZAMBIA ENVIRONMENTAL MANAGEMENT AGENCY
FORMAT OF RESETTLEMENT ACTION PLAN (RAP)

TITLE
DOCUMENT NUMBER:
REVISION:
AUTHORISED BY:
NAME:

DETAILS:	
COMPANY/ LIS CODE	
NAME OF FACILITY	
TYPE OF FACILITY	
REVIEWED DOCUMENT	
LOCATION:	
PROVINCE	
DISTRICT	
ADDRESS	
CONTACT PERSON	
DESIGNATION	
FAX	
TELEPHONE	
E-MAIL	
DATE OF SUBMISSION OF EIS	
DATE OF REVIEW	
REPORT No.	
Performed By:	

EIA Document Review Checklist

Does the RAP include:

Item	**YES/NO**	**Comments**
Executive Summary		
The Executive Summary should provide a short (1-2 page) summary of the Resettlement Action Plan (RAP). It should provide a brief outline of the main characteristics of the project. It should summarise the information on the area and numbers of people affected by the project, eligibility criteria, the proposed compensation or rehabilitation assistance measures, public consultations, the institutional and legal framework for implementation of the Resettlement Action Plan, cost of resettlement and proposed timing for the plan		
Introduction		
The introduction should provide a general description of the project and the components responsible for displacement. It should include a summary of the relevant background information on the project, the area and people affected and the resettlement program. It should cover the following:		
Description of the project and its location;		
Analysis of alternatives, justifying the need for displacement		
Objectives of the resettlement project		
Institutions involved in the project (general areas of responsibility)		
Participation of local agencies, NGOs, organizations of affected people		
Baseline Data		
Area directly or indirectly affected by the project, distinguishing types of land and any other areas affected		
People directly affected by category: Clearly identify: i) all people affected by loss of land and/or productive assets (occupiers), including those that reside in the affected area **and** those who reside outside, ii) all those people affected by loss of housing, and iii) all other people who may be affected by loss of employment (labourers, service providers), income (retail outlets, small enterprises), or other assets (access		

to areas for fishing, grazing, firewood)		
Any vulnerable or "high-risk" groups or sectors that may be affected (indigenous peoples, households headed by single women, the elderly, children)		
Relevant social and cultural information, ethnic groups, language, formal and informal groups and organisations (co-operatives, NGOs, religious organizations) that may be relevant to consultation and implementation of the resettlement plan		
Land tenure and/or ownership rights of the affected population		
Land holdings of affected population		
Agricultural production, livestock and other on-farm income		
Communal productive assets that may be affected		
Other economic activities – any local employment that may be affected		
Household income levels and expenditure. This should include an analysis of the cost of basic services, such as water, sewerage, electricity, and local taxes		
Public infrastructure and social services that will be affected		
Definitions and Eligibility Criteria		
This section should provide a comprehensive description of the eligibility criteria for the compensation program (who will receive compensation or rehabilitation assistance and how will the compensation or rehabilitation assistance be structured). Definitions should be legally valid. It is important to have the following definitions:		
Household – define what constitutes an independent household, eligible to receive the benefits of the compensation or rehabilitation assistance program		
Cut-off date, after which any new entrants to the affected area will no longer be eligible for compensation or rehabilitation assistance, should be provided (There should not be too long a gap between the "cut-off date" and the date that the displacement takes place)		
Other definitions such as Displaced persons or project affected persons, security of tenure, livelihood, host community, replacement cost, rehabilitation assistance, involuntary resettlement, high risk group etc. should be included		
Legal and Institutional Framework		
The legal framework should show entitlements of affected persons under applicable laws and regulations, and should include:		
Laws and regulations dealing with valuation methodology, and payment of compensation or rehabilitation assistance		
Laws dealing with rights of affected persons under the judicial process, dispute resolution and alternative mechanisms		
Relevant laws relating to land ownership, land tenure, acquisition and transfer		
Laws and regulations dealing with the access and use of natural resources		
Laws dealing with social welfare		
Laws that ensure implementation of resettlement activities, including procedures for recognizing claims to land rights and inheritance		
The institutional framework should cover the following:		
The implementing agencies directly involved or should formally approve the Resettlement plan		
Institution (s) to finance the resettlement program		
Institution to carry out valuation, negotiation and payment of compensation for land and property		
Institution mandated to resolve problems relating to irregular land/house titles		
Institutions to communicate and coordinate with affected people, local authorities, NGOs, and other organizations		
Institutions mandated to deal with complaints and arbitration		
Institutions to carry out monitoring and evaluation		
Consideration of Alternatives		
Give a detailed description of alternatives considered giving reasons why the best option was considered. To provide justification for the best option, you may consider what proportion of the overall cost of the project responsible for displacement is represented by the resettlement program. The idea is to minimize physical displacement. Alternatives for compensation, giving reasons for choice of compensation method		
Compensation and Rehabilitation Assistance		
The compensation or rehabilitation assistance should ensure that people are not worse off but that their livelihood is comparable or better thereafter. Therefore compensation or rehabilitation assistance should cover:		
Compensation or rehabilitation assistance for loss of land (total loss, loss of viable holdings, partial loss, restrictions on use, such as transmission lines, conservation areas)		
Compensation or rehabilitation assistance to replace lost housing (owners, tenants, occupants)		

Negotiation procedures		
Detailed description of the resettlement options considered and reasons why a particular option was chosen		
Procedures for identifying and preparing relocation sites where applicable, and criteria to ensure that the relocation sites are comparable to, or better than those affected		
Legal and institutional arrangements for regularizing tenure and transferring or issuance of titles to resettled households, and where this involves repayments, the plan should demonstrate that the affected families will be able to pay		
Measures to prevent land speculation, or invasion of the affected areas and/or proposed resettlement sites		
Detailed description of the housing and service solutions, with analysis of likely choices, and any potential problems (costs of service provision, maintenance, taxes, style of housing), and the plan should take population growth into account, and, as appropriate, should present the proposals for site development, and the engineering and architectural designs for the facilities		
Dispute settlement and arbitration procedures		
Compensation or rehabilitation assistance measures for loss of income (permanent crops, pasture, retail outlets, industry and services)		
Compensation or rehabilitation assistance for social and/or public infrastructure		
Impact of affected families on “host” populations, and measures to avoid potential conflicts		
Facilities required for accommodating demand from influx of construction workers (health services, schooling, etc.)		
Transitional Arrangements		
Transport to new sites. This should address compensation for the cost of transport, or, where relevant, provision of adequate transport for the affected families, their personal effects, equipment, livestock, and housing materials. If necessary it would cover arrangements or contingency plans for temporary accommodation		
Timing of the move. Where appropriate, this should consider the timing of resettlement in relation to the agricultural cycle		
Compensation or rehabilitation assistance for temporary loss of income or productive assets. This would include temporary loss of clientele for retail outlets, compensation for farmers who lose an agricultural season. The description should cover eligibility, valuation procedures, timing, and procedures for dispute resolution		
Compensation for legal costs including regularization of titles to the land or housing that is lost, and costs related to the acquisition of replacement land or housing.		
Social and Environmental Impacts of the Resettlement Program		
This section should discuss the social and environmental impacts of the resettlement program, **not** the impacts of the project that is causing the resettlement. For example, impacts may include:		
New Housing construction: Impacts may arise from the housing program, including temporary construction impacts and long term impacts, particularly relating to the sources and use of water, sewage, street drainage, and the disposal of solid waste;		
Impact of resettled population on local services (health, schooling)		
Impact of resettled population on the host population (especially vulnerable populations, such as indigenous peoples)		
Impacts on natural resources, such as the collection of firewood, impacts on fisheries or wildlife		
Potential public health issues, epidemiological vigilance and control measures (include impact of work camps on the affected population, impact of affected population on host populations)		
Impact of income restoration projects, such as agricultural and livestock programs that have the potential for deforestation, soil erosion, and the use of agro-chemicals and/or small industries may affect water use or have a potential for contamination		
Health and safety issues related to the income restoration programs		
This section should also describe the measures to mitigate the impacts identified above		
Public Consultation		
The Resettlement Action Plan should describe the consultations that have taken place, summarizing the principal issues that were identified, and/or agreements that were reached to address these issues. The plan should show how the consultation exercise was carried out and should cover the following:		
The proposed procedures for consultation, public disclosure and communication of information about the project and the Resettlement Action Plan		
Institutional responsibility for organizing consultation and social communication		
Detailed description of the program, achievements to date, and timetable for future activities		

Stakeholders involved in public consultation, including in particular the affected population, potential representatives of the affected population, and vulnerable groups		
Measures to review, summarize and disclose the results of the public consultations		
Institutional arrangements to ensure that affected people can communicate their concerns to project authorities throughout planning and implementation, including grievance procedures for issues other than compensation		
Proposals for public involvement in monitoring and evaluation		
Schedule		
The Resettlement Action Plan must include a timetable for implementation. This is usually presented in the form of Gantt charts. The timetable should show:		
The timing of all the activities identified in the Resettlement Action Plan, including, as appropriate, the baseline studies (for areas affected by the compensation program), cut-off dates, valuation of land/property/crops, assessment of loss of earnings, payment of compensation, move to the new site (displacement date), economic rehabilitation programs, construction of housing and infrastructure at the new site, and social and technical assistance programs		
Costs		
The Resettlement Action Plan should provide an accurate estimate of the costs of the different components, along with the schedule for disbursements. This schedule of disbursements is essential to ensure that sufficient funds are available, at the right time, and to control expenditure during implementation of the plan. The section on costs should include the following:		
Estimated cost for each component and sub-component of the resettlement action plan (land acquisition and compensation, housing, social infrastructure, economic rehabilitation, training)		
Estimated cost for each component, broken down by expected month/year of disbursement		
Cost of contractors required for implementation of the program or sub-programs (where these are contracted out)		
Overheads, by institutions involved in RCP implementation and monitoring, and by month/year (staff costs, office and running costs, transport)		
Monitoring and Evaluation		
The Resettlement Action Plan should include the following information in relation to monitoring and evaluation:		
Institutional responsibilities for monitoring and for evaluation;		
Indicators used for monitoring of project implementation (valuations, negotiations, payment of compensation, resettlement, provision of housing/services, productive projects, communication program)		
Indicators used for monitoring compensated and/or resettled households (quality of replacement assets, including land, housing, and productive assets; income levels, subsistence production, health indicators, educational indicators, etc.)		
Maps and Appendices		
The Resettlement Action Plan should include detailed maps, showing the location of the project and the area affected. It is useful to have detailed maps showing the landholdings in the affected area and land use (rural areas)		
The appendices should include any detailed relevant legal documents, agreements, Asset valuation report, etc.		