Ministry of Local Government and Housing
The Republic of Zambia

PREPARATORY SURVEY REPORT
ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT
IN
LUAPULA PROVINCE PHASE 2
IN
THE REPUBLIC OF ZAMBIA

MAY 2011

JAPAN INTERNATIONAL COOPERATION AGENCY

JAPAN TECHNO CO., LTD.

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PREFACE

Japan International Cooperation Agency (JICA) decided to conduct the preparatory survey and entrust the survey to Japan Techno Co., Ltd.

The survey team held a series of discussions with the officials concerned of the Government of Zambia, and conducted a field investigations. As a result of further studies in Japan, the present report was finalized.

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

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

May, 2011

Shinya Ejima
Director General
Global Environment Department
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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 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.

The World Bank estimates that Zambia has a population of about 12.94 million in 2009, and the annual population growth rate is estimated as 2.5%.

As for the economy in Zambia, GNI is US$12.56 billion with US$970 as per capita GNI in 2008, and the economic growth rate shows 6.3% (World Bank 2009). The primary sector of economy comprises 19.7%; secondary, 32.4%; and tertiary, 47.9% (CIA 2009). 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.

According to UNDP, the Human Development Index (HDI) of Zambia is ranked at 150th among 169 countries in 2010. In addition, due to diarrhea and other diseases in a condition of

undeveloped health services, the under age 5 mortality rate in Zambia shows 148 per 1,000 births (WHO 2008), which is extremely higher than the world average at 65. The big issue is therefore the development of basic infrastructures to assure safe water supply.

2. Background and Summary of the Project

In Zambia, the water issue is prioritized as one of the most important agendas. However, Zambia's coverage rate of water supply services remains at a low level, and the access rate to safe water in the whole country is 59% of the total population, 89% in the urban areas, and 43% in the rural areas[1]. In Luapula Province, which is the targeted area of this Project, the access rate remains at 23.1% (August, 2010) at the lowest level in the country.

In response to such situation in the rural water supply sector, the Ministry of Local Government and Housing (hereinafter referred to as "MLGH") formulated and launched in November 2007 "the National Rural Water Supply and Sanitation Program (2006-2015)" (hereinafter referred to as "NRWSSP"), to increase and improve the coverage of water supply to 75% by 2015. In order to achieve this goal, in 2004 the Government of Zambia requested to the Government of Japan the grant aid assistance for "the Project for Groundwater Development in Luapula Province" (hereinafter referred to as "Phase I Project), which targeted all seven districts in Luapula Province where the access rate to safe water is the lowest out of nine provinces in Zambia. The Phase I Project, which was commenced in 2008 and completed in 2010, constructed 200 borehole water supply facilities fitted with handpumps in all seven districts in Luapula Province and increased the accessibility to safe water from about 162,000 inhabitants up to 212,300 inhabitants. At present, the coverage rate has improved at 23.1%, as a result of both the Phase I Project and other Cooperating Partners' assistance.

Based on the experience acquired from the Phase I Project, the Government of Zambia made a new request to the Government of Japan for grant aid assistance, in order to contribute to further improvements in the access rate of stable and safe water supply in Luapula Province. The contents of the request contain construction of borehole water supply facilities fitted with handpumps at 320 sites in four districts (Nchelenge, Mwense, Mansa and Milenge), which excludes three districts (Chiengi, Kwambwa and Samfya) receiving assistance from the African Development Bank for the rural water supply and sanitation sector, and strengthening the capacity of related local administration and residents in operation and maintenance of the facilities and sanitation education.

Under such situation, the survey was decided to be conducted at the requested 320 sites in four districts in Luapula Province.

[1] The Living Conditions Monitoring Survey, 2006

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

In response to the request based on results and circumstances in the Phase I Project, Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the preparatory survey team from 21th June until 21th August in 2010, 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 3rd January to 12th January, 2011 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 handpumps in the above mentioned four districts in Luapula Province, and to secure a sustainable and safe water supply to direct beneficiaries of 54,000 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.

Summary of Outline Design	
Target Sites of the Project	216 sites in four districts (Nchelenge, Mwense, Mansa and Milenge) in Luapula Province
Outline of the Project	- Construction of borehole water supply facilities fitted with handpumps at 216 sites in four districts in Luapula Province - Organizing the Village Water, Sanitation and Hygiene Education Committee (hereinafter referred to as "V-WASHE") and village sensitization activities regarding maintenance and sanitation
Direct Beneficiaries	54,000 residents of four district in Luapula Province

The number of candidate sites for construction was decided through screening using the following criteria.

1) Existence of demand for safe and stable water supply
2) Possibility to access the site (including security for working)
3) Satisfactory hydrogeological conditions (possibility to provide water with standard quality of Zambia)

4) Non-availability of existing water supply facilities (sites with sufficient existing facilities are to be excluded)
5) No duplication of Project sites with other cooperating partners
6) Possibility to establish a water management committee(V-WASHE), and
7) Community's willingness to pay for water tariff to cover operation and maintenance costs

As a result of screening, the number of sites satisfying the above criteria turned out to be 291 out of the requested 320 sites.

The Project shall suspend the construction works of borehole drilling during the rainy season due to difficulties in accessibility to the sites for heavy machines such as drilling rigs and trucks. Therefore, the period possible to carry out borehole drilling works would be 9 months a year excluding the 3 months of the rainy season (handpump installation and appurtenant construction shall be done during the rainy season). Assuming that 8 successful boreholes/ month/ team are achieved, 216 successful boreholes in total shall be considered to be developed during the implementation period of the Project if 3 drilling teams are utilized. The remaining 75 sites (291 sites minus 216 sites), which were not selected as candidates through this procedure, shall be treated as alternative sites for drilling in the Project. It means that, when 2 unsuccessful boreholes are drilled in a single site, a new candidate site for drilling shall be selected from these 75 alternative sites and the Project seeks to achieve the goal of 216 successful boreholes in total.

District	No. of Target Sites	No. of Alternative Sites
Nchelenge	64	29
Mwense	44	15
Mansa	61	18
Milenge	47	13
Total	216	75
Possible Sites for drilling	291	

Note: Details of the target site selection process will be described in Chapter 2.

Main contents of the Project are shown below.

(1) Construction of Water Supply Facilities

The Project is to construct borehole water supply facilities fitted with handpumps. In detail, construction of boreholes, appurtenant facilities and installation of handpumps shall be carried out as well as iron removal plants in the sites where the iron contents in the boreholes are found to exceed Zambia's standards.

Main Contents of Borehole Water Supply Facilities fitted with Handpumps

Construction Items	Specifications and Construction Works	Quantity
Borehole	- Depth: Not less than 30m, average 63m - 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	216 nos.
Appurtenant Facility	Concrete, round shape, which is most frequently adopted in Zambia	216 nos.
Handpump	Afridev or India Mark-II (IM-II) To be selected according to quality and water level of the borehole (*)	Afridev: 160nos. IM-2: 56nos. (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.	39 nos.

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

(2) Software Component

The Project sets its objective as to realize a sustainable supply of safe and stable water through borehole water supply facilities fitted with handpumps to be constructed in the target communities. The Project therefore implements the software component programme for the purpose of providing necessary assistance to establish an operation and maintenance structure at village level, setting the communities as the main actors. Establishment and strengthening of the operation and maintenance structure in the target sites shall be conducted by utilizing a local NGO/ consultant. The detailed contents of the activities are shown in Chapter 2, "2-2-4-7 Software Component (Technical Assistance) Plan".

4. Project period

The Project shall be conducted under grant aid assistance and its implementation schedule shall be as follows.

[Construction Works]

a. Exchange of Notes (E/N)

b. Grant Agreement (G/A)
c. Agreement on Consulting Services for Detailed Design and Supervision of Construction
d. Detailed Design: Detailed Design Study, Preparation and Approval of Tender Documents
e. Software Component
f. Tendering and Contracting with Contractor
g. Construction of Borehole Water Supply Facilities fitted with Handpumps
h. Completion and Handover

As per the implementation schedule of the Project, it takes 24 months from G/A, which includes the detailed design study, software component, borehole drilling, handpump installation, apron construction, and installation of iron removal plants.

(a) Consultant Agreement, Software Component (V-WASHE formulation), Detailed Design Study, OD/DD Comparison, Preparation of Tender Documents, Approval of Tender Documents	6.0 months
(b) Tendering, Contracting with Contractor, Verification of the Contract, Borehole Drilling, Handpump Installation, Appurtenant Facilities Construction, Construction of Iron Removal Plants (Drilling will be suspended during rainy season), Software Component	18.0 months
Total	24.0 Months

The Project shall suspend construction works of borehole drilling during the rainy season due to difficulties in accessibility to the sites for drilling rigs (heavy machines). Therefore, the period possible to carry out the drilling of boreholes shall be 9 months a year, excluding the rainy season for 3 months.

5. Evaluation of the Project

Through implementation of the Project, the following relevance and effectiveness are expected.

1) Relevance of the Project

a) The beneficiaries of the Project are the residents in four districts of Luapula province in Zambia and are estimated to be about 54,000 persons.
b) 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”).
c) The borehole water supply facilities fitted with handpumps constructed by this Project are predicted to be sustainably operated and maintained, and water tariff collected under responsibility of each level WASHEs.

d) 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.

e) The water supply facilities of the Project are to be provided free to local villages where most of the people are at the poverty level. After completion of the construction works, V-WASHE will manage and maintain the facilities by collecting fees from water users. Since making profit is not the objective, it is feasible to implement the Project under the scheme of Grant Aid.

f) As the Project is construction of small-scale borehole water supply facilities fitted with handpumps, 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.

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

h) 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.

2) Effectiveness of the Project

a) Quantitative Effects

The following table shows the expected outputs to be achieved through implementation of the Project.

Index	2010 (before)	2013 (after)
Increase in water coverage of Luapula Province	247,876 residents	301,876 residents
Stable supply of water	Unstable amount of water	30L/person/day

b) Qualitative Effects

The Project expects the following qualitative effects.

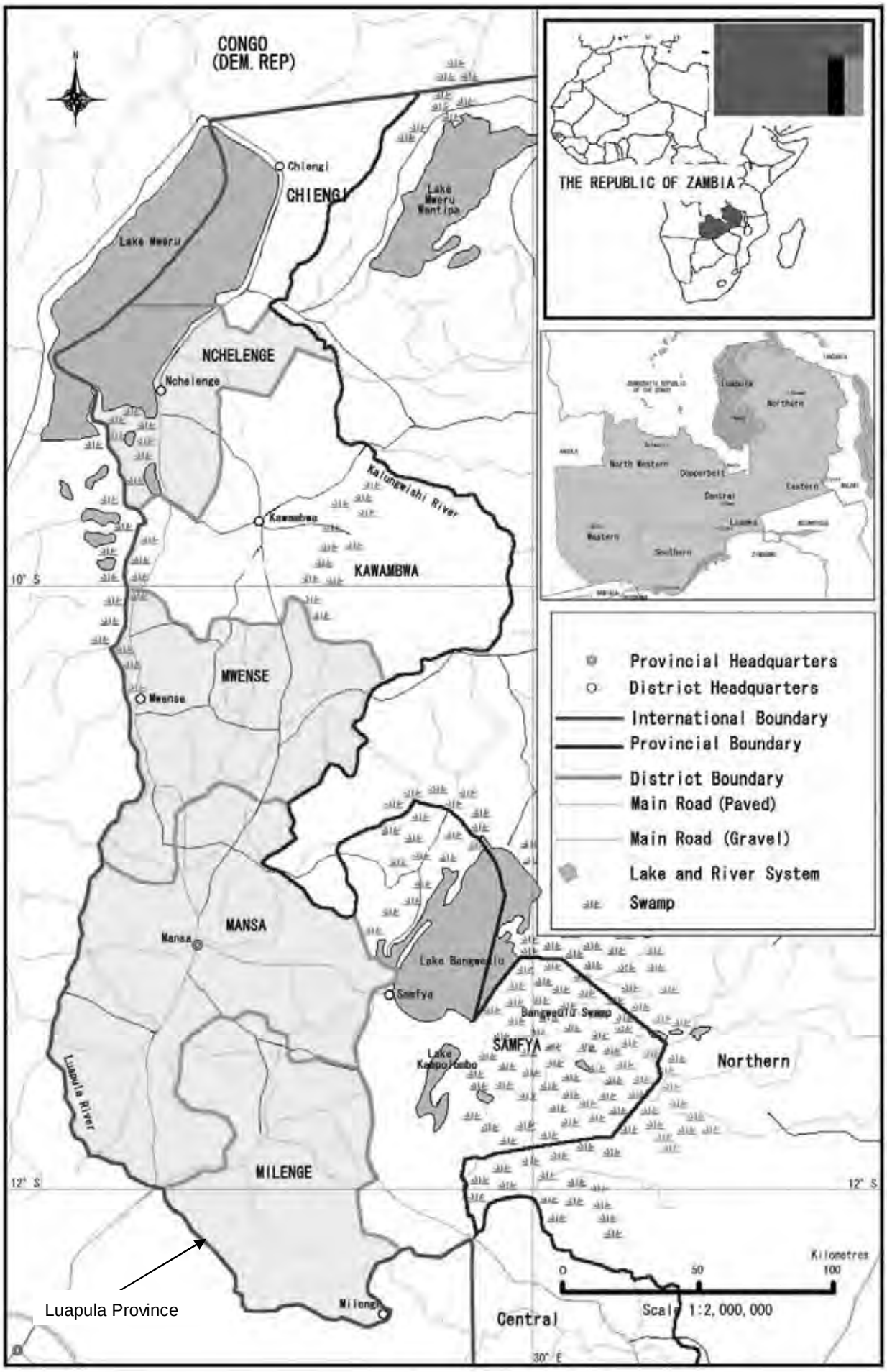
- Reduction of waterborne diseases is expected because of improvements in sanitation conditions through use of safe and stable water.
- Women and children will be relieved from the burden of fetching and carrying water and gain more spare time.

The Project will construct borehole water supply facilities fitted with handpumps in the target sites in Zambia for the purpose of stable supply of safe water to the target residents. The Project thereby will contribute to the improvements in coverage of rural water supply targeted

by the government of Zambia, which is expected that will improve various aspects of the residents such as residents' economic activities, education and health. Under such circumstances, it is highly feasible to implement the Japan's grant aid project and its effectiveness is expected to be high as well.

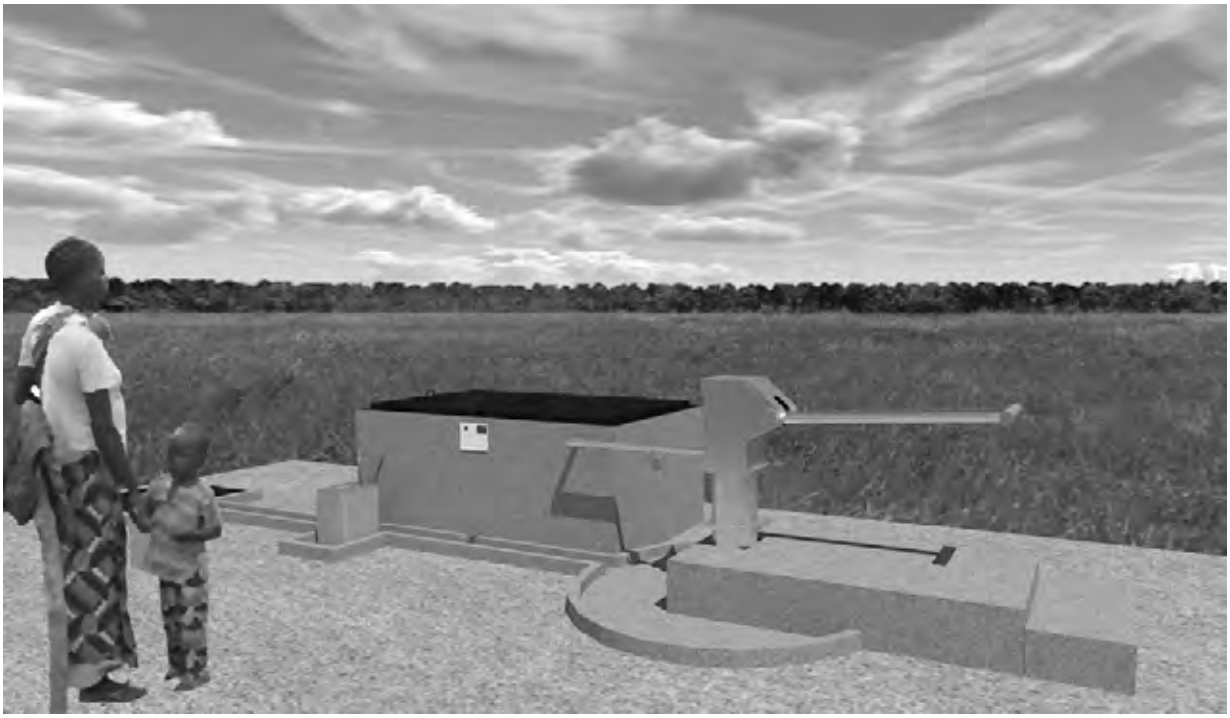
CONTENTS

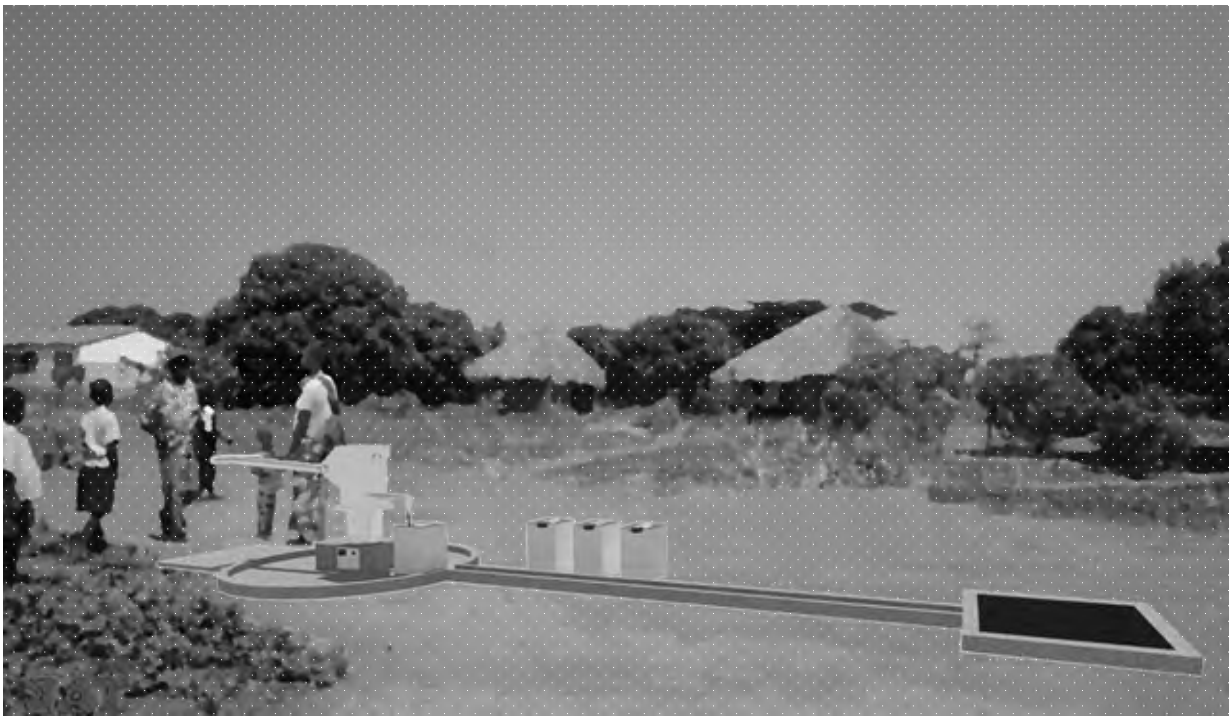
APPENDICES



Luapula Province

LOCATION MAP OF THE PROJECT AREA





THE PROJECT FOR GROUNDWATER DEVELOPMENT IN LUAPULA PROVINCE PHASE 2

PERSPECTIVE OF THE WATER SUPPLY FACILITY

LIST OF FIGURES AND TABLES

Page

FIGURES

TABLES

ABBREVIATIONS

ADC	Area Development Committee
AfDB	African Development Bank
A/P	Authorization to Pay
APM	Area Pump Mender
B/A	Banking Arrangement
BHN	Basic Human Needs
CIA	Central Intelligence Agency(USA)
CLTS	Community-Led Total Sanitation
CPs	Cooperating Partners
DANIDA	Danish International Development Agency
DHID	Department of Housing and Infrastructure Development
DRC	Democratic Republic of Congo
DTH	Down-the-Hole
DWA	Department of Water Affairs
D-WASHE	District Water, Sanitation and Health Education (Committee)
EHT	Environment Health Technician
E/N	Exchange of Notes
FPP	Focal Point Person
G/A	Grant Agreement
GDP	Gross Domestic Product
GNI	Gross National Income
HDI	Human Development Index
HIPC	Heavily Indebted Poor Countries
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immunodeficiency Syndrome
HP	Hand Pump
IMS	Information Management System
IRP	Iron Removal Plant
ITCZ	Inter-Tropical Convergence Zone
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt fur Wierderaufbau
M/D	Minutes of Discussion
MDGs	Millennium Development Goals
MFNP	Ministry of Finance and National Planning
MLGH	Ministry of Local Government and Housing
MMD	Movement for Multi-Party Democracy
NGO	Non-governmental Organization
NRWSSP	National Rural Water Supply and Sanitation Programme

NWP	National Water Policy
OD/DD	Outline Design/Detailed Design
pH	potential Hydrogen, power of Hydrogen
PQ	Pre-Qualification
PRA	Participatory Rapid(Rural) Appraisal
PST	Programme Support Team
PVC	Polyvinyl Chloride
RHC	Rural Health Centre
RWSS	Rural Water Supply and Sanitation
RWSSU	Rural Water Supply and Sanitation Unit
SOMAP	Sustainable Operation and Maintenance Project
Sub-WASHE	Sub-District Water, Sanitation and Health Education (Committee)
UNICEF	United Nations (International) Children's (Emergency) Fund
UNIP	United National Independence Party
VIP	Ventilated Improved Pit
V-WASHE	Village Water, Sanitation and Health Education (Committee)
WASHE	Water, Sanitation and Health Education Committee
WHO	World Health Organization
WSP	Water and Sanitation Programme
ZMK	Zambian Kwacha
ZS	Zambian Standard

CHAPTER 1

BACKGROUND OF THE PROJECT

Chapter 1 Background of the Project

1-1 Background and Outline of the Project

The Government of the Republic of Zambia has a goal of achieving a safe water access rate of 75% in rural areas by 2015. In 2004, to contribute to achieving the goal, the Zambian Government requested the Japanese Government for Grant Aid cooperation assistance regarding the “Project for Groundwater Development in Luapula Province” (hereinafter referred to as the “Phase I Project”) for all seven districts in Luapula Province. The “Phase I Project”, started in 2008 and completed in 2010, constructed 200 boreholes fitted with handpumps in all seven districts, increasing the number with stable and safe water supply from 162,000 inhabitants (access rate of 17%, 2007) to 212,300 inhabitants (access rate of 20%, 2010). Including the assistance from other Cooperating Partners’ (CPs), the present access rate is 23.1%

Based on the results of the "Phase I Project", the Zambian Government made a new request to the Japanese Government for continued assistance (hereinafter referred to as the "Phase II Project") in pursuit of further improvement in access to safe water supply in Luapula Province. The target areas specified in the request for assistance are four districts (Nchelenge, Mwense, Mansa, and Milenge) excluding the three districts (Chiengi, Kawambwa, and Samfya) where the African Development Bank (AfDB) is providing assistance in the rural water supply and sanitation sector. The request includes construction of boreholes fitted with handpumps at 320 sites and promoting activities for strengthening skills in operation and maintenance and sanitation education at district level (four districts) and village committees.

1-2 Environmental and Social Considerations

This Project shall construct boreholes of small diameter (100 mm) using handpumps to pump up groundwater. Even if water is pumped up for ten continuous hours per day, the pumping discharge will be 7 to 10m^3 per day at most. Therefore, this Project is expected to be least likely to cause lowering of groundwater level, adversely influence other boreholes, or apply environmental impacts such as ground subsidence and salinization of groundwater. There is no risk of contamination due to runoffs from the water supply facilities during pumping because the runoffs will only arise from water spilling during filling of water into buckets or plastic containers.

Since the water supply facilities fitted with handpumps to be constructed in this Project are small structures as shown in the diagram of appurtenant facilities, there are no risks of resident resettlement, community severance or other social issues. On the other hand, attention should be

given to the decision on where to construct the facilities in each target site in order to realise both the public value and convenience of residents while meeting the hydrogeological conditions. It should be ensured that benefits are not based in favour of particular households or groups.

As described above, this Project, being a small-scale groundwater development project, will have low possibility of giving adverse impacts on groundwater. Therefore, according to JICA‘s Guidelines for Environmental and Social Considerations, it is categorized as "C".

CHAPTER 2

CONTENTS OF THE PROJECT

Chapter 2. Contents of the Project

2-1 Basic Concept of the Project

2-1-1 Project Objective and Overall Goal

The Government of the Republic of Zambia (hereinafter referred to as Zambia) in November 2007, launched the National Rural Water Supply and Sanitation Programme 2006-2015 (NRWSSP) to increase and improve access to water supply and sanitation, to achieve the Millennium Development Goals (MDGs) for water supply and sanitation and to meet the nation vision for universal coverage by 2030. The NRWSSP is a comprehensive implementation plan in the sector of rural water supply and sanitation in the Fifth National Development Plan 2006-2010 (FNDP), with a goal of achieving a safe water access rate of 75% and sanitation access rate of 60% in rural areas by 2015.

To contribute to the achievement of the above goal, the Zambian Government requested to the Japanese Government for Grant Aid cooperation assistance regarding the "project for Groundwater Development in Luapula Province" (hereinafter referred to as the "Phase I Project") for all the seven districts of Luapula Province, which had the lowest safe water access among all the nine provinces of Zambia. The “Phase I Project” started in 2008 and was completed in 2010. In the "Phase I Project," the borehole water supply facilities fitted with handpumps were constructed at 200 sites in all the seven districts of Luapula Province, resulting in an increase in the number of people provided with continuous access to safe water from about 162,000 inhabitants (access rate of 17%; 2007) to 212,300 inhabitants (access rate of 20%; 2010). In August 2010, the access rate had reached 23.1%[1] owing also to other Cooperating Partners’ (CPs) assistance.

Based on the result of the "Phase I Project," the Zambian Government again made a new request to the Japanese Government for assistance (hereinafter referred to as the "Project") in pursuit of further improvement of the access to safe water supply in Luapula Province. The target areas specified in the request for assistance are the four districts (Nchelenge, Mwense, Mansa, and Milenge) excluding the three districts (Chiengi, Kawambwa, and Samfya) where the African Development Bank (AfDB) is providing assistance in the rural water supply and sanitation sector.

[1] According to the “Living Conditions Monitoring Survey Report, 2004” prepared by the Central Statistical Office, the access rate to safe water supply in 2004 was 16.4%. As about 80,000 inhabitants in Luapula Province were able to secure safe water through assistance of Phase I project and CPs’, 248,000 inhabitantas out of 1,071,000 inhabitants, the estimated total population in Luapula Province in 2010, could access to safe water. Therefore, 248,000 inhabitants out of 1,071,000 inhabitants means 23.1%.

This Project expects to increase the access to safe water in the entire Luapula Province from 23.1% to 25.6% through construction of the 216 borehole water supply facilities fitted with handpumps in the four target districts (Nchelenge, Mwense, Mansa, and Milenge) .

2-1-2 Outline of the Project

In order to achieve the project purpose described above, this Project shall seek to construct the borehole water supply facilities fitted with handpumps and to develop the abilities required for operation and maintenance of the facilities in the four target districts. These activities are expected to improve the current water supply conditions and ensuring the supply of safe and stable water to about 54,000 target residents.. The project to which Japanese Government shall provide support is as follows:

[Facility construction]	:	Construction of the borehole water supply facilities fitted with handpump at 216 sites in the four districts in Luapula Province (Nchelenge, Mwense, Mansa, and Milenge)
[Technical assistance]	:	Institutionalisation of V-WASHE Committees and promoting activities for strengthening skills in operation and maintenance and sanitation

The initial request made by Zambian Government to the Japanese Government specified 320 target sites for this Project. As a result of detailed examination based on the field survey, however, it was decided to implement this Project at 216 sites, select 75 sites as alternative sites, and exclude the remaining 29 sites. The details of this examination are described in Paragraph “2-2 Outline Design of the Japanese Assistance"

2-2 Outline Design of the Japanese Assistance

2-2-1 Design Policy

The following shows the basic policies and examination details regarding the content of the assistance project.

2-2-1-1 Basic Policy

(1) Screening of project sites

The 320 sites in the four districts in Luapula Province specified by the Zambian Government in the request for assistance were screened according to an agreement with the said government in order to examine the validity of implementation of the Japanese Grant Aid project, using the following criteria:

i. Demand for safe and stable water supply
ii. Accessibility to the site (including the absence of problems of safety control during construction of the facilities)
iii. Hydrogeological conditions (including the satisfaction of the Zambian Water Quality Standard)
iv. Presence or absence of existing water supply facilities (sites with sufficient water supply from the existing facilities shall be excluded.)
v. There is no overlapping with projects of other CPs
vi. Possibility of forming a Village Water, Sanitation and Health Education Committee (V-WASHE committee)
vii. Site residents' willingness to pay operation and maintenance costs of the facilities

As a result of screening, 291 sites meeting the criteria above were selected from the 320 sites specified in the request.

(2) Estimation of the number of facilities that can be constructed

From the experience and knowledge acquired in the "Phase I Project," it is considered appropriate to conduct the borehole-drilling operation in expectation of successful drilling of eight boreholes per month per team in order to maintain a constant quality level.

Additionally, it is advisable to hire local construction companies as subcontractors for the sake of cost reduction and conduct the construction by three teams at the maximum in consideration of their capabilities as well as the supervision structure of the Japanese companies.

Note that borehole drilling work will be halted in the rainy season as heavy machinery such as drilling equipment and trucks will have difficulties in accessing the sites. Therefore, drilling is possible for a total of nine months per year excluding the three months in the rainy season. Assuming that there are eight successful boreholes per month per team, it is expected that successful boreholes will be obtained at a total of 216 sites using three teams at the maximum within the project implementation period.

(3) Selection of project target sites

As a result of screening based on the results of survey on hydrogeology, geophysics and social conditions implemented under the Preparatory Survey, 291 sites out of requested 320 sites were identified to be possible for development of new groundwater sources under the Project.

The table 2-1 below shows the number of possible boreholes by districts estimated through the above criteria. Since the number of boreholes to be drilled under the Project will be 216 in total in consideration of the implementation schedule of the Project, the number of borehole to be constructed for each district were determined by using the same proportion per district for the originally requested number. The table below shows the outline of selection results for the project target sites.

Table 2-1 Number of Borehole per District

District	Requested Number (A)	Proportion per District (B)=(A)÷320	Number of Project Sites	Number of Alternative Sites	Number of Cancelled Sites
1) Nchelenge	95	29.7%	64	29	2
2) Mwense	65	20.3%	44	15	6
3) Mansa	90	28.1%	61	18	11
4) Milenge	70	21.9%	47	13	10
Total	320	100.0%	216	75	29
	Number of Sites with Possibility to Develop Groundwater		291		

(4) Alternative sites and its priority

As stated above, the Project shall construct borehole water supply facilities fitted with handpumps in 216 sites in total, out of 291 potential sites for groundwater development, in accordance with its priority.

75 sites, which are not selected for the target sites in the above process, will be treated as alternative sites of the project. That is, the project shall select a new target site for drilling borehole from those alternative sites in accordance with its priority in a case where 2

unsuccessful boreholes were drilled in a single site as a result of borehole development. Therefore, the Project shall seek for 216 successful boreholes in total to be drilled.

The result of the site selection are shown in the “table 2-3 List of Project Sites”.

(5) Operation and maintenance of the borehole water supply facilities fitted with handpumps and contributions from residents

In this Project, the expenses for operation and maintenance of the facilities shall be shouldered by the residents as the facility users in principle. Furthermore, assistance shall be supplied using the soft component to promote continuous maintenance of facilities on the initiative of the residents. For details, see Section 4-2, "Policies on Operation and Maintenance Plans."

The guidelines of NRWSSP require that the site residents contribute ZMK1.5 million (about JY30,000) for the construction of borehole water supply facility fitted with handpump, and specify that this is a prerequisite for starting the construction. It is also specified that the collected amount shall be managed by the district local authority and can be used by the district for implementing the rural water supply and sanitation project (e.g., development of a spare parts supply chain). However, other CPs (such as AfDB, UNICEF, Water Aid, and Plan International) providing assistance in the same type of rural water supply and sanitation projects in the target area of this Project, consider it unrealistic. Particularly, in poverty-stricken area, it is difficult to impose such collection as a prerequisite for facility construction. Furthermore, there are not yet any mechanisms for collection and fund management nor guidelines for use of the collected money. The local authorities that are supposed to manage and use the funds were observed to have inconsistent understanding about the introduction and use of these funds. Therefore, this Project will not consider community contributions as a pre-requisite of commencement of construction of the facilities. The responsibility for collection of contributions as well as promotion activities to the residents, shall be under the Implementing Agency and local authority offices, taking into consideration the process of defining the target site and construction schedule.

(6) Safety control

Some of the project target sites out of 216 target sites are located along the border with the Democratic Republic of the Congo. Actually, in terms of security it is stable, but for the Project implementation, the following basic policies shall be used.

i. The safety measures of JICA shall be observed.
ii. The project team shall keep close contact with the Implementing Agency, JICA Zambia

office, and the Japanese Embassy in Zambia in order to collect relevant information, and promptly comply with instructions from them.

2-2-1-2 Policy Concerning Natural Conditions

(1) Temperatures and precipitations

In the project target areas, the minimum temperature is around 8℃, and the maximum temperature is around 32℃. Therefore, attention must be given to handling, mixing, casting, and curing of concrete materials that are susceptible to temperature.

The implementation schedule should be prepared in consideration of difficulty of access to a borehole drilling site in the rainy season. Passage through or between farms is often unavoidable. During the rainy season, large vehicles loaded with heavy equipment required for construction are frequently stalled on bad roads after rains. For this reason, this kind of construction work is not normally implemented in the high-precipitation months of January to March in Zambia. In this Project, too, therefore, the work related to borehole construction shall be halted in the above three months.

Table 2-2 Monthly Rainfall Data (Mansa Meteorological Station)

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Aver.Rainfall (mm)	174	153	189	72	3	0	0	0	3	45	96	159
No. of days with rainfall	19	17	19	11	3	0	1	1	1	8	13	20

Source: World weather online

(2) Hydrogeology

In the target area of this Project, there are distributions of “Basement Supergroup”, “Muva Supergroup”, “Katanga Supergroup”, and Alluviums, etc. Based on the results of field analysis of the geology in the area, the drilling logs of the “Phase I Project”, and the geophysical sounding carried out in the survey, the basic policies on groundwater development shall be as follows:

In the areas of granitic rocks of the Basement Supergroup, there are mostly highly-weathered layers which became clay or sands down to a depth of 20 m to 30 m. In some areas, granitic rocks must be weathered to an even further depth. Considering the higher permeability of sandy portions compared with the clay portion, the target for groundwater development shall be the weathered granitic areas than the argillaceous areas at a relatively high depth.

In an area with relatively fresh rocks on the whole, a large fractured area shall be surveyed for groundwater exploration. In an area with a distribution of meta-volcanic rocks or meta-quartzites as the Basement Supergroup, which have low success rate of groundwater development, survey shall be carefully conducted by assessing topographic lineaments to search the fracture zones.

Muva Supergroup consists of sandstones, quartzites, shale and these alternations. Development shall be targeted at sandstones and quartzites because the possibility of development in shale is expected to be low. However, due to the low permeability of the bedrock, development of fissure water in fractured zones shall be pursued. In an area with these lithofacies where many fault lineaments are observed, there is expected to be a good development of fractured or sheared zones. Development shall be conducted after fully identifying the tendencies of these lineaments.

This Project site excluding Mansa District and western area of Milenge District, is located in the Katanga Supergroup area. Sandstone and conglomerates are predominant on the whole, however, some areas are predominantly shale, where the possibility of groundwater development is low. The following are the three major lithostratigraphic conditions in the case of sandstones and conglomerate:

Area A: Composed of horizontal bedrock with a bedding thickness less than about 1 m
Area B: Composed of sandy or gravelly materials due to significant weathering
Area C: Composed of hard and massive bedrock with relatively few fractures

In Area A described above, groundwater exists in the voids in conglomerate and around the bedding plane, making up a good aquifer. In Area B, it is possible to assume an aquifer equivalent to unconsolidated sand and gravel layer. However, attention is needed because such weathered bedrock also contains lots of clay and silt, resulting in a low permeability in some places. In Areas A and B, development shall be conducted assuming that they are equivalent to stratum aquifers. In Area C with a low possibility of occurrence of groundwater except for relatively concentrated fractured zones, groundwater development shall be conducted by carefully conducting exploration of fractured zones.

The drilling points in each site shall be selected in accordance with the hydrogeological conditions through careful field reconnaissance and geophysical sounding. But priority shall be given to the local residents' demands, while giving careful consideration to possibility of groundwater contamination due to the residents' domestic wastewater, etc.

(3) Water quality

The water quality survey conducted in the "Phase I Project" and the other Donor's constructed sites in the Project area, revealed a tendency that the iron content is 1.0mg/lit or less if the pH value is 6.5 or higher, and that the pH value changes with time after the completion of a borehole. On the other hand, although the water quality monitoring conducted in the said project measured pH values of 7 and lower at the completion of boreholes, the iron content values measured after the installation of the India Mark-II handpumps were higher in many of the sites than the Zambian drinking water standard of 1.0mg/lit. For sites with pH values of 7 and higher at the time of borehole construction, the iron content seems to be gradually increasing in accordance with the drop in the pH value after the construction but with relatively small increments. Therefore, the types of handpumps to be installed in boreholes shall be selected in consideration of the above water quality characteristics in Zambia and the mutual influences of pump materials and water quality. As described in detail later, it is advisable to install in principle Afridev-type handpumps with a riser pipe made of PVC in sites with pH values of 7 and lower at the time of borehole construction.

This Project shall be implemented in conformity with the water quality standard specified in the Zambian water quality guidelines ZS190:1990. However, whereas the pH values are specified to be 6.5-8.0 in these guidelines, the WHO guidelines, pays more attention to the effects on facilities such as piping than on human bodies, the WHO therefore does not specify a standard value for pH. During groundwater development, the water quality often remains unchanged in boreholes drilled in different positions in a village. If the water quality standard is strictly observed in evaluating the water quality, there is a risk of not acquiring any successful borehole in a village. Therefore, in consideration of the fact that pH is not an influential item for health, the pH value shall be 5.0 or higher as the water quality standard for successful boreholes in this Project.

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

(1) Residents' ability and willingness to pay operation and maintenance costs

Demand for an improvement in the current water supply environment is strong and in a household survey, 93% of households responded that "it is desirable that the facilities with boreholes with handpumps will be installed even if the operation and maintenance costs need extra contributions compared with the present." In addition, approximately half of households responded that the primary responsibility for daily operation and maintenance of such water supply facilities lies with "V-WASHE" if any such facilities are installed, followed by "users of such facilities" (23%) and "village residents' associations" (17%). It can be said that residents have sufficiently recognised that they should take the responsibility for operation and maintenance of water supply facilities in a proactive manner.

Monthly costs related to operation and maintenance of borehole water supply facilities with handpumps amount to ZMK81,000 (JPY1,500) per borehole. If a borehole is jointly used by about 50 households (each handpump is used by 250 persons based on a calculation of 4.8 persons in a household on average), operation and maintenance costs to be borne per household will be ZMK1,620 per month (JPY30 per month). Since average income per household at target sites is ZMK100,000 (JPY1,880 per month) (median), the above operation and maintenance costs per household account for about 2% and are less than 4% of the total household income (recommended value of the World Bank), which indicates that residents have sufficient ability to pay. Meanwhile, when looking at their "willingness to pay," a largest number of households, or 42%, responded that they are willing to pay between ZMK1,000 and less than 1,500 per household, on an average of all target sites, followed by between ZMK500 and less than 1,000 (25%) and between ZMK1,500 and less than 2,000 (18%). In the household survey, it was found that residents "willingness to pay" was smaller than their "ability to pay" in monetary terms.. This is considered to be so because they have not fully recognised the necessary costs to maintain handpumps. It was determined, therefore, to make it a policy to develop residents' recognition through soft component activities.

(2) Household economic situation

At the target sites of this survey, 85% of households engage in agriculture and of these, 58% are full time farm households and 12% are engaged in fishery for additional income. From December to February of the year, the sowing season, farmers' cash income stops coming in and those farmers who are also part-time fishermen cannot earn hard cash from fishery during the same period because the fishing season is closed. Households who earn a living from agriculture or fishery will be burdened with any cash expenditures during the period. Therefore, in establishing a system to collect fees for water supply facilities operation and maintenance, it was determined to make it a policy to take these households' economic situation into account.

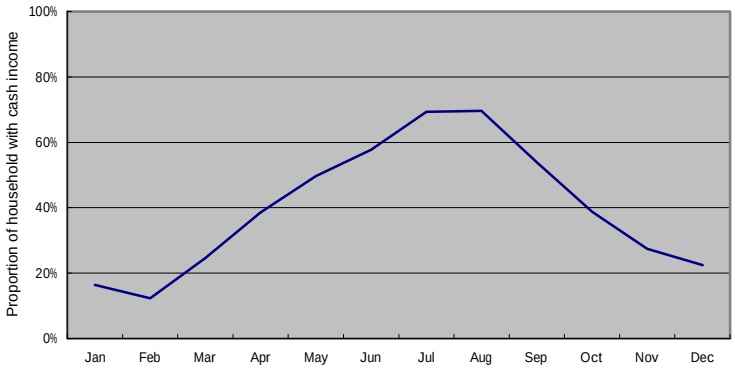


Fig. 2-1 Availability of income by cash per month
(Source: Socio-Economic Survey)

(3) Health and sanitary environment and residents' sanitary practice and consciousness

In order to allow residents at target sites to use water supply facilities to be developed in this Project and to effectively use safe water in a sustainable manner, residents' knowledge, attitude and practice related to sanitation should be improved through the soft component of this Project.

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

In order to realise cost reduction, it was determined to make it a policy to apply local specifications as much as possible in designs and specifications in this Project and such local specifications will be reviewed from time to time as necessary. In constructing borehole water supply facilities fitted with handpumps and iron removal plants, it was decided to use local companies under the supervision of Japanese construction companies, based on the results of the "Phase I Project" and this survey, and in order to ensure a certain level of quality and cost reduction.

Of the construction materials planned to be used in this Project, cement, reinforcing steel, aggregate and gravel pack for boreholes are available locally, while PVC casing screens for boreholes, valves and handpumps are available through import.

Local borehole drilling companies often import PVC casing screens from neighbouring countries, and handpumps from neighbouring countries and from India. Handpumps are available through local agents. It was found, however, that handpumps' quality varied depending on the production lot; therefore, special attention should be paid when selecting materials for construction and when carrying out quality inspection.

Basically, design criteria for construction of borehole water supply facilities fitted with handpumps should be based on the "National Guidelines for Sustainable Operation and Maintenance of Handpumps in Rural Areas (MLGH/JICA 2007)" of Zambia. In addition, in this Project, for detailed specifications for the construction of boreholes, those of similar boreholes constructed with Japan's assistance will be adopted since no durability and quality problems have been found in them.

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

In Zambia, there are a number of drilling companies, while there are several consultants specialised in hydrogeology and geophysical exploration including individual consultants. These companies and consultants have a certain level of technology and economic strength as potential contractors for the scale of facilities construction planned under this Project and they

have a satisfactory track record in domestic projects, too. In order to ensure a certain level of quality in the outcome of this Project, it is necessary to supervise the construction works strictly. In addition, since local construction companies have not sufficient knowledge and recognition of safety and schedule control, Japanese companies' supervision will be indispensable. Particularly, since the target sites of this Project are scattered over a large area; construction areas should be selected and concentrated to one or two districts at a time so that construction can advance without delay. It is a policy to carry forward construction works effectively.

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

In establishing a system for operation and maintenance of water supply facilities in this Project, it was made policy to have key foundations in place. On the one hand, an operation and maintenance system should be developed, in which communities of local residents and users play a main role, in accordance with the National Water Policy of Zambia (revised in 2010) and NRWSSP, a development strategy for this sector, and, on the other hand, the local authorities' support service to promote the operation and maintenance system should be enhanced, mainly by support from related districts.

The District Water, Sanitation and Health Education Committee (D-WASHE), which is composed of the Rural Water Supply and Sanitation Units (RWSS Units) established and assigned as a section of each District Council, the Focal Point Persons (FPPs) of the rural water supply and sanitation sector, several district-level branch offices of the central government's ministries and agencies and District Governments, will be the central body to promote the establishment of an operation and maintenance system for water supply facilities in this Project, in which communities of local residents and users will play the main role.

The Area Development Committee (ADC) currently being developed in each district as the medium between the District Councils and local residents is expected to play the role of contact point in coordinating and promoting the formation and implementation of all of the development plans within the relevant area. In this Project, in establishing an operation and maintenance system in which communities of rural residents and users play the main role, ADCs are also expected to play an active role in the formation and reconstruction, capability development/enhancement and monitoring of activities of V-WASHE.

Based on the National Water Policy of Zambia, V-WASHE will be formed and reconstructed at the village level and will be responsible for the general and daily operation and maintenance as the owner of village's water supply facilities. Meanwhile, handpump maintenance and repair techniques will be transferred to Area Pump Menders (APMs) selected from local communities

and, if there is any repair problems which communities cannot handle, APMs will offer a repair service on a charge basis.

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

Major facilities to be constructed in this Project include the borehole water supply facilities fitted with handpumps and, if iron content in water exceeds the guideline value (1.0mg/lit), iron removal plants will be installed.

With respect to types of handpumps, specifications proposed in the Zambian government's ongoing efforts to standardise handpumps will be reviewed based on plans made by MLGH. Since groundwater at the Project target sites is often acidic at pH of 5 to 6 and, therefore, it is necessary to use acid resistant material for handpumps that may contact water where groundwater is acidic. To this end, it was determined that handpumps, either India Mark-II or Afridev handpumps, both of which are highly common in Zambia currently, should be used depending on the water level and pH value of groundwater.

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

(1) Policy on construction method

The construction method shall be as follows:

1) Borehole drilling works

The drilling method suitable for the Project area will be rotary drilling with mud circulation method or down-the-hole hammer method (DTH), when taking into account the local areas' geologic features and a need to shorten the construction period. Drilling rig suitable for these drilling methods include truck mounted top head drive rigs or table type rigs, where both are used very commonly in Zambia. The drilling capability of these types of equipments should be 203mm (8") in finished drilled borehole diameter (although it is 152mm (6 1/4") if DTH is used, mud circulation method needs as large as 203mm (8")) and up to 100m in depth.

After drilling the top surface and setting up a 203-250mm temporary casing, then, drilling will be continued further until it reaches a predetermined depth, and the position in which the screen should be installed will be identified through borehole logging. Since almost no local drilling companies have borehole logging equipments, the Contractor will bring such equipments into Zambia and carry out the logging. Based on the result of logging, a casing and a screen pipe made of hard polyvinyl chloride (PVC pipe with a diameter of 100mm) will be inserted and gravel pack will be installed to prevent fine sand from entering inside of the

borehole. After setting up and installing the casing, the screen pipe and gravel packing, the borehole will be developed until the water gets clean.

2) Pumping test

The pumping test is composed of different tests including: (i) preliminary pumping test, (ii) step drawdown test, (iii) continuous test (including water quality sampling), (iv) recovery test and (v) water quality test, all of which will be the basis for making a decision on hydrogeological characteristics and success or failure of the constructed borehole.

i. Preliminary pumping test

a. During the preliminary pumping test, the pump will be operated intermittently and the finishing of the borehole will be confirmed by looking at the turbidity of water. If effectiveness of the finishing of the borehole cannot be confirmed, the pump will continue to operate intermittently until clear water can be pumped.
b. Based on the results of the preliminary pumping test, the gradual pumping test will be planned.

ii. Step drawdown test

a. The step drawdown test is a test to be planned based on the result of the preliminary pumping test and in principle it is carried out in 4 steps.
b. Pumping for each step should continue for a period until the dynamic water level becomes stable or for 2 hours.
c. The interval of water level measurement will be determined in accordance with design drawings and specifications.
d. The values of pH, electric conductivity and temperature of pumped water will be measured and recorded during each step of this test.

iii. Continuous pumping test

a. The continuous pumping test will be carried out with appropriate discharge, based on the result of step drawdown test.
b. Pumping should continue until the dynamic water level becomes stable or for 10 hours. If the dynamic water level becomes stable earlier, the test will be discontinued for 6 hours.
c. The interval of water level measurement will be determined in accordance with design drawings and specifications.
d. The values of pH, electric conductivity and temperature of water will be measured and recorded properly during and before the completion of the continuous pumping test. Just before this test is completed, water sample will be obtained for water quality analysis.

iv. Recovery test

a. Immediately after the completion of the continuous pumping test, the recovery test will be carried out.
b. The test should continue until the water level recovers 90% of its original position or up to 8 hours.
c. The interval of water level measurement will be determined in accordance with design drawings and specifications.

v. Water quality test

Water quality analysis will be carried out on site and at a testing laboratory in Lusaka city.

3) Installation of handpumps, appurtenant facilities construction works, and construction works related to iron removal plant

In this Project handpumps of both India-Mark II and Afridev will be used. Handpump installation works are composed of works for appurtenant facilities which include pump base of reinforced concrete on which the pump is to be installed, apron, drainage and soakaway, and works for installation of the pump and iron removal plants to remove iron content from the water, if iron concentration is found above the Zambian Standard.

It is a policy to carry out the above construction method as follows, taking the local conditions into account:

i. Earth works

Earth works associated with the construction of apron, drainage ditch, and iron removal plant will be carried out mainly by simple hand dug.

ii. Structure construction works

Pump base, apron, drainage and iron removal plant should be constructed using reinforced concrete.

iii. Concrete works in general

Manual-mixing methods at the site should be used for concrete works in order to ensure uniformity and strength of concrete, rapid and efficient work process, and appropriate access time to the construction site.

(2) Policies on construction schedule

The number of days required for construction works is calculated based on the results of the "Phase I Project" implemented at the same target area of this Project. As the result, it is considered possible for a team to construct a total of 8 success boreholes per month. It is

advisable to the Japanese Contractor to hire local drilling companies as subcontractors for the sake of cost reduction and implement borehole drilling works with three teams at the maximum in consideration of their capabilities as well as administrative structure. In addition, in the rainy season, since it would be difficult to ensure access of heavy machinery such as drilling rigs and cargo trucks to the drilling sites, borehole drilling works will be halted. Therefore, drilling is possible for a total of 9 months per year excluding the three months in the rainy season and, as a result, the number of boreholes to be constructed successfully in this Project can be calculated as follows:

$$\underline{8 \text{ boreholes/month} \times 3 \text{ teams} \times 9 \text{ months} = 216 \text{ boreholes}}$$

2-2-2 Basic Plan (Construction Plan)

2-2-2-1 Overall Plan

(1) Contents of the request

- Facilities construction: Borehole water supply facilities fitted with handpumps at a total of 320 sites in four districts of Luapula Province
- Technical assistance: Implementation of soft component

(2) The number of project target sites

As a result of screening based on the results of field survey on hydrogeology, geophysics and socio-economical conditions implemented under the Preparatory Survey, 291 sites out of requested 320 sites were identified to be possible for development of new groundwater sources under the Project. However, due to limitation of one-year schedule of implementation of the Project, the number of possible sites for construction under the Project is 216 sites, and the remaining 75 sites will be treated as alternative sites in case where 216 successful boreholes are not available because of hydrogeological conditions.

In the following pages, a list indicating the selection results for the Project target sites and a map of Project site locations are shown in the Table 2-3 (1/3 to 3/3) and Figure 2-2a to 2-2d respectively.

Table 2-3 List of Project Sites (1/3)

NCHELENGE					
Site Code	Site Name	Pop.	Priority	Short List	Remarks
NCII-75	Mulonda B. School	2,518	1	Project	
NCII-07	Kefulwa clinic	2,320	2	Project	
NCII-77	Kambwali clinic	2,100	3	Project	
NCII-76	Mofwe B. School	1,506	4	Project	
NCII-86	Lushiba Basic School	1,356	5	Project	
NCII-06	Kafutuma clinic	1,352	6	Project	
NCII-51	Kalweo Community Sch.	1,148	7	Project	
NCII-87	Kanyembo Basic Sch.	1,081	8	Project	
NCII-36	Kanengwa B. School	916	9	Project	
NCII-04	Mweru Basic School	460	10	Project	
NCII-03	Miba Community Sch.	440	11	Project	
NCII-78	Lukokesha Basic Sch.	436	12	Project	
NCII-01	Mangamu Basic Sch.	384	13	Project	
NCII-19	St. Paul hospital	344	14	Project	
NCII-02	Mutono Basic School	300	15	Project	
NCII-35	Kasamba B. School	295	16	Project	
NCII-94	Shindoni Village	9,600	17	Project	Existing 1 BH
NCII-34	Kaseka Village (near Rd)	4,373	18	Project	
NCII-93	Kabosha Village	3,840	19	Project	
NCII-14	Mutampuka Village	3,264	20	Project	
NCII-72	Mutono Village (2)	3,840	21	Project	Existing 3 BH
NCII-85	Shinjoni Village	2,880	22	Project	
NCII-92	Chile	2,880	23	Project	
NCII-59	Mutabwa Village	2,338	24	Project	
NCII-88	Kasheta Village	2,261	25	Project	
NCII-50	Mutepuka Village	2,064	26	Project	
NCII-10	Chofwe Kabila Village	1,920	27	Project	
NCII-65	Felushi Village	1,920	28	Project	
NCII-74	Chabilikila Village	1,920	29	Project	
NCII-24	Shimutambala Village	1,824	30	Project	
NCII-33	Mukeya Village	1,814	31	Project	
NCII-15	Belu Village	1,776	32	Project	
NCII-70	Katuna Village	1,776	33	Project	
NCII-09	Kandeke Village	1,680	34	Project	
NCII-45	Chibwili Village	1,680	35	Project	
NCII-67	Diamond Village	1,661	36	Project	
NCII-17	Seketeni Village	1,440	37	Project	
NCII-84	Labani Village	1,440	38	Project	
NCII-32	Shimalita	1,872	39	Project	Existing 2 BH
NCII-20	Chishipula Village	1,349	40	Project	
NCII-82	Chikuni Village	1,344	41	Project	
NCII-83	Shimpundu Village	1,267	42	Project	
NCII-30	Mwanamwishi Village	1,248	43	Project	
NCII-41	Pingwila Village	1,229	44	Project	
NCII-54	Chapita Village	1,200	45	Project	
NCII-47	Sela Village	1,166	46	Project	
NCII-08	Mutono Village (1)	1,100	47	Project	
NCII-66	Chomba Village	1,066	48	Project	
NCII-58	Chimba Village	1,046	49	Project	
NCII-40	Shikapambwe	960	50	Project	
NCII-52	Kaseketi Village	960	51	Project	
NCII-53	Mushili Village	950	52	Project	
NCII-68	Kaputo Village	864	53	Project	
NCII-73	Toka Village	816	54	Project	
NCII-28	Kapambwe Village	792	55	Project	
NCII-16	Kasonso Village	720	56	Project	
NCII-26	Chokolo Village	720	57	Project	
NCII-63	Kaputo Village	720	58	Project	
NCII-81	Chiminaula Village	912	59	Project	Existing 1 BH
NCII-44	Shanyemba Village	624	60	Project	
NCII-79	Kapepele Village	614	61	Project	
NCII-42	Kabeke Village	605	62	Project	
NCII-13	Kasalaulo Village	576	63	Project	
NCII-27	Holland Village	576	64	Project	
NCII-31	Nshoka Village	528	65	Alternative	
NCII-39	Fwengeni Village	504	66	Alternative	
NCII-18	Chisukulu Village	480	67	Alternative	
NCII-21	Chipanta Village	480	68	Alternative	
NCII-43	Kanama Village	480	69	Alternative	
NCII-89	Mukanda Village	480	70	Alternative	
NCII-22	Luswili Village	461	71	Alternative	
NCII-91	Samashi Village	413	72	Alternative	
NCII-71	Sonka Village	398	73	Alternative	
NCII-80	Chisambo Village	398	74	Alternative	
NCII-46	Mushingo Village	370	75	Alternative	
NCII-55	Shimwense Village	360	76	Alternative	
NCII-38	Block 5	336	77	Alternative	
NCII-48	Chansa Village	336	78	Alternative	
NCII-37	Chofwe Mulenga Village	293	79	Alternative	
NCII-57	Chinkobwe Village	269	80	Alternative	
NCII-90	Chishimba Luwi Village	264	81	Alternative	
NCII-12	Chilongoshi (B)	250	82	Alternative	
NCII-61	Munkombwe Village	250	83	Alternative	
NCII-29	Musanda Village	250	84	Alternative	
NCII-25	Kanguluma Village	206	85	Alternative	
NCII-23	Mwanda Village	202	86	Alternative	
NCII-49	Nabwendo Village	197	87	Alternative	
NCII-60	Chilamba Village	192	88	Alternative	
NCII-69	Kapempe Village	173	89	Alternative	
NCII-56	Lembati Village	168	90	Alternative	
NCII-11	Chebele Village	149	91	Alternative	
NCII-64	Mwaba Village	106	92	Alternative	
NCII-62	Chungu Village	96	93	Alternative	
NCII-05	Munsa Basic school	Existing Water Facility is Sufficient			Cancelled
NCII-95	Kanyembo clinic	Existing Water Facility is Sufficient			Cancelled

BH: Borehole

Table 2-3 List of Project Sites (2/3)

MWENSE

Site Code	Site Name	Pop.	Priority	Short List	Remarks
MWII-11	Kapamba Basic School	5,315	1	Project	
MWII-05	Lubunda Basic School	2,678	2	Project	
MWII-19	Chembe Comm. Sch.	2,199	3	Project	
MWII-25	Chibondo Basic Sch.	896	4	Project	
MWII-27	Sichama Comm. Sch.	736	5	Project	
MWII-54	Mulunda B.School	730	6	Project	
MWII-56	Bunda Chunsu Basic Sch.	710	7	Project	
MWII-51	Mutipula B. School	525	8	Project	
MWII-15	Kangomba Comm. Sch.	417	9	Project	
MWII-35	Chisheta	6,240	10	Project	
MWII-03	Chilolo	3,360	11	Project	
MWII-30	Chibunse	1,920	12	Project	
MWII-28	Losa Mukunkutu	1,680	13	Project	
MWII-23	James Chiwasha	1,642	14	Project	
MWII-07	Luamfwe Village	1,632	15	Project	
MWII-12	Mumpolokoso Village	1,627	16	Project	
MWII-20	Chilumbi	1,200	17	Project	
MWII-41	Chalwe Chibwe	1,032	18	Project	
MWII-65	Musalango	1,200	19	Project	Existing 1 BH
MWII-06	Kanama Village	912	20	Project	
MWII-32	Kafwimbi	720	21	Project	
MWII-46	Chibwe Village	720	22	Project	
MWII-02	Kabengele	715	23	Project	
MWII-62	Tambalala	538	24	Project	
MWII-44	Mwense East Farm	528	25	Project	
MWII-04	Polo Kankomba Vill.	499	26	Project	
MWII-01	Chitasu	480	27	Project	
MWII-09	Shimaria	480	28	Project	
MWII-39	Sungusungu	480	29	Project	
MWII-50	Chikubi	470	30	Project	
MWII-10	Mutonto	461	31	Project	
MWII-13	Chibele East	384	32	Project	
MWII-14	Kateule Village	360	33	Project	

Site Code	Site Name	Pop.	Priority	Short List	Remarks
MWII-26	Katebula	336	34	Project	
MWII-40	Kaoma	331	35	Project	
MWII-08	Kawama Village	307	36	Project	
MWII-18	Anas	298	37	Project	
MWII-55	Longa Village (Loonga)	268	38	Project	
MWII-21	Kalasa	265	39	Project	
MWII-38	Fyansoni	254	40	Project	
MWII-37	Mweshi Village	250	41	Project	
MWII-59	Chilolo	250	42	Project	
MWII-34	Munkupa	242	43	Project	
MWII-58	Chifuntwe	240	44	Project	
MWII-29	Mutima	206	45	Alternative	
MWII-47	Kamami Village	202	46	Alternative	
MWII-17	Nyengele	192	47	Alternative	
MWII-24	Chisulo	178	48	Alternative	
MWII-43	Sepe	172	49	Alternative	
MWII-63	Bunda	168	50	Alternative	
MWII-53	Pibelibe	163	51	Alternative	
MWII-64	Leo	163	52	Alternative	
MWII-57	Kapalaula	158	53	Alternative	
MWII-36	Mutanti	144	54	Alternative	
MWII-60	Kane	139	55	Alternative	
MWII-16	Kakusa B. Village	134	56	Alternative	
MWII-22	Chansa Village	336	57	Alternative	Existing 1 BH
MWII-48	Nshi ndano	82	58	Alternative	
MWII-49	Chipepa	48	59	Alternative	
MWII-31	Chalata	Low Groundwater Potential			Cancelled
MWII-33	Kapakala West	Low Groundwater Potential			Cancelled
MWII-42	Mulubika	No access			Cancelled
MWII-45	Kapesha Village(B)	Low Groundwater Potential			Cancelled
MWII-52	Kambele	No access			Cancelled
MWII-61	Moba	No access			Cancelled

MANSA

Site Code	Site Name	Pop.	Priority	Short List	Remarks
MAII-01	Chitamba Basic Sch.	3,398	1	Project	
MAII-03	Mantumbusa Basic Sch.	2,775	2	Project	
MAII-51	Fibale Basic School	2,268	3	Project	
MAII-49	Kalasakando Basic Sch.	2,216	4	Project	
MAII-52	Mupofwe Comm. Sch.	2,138	5	Project	
MAII-68	Mushitu Comm. Sch.	845	6	Project	
MAII-34	Kapapa Comm. Sch.	539	7	Project	
MAII-65	Kamipundu Comm. Sch.	446	8	Project	
MAII-60	Kabulaya Musesha (Com. Sch)	418	9	Project	
MAII-33	Shoti (Chansunsu Com. Sch)	415	10	Project	
MAII-35	Chiwele Comm. Sch.	393	11	Project	
MAII-24	Musaila RHC	341	12	Project	
MAII-08	Kasongo	3,000	13	Project	
MAII-16	Chitakwa	2,650	14	Project	Existing 1 BH
MAII-32	Chabala	3,600	15	Project	Existing 1 BH
MAII-61	Yasakwa (Bena Section)	1,776	16	Project	
MAII-78	Chimese Local Court	1,700	17	Project	
MAII-21	Chofwe	1,690	18	Project	
MAII-54	Eshon & Banda Area	1,920	19	Project	Existing 1 BH
MAII-02	Lukakula	1,200	20	Project	
MAII-13	Kunda Ndomi	1,104	21	Project	
MAII-27	Kalyondo	1,003	22	Project	
MAII-22	Chakaba	960	23	Project	
MAII-09	Chikuwe	720	24	Project	
MAII-19	Kalaba	720	25	Project	
MAII-42	Kasoma	596	26	Project	
MAII-43	Kachepeshi	576	27	Project	
MAII-89	Chabwe	576	28	Project	
MAII-28	Temfwe	800	29	Project	Existing 1 BH
MAII-53	Chisukulo	753	30	Project	Existing 1 BH
MAII-75	Saili	480	31	Project	
MAII-71	Mabumba Market	943	32	Project	Existing 2 BH
MAII-23	Kambalikila	432	33	Project	

Site Code	Site Name	Pop.	Priority	Short List	Remarks
MAII-38	Chansa(Kalukusha Area)	422	34	Project	
MAII-85	Motoka	379	35	Project	
MAII-64	Chipungu	374	36	Project	
MAII-30	Fipatauko	360	37	Project	
MAII-46	Kosamu	336	38	Project	
MAII-76	Lofoyi	576	39	Project	Existing 1 BH
MAII-31	Kalaba	310	40	Project	
MAII-67	Chief Mabumba's Palace	293	41	Project	
MAII-45	Matipa	288	42	Project	
MAII-47	Makunka	288	43	Project	
MAII-66	Chisumbu	288	44	Project	
MAII-74	Tubi	265	45	Project	
MAII-62	Chitungula	264	46	Project	
MAII-55	Kalungushi	259	47	Project	
MAII-26	Shamende	248	48	Project	
MAII-29	Kapu	245	49	Project	
MAII-07	Mutiti	240	50	Project	
MAII-36	Kombaniya	240	51	Project	
MAII-88	Mungulube	240	52	Project	
MAII-63	Mashikolo	235	53	Project	
MAII-17	Mwanachama	480	54	Project	Existing 1 BH
MAII-57	Sanofi	480	55	Project	Existing 1 BH
MAII-37	Sendapu	192	56	Project	
MAII-87	Kapaipi	189	57	Project	
MAII-73	Chibale Kalaliki	186	58	Project	
MAII-06	Milima/Sepe	432	59	Project	Existing 1 BH
MAII-83	Senseleni	172	60	Project	
MAII-48	Musela	168	61	Project	
MAII-58	Kapompole	144	62	Alternative	
MAII-90	Kale (Musenga)	144	63	Alternative	
MAII-80	Luka Ngosa	139	64	Alternative	
MAII-25	Kalungushi	384	65	Alternative	Existing 1 BH
MAII-40	Kapitolo	120	66	Alternative	

Table 2-3 List of Project Sites (3/3)

MANSA(continuation)					
Site Code	Site Name	Pop.	Priority	Short List	Remarks
MAII-82	Kasanda Local Court	111	67	Alternative	
MAII-44	Kawama	101	68	Alternative	
MAII-50	Kapansa	101	69	Alternative	
MAII-84	Makeleta	96	70	Alternative	
MAII-86	Kalimwengo	96	71	Alternative	
MAII-18	Mibenge	92	72	Alternative	
MAII-41	Kabushi	86	73	Alternative	
MAII-77	Kalyongo	576	74	Alternative	Existing 2 BH
MAII-10	Kalibuku	72	75	Alternative	
MAII-79	Mabo's Village	317	76	Alternative	Existing 2 BH
MAII-20	Swala	288	77	Alternative	Existing 2 BH
MAII-70	Kapili	38	78	Alternative	
MAII-72	Nalwamba	38	79	Alternative	
MAII-04	Kasengu	No access			Cancelled
MAII-05	Mwalashi	No access			Cancelled
MAII-11	Lusaya	Low groundwater potential			Cancelled
MAII-12	Kalimba	Low motivation to form V-WASHE			Cancelled
MAII-14	Kampalala	Existing Water Facility is Sufficient			Cancelled
MAII-15	Kakuka	No access			Cancelled
MAII-39	Chief Kale Palace	Existing Water Facility is Sufficient			Cancelled
MAII-56	Katambala	No access			Cancelled
MAII-59	Lule Community School (Mwansa Mutale)	Existing Water Facility is Sufficient			Cancelled
MAII-69	Chofoshi Basic School	Existing Water Facility is Sufficient			Cancelled
MAII-81	Chikombola	Existing Water Facility is Sufficient			Cancelled

MILENGE					
Site Code	Site Name	Pop.	Priority	Short List	Remarks
MLII-55	Matontola Basic Sch.	1,856	1	Project	
MLII-31	Tande Basic Sch.	1,016	2	Project	
MLII-32	Milulu health Post	648	3	Project	
MLII-27	Mumbotuta Basic Sch.	446	4	Project	
MLII-30	Mulungushi Basic Sch.	337	5	Project	
MLII-58	Kabange RH Post	319	6	Project	
MLII-66	Chabuka Baushi Basic Sch.	300	7	Project	
MLII-70	Kalaba Shitembeye Comm. Sch.	296	8	Project	
MLII-09	Riverside Comm. Sch.	295	9	Project	
MLII-26	Changwe Lungo Basic Sch.	295	10	Project	
MLII-59	Kabange	1,114	11	Project	
MLII-57	Moffat	960	12	Project	
MLII-01	Garden (A)	1,080	13	Project	Existing 1 BH
MLII-56	Chandika	720	14	Project	
MLII-51	Kachenge (A)	960	15	Project	Existing 1 BH
MLII-12	Chililufya Yamwela	672	16	Project	
MLII-68	Musongo	617	17	Project	
MLII-40	Chenga (B)	528	18	Project	
MLII-06	Chisensa	619	19	Project	Existing 1 BH
MLII-14	Chipundu(B)(Makole) Vill.	365	20	Project	
MLII-65	Kalubini	355	21	Project	
MLII-08	Sokontwe Old	336	22	Project	
MLII-07	Sokontwe New	307	23	Project	
MLII-38	Kabongo (B)	302	24	Project	
MLII-62	Chifwalo	300	25	Project	
MLII-47	Chamakapoli (A)	264	26	Project	
MLII-18	Kaputa (C)(Pa Gosteni Mumba)	260	27	Project	
MLII-13	Chipundu (A) (Kapu)	250	28	Project	
MLII-28	Changwe Lungo Village	250	29	Project	
MLII-39	Chenga (A)	250	30	Project	
MLII-52	Kachenge (B)	250	31	Project	
MLII-49	Mulumbi (A)	240	32	Project	
MLII-64	Itemba Local Court	240	33	Project	
MLII-53	Scheme (A)	235	34	Project	
MLII-41	Muyayi	230	35	Project	
MLII-67	Kapalamuna	230	36	Project	
MLII-20	Shitambuli (B)	216	37	Project	
MLII-25	Miyambo Village	192	38	Project	
MLII-69	Chibende	168	39	Project	
MLII-22	Allan Senga	154	40	Project	
MLII-23	Kaloko (A)	154	41	Project	
MLII-43	Vincent	154	42	Project	
MLII-37	Kabongo (A)	144	43	Project	
MLII-10	Musongo Mwewa	134	44	Project	
MLII-45	Alas	130	45	Project	
MLII-36	Kalali (B)	126	46	Project	
MLII-33	Musumali	125	47	Project	
MLII-29	Buyantashi Village	120	48	Alternative	
MLII-34	Mote	120	49	Alternative	
MLII-46	N'gomba	120	50	Alternative	
MLII-21	Shitambuli (C)	110	51	Alternative	
MLII-61	Kabayi	101	52	Alternative	
MLII-03	Munushi Compound	96	53	Alternative	
MLII-60	Itemba	96	54	Alternative	
MLII-35	Kalali (A)	91	55	Alternative	
MLII-63	Kakasu	91	56	Alternative	
MLII-04	Kamupapa	86	57	Alternative	
MLII-05	Kalotoli	77	58	Alternative	
MLII-02	Garden (B)	72	59	Alternative	
MLII-44	Kanono	70	60	Alternative	
MLII-11	Musongo Mwewa	Combined with site MLII-10			Cancelled
MLII-15	Chilufya Kabinda	Existing Water Facility is Sufficien			Cancelled
MLII-16	Kaputa (A)	Combined with site MLII-18			Cancelled
MLII-17	Kaputa (B)(Bupe Kabwe)	Combined with site MLII-18			Cancelled
MLII-19	Shitambuli (A)	Existing Water Facility is Sufficien			Cancelled
MLII-24	Kaloko (B)	Combined with site MLII-23			Cancelled
MLII-42	Mumanse	Existing Water Facility is Sufficien			Cancelled
MLII-48	Chamakapoli (B)	Combined with site MLII-47			Cancelled
MLII-50	Mulumbi (B)	Combined with site ML-49			Cancelled
MLII-54	Scheme (B)	Combined with site MLII-53			Cancelled

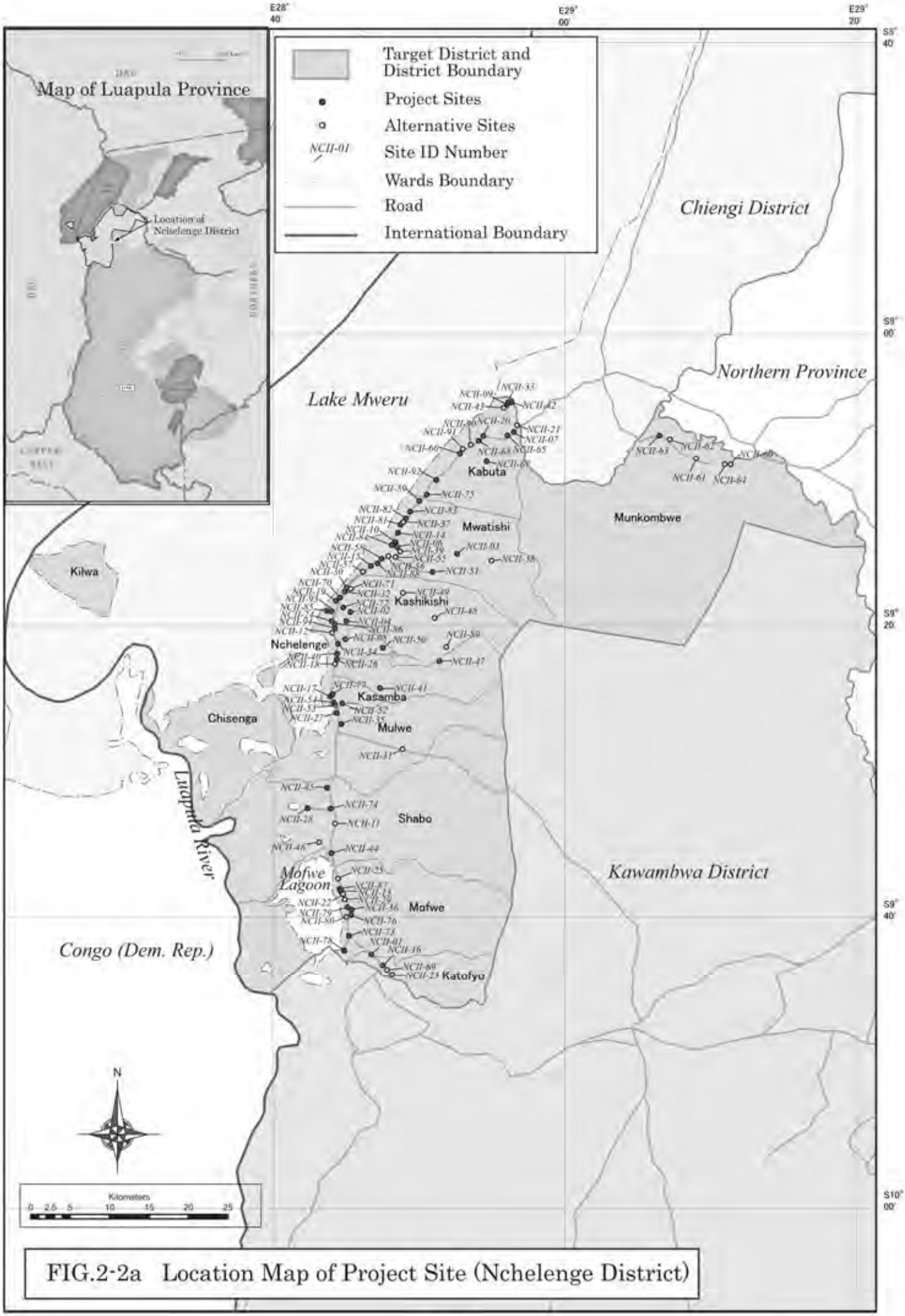


FIG.2-2a Location Map of Project Site (Nchelenge District)

FIG.2-2b Location Map of Project Site (Mwense District)

FIG.2-2c Location Map of Project Site (Mansa District)

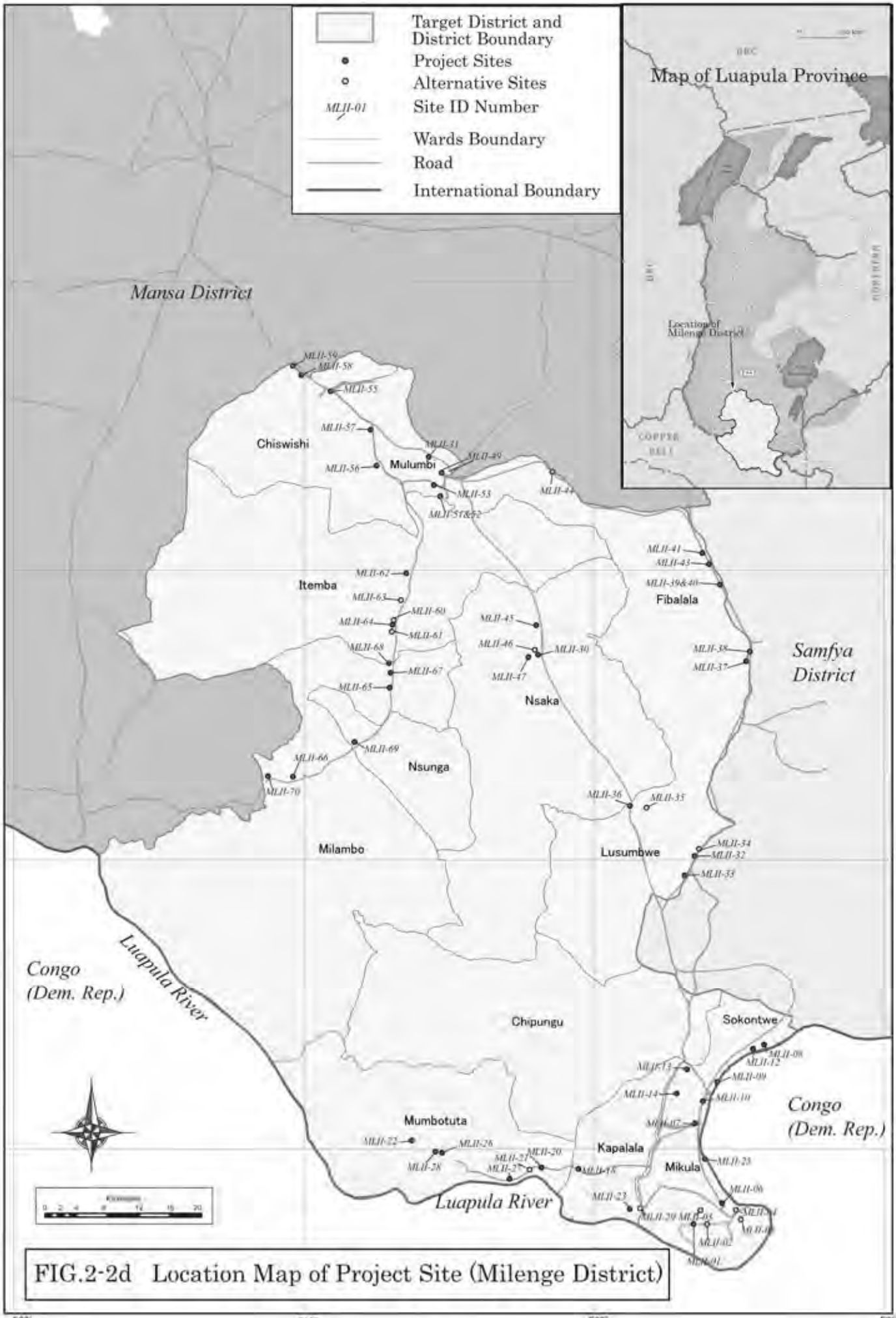


FIG.2-2d Location Map of Project Site (Milenge District)

2-2-2-2 Facility Construction Plan

(1) Design criteria for water supply facilities

Taking into consideration the guidelines and designs that are traditionally and locally applied in the country, and achievements made in the "Phase I Project" and results of this Study, it was determined that this Project should adopt the following design criteria.

Water supply system	:	Borehole fitted with handpump and iron removal plant
Water supply unit	:	The guidelines for basic unit of water supply indicated in Zambia's rural water supply program should be adopted and the basic unit of 30lit/person/day should be established.
Population per water point	:	250 persons per each water supply facility with handpump
Planned water supply volume	:	30Lit x 250 persons = 7.5m^3/day

Specifications of the water supply facilities are also shown in the Table 2-4 below.

Table 2-4 Design Conditions for Borehole Fitted with Handpumps

Item	Specifications and design conditions
1. Successful ratio of borehole drilling	Will be adopted 75.5%.
2. Number of unsuccessful borehole per site	In case of the first attempt is unsuccessful, a second drilling will be carried out. Therefore, a maximum two drilling attempt shall be carried out in one site.
3. Judgment for site cancellation	In case of the second attempt is judged unsuccessful, it will be considered that the groundwater potential in the area is low, and the site shall be cancelled.
4. Type of handpump and standard accessories	The type of handpump shall be India Mark-II and/or Afridev. Will be selected based on the availability of spare parts, the pumping water level and water quality of the borehole. Standard accessories: spare parts kit and maintenance tools
5. Water quality guidelines	Will be adopted the Zambian standard ZS190:1990 and additionally the guidelines of WHO. However, pH should be more than 5.0.
6. Installation of Iron Removal Plant (IRP)	In case the contents of iron in the groundwater exceed the Zambian guideline, iron removal plant shall be installed. There is cases where the water quality varies in the groundwater after several time, it will be considered a monitoring period of water quality.
7. Water supply per person	30Lit/person/day (*)

8. Discharge of borehole	0.2Lit/sec (*)
9. Borehole diameter	In consolidated formation: not less than 152mm In unconsolidated formation: not less than 203mm
10. Borehole depth	Not less than 30m(*), average 63m
11. Pumping water level	Based on the normal usage condition of the handpump. ・ Within 30m: Afridev ・ Within 40m: India Mark-II If the Pumping water level is out of the above mentioned depth, than the borehole shall be basically considered unsuccessful, but for the final decision, it will be considered the actual need of safe water in the area, the population and after discussion with the Implementing Agency.
12. Casing/Screen Pipes	Nominal Diameter: 100mm(*) or more, PVC made
13. Size of screen slot	0.25mm to 1.0mm
14. Other conditions for site selection	The location of the borehole shall be at least 30m of distance from pit latrine or any other source of contamination, such as waste dumping site.(*)
15. Others	In the borehole, it will be installed apron, drainage, soakaway, gravel packing, clay seal, cementation and bottom plug. (*)

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

(2) Facilities Design

(i) Water source facilities

In this Project, water will be sourced from boreholes and casing/screens, gravel packing will be installed in all the boreholes. It was decided to make it a policy to carry out pumping tests, calculate adequate discharge and carry out water quality analysis on site and at a public institution's chemical laboratory.

(ii) Types of groundwater pumping equipments

Handpumps to be installed at each site should be either India Mark-II or Afridev type, both being the most popular in Zambia. The selection should be made depending on the pH value and groundwater level of the borehole.

(iii) Appurtenant facilities

At each site, a drainage ditch and a soakaway will be installed to a circular-shape apron, which is commonly adopted in Zambia. If water cannot infiltrate into the soil, an open drainage ditch will be installed.

(iv) Iron Removal Plant

Structure: Reinforced concrete structure (no water proof finishing should be applied for the purpose of cost reduction)

(3) Setting of success rate for borehole drilling works

According to the results of hearing surveys made to the Luapula Province branch office of the Department of Water Affairs (DWA), Ministry of Energy and Water Development (MEWD), which carries out borehole drilling works in Luapula Province, approximately 70% of such works have succeeded in Luapula Province on average. Meanwhile, in the "Phase I Project," the success rate was 75.5%. Given the results of the "Phase I Project," the success rate of 75.5% should be adopted in this Project. Also, in this Project, the borehole's finish depth should be established as 63m on average, taking into account the actual results of the "Phase I Project" and its drilling data as well as the results of geophysical prospecting.

(4) Priorities and arrangement for alternative sites

As mentioned in the section 2-2-1, the number of sites where water source development is possible is 291 and, of these sites, 216 sites are targeted for water source development in this Project. It was determined that the remaining 75 sites which were not selected as the target sites should be alternative sites of this Project. That is, if any of the already selected sites needs to be cancelled based on the drilling results, a new drilling site will be selected from these 75 alternative sites in the order of priority. In other words, this Project's goal is to successfully construct a total of 216 boreholes.

(5) Types of handpumps

Currently in Zambia, India Mark-II handpumps are most commonly used, while the Afridev handpump has become popular gradually. Since, these two models were used in the "Phase I Project", it was decided to make it a policy to use these models also in this Project.

The major differences between these two types are as follows. Since the India Mark-II handpump has a riser pipe made of steel and has a considerable strength, it can be used even for boreholes with a relatively low groundwater level (approx. 40m) but the pipe can be easily corroded if the groundwater is acidic. On the other hand, the Afridev handpump has a PVC pipe which is resistant to corrosion and cannot be easily affected by water quality. PVC pipes, however, are less strong than steel pipes and the Afridev handpump has difficulties to pump water if the groundwater level is relatively low. The groundwater level can also affect its durability. The Afridev handpump should be used for a groundwater level of up to about 30m because its parts could need to be replaced more frequently due to abrasion.

According to the data on borehole construction obtained during the "Phase I Project," the groundwater level is relatively low in areas listed below. Meanwhile, in other areas, the groundwater level is at about 20m at a maximum.

Nchelenge District	Mwatishi and a part of Kashikishi Ward Groundwater level: about 30m
Mwense District	Chachacha, Munwa, Mambilima, Lundashi, Musonda, Chibembe, Katuta and the entire area of Mpasa Ward Groundwater level: about 30-40m

If the India Mark-II is used, there is a concern that the steel riser pipe can be corroded as the groundwater becomes lower in pH value and the iron content of the pumped groundwater could be affected, too. Therefore, construction works in the "Phase I Project" were carried out selecting the handpump type, depending on the groundwater's pH level (India Mark-II handpump for alkaline water and Afridev handpump for acidic water, setting the borderline at pH 6.5).

Through water quality surveys made in this Study on existing boreholes, correlations between pH value and iron content in sampled groundwater pumped with India Mark-II handpumps were confirmed. And it was found that the iron content differed greatly when the value crossed the borderline of pH 6.5, as shown in the following Figure. It shows that the criteria for decision making used in the "Phase I Project" was appropriate.

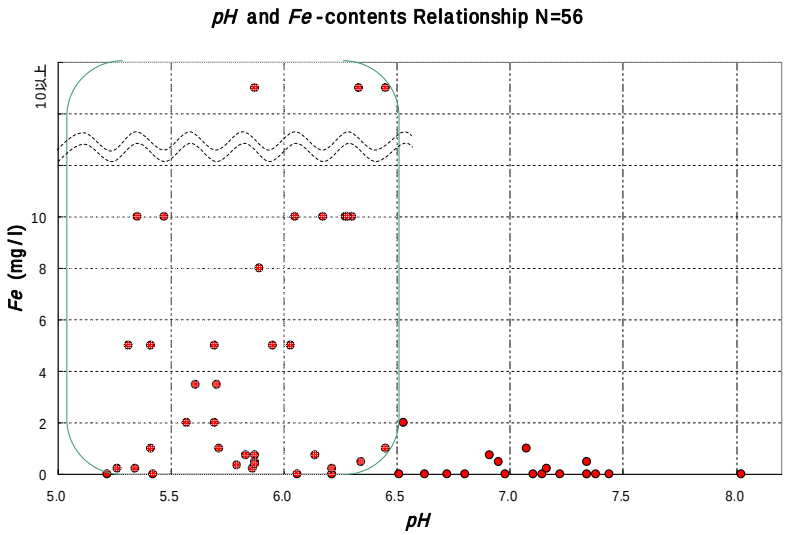


Fig. 2-3 Correlations between pH and iron (Fe) contents

To decide about the installation of iron removal plant in the "Phase I Project", water quality

monitoring has been done, and it was found that both the iron content and the pH value obtained during the monitoring process were different from those obtained during the pumping tests. Furthermore, in boreholes where India Mark-II were installed, during the monitoring period it was found that at 6 sites out of 53 sites, the iron contents has increased and exceeded the Zambian standard of 1.0mg/lit. The iron has increased only in sites where the pH value was between 6.5 and less than 7.0 during the pumping test. In 4 sites with India Mark-II, the iron contents were above the Zambian standard from the beginning, say, it was found during the usual water quality analysis in the pumping test stage.

Therefore, in this Project, considering some safe factor, the selection between the India Mark-II and Afridev handpumps will be carried out by setting the borderline at pH 7.0. (Reference data: see Annex-4)

Design policy for selection between handpump models (to be determined based on the pH value obtained at the time of borehole drilling works).

- pH 7.0 or higher: India Mark-II handpump will be selected
- pH less than 7.0: Afridev handpump will be selected

As already mentioned, in Chachacha, Munwa, Mambilima, Lundashi, Musonda, Chibembe, Katuta and Mpasa Wards of Mwense District, the groundwater level is relatively low at 30-40m and, therefore, the India Mark-II model should be used in these areas, by considering the lower groundwater level, even if the pH value is less than 7.0. In Nchelenge District, the Afridev model can be used considering the groundwater level is at an acceptable level of about 30m at the deepest.

Based on the above considerations, handpump selection between the India Mark-II and Afridev models will be made with ratios shown in the Table 2-5 below.

Table 2-5 Type of handpump per District

Type of handpump	District				
	Nchelenge	Mwense	Mansa	Milenge	Total
India Mark-II	24 nos.	19 nos.	3 nos.	10 nos.	56 nos.
Afridev	40 nos.	25 nos.	58 nos.	37 nos.	160 nos.
Total	64 nos.	44 nos.	61 nos.	47 nos.	216 nos.

(6) Iron Removal Plants

The Project verified the installation of the iron removal plants through considerations of the following two results of observations.

With respect to boreholes equipped with India Mark-II handpumps constructed by the "Phase I Project" in this Project's target districts, it was confirmed during the water quality monitoring process that the iron content tended to increase at about a half of the boreholes after the facilities been started working (refer to the Annex-4). It was estimated, therefore, to have a plan to install the iron removal plants at half of the boreholes that are equipped with India Mark-II handpumps shown in the above Table 2-5.

In addition, according to data obtained through water quality tests on iron content carried out at the "Phase I Project" sites, at an average of 5.4% in four target districts, iron content exceeded Zambia's national water quality standard of 1.0mg/lit at the time the borehole was constructed, regardless of the type of handpump. Therefore, review should be made concerning possible installation of iron removal plants even for boreholes with Afridev handpumps as appropriate. The ratio for iron removal plants that should be installed in four districts are shown in the Table 2-6 below.

Table 2-6 List of Iron Removal Plant per District

	Nchelenge	Mwense	Mansa	Milenge	Total
50% of the sites with India Mark-II	18.8% (12/64)	21.6% (9.5/44)	2.5% (1.5/61)	10.7% (5/47)	12.9%
Iron contents is more than 1mg/lit in its natural condition	0.0%	3.2%	7.7%	10.3%	5.4%
Total	18.8%	24.8%	10.2%	21.0%	18.3%
Number of Iron Removal Plant	12 nos.	11 nos.	6 nos.	10 nos.	39 nos.

Source: Annex-9.

The ratio that the iron removal plants should be installed is about 18.3% in all of the Project target area.

The final decision on whether the Plants can be installed or not will be made later, based on the results of water quality monitoring to be carried out 2 months after the installation of the handpump, and starting of water supply. This is because it is necessary to make a decision after confirming if the pH value has a tendency to decline greatly and/or if the iron content also tends to increase.

According to water quality data, it was found that sites where iron content was above 1.0mg/lit in the natural state were distributed mainly in granitic formation such as in Mansa District and the western part of Milenge District.

In addition, when reviewing the regional characteristics of boreholes equipped with India Mark-II handpumps where iron content increases, relatively distinctive localities can be found. Such distinctive characteristics are largely found in the south-eastern shore of the Lake Muweru, near the Luapula River in Mwense District and near the Luapula River in Mansa District.

(7) Appurtenant facilities of the handpumps

Appurtenant facilities for handpumps include a concrete apron, a drainage ditch, and a soakaway pit. Appurtenant facilities with designs generally used in Zambia should be adopted.

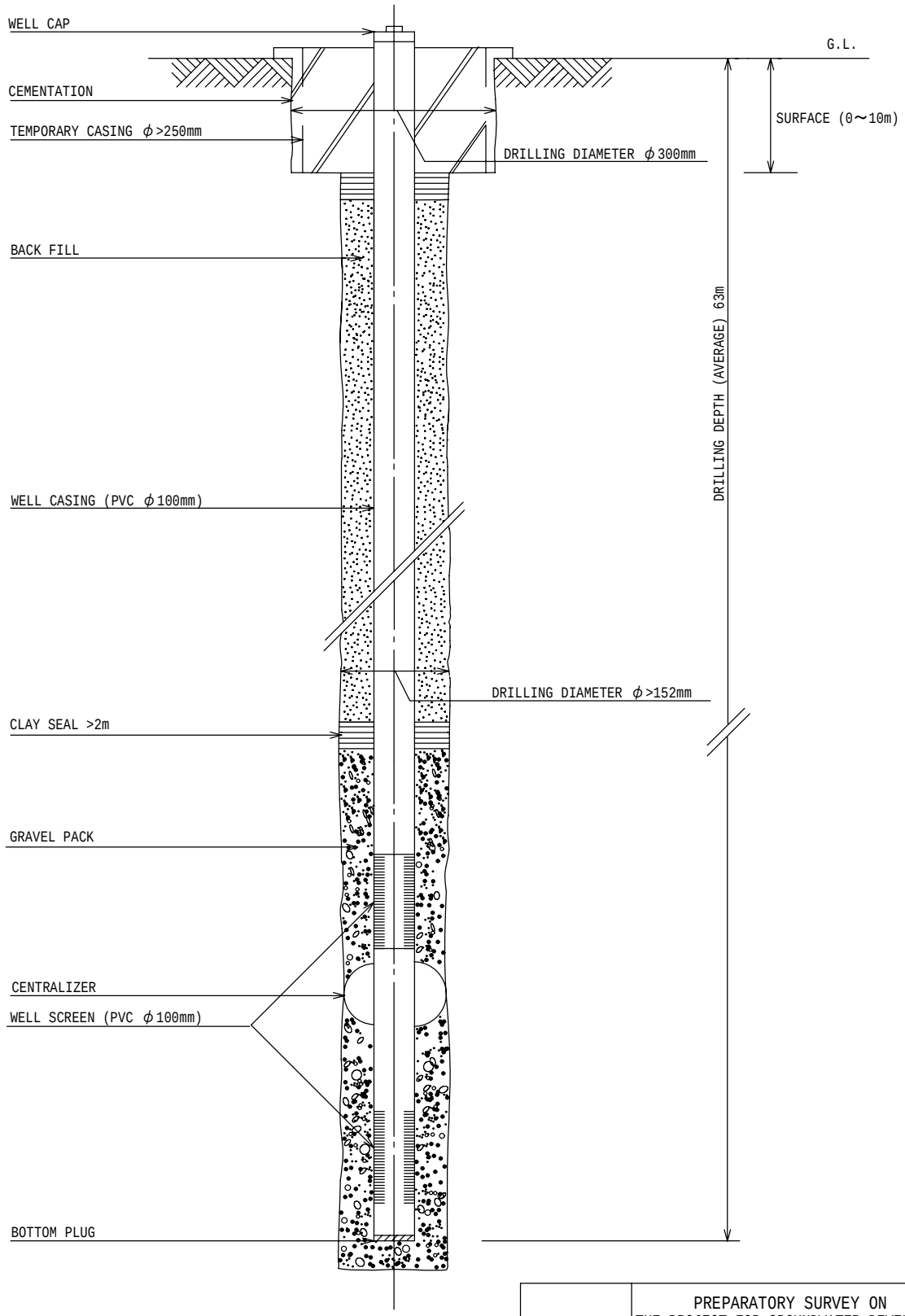
As mentioned in Section (6), in this Project it is a policy to install an iron removal plants at sites where water contains iron above the Zambian standard. In order to remove iron more effectively, however, the position of handpumps should be elevated higher than the normal position, and concrete steps will be constructed to allow users to use the facility more comfortable.

(8) 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 it is not planned to tear down or dismantle any facilities in this Project, measures against asbestos will not be made, but it is a basic policy to have anti-scattering measures if any teardown or dismantling becomes necessary.

2-2-3 Outline Design Drawing

The outline drawings of the borehole, appurtenant facilities and iron removal plant under the Project are shown in the following pages.

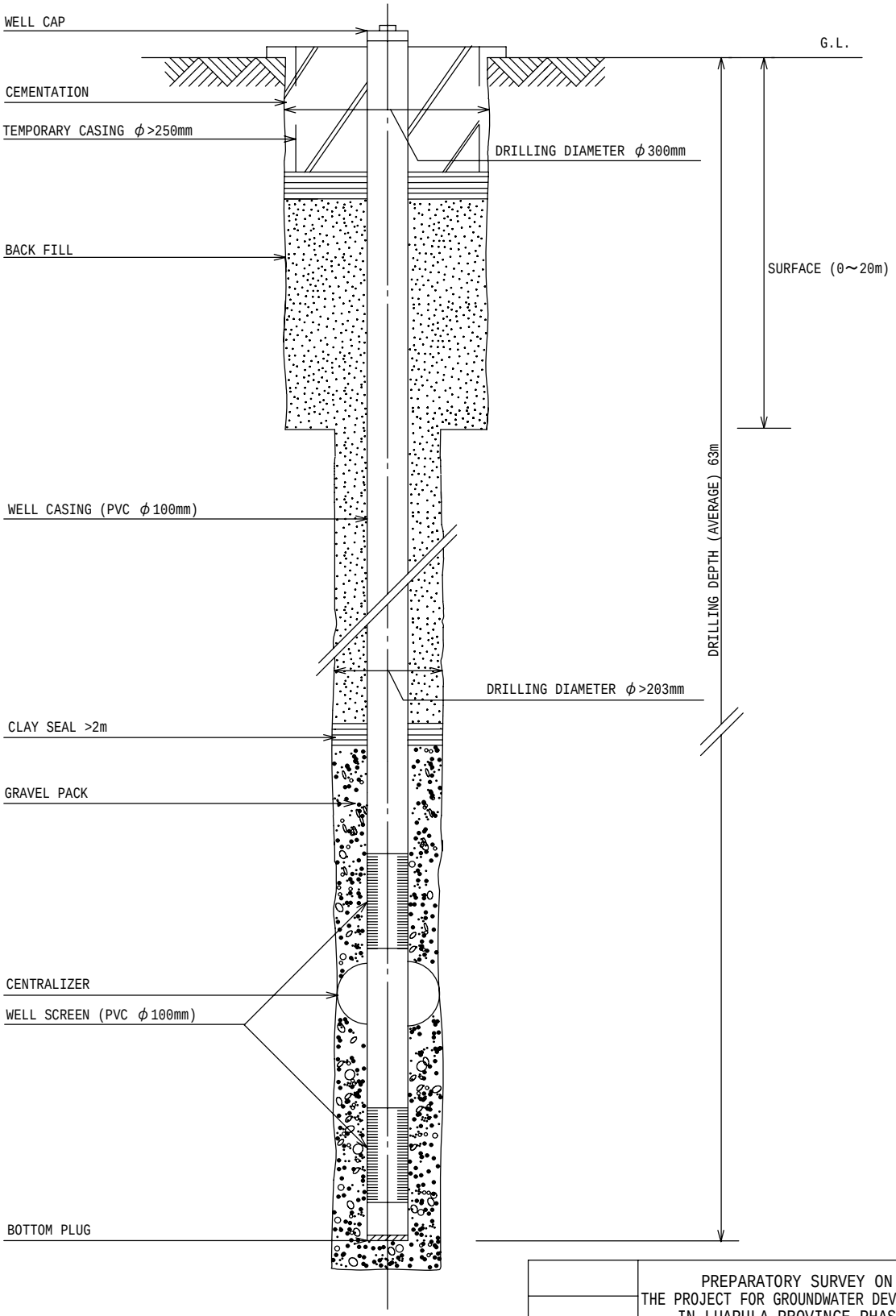


PREPARATORY SURVEY ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT
IN LUAPULA PROVINCE PHASE 2
IN THE REPUBLIC OF ZAMBIA

FIG. 2-4 BOREHOLE STRUCTURE
(DTH DRILLING FOR CONSOLIDATED FORMATION)

NOT TO SCALE

JAPAN TECHNO

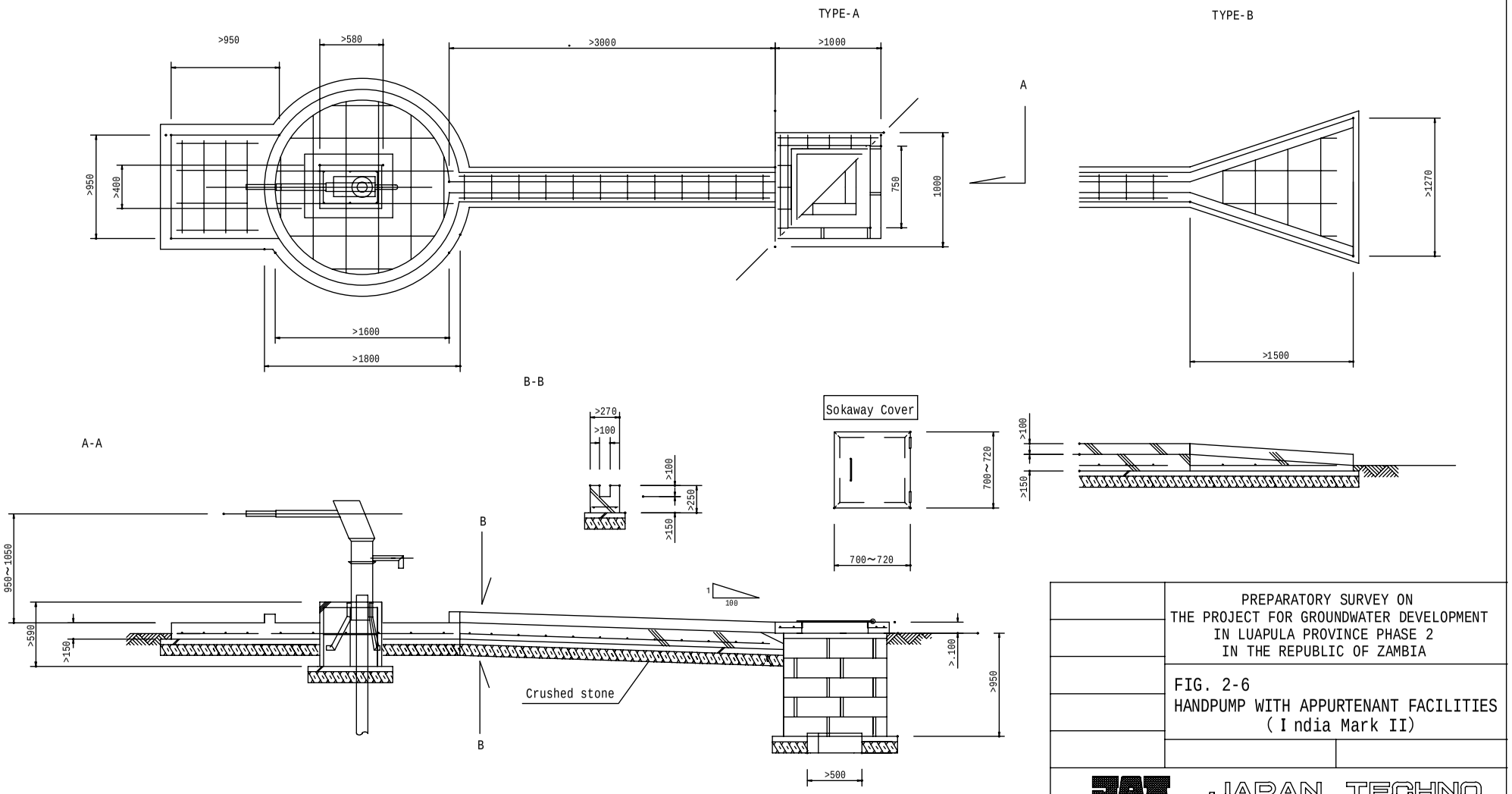


PREPARATORY SURVEY ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT
IN LUAPULA PROVINCE PHASE 2
IN THE REPUBLIC OF ZAMBIA

FIG. 2-5 BOREHOLE STRUCTURE
(MUD DRILLING FOR UNCONSOLIDATED FORMATION)

NOT TO SCALE

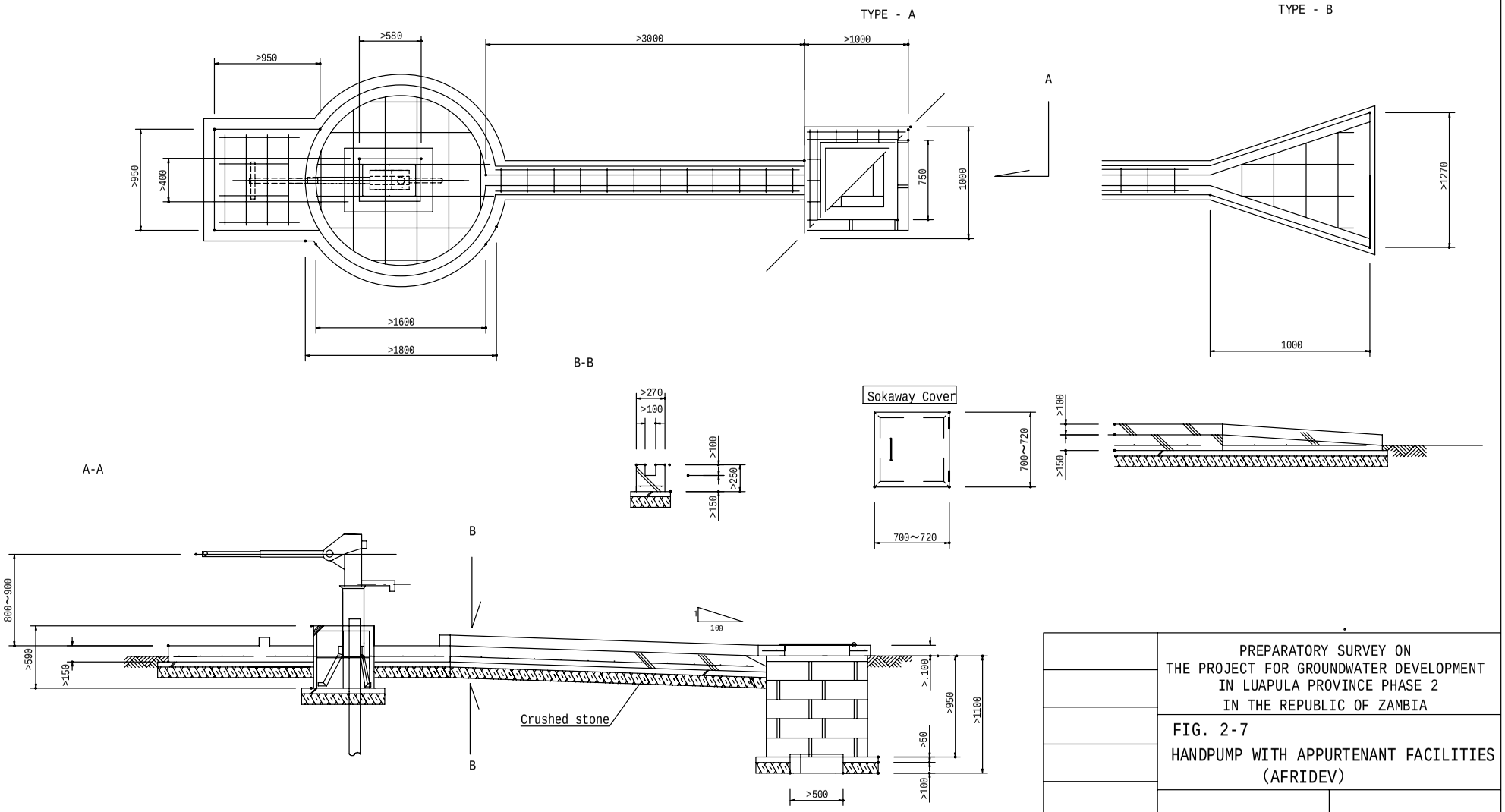
JAT JAPAN TECHNO



PREPARATORY SURVEY ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT
IN LUAPULA PROVINCE PHASE 2
IN THE REPUBLIC OF ZAMBIA

FIG. 2-6
HANDPUMP WITH APPURTENANT FACILITIES
(I ndia Mark II)

JAT JAPAN TECHNO



PREPARATORY SURVEY ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT
IN LUAPULA PROVINCE PHASE 2
IN THE REPUBLIC OF ZAMBIA

FIG. 2-7

HANDPUMP WITH APPURTENANT FACILITIES
(AFRIDEV)

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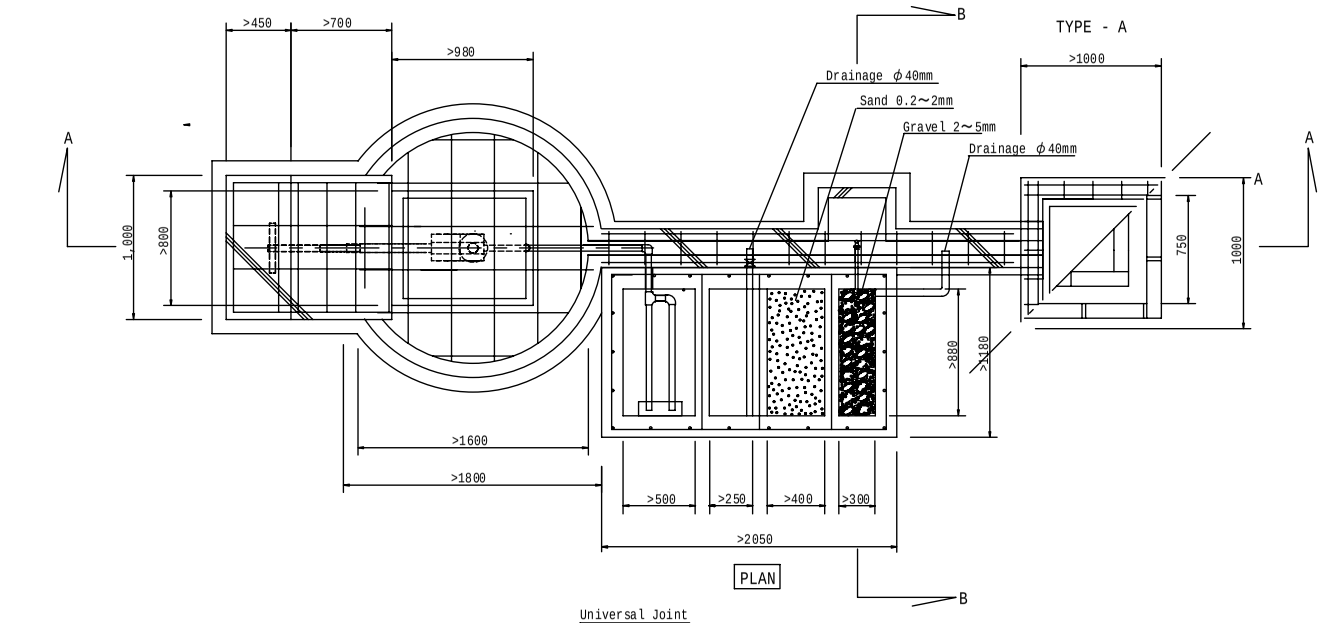
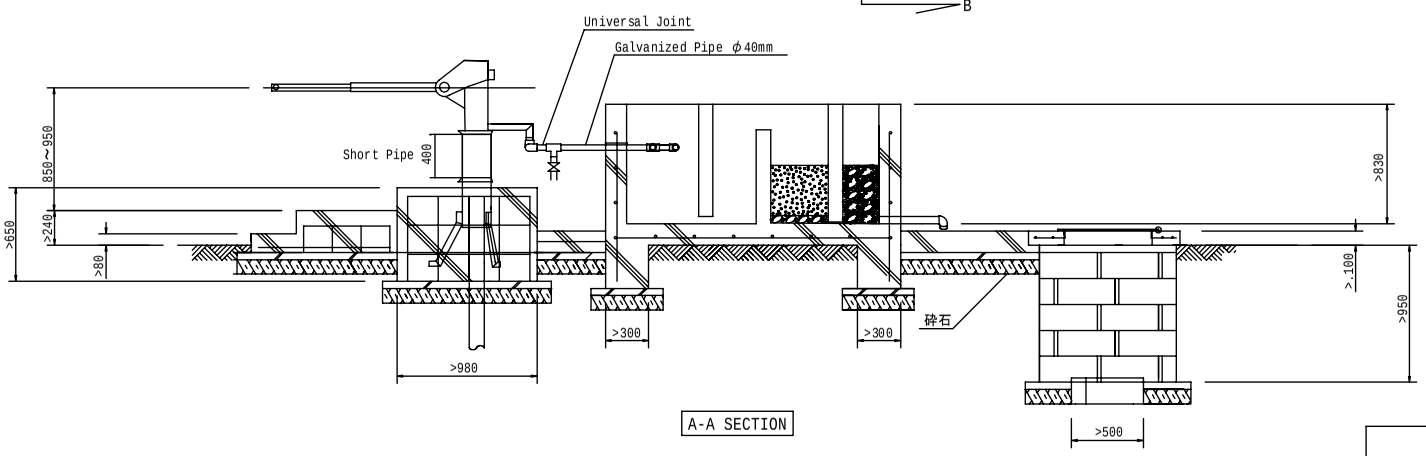
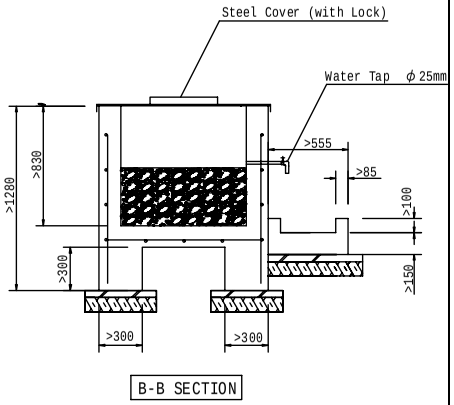






PREPARATORY SURVEY ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT
IN LUAPULA PROVINCE PHASE 2
IN THE REPUBLIC OF ZAMBIA

FIG. 2-8
IRON REMOVAL PLANT

JAT JAPAN TECHNO

2-2-4 Implementation Plan

2-2-4-1 Implementation Policy

The Contractor for execution of the works under the Project will be a Japanese firm, considering the Japanese Grant Aid scheme. The Contractor will complete the procurement and construction of water supply facilities within the period stipulated in the contract with the supervision of Japanese Consultant.

For the Project Implementation Plan, it is necessary to set up appropriately the construction schedule and implementation structure, including sufficient consideration on the Grant Aid System. Fig. 2-9 shows the Project Implementation Structure.

Whenever possible, the Project will apply the Zambian standards for its design and procure locally distributed goods and materials based on its specifications in consideration of the cost reduction measures. Also, the Project will utilise local personnel resources for the supervision to possible extent in a view of cost reduction though it is desirable to leverage Japanese engineers considering the requirement of quality and schedule management. Section "2-2-4-4 Consultant Supervision" shows the main personnel and their work contents.

The Project should be undertaken by MLGH/DHID and is responsible for the detail design study, construction and maintenance of the facilities. During the construction work, the persons in charge from DHID and Provincial office will supervise the work, and V-WASHE will maintain the facility after completion. D-WASHE will be responsible for the sensitisation activities and monitoring to V-WASHE.

On the other hand, after the Exchange of Notes between both countries and as well as the Grant Agreement between Zambian Government and JICA, a Japanese Consultant of the Project 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 execution of tender and conclusion of contract (between MLGH and the selected Contractor) and supervise the construction works.

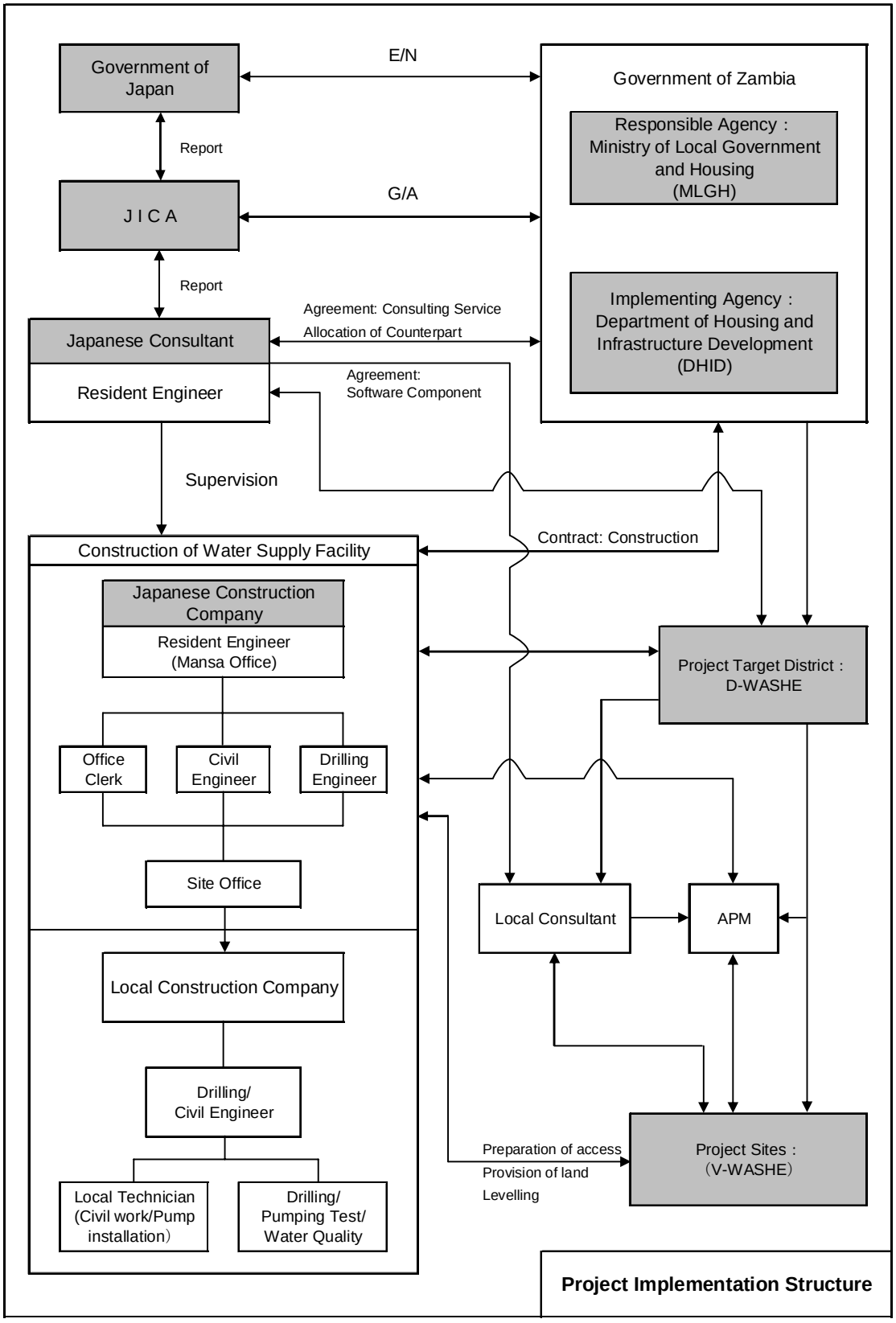


Fig. 2-9 Project Implementation Structure

2-2-4-2 Implementation Conditions

Since the project sites are located in a large area of 350km north-south and 100km east-west, it is required to maintain the quality of construction works and implement the works efficiently without any delays. Therefore, the Project will adopt a supervision structure which allocates a Japanese Consultant's resident engineer and local engineers to a possible extent. Also, by concentrating the working area into one or two districts as much as possible, the supervisor can cover whole areas and respond quickly to any unexpected situations.

As it is expected to commence the construction works shortly after the end of the rainy season, an appropriate mobilization schedule will be planned upon confirming the conditions of access roads to the target sites. Also, considering the access conditions to the drilling points during the rainy season, as a principle, the borehole drilling works will be suspended from January to March.

The quality and availability of local materials and equipments will be surveyed to ensure a stable supply. The Contractor should commence the preparations of necessary procedures as soon as possible such as application forms and letters, etc., on the industrial goods to be imported from a third country which include handpumps, drilling materials and other equipments in order to enable Zambian side to complete tax exemption measures without any delay.

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, it will be collected more information and also to arrange necessary measures with relevant organisations as soon as possible, in case that the conditions are changed.

The Project plans not to utilise and procure asbestos materials for the design and construction works.

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 the Zambian side

1) Related to the construction of borehole water supply facility fitted with handpump
   i. Securing, clearing and levelling of the land for construction works at 216 sites

ii. Preparation of access roads (clearing, repairing, expansion, etc.) to the drilling point
iii. Securing, clearing and levelling of space for storage of materials, base camp and sub-base camp
iv. Allocation of necessary counterparts related to the implementation of the Project (at least one officer from both MLGH Headquarter and PST , and one or two officers from each target district
v. Supervision and guidance on sustainable operation and maintenance of the constructed facilities

2) Related to software component

As a part of the responsibilities of the Zambian side for the software component, provision of activities fees, assurance of personnel and allocation of their allowances. Refer to "2-2-4-7 Software Component Activity" for details. Other responsibilities of the Zambian side are listed in "2-3 Obligations of Recipient Country" and "2-5-1-1 Cost borne by the Zambian Government".

(2) Scope of works of Japanese side

1) Related to the construction of borehole water supply facility fitted with handpump
- Construction of 216 borehole water supply facility fitted with handpump in four districts of Luapula Province
- Construction of iron removal plants to the project sites where the contents of iron exceeds the Zambian standard

2) Related to software component

Execution of the software component including activation and re-activation of V-WASHEs which will operate and maintain the constructed water supply facilities, as well as capacity development in terms of integrated knowledge and skills to operate and maintain the facilities and management of V-WASHEs.

2-2-4-4 Consultant Supervision

As the Project will be implemented under the Japanese Grant Aid scheme, a Japanese Consultant firm will be in charge from the detail design to the supervision of procurement and construction. Also, supervision of the software component will be made for community sensitisation, mobilisation, training of operation and maintenance through NGO or a local consultant. The major service contents are described below.

(1) Before construction and procurement stage
- Detail design study
- Supervision of the software component activities
- Preparation of tender documents
- Assistance to execution of tender
- Evaluation of tender results
- Assistance in contracting process

(2) During construction and procurement
- Supervision of construction/procurement
- Supervision of the software component activities
- Inspection and instruction of operation
- Preparation of reports, etc.

During the detail design study, with the cooperation of the Implementing Agency and D-WASHEs, confirmation on the site situation such as land acquisition for the construction of water supply facilities will be done with the villagers to avoid problems during the construction.

In the construction stage, management of quality and implementation schedule should be made through arrangement and coordination with relevant organisations such as the Implementing Agency on necessary subjects for facilitating the Project implementation. A special consideration should be taken into account for the smooth preparation of necessary documents for the tax exemption procedures.

And both the hydrogeologist and the resident engineer will be in charge of supervision of borehole construction such as selection of drilling points and arrangements for unsuccessful boreholes, both the supervision engineer (IRP: Iron Removal Plant) and the resident engineer will supervise the construction of IRP, and training on operation and maintenance of IRP, the personnel in charge of operation and maintenance and the technical supervision engineer (IRP) will carry out through spot supervision. The assigned tasks of the Japanese Consultant are summarised as follows:

Table 2-7 Assignment for the Detail Design Study

Function	Assignment (Detail Design Study)
Chief Consultant	To lead the discussions with the Implementing Agency, the detail design study at the target sites, preparation and verification of tender documents, and supervision of tendering process. To confirm the obligations of Zambian side, and coordinate with other CPs.
Hydrogeologist	To make geological survey of the drilling points and hold discussions with the villagers to finally select the drilling points. To detailed design study and preparation of tender documents will be part of the assignment.
Geophysical Prospection	To perform electrical prospecting at the target sites and analyse the data and give the results/information on the prospection to the hydrogeologist for use in the decision process of the drilling point in each target site. Because of the large number of sites and wide location, two prospection teams will perform the survey.
Cost Estimation/ Tender Document/ Execution Plan	To conduct survey on availability and price of local materials and equipments, carry out cost estimation during detail design, prepare tender documents and draft the pre-qualification conditions.
Operation & Maintenance / Hygiene Education (Spot supervision)	Before commencement of the construction work, will explain about the O&M to the concerned authorities at the district. Also, will support the selection procedure of the NGO/Local Consultant that will be sub-contracted for the software component activities, and technical support and supervision of the said activities.

Table 2-8 Assignment for Supervision of Construction

Function	Assignment (Supervision)
Resident Engineer	・ To verify preparation of equipments and personnel of the Contractor at the commencement of the construction works for proper borehole construction ・ To stay in the target area for supervision works of construction and procurement ・ To make regular reports to the Implementing Agency, organise regular meeting with the Contractor, manage quality control during construction, conduct security management, and report regularly to Japan ・ To conduct inspection after completion of construction works, and hand over to the Zambian side
Hydrogeologist (Spot supervision)	・ To conduct supervisory works on borehole drilling, cleaning, pumping test, and water quality checking at commencement of construction ・ To examine the results of the yield and water quality to give technical advice to the resident engineer of the Consultant to try to improve the success ratio of the drilling work
Technical Supervision Engineer	・ To verify adequacy of construction methods of iron removal plant ・ To verify the residents' usage of IRP

(Iron Removal Plant) (Spot supervision)	・ To visit the sites installed with IRP and verify the situation of functioning
Operation & Maintenance / Hygiene Education (Spot supervision)	・ During the Project implementation, will supervise the software component activity performed by NGO/Local Consultant.

2-2-4-5 Quality Control Plan

Following are the methods for quality control of the construction works, equipment and material to be used.

(1) Equipments, materials and tax exemption

Among the equipments and materials to be used in the Project, the cements, reinforcing bars and aggregates, etc. are produced in Zambia. On the other hand, the equipments and materials such as handpumps, casings and screens for borehole, and others should be procured from the surrounding countries. Therefore, the Project plans to control the quality of the equipments and materials to be used by the following process.

i. The Contractor shall order the equipments and materials only after confirmation of its quality.
ii. As soon as possible after the Contractor have ordered the equipments and materials, the Contractor shall submit the necessary documents for tax exemption procedures to the Implementing Agency and request assistance for the tax exemption.
iii. The field engineers of the Contractor shall examine the equipments and materials again at the time of its arrival in the sites.
iv. The Contractor shall submit the necessary documents such as data for quality test at the factory, strength test, etc. to the Consultant for the purpose of quality management of the equipments and materials.
v. The resident engineer of the Consultant shall verify the quality before construction, arrangement and installation, and decide whether the Project uses the equipments and materials or not.

On the other hand, equipments for borehole drillings possessed by the local private company are expected to be used, under the responsibility of the Japanese Contractor. However, before mobilisation of the equipments into the Project area, the Consultant will verify the capacity of the equipments, their maintenance condition, and appropriateness of the tools and consumables to the geological condition of the Project area. Also, the Consultant will confirm with the

Contractor on the measures to be taken in case that problems arise in the equipment.

(2) Borehole drilling

i. Samplings of the drilling cuttings and geological conditions are carried out at 2m intervals (1m in case of sediments) and at points where stratums change in order to assess the hydrogeological conditions.
ii. After electrical logging, determination of aquifer and the screen position will be selected by the Contractor and approved by the Consultant.
iii. After casing pipes, screens and gravel pack are placed, clay seal and back fill with drilling slime will be installed. Also, cementation and sanitary sealing will be placed.
iv. Pumping tests and its data analysis will be conducted by the Contractor and approved by the Consultant.
v. Water samples are taken shortly before the end of the continuous pumping test to analyse its quality. The water quality shall be briefly checked at the field and examined at a laboratory more accurately.

(3) Installation of handpump and appurtenant facility

i. Foundation for the handpump will be constructed paying attention to maintaining the verticality of the riser pipe to avoid any bending inside the borehole.
ii. At sites where iron removal plants are to be constructed, attention will be paid to the installation of the handpump in a higher position.
iii. Attention will be paid in the slope of the drainage.
iv. As per drainage, the soakaway shall be installed at sites whose soil can enable water to infiltrate, while open-ended drainage shall be constructed at the sites where top soil are argillaceous or bedrock.

(4) Concrete construction for Iron Removal Plant or foundation of handpumps

The Project plans to use job-mixed concrete as the Project sites are located in scattered area and relatively little amount of concrete is used in each facility. Proportioning and measurement of concrete will be done manually, while mixing will be basically made by a portable mixer. Based on the proportion acquired from a trial mixing, job-mixed concrete will be examined through a slump test and a simple chloride concentration test.

2-2-4-6 Procurement Plan

Among the construction materials, cements are manufactured in Zambia, and domestic products can be found easily and plenty with enough quality. The materials for construction of

appurtenant facilities such as gravels, sands and reinforcing bars are available in Luapula Province. On the other hand, handpumps (both India Mark-II and Afridev) can be procured from distributors in Lusaka, the capital city of Zambia. However, it takes longer to purchase Afridev handpumps than India Mark-II, so it is required to arrange well in advance.

2-2-4-7 Software Component (Technical Assistance) Plan

(1) Issues on Operation and Maintenance System in the Target Area

Thorough the Preparatory survey, the issue pertaining to water use and operation and maintenance activity in target area were identified as below. In drawing up the Software Component Programme, both appropriate approach and necessary areas of cooperation were examined to address these issues.

1) Capacity for Implementation of Operation and Maintenance Activities by the Community

Although most of the target sites have formed V-WASHEs, however, the members of these committees do not have the systematic knowledge, skill and experience to manage the committees, to promote water supply and sanitation in the village, and to promote operation and operation and maintenance. Also, due to lack of information on the cost necessary for operation and maintenance, communities are not saving funds to cover the expenditures required for operation and maintenance. Moreover, for existing handpumps, broken facilities are frequently left without repairs because communities lack knowledge and skills on measures to take in case of failures, and preventive maintenance and inspections are not carried out. In order to operate and maintain the constructed water supply facilities by the community members, WASHE facilitators trained in “Phase I Project” are encouraged to be involved in organizing/reorganizing V-WASHE committees and activate them. Also, it is required to provide training for V-WASHE to acquire knowledge and technique to operate and maintain the facility.

2) Awareness on and Practice related to “Water and Sanitation” of Beneficiaries

Most of the community residents in the target sites have received health and sanitation programme related to water borne diseases. However, they use unsanitary water sources for domestic use and the health and sanitation condition is still poor. A program for improvement of sanitary practices focused on promotion of use of safe water is needed to prevent water borne diseases. Moreover, dissemination of appropriate knowledge on “Water and Sanitation” and training to promote it are needed, because raising awareness on water and sanitation will encourage more participation in operation and maintenance of facilities and willingness to pay.

3) Lack of Human Resources with Skills and Experiences on Training for Operation and Maintenance of Borehole Water Supply Facilities Fitted with Handpump

Even if the responsibility for operation and maintenance of water supply facilities is demarcated, because of lack of human resources who can provide technical service for the community, it will be effective to utilize APMs trained in the "Phase I Project", for the daily preventive maintenance and repair work of handpump and establishment of operation and maintenance system at community level. In addition, in order to cover the facilities of which number is to be increased in this project, training and allocation for another APM in each Ward in both Mansa and Nchelenge District is required. On the other hand, in Milenge and Mwense District, technical transfer on repair work on Afridev handpump and how to operate and maintain the iron removal plant is necessary for APMs who received training from other CPs (excluded the ones who received training in the "Phase I Project").

(2) Objectives and Approach of Soft Component

The project objective is to realize sustainable supply of safe and stable water from borehole water supply facility fitted with handpump which are to be constructed in the target communities. Aiming at encouraging the establishment of community-based operation and maintenance system as a basis of project objective, software component is to be implemented for early realization of expected effect of this project. In the target communities, V-WASHE which operates and maintains the facility in a participatory manner in the village will be organized or reorganized, capacity development of V-WASHE on systematic knowledge and technique on operation and maintenance, and management of organization will be encouraged. Moreover, utilizing effectively local authority officers, APMs and WASHE facilitators trained in "Phase I Project", this component aims at establishing their knowledge and technique firmly, and developing the outputs produced in "Phase I project".

2-2-4-8 Implementation Schedule

The implementation schedule of the Project is shown below.

【Construction Stage】

i. Exchange of Notes (E/N)
ii. Grant Agreement (G/A)
iii. Consultant Agreement
iv. Detail Design: Detail Design Study, preparation of tender documents
v. Software Component
vi. Tendering procedure, Contract(for construction)
vii. Supervision of construction
viii. Construction of borehole water supply facility fitted with handpump
ix. Completion and handing over

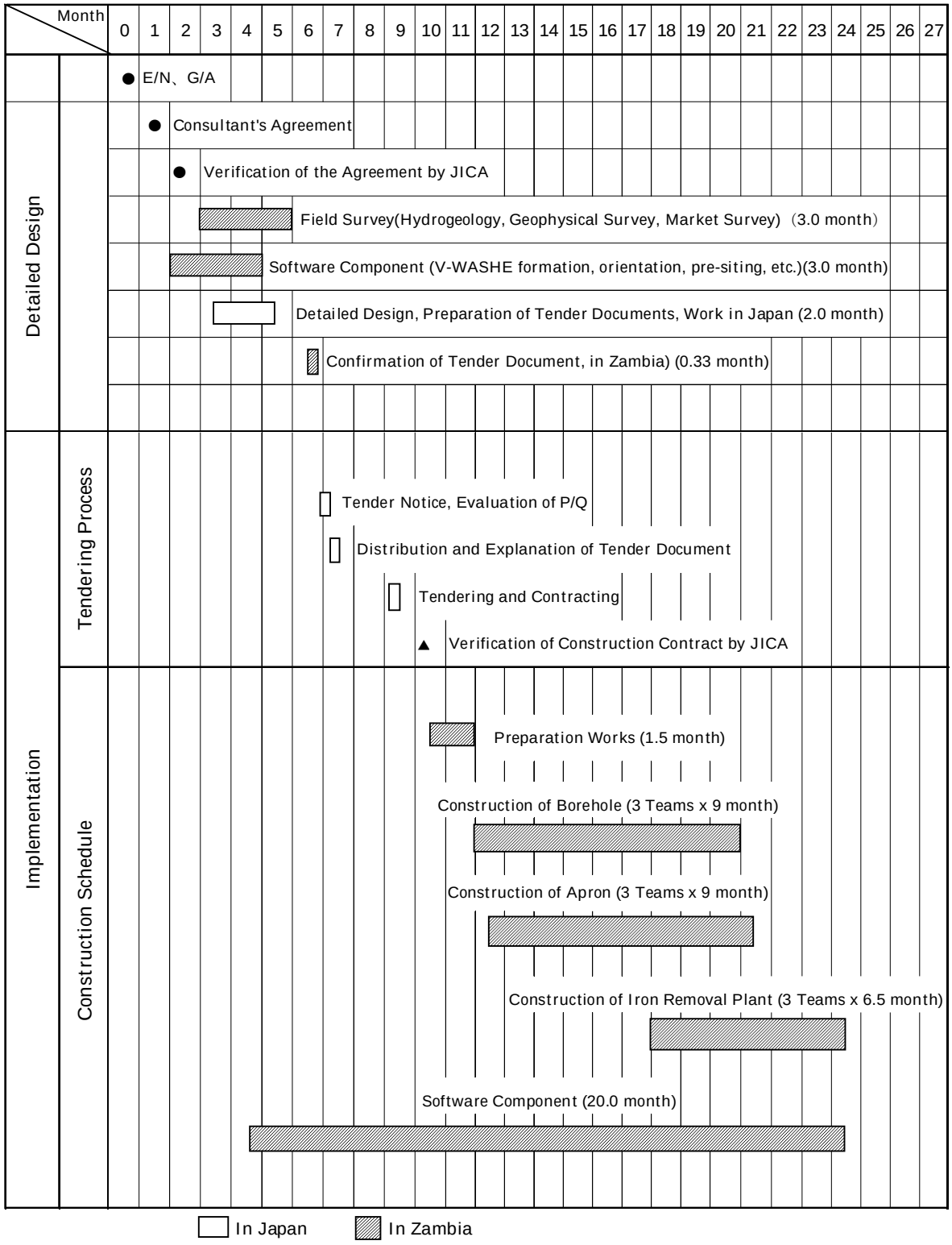
The implementation schedule of the Project needs about 24 months after G/A for the detail design, software component, borehole construction, installation of handpumps, construction of aprons, and installation of iron removal plants.

(a) Consultant Agreement, establishment of V-WASHE, detail design, Contractor's contract, cost estimation review, preparation of tender documents, confirmation of tender documents	6.0 months
(b) Tender, contract for construction, verification of the contract, borehole drilling, installation of handpumps, construction of appurtenant facilities, installation of iron removal plant (during rainy season, drilling work will be suspended)	18.0 months
Total	24.0 months

As it is difficult for the drilling machines to access to the sites in rainy season, drilling works will be suspended during 3 months per year. Therefore, in total 9 months per year is possible to carry out the borehole drilling work.

Based on the above policy, the implementation schedule of the Project is established as shown in the Table 2-9.

Table 2-9 Implementation Schedule



2-3 Obligations of Recipient Country

(1) Obligations of Zambian side

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

- The NRWSSP regulates that community should contribute ZMK1.5 million as a condition for commencement of construction of water supply facilities. As agreed in the field survey, the Implementing Agency and district authority shall conduct the sensitisation activities to the community members and collect the above mentioned contributions for the Project.
- To allocate a Project Manager (PM) from the Implementing Agency in the target area in accordance with the Project and to bear the expenses for a PM.
- To allocate D-WASHE members from the target districts during the Project period, to facilitate them to participate in the inspection of construction and software component activity conducted by a local consultant, and to bear the expenses for 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 the 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.
- To ensure quick procedures for customs clearance and internal transportation of distributed equipments and materials for the Grant Aid.
- To secure land necessary to construct the water supply facilities, and to clear, level and reclaim the land prior to commencement of the construction.
- To secure land necessary for the base camp and stockyard(for the Contractor) in the target district during the construction period.
- To prepare, rehabilitate and/or expand the access routes to the construction site and provide necessary incidental facilities in and around the project sites
- To facilitate community members to establish a fence around a borehole.
- To operate and maintain the facilities constructed and equipment procured under the Grant Aid properly and effectively, and to appoint necessary staff for this operation and maintenance.
- To bear all the expenses other than those covered by the Grant Aid.

(2) Feasibility and adequacy

According to the lessons learnt from the “Phase I Project”, the items mentioned above are imperative for achievements of outcomes of the Project. Therefore, the Government of Zambia is expected to secure the 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, based on the "National Water Policy (established in 1994 and revised in 2010)" which regulates the water sector, the structure of Community-Based Management has been built up through community's voluntary participation to rural water supply and sanitation services. NRWSSP, a strategy of development of Zambia's rural water supply and sanitation sector, lists up the following basic principles in order to secure the sustainable operation and maintenance of rural water supply facilities.

- Cost sharing by beneficiaries: Bearing all the costs of operation and maintenance, cost of ZMK1.5 million for construction of borehole water supply facilities fitted with handpumps, district authority's assistance for rehabilitation of the facilities which exceeds 0.5 million kwacha
- Sustainable supply chain: Service stock of spare parts, setting appropriate price for beneficiaries, and establishment of operation system to assure sustainability
- Ownership for operation and maintenance by beneficiaries: Management of water supply facilities by community, delegation of authority to appropriate level in terms of operation and maintenance, participation of all the stakeholders, and equal commitment by each gender
- Selection of appropriate technology: Selection of (handpump) technology depending on hydrogeological condition, capability of cost sharing for initial cost and operation cost, and decay durability of facilities
- Capacity building: Setting the legal policy framework for assisting the community-owned operation and maintenance system, enlightenment activities and community participation promotion, and skill development of stakeholders (local authorities, community) in the aspect of management, finance and technology necessary for maintenance of the water supply facilities

The structure of operation and maintenance in the Project will adopt a framework of both community's voluntary participation and the support service to facilitate it from the local authorities (especially district and ward level), based on the basic policy of Zambia's National Water Policy and NRWSSP.

As it is necessary for establishing such structure to encourage a district government to act mainly for training and mobilisation of both the Area Development Committees (ADCs) and the

Area Pump Menders (APMs), NRWSSP[2] facilitates the multilayered and comprehensive structure of operation and maintenance including from district to community level (refer to figure below).

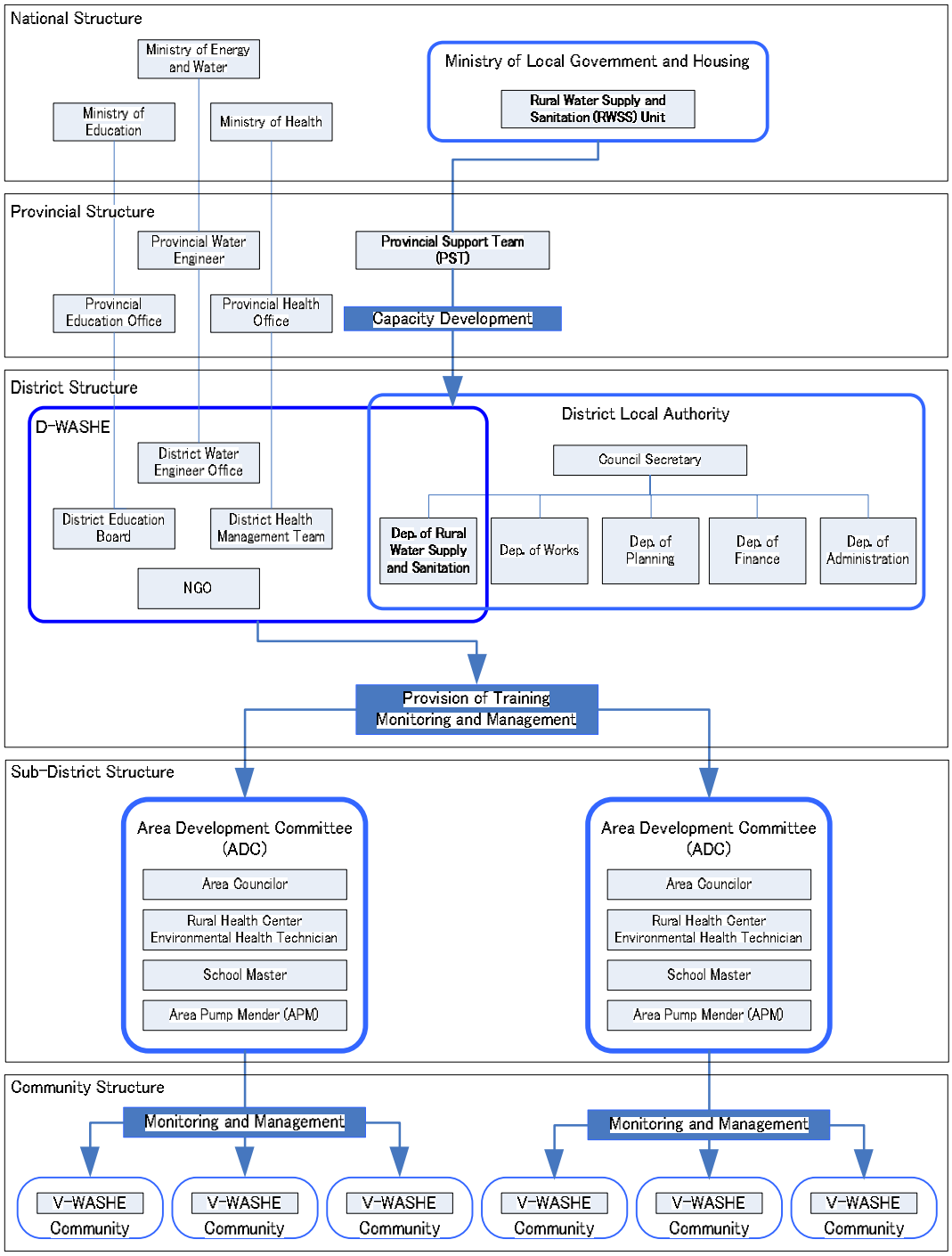


Figure 2-10 Organisations and Institutions of Zambia's Rural Water Supply and Sanitation

[2] Including the "National Guidelines for Sustainable Operation and Maintenance of Handpump in Rural Areas (2007)" and "RWSS O&M Implementation Manual and User Guide (2010)" established under NRWSSP

The Ministry of Local Government and Housing (MLGH) holds administrative responsibilities regarding rural water supply and sanitation promotion services, and the Rural Water Supply and Sanitation Unit of MLGH handles policy planning at national level, policy and technical support to each province and district, and coordination with relevant Ministries and Cooperating Partners. MLGH will function as the Responsible Agency in the Project on operation and maintenance at national level, while the District Rural Water and Sanitation Plan including district's action plan of operation and maintenance will be established and implemented under each district authority's responsibilities.

ADCs are formulated at Ward level in each district, which support establishment and implementation of community's development plans and coordinate between a district councils and communities. ADC is mainly composed of traditional local leaders, local government officers, Area Pump Menders (APMs), Environment Health Technicians (EHTs), Agriculture Assistant and Community Development Assistant, which is registered to the district government[3]. APMs, who are selected from plasterers or technicians of bicycles in a community, receive technical transfer through trainings of repair works and rehabilitation skills conducted mainly by a district local authorities (or Cooperating Partners), and provide fare-paying services of repair works of handpumps which cannot be handled by a community. On the other hand, V-WASHE Committees, which are formulated at village level as a community based organisations, take responsibilities for management of facilities, daily operation, and maintenance as an owner of the facilities. The Project formulates the plan of operation and maintenance based on the above structure.

2-4-2 Basic Policy on Operation and Maintenance

The participatory operation and maintenance structure has been facilitated, while according to verification of existing approaches and the results of social condition survey, the following issues are found.

【District Level】

- NRWSSP regulates that each district should establish a Rural Water Supply and sanitation (RWSS) Unit under the district government and facilitates delegation of function of implementation and authority regarding rural water supply and sanitation services from MLGH into districts. Under such principle of NRWSSP, MLGH obliged every district to establish RWSS Unit by ministerial ordinance, but the

[3] ADCs are facilitated to be formulated as a part of capacity strengthening of district government based on the Decentralisation Implementation Plan (2006 – 2010). However, the Plan is not completely institutionalised as it has not received a cabinet approval, but it became an conventionalisation in each district.

situation of establishment of the Units and allocation of personnel differs in the districts. Among the target districts, Mansa district established Rural Water Supply and Sanitation Department as a RWSS Unit in 2009 which holds 10 personnel including a director, while Nchelenge, Mwense and Milenge districts are able to establish the RWSS Unit in 2009 with allocation of only 1 or 2 RWSS Focal Point Persons (FPPs) because of limited budget[4]. In addition, in those 3 districts a Director of Works or a District Planning Officer doubles as a RWSS FPP, therefore the roles and responsibilities of RWSS Unit such as establishment and implementation of District RWSS Plan including operation and maintenance plan are not realised enough. As a tentative measure before the comprehensive transition into RWSS Unit, NRWSSP stipulates the District Water, Sanitation and Health Education (D-WASHE) Committees, which are established and consisted of several field outreach agencies of some Ministries and district government, to perform functions of implementation of rural water supply and sanitation services continuously. Therefore, before comprehensive commencement of RWSS Units, formulation of participatory operation and maintenance structures in association with RWSS FPP will be important immediate issues.

【Ward Level】

- Under the "Phase I Project", APMs received trainings and were allocated separately in each Ward in the target districts. Since then, one APM has been added in each Ward in both Mwense and Milenge Districts through districts' own efforts or assistance of Cooperating Partners so that 2 APMs provide services in a Ward in those districts. On the other hand, both Mansa and Nchelenge Districts still allocate only one APM in each Ward, but those districts also verify possibilities of allocation of 2 or more APMs into a Ward as it is desirable. The number of APMs to be allocated in a Ward needs consideration of geographical range of each Ward and the number of handpumps covered by one APM in a view of sustainable services of repair works and rehabilitation for communities by making such activities as a part of APM's livelihood. The plan of other trainings and re-training of APMs under the Project will be decided through verification of the existing number of APMs who are trained and allocated in the target districts, their technical level, and the necessary number of APMs to be added in the target districts.
- In Mwense and Milenge Districts where additional APMs are allocated, number of the tool kits to be used for actual repair works and rehabilitation is not enough for existing APMs. Therefore, it is necessary to procure those lacking numbers of tool kits with

[4] RWSS Focal Point Persons in Milenge and Mwense districts receive their salaries from Water Aid.

consideration of additional number of APMs which will be trained under the Project.

- Except for APMs who received training under "Phase I Project" those APMs who provide services in the target area are not equipped with technical skills for Afridev handpumps, while they were provided the training of repair works and rehabilitation of India Mark-II handpumps, which are commonly introduced in the area. Also, as it is necessary for those APMs to acquire technical skills of iron removal plant, the Project plans to improve their capacities through Software Component Programme.
- On the other hand, ADCs are formulated in the target districts in order to realise the purpose of the "Decentralisation Implementation Plan (2006 -2010)" in that ADCs should perform bridging function between a district authority and communities as a part of facilitation of district's development planning, its implementation, and strengthening tax levying[5]. NRWSSP stipulates that a district authority shall facilitate implementation of operation and maintenance activities at village level through utilisation of ADCs with assistance from D-WASHE committee and RWSS Unit. The target districts provide orientations to the formulated ADCs on basic functions such as roles and responsibilities of ADC, coordination of promotion of development plan between a district and communities. In the "Phase I Project", WASHE facilitators were selected separately from each ADC and provided trainings on capacity development for rural water supply and sanitation services. As ADC's active involvement is imperative for establishing and settling the participatory operation and maintenance structure at village level, it is necessary to utilise those WASHE facilitators who are trained in "Phase I Project" in order to activate field level activities by using the lesson learnt in "Phase I Project".
- Also it is noted that structure of supply chain of handpump spare parts in each district is not enough. Although at present, "Sustainable Operation and Maintenance Project (SOMAP)" supports establishment of spare parts supply chain as a part of NRWSSP, formulation of supply chain with spare parts shops as a centre point which follows SOMAP model is not realised in Luapula Province[6]. The main issues are appropriate pricing, sales and saving of revolving funds by revenue of sales in accordance with SOMAP model, and moreover, establishment of mechanism of supply chain such as procurement of spare parts using revolving funds. In this regard, as the next phase of SOMAP expects national expansion of the supply chain, the Project is supposed to procure the standard number of spare parts in accordance with the number of

[5] However, it is noted that there are some unclear points in management of ADCs such as methods of selection of board members or ordinal member and its criteria, and that those members are in a state of flux. This is because preparation of regulations for implementation of decentralisation delays as the "Decentralisation Implementation Plan", established in 2006, has not been approved by the Cabinet.

[6] Spare parts are partially available at material shops in Mansa town but types are limited. In Nchelenge, Mwense and Mansa districts, spare parts procured by UNICEF in the former project are sold to communities at lower price than that of market, but due to lower pricing SOMAP model is not achieved such as saving of revolving funds from the revenue of selling spare parts and replenishment of spare parts as same as sold.

handpumps to be installed under the Project, while it is desirable to establish the supply chain through district's initiative in association with SOMAP.

【Community Level】

- It is necessary to organise V-WASHE committees at village level and facilitate such activities as daily operation and maintenance of water supply facilities. As shown in NRWSSP (2006 – 2015), the serious issue in Zambia in terms of operation and maintenance of water supply facilities with handpumps is that the facilities may remain unrepaired for a long time after they have broken down, so the effects of the projects become sparse (diverse). In order to improve such situation, such aspects are necessary as daily maintenance by community, saving of maintenance cost, appropriate treatment of community contributions (treasurer and accounting), proper decision making regarding management of facilities and budget, and coordination with APM and ADC. Therefore it is necessary to develop capacities in those sectors.

Based on the above issues, the Project sets up the basic policy of operation and maintenance as follows:

(1) Ownership of the facilities by the beneficiaries and burden sharing

V-WASHE committees take responsibilities of the operation and maintenance of the constructed water supply facilities, communities shall manage the facilities and take initiative in decision making through V-WASHE committees on such burden sharing as proper use of the facilities, cost sharing regarding operation and maintenance, promotion of necessary activities for operation and maintenance

V-WASHE committee is basically composed of chairperson, vice chairperson, secretary, treasurer, caretaker and other members. V-WASHE committee mainly performs needs finding, formulation of action plan and its implementation regarding improvement of water supply and sanitation environment in the community, daily management of water supply facility and implementation of simple repair works, arrangement of large scale rehabilitation if it is necessary, collection, management and reporting of maintenance cost, sensitisation of users on proper use of the facility and sanitation promotion, communication with local authorities, etc. Basically, the members shall be selected by the community, with consideration of balanced composition between female and male. Also the Project will verify the approach to facilitate active involvement of female in decision making process.

The Project sets up such basic policy on operation and maintenance plan as all the costs to be borne by the community for operation and maintenance of water supply facility to be constructed. However, as mentioned in 2-2-1-1 (5), costs for construction of the borehole water supply facilities fitted with handpumps will not be borne by community.

(2) Dissemination of operation and maintenance skills of borehole water supply facility fitted with handpump and iron removal plant

In the target area, as the dissemination of knowledge and skills of daily prevention measures of borehole water supply facility fitted with handpump and handling of the process when it is broken, such case can be often found where the community is not able enough to specify the broken point and repair quickly when handpump has a problem, resulting in leaving handpump unrepaired. In order to improve such situation, the caretakers from the target communities were trained under "Phase I Project" for preventive and protection methods which are available at community level as well as APMs. As a result, one APM is allocated into each Ward in the target districts of the Project, then one more APM is added into each Ward in Mwense and Milenge Districts and those districts hold a structure of 2 APMs in each Ward. On the other hand, Mansa and Nchelenge Districts adopt allocation of 1 APM in each Ward but verify feasibility to dispatch 2 or more APMs into each Ward. In consideration on geographical range of the target districts, number of borehole water supply facilities fitted with handpumps both constructed in "Phase I Project" and to be installed in the Project, it is appropriate to introduce 2 APMs into each Ward. The Project plans to deal with APM increasing plans in Mansa and Nchelenge Districts through software component, and to conduct training and OJT for an APM in each Ward. Also, as the training for APMs added after "Phase I Project" did not equip them with practical courses, OJT, and transfer of knowledge and skills for Afridev handpumps and iron removal plant to be introduced in the Project, the Project plans to provide re-training of those APMs and OJT for capacity strengthening through software component.

Also, the Project plans to install iron removal plant in the sites with high iron density in the water. As for understanding of community on the borehole water supply facility fitted with handpump, iron removal plant and utilisation of the facility, it is imperative to sensitise community on sanitation and health and to conduct technical trainings of usage of iron removal plant. In this regard, the Project plans to conduct both sensitisation activities on sanitation improvement at village level and technical trainings of usage of iron removal plant together with activities regarding establishment of operation and maintenance structure.

(3) Promotion of water-centred improvements in awareness, behaviours and practices of sanitation

Although the water supply facilities which offer safe water are to be installed in the target area, the facilities are supposed to be utilised sustainably and effectively, and improvements in long term in health and sanitation environment through deduction of water borne diseases, unless the community understand meanings of usage of improved water supply facilities, methods of usage of appropriate water sources, and methods of handling of drinking water. Therefore, before the commencement of construction of water supply facilities, it is imperative to facilitate understanding of relationship between

individual behaviours and practices of sanitation and water borne diseases, and importance of improvements in environment including safe water usage.

Also, the Project plans to install iron removal plant in the sites with high density of iron in the water. It is imperative to sensitise the community on sanitation awareness, for the purpose of facilitating them to understand the meanings of borehole water supply facilities fitted with iron removal plant and to facilitate their utilisation. In this regard, the Project plans to conduct activities to improve sanitation at village level together with activities regarding establishment of operation and maintenance structure.

(4) Strengthening the facilitating functions of district government and ADCs on operation and maintenance activities

NRWSSP aims to strengthen the function of district councils to implement rural water supply and sanitation services in a decade to come, and promote establishment of a unit in charge of rural water and sanitation services (District RWSS Unit). However, as above mentioned, Mansa District has set up with a RWSS Unit under the district council with 10 personnel, while in other target districts 2 personnel from the district council such as District Planning Officer and Director of Works double generally as FPPs. As the number of personnel and technical capacity are not enough for implementation, such districts provide services of planning and implementation in association with outreach field staffs (appointed as members of D-WASHE committee) from the Ministries regarding rural water supply and sanitation (Ministry of Energy and Water Development, Ministry of Education, Ministry of Health, Ministry of Community Development and Social Welfare, Ministry of Agriculture, Fisheries, & Food Security).

In the facilitation of activities for establishment of operation and maintenance plan at district level and capacity development of V-WASHE committees in the target villages, the Project supposes to work with the District RWSS Unit in Mansa District, and FPPs and D-WASHE members in Milenge, Mwense and Nchelenge Districts. In the three districts where RWSS Unit has not been established, in consideration on gradual realisation of capacity strengthening of district governments facilitated by NRWSSP, the Project considers to realise through the Project a leadership of district government, coordination among stakeholders, summary and recording of information regarding operation and maintenance activities, and strengthening capacity to implement rural water supply and sanitation services such as establishment of action plan.

Also, in establishment of participatory operation and maintenance structure at village level, ADCs are expected to function as coordinator between district government and communities. The Project plans to conduct activities for those ADCs on settlement of technology of WASHE facilitators trained in “Phase I Project” and its dissemination to ADCs, and to facilitate implementation of operation and maintenance activities through cooperation at field.

(5) Coordination with Japanese Technical Cooperation Project

As per establishment of supply chain of spare parts of handpumps, the target districts are supposed to coordinate the SOMAP and establish a supply chain by their own efforts. At the same time, the Project plans to introduce a mechanism of operation and maintenance established through SOMAP assistance based on NRWSSP, within the range of availability and necessity of software component. For instance, capacity development of RWSS Unit (including FPPs) regarding training of ADCs, technical training of APMs (especially for technology of repair works and rehabilitation of Afridev handpumps and iron removal plant), training of ADCs, and activities for facilitation of participation in the field are conducted for strengthening and expanding SOMAP model.

2-5 Project Cost Estimation

2-5-1 Initial Cost Estimation

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

Total ZMK302,174,900(JY5.68million)

Cost Item	Total	Calculation	Remarks
Personnel expenses during siting work in the Detailed Design Study	ZMK11,700,000	MLA: 3Month×26days×3pers×ZMK50,000/day/person	3 D-WASHE member will join the hydrogeological and Geophysical team
Personnel cost during site transfer	ZMK21,700,000	MLA : 7site/day×31days×2pers×ZMK50,000	D-WASHE member and PST will participate in the site transfer
Personnel cost during construction supervision	ZMK7,200,000	MLA : 6days/Month×2pers×12month×ZMK50,000	D-WASHE member and PST will participate in the supervision
Personnel cost during handover inspection	ZMK21,500,000	MLA:5site/day×2person×43days×ZMK50,000	D-WASHE member and PST will participate in the handover of the constructed facilities
Costs during software component activities	ZMK199,196,000		D-WASHE member, PST, fuel, vehicle, etc.
Advising Commission for Authorisation to Pay(A/P)	ZMK1,063,900	Contract : ZMK319,150×2times Amendment: ZMK212,800×2times	Opening of A/P: JY6,000/time A/P amendment : JY4,000/time
Payment commission to the Bank	ZMK39,815,000		
Total	ZMK302,174,900 (JY5.68million)		

MLA: Missing Lunch Allowance; PST: Programme Support Team

2-5-1-2 Conditions for Estimation

(1) Estimation base: August 2010
(2) Exchange rate: U$1.0 = JY91.76
(3) U$1.0 = ZMK4,880.85
(4) ZMK1.0=JY0.0188
(5) Period for Construction: Approximately 24 month from the E/N, including detailed design survey, tendering process and construction. See Implementation Schedule for more details.
(6) 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 cost borne by Zambian side for operation and maintenance of the completed borehole water supply facilities fitted with handpumps is estimated under the “National Guidelines for Sustainable Operation and Maintenance of Rural Water Supply Facilities”(MLGH) and field practice survey for fuel fees. The result will be as follows.

（Unit：ZMK）

Target Organization	Cost Item	Unit Cost	Q'ty	Amount
1) District	Operation and maintenance and Monitoring Activities	3,863,920／District	4	15,455,680
2) Sub District facilitators such as EHT and ADC	Operation and maintenance and Monitoring Activities	1,931,960／Ward	56	108,189,760
3) V-WASHE	Operation and maintenance	974,400／Borehole	216	210,470,400
Total				334,115,840

The details of the cost are as follows.

1) Cost for District Government O&M Monitoring Activities

Fuel Expense : 6days/quarterly×10lit/day×Fuel Fee×4times
＝ZMK 2,263,920

Allowance : 6days/quarterly×allowance×4times
＝ZMK 1,200,000

Preparation Fee for Quarterly Report : Unit cost of report×4times
＝ZMK 400,000

Sub-Total : ZMK3,863,920

2) Cost for Sub District Facilitators O&M Monitoring Activities

Fuel Expense : 1day/month×10lit/day×Fuel Fee×12times
＝ZMK1,131,960

Allowance : 1day/month×allowance×12times
＝ZMK 600,000

Preparation Fee for Quarterly Report : Unit cost of report×4times
＝ZMK 200,000

Sub-Total : ZMK 1,931,960

3) Cost for V-WASHE O&M Activities

Purchase cost for spare parts：	＝ZMK11,200×12 month＝ZMK134,400
Purchase cost for grease：	＝ZMK15,000×12 month＝ZMK180,000
Payment for APM：	＝ZMK20,000×12 month＝ZMK240,000
Payment for caretaker：	＝ZMK5,000×12 month＝ZMK60,000
Payment for the accountant：	＝ZMK10,000×12 month＝ZMK120,000
Costs for V-WASHE activities：	＝ZMK20,000×12 month＝ZMK240,000
Sub-Total：	＝ZMK974,400

RWSS O&M Implementation Manual, MLGH(2009)

As mentioned above, the necessary expenses for maintaining the water supply facilities in the target village is ZMK974,400 per year. Considering an average of 50 household (250 person/borehole, 4.8 person/household) per one water facility, the average expenses per each household will be approximately ZMK1,620/month.

According to the result of socio-economical survey, the monthly average income per household is ZMK100,000.00. If it is compared with the cost of O&M, it is less than 4% of the income, as recommended by the World Bank. Therefore, the cost required for this Project is determined to be feasibly payable by the residents.

2-6 Other Relevant Issues

(1) Structure for borehole drilling

For the borehole drilling work under the Project, it is expected to be used a local resources. There is several local contractors which have capacity to perform the requirement of the Project, but it is required that the Contractor pay attention to select the adequate drilling company, mainly from the point of view of its technical capacity and financial status.

(2) Tax exemption

To avoid delays in the construction work and to make effective use of the Project period, it is required to arrange the tax exemption at appropriate timing. The Contractor, under the Contract for construction, shall prepare soon as possible the list of materials and equipments to be used in the Project and request to the Implementing Agency the necessary support for the clearance of custom duties and tax exemptions.

(3) Measures to support the District in the activities under the Project

During the Project implementation, the PST and D-WASHE members, will participate in activities such as software components, site survey, inspection and handover of facilities. Also, after the completion of the construction work, the D-WASHE member will visit periodically the Project sites for the monitoring of the O&M situation in each site. As the fund for those activities of D-WASHE members in the Project will be sent by MLGH to each target District, it is expected that the disbursement of the fund shall be done smoothly.

(4) Consideration on the rainy season for the construction schedule

Taking in consideration the natural conditions in Zambia, it is necessary to pay attention in the supervision of the work during the rainy season. The Contractor is required to prepare carefully the construction schedule after understanding the natural environment and infrastructure in Zambia. Specially, need to gather enough information for the timing of mobilization of construction equipment, such as drilling rigs, construction materials, etc., and prepare adequate construction schedule to complete the work within the estimated period of time.

CHAPTER 3

PROJECT EVALUATION

Chapter 3 Project Evaluation

3-1 Project Preconditions

3-1-1 Preconditions for Project Implementation

The preconditions for implementation of the Project are shown below.

- Land for Facilities Construction: a small land of approximately 20m^2 is necessary for construction of the borehole water supply facility fitted with handpump, which is to be provided basically by the residents at each target site. The location of the land needs to be finally confirmed with members of V-WASHE to be formed during the Detailed Design stage. Also, the government of Zambia must provide a land for both the base camp and stockyard in each target district during the construction period.
- Securing Accessibility into Drilling Points: Providing accessibility into construction sites for drilling rigs and cargo trucks is necessary, but depending on the site, some may need arrangements such as widening of roads. Therefore, to facilitate quick actions, notifications to both the recipient government and residents are necessary before commencement of construction at such sites.
- Procedures for import and custom taxes must not be delayed, and internal tax exemptions need to be carried out as quickly as possible.

3-1-2 Necessary Inputs by Recipient Country

In order to achieve and sustain the outputs of the Project, it is necessary to realize sustainable safe water supply through the water supply facilities to be constructed under the Project. The preconditions and assumptions of the Project in order to achieve and sustain these outputs are shown below.

[Preconditions]

- Village level operation and maintenance structure based on site resident participation is to be formulated through the software component, but activities monitoring is important after facilities handover. Even after completion of the construction, the District must conduct periodic monitoring of operation and maintenance conditions of the water supply facilities continuously. The costs for such field activities by the District officers must be allocated directly from the Central Government to the District through MLGH. MLGH is thereby required to facilitate smooth budget implementation.
- Sustainable Supply Chain: Establishment of a system with continuous stock of spare parts, affordable tariff setting and appropriate management structure to assure sustainability.

[Assumptions]

- Groundwater potential does not lower beyond predicted conditions.
- Quality of water source at target area does not degrade beyond predicted conditions.
- Social and economic conditions surrounding the target group does not deteriorate rapidly.
- WASHE trainers, WASHE facilitators and V-WASHEs trained through the Project continue their tasks at the target area of the Project.
- Enough officers are dispatched to the unit of MLGH in charge of managing the Project, and PST at provincial level is established smoothly and functions as soon as possible.
- In case a fund raising mechanism in collaboration between the government of Zambia and donors (such as basket funding) for implementation of NRWSSP is rapidly established and executed, this will not give disadvantage to project base supports.

3-2 Project Evaluation

Through implementation of the Project, the following relevance and effectiveness are expected.

3-2-1 Relevance

Relevance through Project implementation is as follows.

1) The beneficiaries of the Project are residents in 4 districts of Luapula province and are estimated to be about 54,000 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) The borehole water supply facilities fitted with handpumps constructed by this Project are predicted to be sustainably operated and maintained, and water tariff collected under the responsibility of each level of WASHEs.
4) The Project corresponds to the policy of NRWSSP (2006-2015), in which MLGH set objectives to increase the coverage of water supply from 37% to 75%, and is supporting the objectives of the policy.
5) The water supply facilities of the Project are to be provided free to local villages where most of the people are at the poverty level. After completion of the construction works, V-WASHE will manage and maintain the facilities by collecting fees from water users. Since making profit is not the objective, it is feasible to implement the Project under the scheme of Grant Aid.
6) As the Project is construction of small-scale borehole water supply facilities fitted with handpumps, 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.

3-2-2 Effectiveness of the Project

3-2-2-1 Quantitative Effects

The following table shows the expected outputs to be achieved through implementation of the Project.

Index	2010 (Before)	2013 (After)
Increase in water coverage of Luapula Province	247,876 residents	301,876 residents
Stable supply of water	Unstable amount of water	30L/person/day

3-2-2-2 Qualitative Effects

The Project expects the following qualitative effects.

- Reduction of waterborne diseases is expected because of improvements in sanitation conditions through use of safe and stable water.
- Women and children will be relieved from the burden of fetching and carrying water and gain more spare time.

3-3 Relevance of the Project

Zambia's coverage rate of water supply services remains at a low level, and the access rate in Luapula Province remains at less than 23.1% (2010). Many villages without enough water supply facilities and poor sanitation education are dependent on unsanitary water. Consequently, the mortality rate of waterborne diseases such as diarrhea in Luapula Province shows 17.8% (2006) which is the highest level in Zambia. Also, residents are severely affected in terms of economic activities and education where, for instance, women and children must spend more than 1 hour to fetch water.

The Project shall construct borehole water supply facilities fitted with handpumps at 216 sites located in rural areas of 4 districts in Luapula Province to secure safe and stable water supply for about 54,000 residents and improve the living and sanitary environment of the target residents. Therefore, the Project is expected to contribute to achieving the goal for "improvements in coverage of rural water supply" described in NRWSSP (2006-2015), a national development plan, and is anticipated to improve the living standards of the residents in aspects such as economic development, education and health.

Under such circumstances, the relevance of the Project is high, and its effectiveness is also expected to be high.

APPENDIX

Appendix-1 Member List of the Study Team

(1) Field Survey

Name	Position	Affiliation
Mr. Shiro NABEYA	Leader	Chief Representative, JICA Zambia Office
Mr. Yuji UNE	Water Supply Planning	Visiting Senior Advisor, JICA
Mr. Hayato SATO	Cooperation Planning	Water Resources Management Division II, Global Environment Department, JICA
Mr. Shoichi YOKOGI	Chief Consultant/ Groundwater Development	Japan Techno Co., Ltd.
Mr. Makoto SUGA	Hydrogeology/ Geophysical Survey	Japan Techno Co., Ltd.
Mr. Naoki MORI	Social Survey 1/ Operation and Maintenance	Japan Techno Co., Ltd.
Ms. Miki ITO	Social Survey 2	Japan Techno Co., Ltd.
Mr. Kazuhiro ARITA	Procurement & Implementation Planning/ Cost Estimation	Japan Techno Co., Ltd.

(2) Explanation of Draft Final Report

Name	Position	Affiliation
Mr. Yuji UNE	Leader	Visiting Senior Advisor, JICA
Mr. Hayato SATO	Cooperation Planning	Water Resources Management Division II, Global Environment Department, JICA
Mr. Shoichi YOKOGI	Chief Consultant/ Groundwater Development	Japan Techno Co., Ltd.
Mr. Makoto SUGA	Hydrogeology/ Geophysical Survey	Japan Techno Co., Ltd.

Appendix-2 Study Schedule

(1) Field Survey

Date			Officials		Consultant				
			Water Supply Plan	Project Coordinator	Project Manager(PM)/ Groundwater Development	Hydrogeology/ Geophysical Survey	Social Condition Survey 1/ Operation and Maintenance Plan	Social Condition Survey 2	Procurement and Implementation Plan/ Cost Estimation
			Yuji UNE	Hayato SATO	Shoichi YOKOGI	Makoto SUGA	Naoki MORI	Miki ITO	Kazuhiro ARITA
1	6/21	Mon	19:10Tokyo⇒01:15Changi		18:30Narita⇒22:10Hongkong 23:45Hongkong⇒07:00Johannesburg				
2	6/22	Tue	02:50hangi⇒07:00J'burg		10:50Johanneburg⇒12:50Lusaka 15:00 JICA-Zambia, Meeting				
3	6/23	Wed	Courtesy call: MLGH、MoFNP; I/R:MLGH; Meeting:SOMAP2 expert			Data collection	Ditto to PM	MLGH、preparation for tender	
4	6/24	Thu	Move: Lusaka⇒Mansa			Data collection	MLGH, IC/R、SOMAP	Data collection	
5	6/25	Fri	Explanation I/R: PST Manager(Luapula) Courtesy call/Site visit:Mansa District, Mwense			Reception of Proposal from Local Consultants	Meeting: SOMAP, MLGH	Data collection	
6	6/26	Sat	Explanation I/R & courtesy call: Milenge Site visit: Milenge			Data compilation Planning of Field Survey	Data Compilation	Data Compilation	
7	6/27	Sun	Move: Mansa⇒Lusaka			Evaluation of Technical Proposal from Lcs	Data Compilation	Move: Lusaka⇒Mansa	
8	6/28	Mon	Meeting with Cps: ADB、UNICEF、Water Aid			Evaluation of Financial Proposal from Lcs	Tender for Socio-Economic Survey	Workshop of SOMAP	
9	6/29	Tue	Discussion on the M/D(Draft)			Data Compilation Planning of Field Survey	Negotiation with LC, preparation for survey	Workshop of SOMAP	
10	6/30	Wed	Discussion on the M/D(Final Version)			Negotiation with selected LC	Negotiation with LC, Preparation for survey	Site survey: Mansa	
11	7/1	Thu	Signing of M/D Report to Embassy of Japan and JICA			Negotiation with selected LC	Signing of Contract, preparation for survey	Site survey: Samfya	
12	7/2	Fri	Departure Lusaka		Visit RESCAP-Pavidia Visit Drilling Company	Meeting with LC	Meeting with MLGH	Site survey: Mansa	
13	7/3	Sat	Arrive Tokyo		Signing of Agreement with LC, preparation for field survey			Site survey: Mansa	
14	7/4	Sun			Move: Lusaka⇒Mansa			Data Compilation	
15	7/5	Mon			Move to Nchelenge, Courtesy call and site survey		Courtesy call: PLGO, visit to Provincial office of Ministry of Health		
16	7/6	Tue			Site survey: Nchelenge		Site survey preparation		
17	7/7	Wed			Site survey: Nchelenge Supervision of LC		Meeting with LC		
18	7/8	Thu			Site survey : Nchelenge Supervision of LC		Supervision of LC (pre-survey, meeting)		
19	7/9	Fri			Site survey : Nchelenge Supervision of LC		Supervision of LC: Mansa	Supervision of LC: Nchelenge	
20	7/10	Sat			Survey : Nchelenge, Move to Mansa Supervision of LC		Data Compilation	Site survey: Nchelenge	
21	7/11	Sun			Data Compilation, Move to Mwense	Move to Mwense	Move to Nchelenge, data compilation		
22	7/12	Mon			Meeting: Mwense District; Survey: Mwense		Visit District office: Nchelenge, Mwense		
23	7/13	Tue			Site survey : Mwense Supervision of LC		Visit Distric office: Milenge		
24	7/14	Wed			Move to Mansa, Meeting: Water Aid	Site survey : Mwense, Supervision of LC	Move: Mans⇒Lusaka	Visit Cps: Water Aid	
25	7/15	Thu			Data Compilation; Meeting with PLGO	Site survey : Mwense, Move to Mansa	Meeting: SOMAP, LC	Data Compilation	
26	7/16	Fri			Meeting: D-WASHE Mansa; PLGO		Meeting: Water Aid、UNICEF	Site survey: Mansa	
27	7/17	Sat			Survey: Mansa	Data Compilation	資料整理	Site survey: Mansa	
28	7/18	Sun			Move to Milenge	Move to Milenge	Data Compilation	Data Compilation	
29	7/19	Mon			Meeting: Milenge, Site Survey		07:20Lusaka⇒ 09:25J'burg12:35J'burg⇒	Supervision of LC Pre-survey	
30	7/20	Tue			Meeting: D-WASHE Milenge	Site survey: Milenge, Supervision of LC	⇒07:05Hongkong 09:05H'kong⇒	Supervision of LC: East of Milenge	
31	7/21	Wed			Site survey: Milenge Move to Mansa	Site survey: Milenge, Supervision of LC		Supervision of LC: East of Milenge	
32	7/22	Thu			Site survey: Milenge Supervision of LC			Supervision of LC: Nchelenge	
33	7/23	Fri			Site survey: Milenge Move to Mansa			Supervision of LC: Nchelenge	
34	7/24	Sat			Data Compilation	Data Compilation		Supervision of LC: Mwense	
35	7/25	Sun			Site survey : Mansa	Site survey: Milenge, Supervision of LC		Data Compilation	
36	7/26	Mon			Site survey : Mansa			Supervision of LC: Mansa	
37	7/27	Tue			Site survey : Mansa Supervision of LC			Meeting with LC	
38	7/28	Wed			Site survey : Mansa Supervision of LC			Supervision of LC: Mansa	
39	7/29	Thu			Market survey: Mansa	Site survey : Mansa, Supervision of LC		Supervision of LC: West of Milenge	
40	7/30	Fri			Site survey : Mansa Site survey: Mwense	Supervision of LC		Supervision of LC: Mwense	

LC: Local Consultant

(1) Field Survey (Cont.)

Date			Officials		Consultant				
			Water Supply Plan	Project Coordinator	Project Manager(PM)/ Groundwater Development	Hydrogeology/ Geophysical Survey	Social Condition Survey 1/ Operation and Maintenance Plan	Social Condition Survey 2	Procurement and Implementation Plan/ Cost Estimation
			Yuji UNE	Hayato SATO	Shoichi YOKOGI	Makoto SUGA	Naoki MORI	Miki ITO	Kazuhiro ARITA
41	7/31	Sat			Site survey: Mansa	Supervision of LC		Supervision of LC: Nchelenge	
42	8/1	Sun			Move: Mansa⇒Lusaka	Data Compilation		Data Compilation	
43	8/2	Mon			Data Compilation	Site survey: Mansa, Supervision of LC		Meeting with LC	18:30Narita⇒ 22:10H'kong
44	8/3	Tue			Market survey, data compilation	Move to Lusaka		Move:Mansa⇒Lusaka	10:50J'burg⇒ 12:50Lusaka Internal
45	8/4	Wed			Market survey, data compilation	Data compilation, Reporting		Supervision of LC: Data input	Market survey: Lusaka
46	8/5	Thu			Market survey, data compilation	Meeting with LC		Visit Statistic Dept.	Market survey: Lusaka
47	8/6	Fri			Signing Technical Note, Report: MLGH、Embassy of Japan, JICA	Report: MLGH, JICA, Embassy of Japan		Report to JICA	Market survey: Lusaka
48	8/7	Sat			Market survey, data compilation	Reception of 1st draft of Geophysical survey		Preparation of Report	Market survey: Lusaka
49	8/8	Sun			07:20Lusaka⇒09:25J'burg 12:35J'burg⇒			07:20Lusaka⇒09:25J'burg 12:35J'burg⇒	Move: Lusaka⇒Mansa
50	8/9	Mon			⇒07:05Hongkong 09:05Hongkong⇒14:35Narita			⇒07:05Hongkong 09:05H'kong⇒	Market survey: Mansa
51	8/10	Tue							Market survey: Mansa
52	8/11	Wed							Market survey: Mansa
53	8/12	Thu							Move: Mansa⇒Lusaka
54	8/13	Fri							Market survey: Lusaka
55	8/14	Sat							Market survey: Lusaka
56	8/15	Sun							Data compilation
57	8/16	Mon							Market survey: Lusaka
58	8/17	Tue							Market survey: Lusaka
59	8/18	Wed							Market survey: Lusaka
60	8/19	Thu							Market survey: Lusaka
61	8/20	Fri							07:20Lusaka⇒ 09:25J'burg12:35J'burg⇒
62	8/21	Sat							⇒07:05H'kong 09:05H'kong⇒

(2) Explanation of Draft Final Report

Date			Officials		Consultant	
			Leader	Project Coordinator	Project Manager(PM)/ Groundwater Development	Hydrogeology/ Geophysical Survey
			Yuji UNE	Hayato SATO	Shoichi YOKOGI	Makoto SUGA
1	1/3	月	18:20Narita⇒22:35H'kong 23:45H'kong⇒		18:30Narita⇒22:10Hongkong 23:45Hongkong⇒	
2	1/4	火	⇒06:35Johannesburg 10:30J'burg⇒12:30Lusaka Meeting: JICA Zambia Office			
3	1/5	水	Courtesy call: MLGH/DHID Explanation of Draft Final Report: MLGH/DHID Submission of 1st Draft Minutes of Meeting			
4	1/6	木	Explanation of Draft Final Report: MLGH/DHID Meeting: M/D(Draft)			
5	1/7	金	Signing: Minutes of Discussion, Report to Embassy of Japan and JICA			
6	1/8	土	07:20Lusaka⇒09:25J'burg 12:35J'burg⇒		Market survey, data compilation	
7	1/9	日	⇒07:05H'kong 08:30H'kong⇒13:25Haneda		Data Compilation	
8	1/10	月			Meeting: DHID	Data Compilation
9	1/11	火			07:20Lusaka⇒09:25J'burg 12:35J7burg⇒	
10	1/12	水			⇒07:05H'kong 09:05H'kong⇒14:10Narita	

Appendix-3 List of Parties Concerned in the Recipient Country

Embassy of Japan

Mr. Akio Egawa	Ambassador (at Draft Final Report Explanation)
Mr. Hideto Mitamura	Ambassador (at Outline Design Field Survey)
Mr. Toshihiko Horiuchi	Minister
Mr. Junichi Kubo	Second Secretary

JICA Zambia Office

Mr. Shiro Nabeya	Resident Representative
Mr. Katuji Miyata	Deputy Resident Representative
Ms. Yuki Shibuya	Assistant Resident Representative
Ms. Miki Okada	Assistant Resident Representative

Ministry of Local Government and Housing(MLGH)

Mr. Peter Lubambo	DHID	Director
Mr. Davies C. Zulu	DHID	Assistant Director
Mr. Silvester Mphande	DHID	Chief Purchasing and Supplies Officer
Mr. Oswell Katooka	RWSSU	Principal Engineer
Mr. Davy Ng'oma	RWSSU	Acting Head
Ms. Marjorie Mwale Lusaka	RWSSU	Senior Engineer
Ms. Yoko Matsuya	SOMAP	JICA Expert
Mr. Stephen Synkala	NRWSSP-Luapula	PST Manager-Luapula

Luapula Province

Mr. John Chibwe Chatama	Provincial Office	Provincial Local Government Officer

Ministry of Finance and National Planning (MoFNP)

Mr. Paul Lupunga	MoFNP	Acting Chief Economist

Ministry of Energy and Water Development (MEWD)

Mr. Adam Hussen	Headquarter	DWA, Director
Mr. Mr. S. M. Chilufya	Luapula	DWA, Provincial Water Officer

Mansa District

Mr. Bwanga K. Kapumpa	Mansa District	Town Clark
Mr. Benson Sakala	RWSS	Acting Director
Mr. Swala Mumba	RWSS	Assistant

Milenge District

Ms. Rosmary Malutu		District Commissioner
Mr. Eddy Muyayi Chitalu	RWSS	Director of Works

Mr. Mulala Libombela	RWSS	Focal Point Person
Mr. Mannix Ngabwe	Ministry of Health	District Heath Information Officer
Ms. Mundela Tembo	RWSS	Assistant District Planning Officer
Mr. Peter Nkandu	RWSS	Assistant Director of Works
Mr. Stanley Mwanza		Treasurer
Mr. Kushikila Justine	RWSS	Assistant Focal Point Person

Mwense District

Mr. Chama Benjamin		District Commissioner
Mr. Chungu Kabaso J		Council Secretary
Mr. Chishimba Patrick		Director of Works
Ms. Mwaka Ngosa	RWSS	Assistant Focal Point Person
Mr. Lackson Mofya		Senior Administrator Officer
Mr. Mbuluwe Kalama	DWA	Member of D-WASHE

Nchelenge District

Mr. Mwilu Lukwesa		Council Secretary
Mr. Chibinda Danny		District Planning Officer-FPP
Mr. Lubasi Maliwa	Ministry of Health	Environment Health Officer

Central Statistical Office

Mr. Humphrey Zimba	Dissemination	Officer

Cooperating Partners

Mr. Rees Mwasambili	AfDB	Water and Sanitation Specialist
Ms. Silvia Gaya	UNICEF	Chief, Water and Sanitation
Ms. Malama Munkonge	UNICEF	Water and Sanitation Officer
Mr. Edwin Adenya	UNICEF	Programme Officer WASHE
Mr. Humble Siboli	Water Aid	Program Manager (Urban)
Mr. Joseph Pupe	Water Aid	Program Manager (Rural)
Mr. Moses Mumba	Water Aid	Provincial Projects Manager(Luapula)
Mr. Khama Chilema	Plan International	Program Coordinator-Health
Mr. Simulekwa Sifaya	Plan International	Project Coordinator-Water and Sanitation
Mr. Samson Nbale	World Vision	Development Facilitator

AfDB: African Development Bank
DHID: Department of Housing and Infrastructure Development、MLGH
DWA: Department of Water Affairs, MEWD
FPP: Focal Point Person
PST: Programme Support Team
RWSSU: Rural Water Supply and Sanitation Unit
UNICEF: United Nation Children's Fund
WASHE: Water Sanitation and Health Education

MINUTES OF DISCUSSIONS
ON
THE PREPARATORY SURVEY
ON
THE PROJECT
FOR
GROUNDWATER DEVELOPMENT IN LUAPULA PROVINCE PHASE 2
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 2 (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. Shiro Nabeya, Chief Representative, JICA Zambia Office, and is scheduled to stay in the country from 22 June 2010 to 19 August 2010.

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, 1 July 2010

Mr. Shiro Nabeya
Leader
Preparatory Survey Team
Japan International Cooperation Agency (JICA),
Japan

Mr. Timothy Hakuyu
Acting Permanent Secretary
Ministry of Local Government and Housing (MLGH),
The 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 handpump and

(2) 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 19 August 2010.

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 January 2011.

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 June 2011.

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

7. Other relevant issues

7-1. Title of the Project

Both sides agreed to name the title of the Project "The Project for Groundwater Development in Luapula Province Phase 2" instead of "The Project for Groundwater Development in Luapula Province to be extended to other needy areas".

7-2. Criteria for the project site selection

Both sides confirmed that the Project sites will be determined through the criteria described bellow;

(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,
(g) Possibility to establish a water management committee (V-WASHE) and
(h) Community's willingness to pay for water tariff to cover operation and maintenance cost

7-3. 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" (hereinafter referred to as "Phase 1") 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 used in the Project both sides also agreed that the most appropriate type shall be selected according to the water quality (pH and iron contents) and water level of groundwater in the target area taking into consideration of operation and maintenance by the community.

7-4. 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.

7-5. Iron Removal Plant

Considering the effectiveness of the Iron Removal Plant (hereinafter referred to as "IRP") in high concentration of iron in the groundwater, Zambian side agreed on the possibility to apply IRP in the Project. Finally, the type of IRP in the Project will be decided based on the evaluation of current operation and maintenance of the IRPs installed in Phase1.

7-6. Application of SOMAP O&M model

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

7-7. Community's cash contribution

According to NRWSSP, the communities of the Project sites are obliged to make cash contribution of 1,500,000ZMK when a new borehole with handpumps is constructed.

Both sides agreed that the sensitization and collection of the said cash contribution on this settlement would be undertaken by Zambian side, and also that the full cash contribution by the community is not the condition of the commencement of the construction of the water facilities in the site.

7-8. Demarcation with other cooperating partners (CPs)

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.

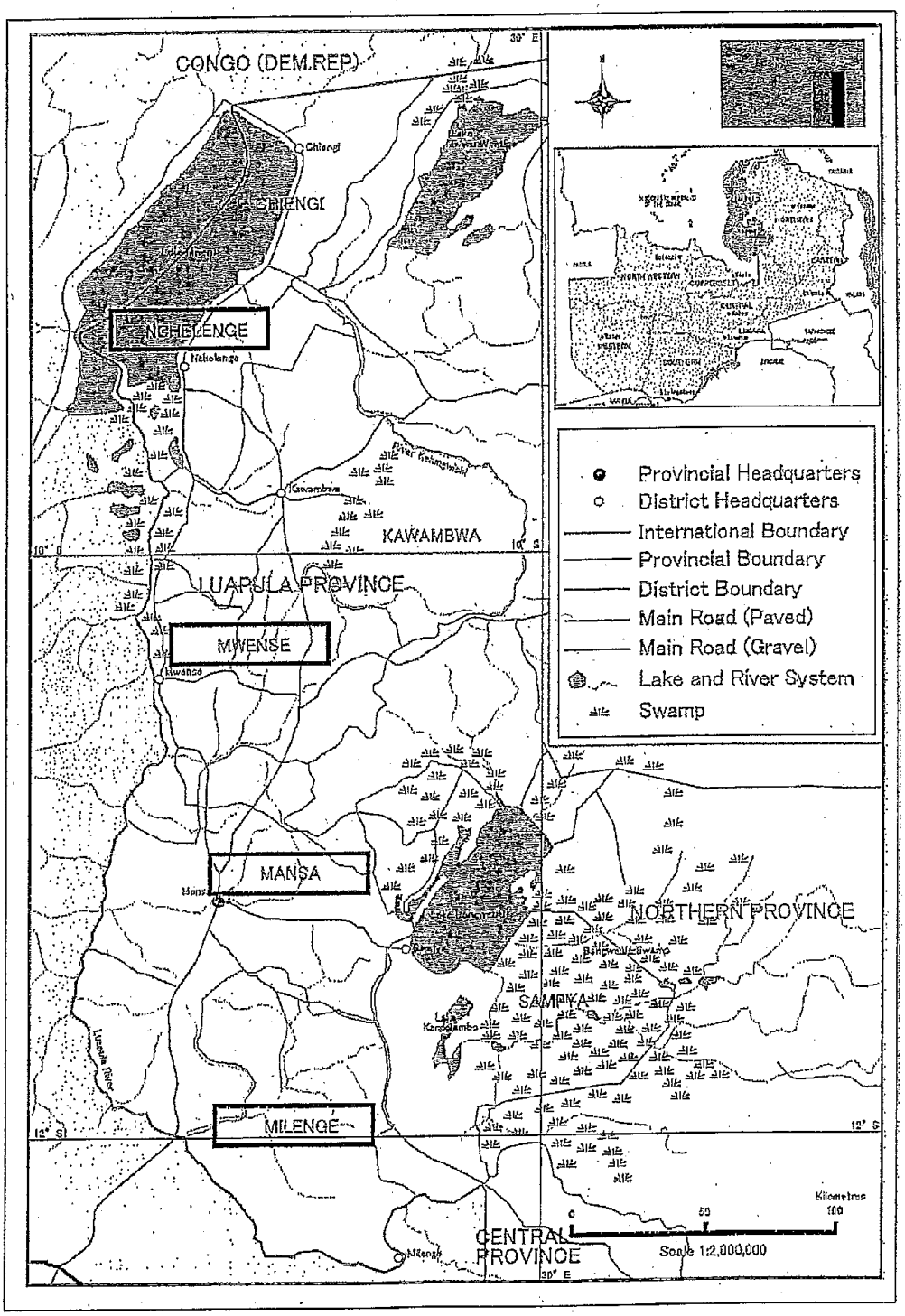
7-9. Custom clearance of the equipment and materials

Japanese side requested Zambian side to support the smooth custom clearance of the equipment and materials of the Project. Zambian side understood the request and will 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

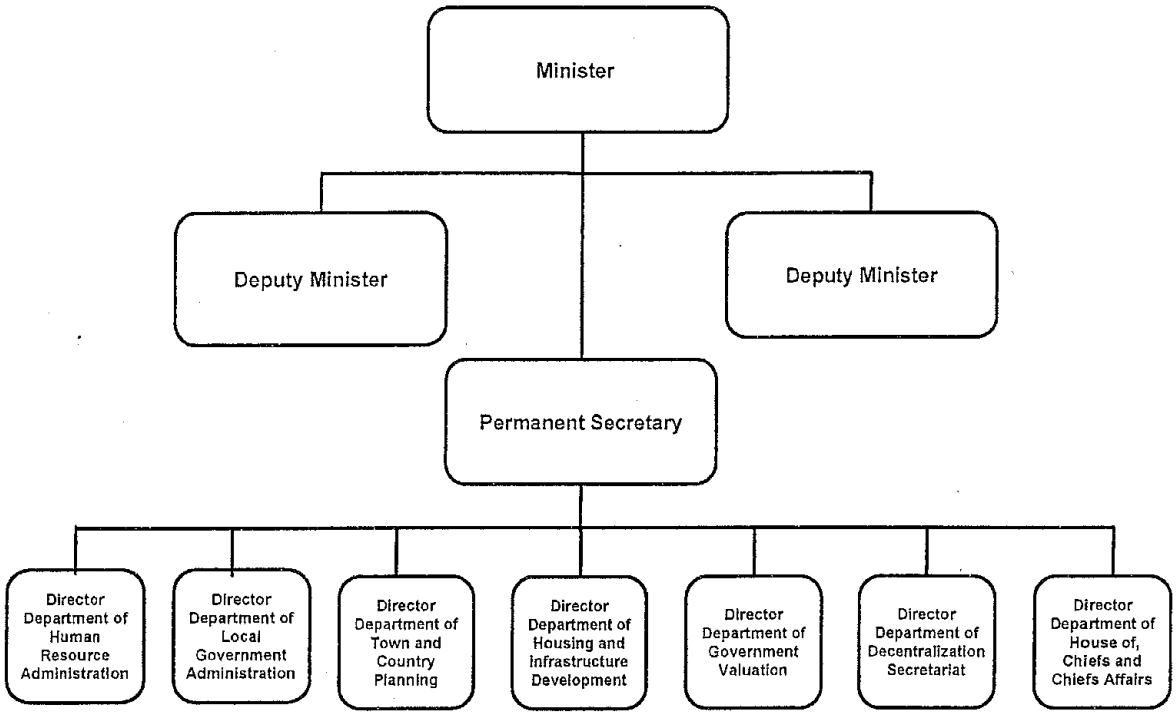


THE PROJECT FOR GROUNDWATER DEVELOPMENT IN LUAPULA PROVINCE IN THE REPUBLIC OF ZAMBIA

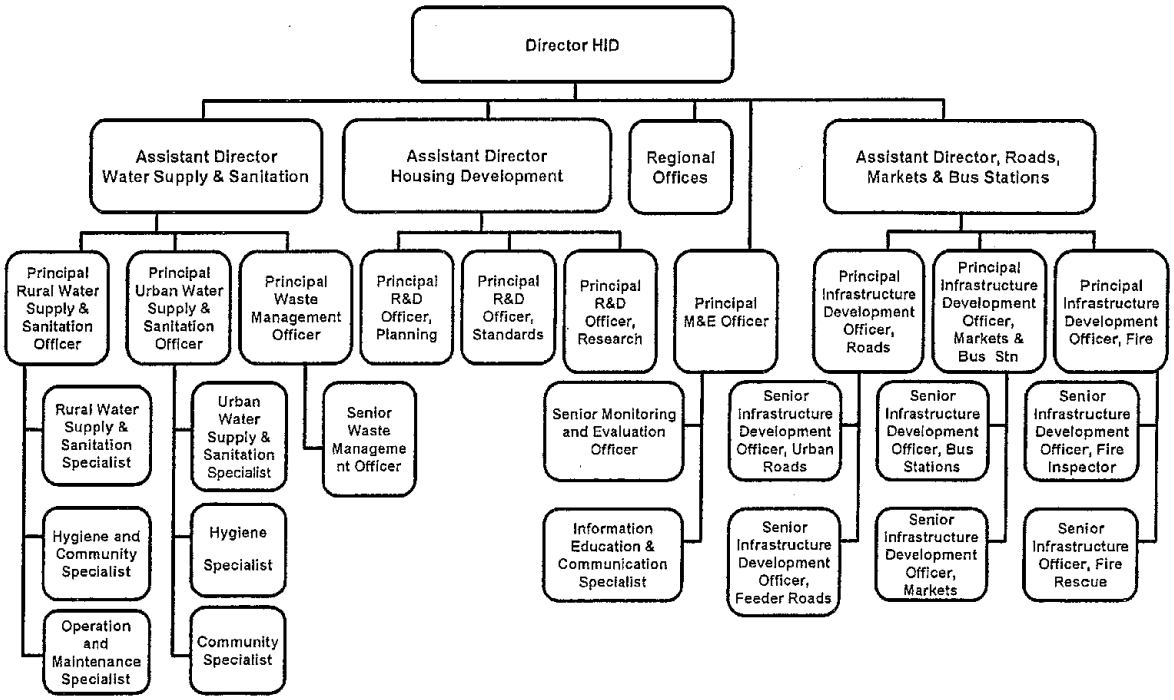
LOCATION MAP OF PROJECT AREA

Organization Chart

MINISTRY OF LOCAL GOVERNMENT AND HOUSING HIGHER LEVEL STRUCTURE



DEPARTMENT OF HOUSING AND INFRASTRUCTURE DEVELOPMENT (DHID)



Annex-3

List of Requested Sites

Nhelenge District			
S/N	Site Name	Ward	
1	Mangamu Basic School	Katofyo	1
2	Mutono Basic School	Kashikishi	1
3	Miba Community School	Mwatishi	1
4	Mweru Basic School	Kashikishi	1
5	Munsa Basic School	Kabuta	1
6	Kafutuma Clinic	Mwatishi	1
7	Kefulwa Clinic	Kabuta	1
8	Mutono Village (1)	Kashikishi	1
9	Kandeke Village	Kabuta	1
10	Chofwe Kabila Village	Mwatishi	1
11	Chebele Village	Shabo	1
12	Chomba Village	Shabo	1
13	Kasalaulo Village	Mofwe	1
14	Muntapuka Village	Mwatishi	1
15	Belu Village	Mwatishi	1
16	Kasonso Village	Katofyo	1
17	Seketeni Village	Kasamba	1
18	Chisukulu Village	Nchelenge	1
19	Nite Village	Chilongo	1
20	Shishipula Village	Kabuta	1
21	Chipanta Village	Kabuta	1
22	Luswili Village	Mofwe	1
23	Mwanda Village	Katofyo	1
24	Shimutambala Village	Nchelenge	1
25	Kanguluma Village	Mofwe	1
26	Chokolo Village	Nchelenge	1
27	Holland Village	Mulwe	1
28	Kapambwe Village	Shabo	1
29	Musanda Village	Mofwe	1
30	Mwanamweshi Village	Kashikishi	1
31	Chinyanta Village	Mulwe	1
32	Shimalita	Kashikishi	1
33	Mukeya Village	Kabuta	1
34	Kaseka Village (near Rd)	Nchelenge	1
35	Kasamba B. School	Mulwe	1
36	Kanengwa B. School	Mofwe	1
37	Chofwe Mulenga Village	Mwatishi	1
38	Block 5	Mwatishi	1
39	Fwengeni Village	Mwatishi	1
40	Shikapambwe	Nchelenge	1
41	Pingwila Village	Chilongo	1
42	Kabeke Village	Kabuta	1
43	Kanama Village	Kabuta	1
44	Shanyemba Village	Shabo	1
45	Chibwili Village	Shabo	1

Mwense District			
S/N	Site Name	Ward	
1	Chitasu	Kaombe	1
2	Kabengele	Kaombe	1
3	Chilolo	Nkanga	1
4	Polo Kankomba Village	Katiti	1
5	Lubunda B. School	Katiti	1
6	Kawama Joe Village	Nkanga	1
7	Lumfwe Village	Nkaombe	1
8	Kawama Village	Kasengu	1
9	Shimaria	Kasengu	1
10	Mutinta	Katiti	1
11	Kapamba B. School	Luche	1
12	Mupmporokoso Village	Luche	1
13	Chebele North	Kalanga	1
14	Kateule Village	Kasengu	1
15	Kandomba Community School	Kaombe	1
16	Kakusha B. Village	Pebekabesa	1
17	Nyemgele	Kattiti	1
18	Musangati	Chachacha	1
19	Chembe Community School	Chachacha	1
20	Chilengwe	Chachacha	1
21	Kalasa	Kaombe	1
22	Chansa Village	Kasengu	1
23	Kateta	Luche	1
24	Chisulo	Katuta	1
25	Chibondo B School	Chibenbe	1
26	Katebula	Musonda	1
27	Shchama Community School	Kalanga	1
28	Losa Mukukutu	Musonda	1
29	Mutima	Munwa	1
30	Muchinga Village	Musonda	1
31	Chalata	Lundashi	1
32	Kafwimbi	Kalanga	1
33	Mwashi A	Kalanga	1
34	Mwashi B.	Kalanga	1
35	Kamboo	Kalanga	1
36	Nonga	Munwa	1
37	Mweshi Village	Chibembe	1
38	Fyansuno	Mpasa	1
39	Sungubungu	Mpasa	1
40	Kaoma	Mpasa	1
41	Chalwe Chiwe	Lundashi	1
42	Bulaki	Musonda	1
43	Sepe	Musonda	1
44	Mwense East Farm	Kalanga	1
45	Kapesha	Mpasa	1

Mansa District			
S/N	Site Name	Ward	
1	Chitamba Basic School	Mulenshi	1
2	Lukakula	Mulenshi	1
3	Mantubusa	Chilyapa	1
4	Kasengu	Mushipashi	1
5	Mwalashi	Mushipashi	1
6	Filima	Mansa	1
7	Mutiti	Mansa	1
8	Kasongo	Muchinka	1
9	Chikowe	Muchinka	1
10	Kalibuku	Lukola	1
11	Lusaya	Lukola	1
12	Kalimba	Misakalala	1
13	Kunda Ndomi	Misakalala	1
14	Kampalala	Misakalala	1
15	Kakuka	Mushipashi	1
16	Mwana Chama	Mansa	1
17	Chitakwa	Kaole	1
18	Mibenge	Kaole	1
19	kalaba	Myulu	1
20	Swala	Myulu	1
21	Chofwe	Kaole	1
22	Chakaba	Katangashi	1
23	Kambalikila	Katangashi	1
24	Musaila Rural Health Centre	Katangashi	1
25	Kalungushi	Lukangaba	1
26	Shamende	Lukangaba	1
27	Kalyondo	Lukangaba	1
28	Temfwe	Luapula	1
29	Kapu	Luapula	1
30	Fipatauko	Chansunsu	1
31	Kalaba	Chansunsu	1
32	Chilumba	Luapula	1
33	Shoti (Chansunsu Community School)	Chansunsu	1
34	Kapapa Community School	Lukangaba	1
35	Chiwele Community School	Chansunsu	1
36	Kombaniya	Lwingishi	1
37	Sendapu	Lwingishi	1
38	Chansa	Mushipashi	1
39	Chief Kale Palace	Lwingishi	1
40	Kapitolo	Katangashi	1
41	Kabushi	Misakalala	1
42	Chibemba	Katangashi	1
43	Chipense	Lukola	1
44	Kaoma	Mutuna	1
45	Matipa	Mutuna	1

Milenge District			
S/N	Site Name	Ward	
1	Garden	Mikula	2
2	Munushi Compound	Mikula	1
3	Kamupapa	Mikula	1
4	Kalotoli	Mikula	1
5	Chisensa	Mikula	1
6	Sokontwe	Sokontwe	2
7	Riverside Community School	Sokontwe	1
8	Musongo	Sokontwe	1
9	Mwewa	Sokontwe	1
10	Chilufya Yamwela	Sokontwe	1
11	Chipundu	Chipundu	2
12	Chilufya Kabinda	Chipundu	1
13	Kaputa	Mumbotuta	3
14	Shitambuli	Mumbotuta	3
15	Allan	Mumbotuta	1
16	Kaloko	Kapalala	2
17	Lungu Mukuta & Muke	Nsunga	2
18	Kashila	Nsunga	2
19	Lungu Mukuta Basic School	Nsunga	1
20	Lupiya	Nsunga	1
21	Lupiya Community school	Nsunga	1
22	Milulu Health Post	Lusumbwe	1
23	Musumali	Lusumbwe	1
24	Moti	Lusumbwe	1
25	Kalali	Lusumbwe	2
26	Kabongo	Lusumbwe	2
27	Chenga	Fibalala	2
28	Muyayi	Fibalala	1
29	Mumanse	Fibalala	1
30	Vincent	Fibalala	1
31	Kanono	Fibalala	1
32	Alas	Nsaka	1
33	Ngomba	Nsaka	1
34	Chamakapoli	Nsaka	2
35	Mulumbi	Mulumbi	2
36	Kachenge	Mulumbi	2
37	Scheme	Mulumbi	2
38	Matontola Basic	Chiswishi	1
39	Chandika	Chiswishi	1
40	Mophat	Chiswishi	1
41	Kabange Rural Health Post	Chiswishi	1
42	Kabange	Chiswishi	1
43	Itemba	Itemba	1
44	Kabayi	Itemba	1
45	Chifwalo	Itemba	1

46	Mushingo Village	Shabo	1
47	Sela Village	Chilongo	1
48	Chansa Village	Chilongo	1
49	Nabwendo Village	Chilongo	1
50	Mutepuka Village	Chilongo	1
51	Kalwe Comm. School	Mwatishi	1
52	Kaseketi Village	Kasamba	1
53	Mushili Village	Kasamba	1
54	Chapita Village	Kasamba	1
55	Shimwense Village	Mwatishi	1
56	Lembati Village	Mwatishi	1
57	Chinkobwe Village	Mwatishi	1
58	Chimba Village	Mwatishi	1
59	Mutabwa Village	Mwatishi	1
60	Chilamba Village	Munkombwe	1
61	Munkombwe Village	Munkombwe	1
62	Chungu Village	Munkombwe	1
63	Kaputo Village	Munkombwe	1
64	Mwaba Village	Munkombwe	1
65	Felushi Village	Kabuta	1
66	Chomba Village	Kabuta	1
67	Diamond Village	Kabuta	1
68	Kaputo Village	Kabuta	1
69	Kapempe Village	Katofyo	1
70	Katuna Village	Kashikishi	1
71	Sonka Village	Kashikishi	1
72	Mutono Village (2)	Kashikishi	1
73	Toka Village	Mofwe	1
74	Chabilikila Village	Shabo	1
75	Mulonda B. School	Kabuta	1
76	Mofwe B. School	Mofwe	1
77	Kambwali Clinic	Kasamba	1
78	Lukokesha Basic School	Mofwe	1
79	Kapepele Village	Mofwe	1
80	Chisambo Village	Mofwe	1
81	Chiminaula Village	Mwatishi	1
82	Chikuni Village	Mwatishi	1
83	Shimpundu Village	Mwatishi	1
84	Labani Village	Mwatishi	1
85	Shinjoni Village	Nchelenge	1
86	Kenani Basic School	Kashikishi	1
87	Kanyembo Basic School	Mofwe	1
88	Kasheta Village	Mwatishi	1
89	Mukanda Village	Chilongo	1
90	Chishimba Luwi Village	Kabuta	1
91	Samashi Village	Kabuta	1
92	Chile	Kabuta	1
93	Kabosha Village	Kashikishi	1
94	Shindoni Village	Kashikishi	1
95	Kanyembo Clinic	Mofwe	1
Total Nunber of Boreholes			95

46	Chibwe Village	Chibalashi	1
47	Kamami Village	Nkonge	1
48	Nshi ndano	Nsenga	1
49	Chipepa	Nsenga	1
50	Chikubi	Nalupembe	1
51	Mutipula B. School	Nkonge	1
52	Katuta Turn off	Nalupembe	1
53	Pibelibe	Nsenga	1
54	Mulunda B. School	Mweshi	1
55	Chishinki B School	Mweshi	1
56	Bund Chunsu B School	Chibalashi	1
57	Kapalaula	Chibalashi	1
58	Chifuntwe	Mweshi	1
59	Chilolo	Mweshi	1
60	Kane	Nkonge	1
61	Moba	Mumbwe	1
62	Tambalala	Mumbwe	1
63	Kalla Kokoto	Nalupembe	1
64	Lelo	Nalupembe	1
65	Musango	Nkonge	1
Total Nunber of Boreholes			65

46	Kosamu	Chibeleka	1
47	Makunka	Chibeleka	1
48	Musela	Mutuna	1
49	Kalasakando Basic School	Chibeleka	1
50	Kapansa	Mutuna	1
51	Fibale	Mulenshi	1
52	Mupofwe Community School	Chansunsu	1
53	Chisukulo	Lukangaba	1
54	Eshon and Banda Area	Chansunsu	1
55	Kalungushi	Mushipashi	1
56	Katambala	Misakalala	1
57	Matelo	Mushipashi	1
58	Kapompole	Kaole	1
59	LULE	Myulu	1
60	Kabulaya Musesha Community School	Chibeleka	1
61	Yasakwa	Chansunsu	1
62	Chitungulu	Mushipashi	1
63	Mashikolo	Lukangaba	1
64	Chipungu	Lukangaba	1
65	Kamipundu Community School	Misakalala	1
66	Chisumbu	Misakalala	1
67	Chief Mabumba Palace	Chansunsu	1
68	Mushitu Communily School	Chansunsu	1
69	Chofoshi	Mansa	1
70	Kapili	Misakalala	1
71	Mababumba Market	Chansunsu	1
72	Nalwamba	Misakalala	1
73	Chibale Kalafiki	Chansunsu	1
74	Tubi	Myulu	1
75	Saili	Kaole	1
76	Lofoyi	Chibeleka	1
77	Kalyongo	Chibeleka	1
78	Chimese Local Court	Kaole	1
79	Sub Chief Mbao Palace	Chibeleka	1
80	Luka Ngosa	Chibeleka	1
81	Chikombola	Lukangaba	1
82	Kasanda	Lukangaba	1
83	Senseleni	Lukangaba	1
84	Makeleka	Lukangaba	1
85	Motoka	Lukangaba	1
86	Kalimwengo	Lukangaba	1
87	Kapaipi	Lukangaba	1
88	Mungulube	Lukangaba	1
89	Chabwe	Lukangaba	1
90	Kale	Chansunsu	1
Total Nunber of Boreholes			90

46	Kakasu	Itemba	1
47	Itemba Local Court	Itemba	1
48	Kalubili	Milambo	1
49	Chabuka Baushi Basic	Milambo	1
50	Kapalamula	Milambo	1
51	Musongo	Milambo	1
52	Chibende	Milambo	1
53	Kalaba Shitembeye Community School	Milambo	1
Total Nunber of Boreholes			70

A-13

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 this law and the decision of 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 provided to a recipient country to procure the facilities, equipment and services (engineering services and transportation of the products, etc.) for its economic and social development 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 Japan's Grant Aid is supplied through following procedures:

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

- Confirmation of the background, objectives, and benefits of the Project and also institutional capacity of relevant agencies 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 between both parties concerning the basic concept of the Project.
- Preparation of a outline 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 Outline Design of the Project is confirmed based on the guidelines of the Japan's Grant Aid scheme.

JICA requests the Government of the recipient country to take whatever measures necessary to achieve 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 of the recipient country which actually implements the Project. Therefore, the implementation of the Project is confirmed

by all relevant organizations of the recipient country based on the Minutes of Discussions.

(2) Selection of Consultants

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

(3) Result of the Survey

JICA reviews the Report on the results of the Survey and recommends the GOJ to appraise the implementation of the Project after confirming the appropriateness 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 pledge 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

In order to maintain technical consistency, the consulting firm(s) which conducted the Survey will be recommended by JICA to the recipient country to continue to work on the Project's implementation after the E/N and G/A.

(3) Eligible source country

Under the Japan's 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 fulfill 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.

(6) "Proper Use"

The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and 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 under 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.

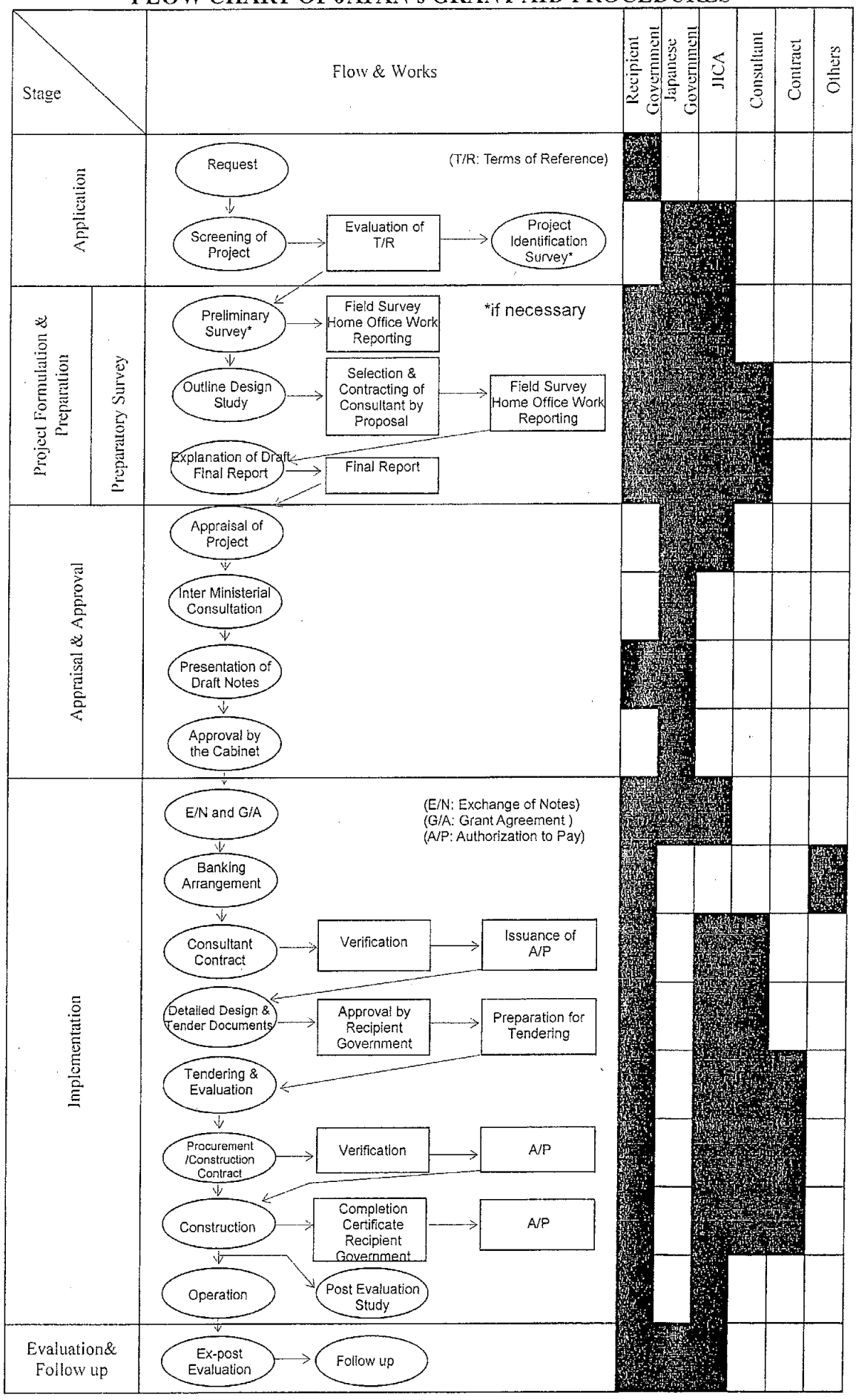
(9) Authorization to Pay (A/P)

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

(10) Social and Environmental Considerations

A recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure lots of lands necessary for the implementation of the Project and to clear the sites		●
2	To ensure prompt customs clearance of the products and to assist internal transportation of the products in the recipient country		
	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 may 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 may 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
THE PREPARATORY SURVEY
ON
THE PROJECT
FOR
GROUNDWATER DEVELOPMENT IN LUAPULA PROVINCE PHASE 2
IN
THE REPUBLIC OF ZAMBIA
(Explanation of Draft Outline Design)

In June 2010, the Japan International Cooperation Agency (hereinafter referred to as "JICA") dispatched the Preparatory Survey Team on the Project for Groundwater Development in Luapula Province Phase 2 (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 of the survey in Japan, JICA prepared a Draft Outline Design of the Survey.

In order to explain and to consult with the Government of Zambia on the components of the Draft Outline Design, JICA sent to Zambia the Draft Outline Design Explanation Team (hereinafter referred to as "the Team") from 4 January 2011 to 8 January 2011. The team was headed by Mr. Yuji Une, the JICA Visiting Senior Advisor, from 4 January 2011 to 8 January 2011.

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

Lusaka, 7 January 2011

Mr. Yuji Une
Leader
Draft Outline Design Explanation Team
Japan International Cooperation Agency (JICA),
Japan

Mr. Timothy Hakuyu
Permanent Secretary
Ministry of Local Government and Housing
(MLGH),
The Republic of Zambia

ATTACHMENT

1. Components of the Draft Outline Design (Draft Preparatory Survey Report)

The Zambian side agreed and accepted in principle the components of the Draft Outline Design (Draft Preparatory Survey Report) explained by the Team.

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

2. Responsible and Implementing Organization

2-1. The responsible organization is Ministry of Local Government and Housing (hereinafter referred to as "MLGH").

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

3. Japan's Grant Aid Scheme

3-1. The Zambian side understood the Japan's Grant Aid Scheme as described in Annex-1.

3-2. 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

4. Schedule of the Survey

JICA will complete the final report in accordance with the confirmed items and send it to the Government of Zambia by the end of May 2011.

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.

The Zambian side promised to secure necessary budget as attached in Annex-5.

5-3. Project Sites

Based on the result of field survey done in all the three hundred and twenty (320) requested sites, 291 sites out of requested 320 sites were identified to be possible for development of new groundwater sources under the Project. However, due to limitation of one-year schedule of implementation of the Project, the number of possible sites for construction under the Project is 216 sites, and the remaining 75 sites will be treated as alternative sites in a case where any one of the 216 successful boreholes are not available because of hydrogeological conditions.

The number of boreholes to be constructed in the Project would be two hundred and sixteen (216) as shown in Annex-5, if the Government of Japan would finally decide to implement the Project.

The numbers of sites in each District were distributed to the proportion of the original request as shown in Annex-6.

There will not be third drilling after two trials are concluded as unsuccessful in terms of water quantity and quality at the same site.

5-4. Type of Hand Pump

Both sides confirmed that hand pumps to be installed at each site should be either India Mark-II model or Afridev model, both being appropriate to the Zambian conditions and the selection of type of hand pump will be made based on the pH value and groundwater level of the borehole.

Therefore, both sides agreed that the selection of hand pump models would be determined according to the following criteria;

a) India Mark-II hand pump will be selected in the case when the pH value of the groundwater is equal to or higher than 7.0 or if the groundwater level is deeper than 30 m.
b) Afridev hand pump will be selected in the case when the pH value of the groundwater is lower than 7.0 and the groundwater level is shallower than 30 m.

5-5. Iron Removal Plant

According to the result of field survey, it was found that the groundwater in the target area often contains iron with higher value than the Zambian guideline standard (1mg/l), and in several existing boreholes, the concentration of iron reaches more than 5mg/l; the water cannot be used for drinking without iron removal plant.

Therefore, both sides agreed that in the Project, if the concentrations of iron exceed the Zambian guideline standard (1mg/l) and the Japanese consultant judge that it is effective and appropriate to install iron removal plant in the site, then the Japanese consultant will consult with representatives of MLGH and Local Authorities. With agreement of both representatives, iron removal plant will be installed and the borehole will be treated as successful if the treated water attains the level of less than 1 mg/l in its iron content.

In such sites, operation and maintenance training of the iron removal plant will be conducted through Soft Component Program to Area Pump Mender (APM) and Village Water Sanitation and Hygiene Education (V-WASHE).

Both sides confirmed that MLGH and Local Authorities should keep continuous monitoring and follow-up activities for operation and maintenance of all hand pumps as well as iron removal facilities.

5-6. Water Quality Standard for pH

According to the result of field survey, it was found that the groundwater in the target area often contains pH below the Zambian standard (6.5).

With regard to assessing successful borehole, both sides agreed to adopt water quality standard of "not less than 5.0 for pH" same as the Project for Groundwater Development in Luapula Province (Phase 1).

5-7. Soft Component Program

Both sides confirmed the contents of Soft Component Program as follows;

a) Capacity Development and On-the-Job-Training (OJT) of WASHE facilitators including actual community sensitization activities (formulating V-WASHE) in all the 216 sites
b) Training for APM including WASHE instructor to APM
c) Technical transfer regarding operation and maintenance technique of iron removal facilities to APM and V-WASHE in the sites where iron removal facilities are installed

5-8. Operation and Maintenance

MLGH should be responsible for operation and maintenance of the facilities to ensure sustainability of the water supply facilities to be constructed under the Project.

WASHE committees in district and village level will function for proper operation and maintenance of the completed water supply facilities.

The beneficiary residents in the Project sites will cover entire costs for operation and maintenance of the completed water supply facilities, receiving the support of WASHE committees.

5-9. Undertakings of the Zambian Side

The Zambian side agreed to take the following necessary measures;

a) To conduct sensitisation activities to the community members and to collect the community contributions of amount of ZMK1.5 million obliged according to National Rural Water Supply and Sanitation Programme (NRWSSP). 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.
b) To allocate a Project Manager to assist the smooth implementation of the Project
c) 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
d) 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
e) To prepare access routes necessary for the construction of water supply facilities
f) To secure land necessary for the base camp and stockyard in the target districts during construction
g) 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
h) 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.
i) To facilitate community members to establish a fence around a borehole
j) To operate and maintain the facilities constructed under the Grant Aid properly and effectively, and to appoint necessary staff for this operation and maintenance
k) To bear all the expenses other than those covered by the Grant Aid

5-10. Demarcation with Other Cooperating Partners (CPs)

Zambian side agreed that they will be responsible for coordinating the CPs in order to avoid duplication among CPs on the sites of the Project.

End

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

Annex-1 Japan's Grant Aid Scheme

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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 fulfill 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-2.

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The Government of the recipient country is required to maintain and use properly and effectively the facilities constructed and the equipment purchased under the Grant Aid, to assign staff necessary for this operation and maintenance and 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 under 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.

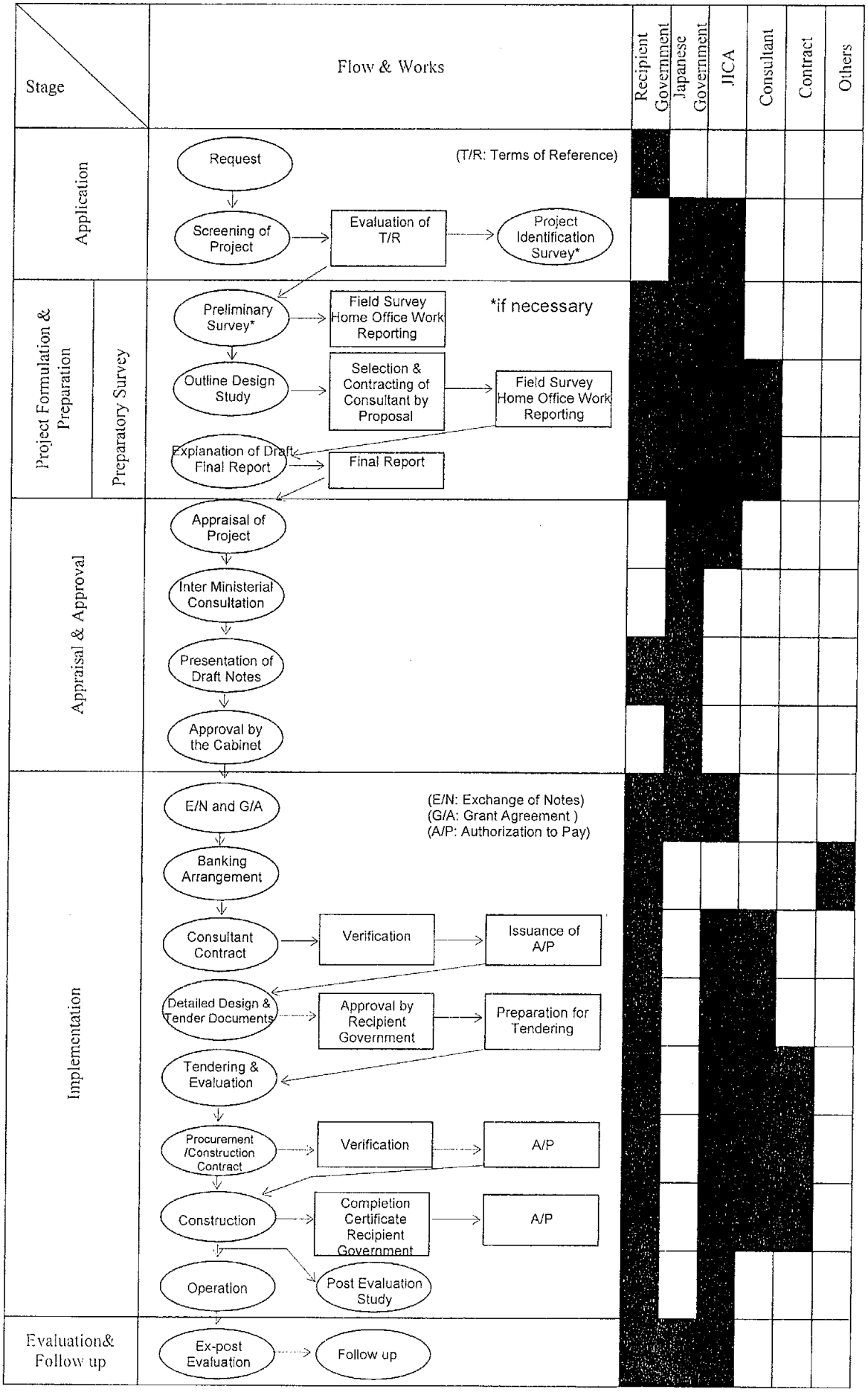
(9) Authorization to Pay (A/P)

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

(10) Social and Environmental Considerations

The recipient country must carefully consider social and environmental impacts by the Project and must comply with the environmental regulations of the recipient country and JICA socio-environmental guidelines.

FLOW CHART OF JAPAN's GRANT AID PROCEDURES



Annex-2 Major Undertakings to be taken by Each Government

No.	Items	To be covered by Grant Aid	To be covered by Recipient Side
1	To secure lots of lands necessary for the implementation of the Project and to clear the sites		●
2	To ensure prompt customs clearance of the products and to assist internal transportation of the products in the recipient country		
	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 may 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 may 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)

Annex-4 Necessary Budget to be covered by the Zambian Side

Total ZMK302,174,900(JY5.68million)

Cost Item	Total	Calculation	Remarks
Personnel expenses during siting work in the Detailed Design Study	ZMK11,700,000	MLA: 3Month×26days×3pers×ZMK50,000/day/person	3 D-WASHE member will join the hydrogeological and Geophysical team
Personnel cost during site transfer	ZMK21,700,000	MLA : 7site/day×31days×2pers×ZMK50,000	D-WASHE member and PST will participate in the site transfer
Personnel cost during construction supervision	ZMK7,200,000	MLA : 5days/Month×2pers×12month×ZMK50,000	D-WASHE member and PST will participate in the supervision
Personnel cost during handover inspection	ZMK21,500,000	MLA:5site/day×2person×43days×ZMK50,000	D-WASHE member and PST will participate in the handover of the constructed facilities
Costs during software component activities	ZMK199,196,000		D-WASHE member, PST, fuel, vehicle, etc.
Advising Commission for Authorisation to Pay(A/P)	ZMK1,063,900	Contract : ZMK319,150×2times Amendment: ZMK212,800×2times	Opening of A/P: JY6,000/time A/P amendment : JY4,000/time
Payment commission to the Bank	ZMK39,815,000		
Total	ZMK302,174,900 (JY5.68million)		

MLA: Missing Lunch Allowance; PST: Programme Support Team

Annex-5 Project Sites List

NCHELENGE

Site Code	Site Name	Pop.	Priority	Short List	Remarks
NCII-75	Mulonda B. School	2,518	1	Project	
NCII-07	Kefulwa clinic	2,320	2	Project	
NCII-77	Kambwali clinic	2,100	3	Project	
NCII-76	Mofwe B. School	1,506	4	Project	
NCII-86	Lushiba Basic School	1,356	5	Project	
NCII-06	Kafutuma clinic	1,352	6	Project	
NCII-51	Kaiweo Community Sch	1,148	7	Project	
NCII-87	Kanyembo Basic School	1,081	8	Project	
NCII-36	Kanengwa B. School	916	9	Project	
NCII-04	Mweru Basic School	460	10	Project	
NCII-03	Miba Community School	440	11	Project	
NCII-78	Lukokesha Basic School	436	12	Project	
NCII-01	Mangamu Basic School	384	13	Project	
NCII-19	St. Paul hospital	344	14	Project	
NCII-02	Mutono Basic School	300	15	Project	
NCII-35	Kasamba B. School	295	16	Project	
NCII-94	Shindoni Village	9,600	17	Project	Existing 1 BH
NCII-34	Kaseka Village (near Rd)	4,373	18	Project	
NCII-93	Kabosha Village	3,840	19	Project	
NCII-14	Mutampuka Village	3,264	20	Project	
NCII-72	Mutono Village (2)	3,840	21	Project	Existing 3 BH
NCII-85	Shinjoni Village	2,880	22	Project	
NCII-92	Chile	2,880	23	Project	
NCII-59	Mutabwa Village	2,338	24	Project	
NCII-88	Kasheta Village	2,261	25	Project	
NCII-50	Mutepuka Village	2,064	26	Project	
NCII-10	Chofwe Kabila Village	1,920	27	Project	
NCII-65	Felushi Village	1,920	28	Project	
NCII-74	Chabilikila Village	1,920	29	Project	
NCII-24	Shimutambala Village	1,824	30	Project	
NCII-33	Mukeya Village	1,814	31	Project	
NCII-15	Belu Village	1,776	32	Project	
NCII-70	Katuna Village	1,776	33	Project	
NCII-09	Kandeke Village	1,680	34	Project	
NCII-45	Chibwili Village	1,680	35	Project	
NCII-67	Diamond Village	1,661	36	Project	
NCII-17	Seketeni Village	1,440	37	Project	
NCII-84	Labani Village	1,440	38	Project	
NCII-32	Shimalita	1,872	39	Project	Existing 2 BH
NCII-20	Chishipula Village	1,349	40	Project	
NCII-82	Chikuni Village	1,344	41	Project	
NCII-83	Shimpundu Village	1,267	42	Project	
NCII-30	Mwanamwishi Village	1,248	43	Project	
NCII-41	Pingwila Village	1,229	44	Project	
NCII-54	Chapita Village	1,200	45	Project	
NCII-47	Sela Village	1,166	46	Project	
NCII-08	Mutono Village (1)	1,100	47	Project	
NCII-66	Chomba Village	1,066	48	Project	
NCII-58	Chimba Village	1,046	49	Project	
NCII-40	Shikapambwe	960	50	Project	
NCII-52	Kaseketi Village	960	51	Project	
NCII-53	Mushili Village	950	52	Project	
NCII-68	Kaputo Village	864	53	Project	
NCII-73	Toka Village	816	54	Project	
NCII-28	Kapambwe Village	792	55	Project	
NCII-16	Kasonso Village	720	56	Project	
NCII-26	Chokolo Village	720	57	Project	
NCII-63	Kaputo Village	720	58	Project	
NCII-81	Chiminaula Village	912	59	Project	Existing 1 BH
NCII-44	Shanyemba Village	624	60	Project	
NCII-79	Kapepele Village	614	61	Project	
NCII-42	Kabeke Village	605	62	Project	
NCII-13	Kasalaulo Village	576	63	Project	
NCII-27	Holland Village	576	64	Project	
NCII-31	Nshoka Village	528	65	Alternative	
NCII-39	Fwengeni Village	504	66	Alternative	
NCII-18	Chisukulu Village	480	67	Alternative	
NCII-21	Chipanta Village	480	68	Alternative	
NCII-43	Kanama Village	480	69	Alternative	
NCII-89	Mukanda Village	480	70	Alternative	
NCII-22	Luswili Village	461	71	Alternative	
NCII-91	Samashi Village	413	72	Alternative	
NCII-71	Sonka Village	398	73	Alternative	
NCII-80	Chisambo Village	398	74	Alternative	
NCII-46	Mushingo Village	370	75	Alternative	
NCII-55	Shimwense Village	360	76	Alternative	
NCII-38	Block 5	336	77	Alternative	
NCII-48	Chansa Village	336	78	Alternative	
NCII-37	Chofwe Mulenga Village	293	79	Alternative	
NCII-57	Chinkobwe Village	269	80	Alternative	
NCII-90	Chishimba Luwi Village	264	81	Alternative	
NCII-12	Chilongoshi (B)	250	82	Alternative	
NCII-61	Munkombwe Village	250	83	Alternative	
NCII-29	Musanda Village	250	84	Alternative	
NCII-25	Kanguluma Village	206	85	Alternative	
NCII-23	Mwanda Village	202	86	Alternative	
NCII-49	Nabwendo Village	197	87	Alternative	
NCII-60	Chilamba Village	192	88	Alternative	
NCII-69	Kapempe Village	173	89	Alternative	
NCII-56	Lembati Village	168	90	Alternative	
NCII-11	Chebele Village	149	91	Alternative	
NCII-64	Mwaba Village	106	92	Alternative	
NCII-62	Chungu Village	96	93	Alternative	
NCII-05	Munsa Basic school	Existing Water Facility is Sufficient			Cancelled
NCII-95	Kanyembo clinic	Existing Water Facility is Sufficient			Cancelled

BH: Borehole

MWENSE

Site Code	Site Name	Pop.	Priority	Short List	Remarks
MWII-11	Kapamba Basic School	5,315	1	Project	
MWII-05	Lubunda Basic School	2,678	2	Project	
MWII-19	Chembe Community Sch	2,199	3	Project	
MWII-25	Chibondo Basic School	896	4	Project	
MWII-27	Sichama Community Sch	736	5	Project	
MWII-54	Mulunda B.School	730	6	Project	
MWII-56	Bunda Chunsu Basic Sch	710	7	Project	
MWII-51	Mutipula B. School	525	8	Project	
MWII-15	Kangomba Community S	417	9	Project	
MWII-35	Chisheta	6,240	10	Project	
MWII-03	Chililo	3,360	11	Project	
MWII-30	Chibunse	1,920	12	Project	
MWII-28	Losa Mukunkutu	1,680	13	Project	
MWII-23	James Chiwasha	1,642	14	Project	
MWII-07	Luamfwe Village	1,632	15	Project	
MWII-12	Mumpolokoso Village	1,627	16	Project	
MWII-20	Chilumbi	1,200	17	Project	
MWII-41	Chalwe Chibwe	1,032	18	Project	
MWII-65	Musalango	1,200	19	Project	Existing 1 BH
MWII-06	Kanama Village	912	20	Project	
MWII-32	Kafwimbi	720	21	Project	
MWII-46	Chibwe Village	720	22	Project	
MWII-02	Kabengele	715	23	Project	
MWII-62	Tambalala	538	24	Project	
MWII-44	Mwense East Farm	528	25	Project	
MWII-04	Polo Kankomba Village	499	26	Project	
MWII-01	Chitasu	480	27	Project	
MWII-09	Shimaria	480	28	Project	
MWII-39	Sungusungu	480	29	Project	
MWII-50	Chikubi	470	30	Project	
MWII-10	Mutonto	461	31	Project	
MWII-13	Chibele East	384	32	Project	
MWII-14	Kateule Village	360	33	Project	

Site Code	Site Name	Pop.	Priority	Short List	Remarks
MWII-26	Katebula	336	34	Project	
MWII-40	Kaoma	331	35	Project	
MWII-08	Kawama Village	307	36	Project	
MWII-18	Anas	298	37	Project	
MWII-55	Longa Village (Loonga)	268	38	Project	
MWII-21	Kalasa	265	39	Project	
MWII-38	Fyansoni	254	40	Project	
MWII-37	Mweshi Village	250	41	Project	
MWII-59	Chililo	250	42	Project	
MWII-34	Munkupa	242	43	Project	
MWII-58	Chifuntwe	240	44	Project	
MWII-29	Mutima	206	45	Alternative	
MWII-47	Kamami Village	202	46	Alternative	
MWII-17	Nyengele	192	47	Alternative	
MWII-24	Chisulo	178	48	Alternative	
MWII-43	Sepe	172	49	Alternative	
MWII-63	Bunda	168	50	Alternative	
MWII-53	Pibelibe	163	51	Alternative	
MWII-64	Leo	163	52	Alternative	
MWII-57	Kapalaula	158	53	Alternative	
MWII-36	Mutanti	144	54	Alternative	
MWII-60	Kane	139	55	Alternative	
MWII-16	Kakusa B. Village	134	56	Alternative	
MWII-22	Chansa Village	336	57	Alternative	Existing 1 BH
MWII-48	Nshi ndano	82	58	Alternative	
MWII-49	Chipepa	48	59	Alternative	
MWII-31	Chalata	Low Groundwater Potential			Cancelled
MWII-33	Kapakala West	Low Groundwater Potential			Cancelled
MWII-42	Mulubika	No access			Cancelled
MWII-45	Kapesha Village (B)	Low Groundwater Potential			Cancelled
MWII-52	Kambele	No access			Cancelled
MWII-61	Moba	No access			Cancelled

MANSA

Site Code	Site Name	Pop.	Priority	Short List	Remarks
MAII-01	Chitamba Basic School	3,398	1	Project	
MAII-03	Mantumbusa Basic School	2,775	2	Project	
MAII-51	Fibale Basic School	2,268	3	Project	
MAII-49	Kalasakando Basic School	2,216	4	Project	
MAII-52	Mupofwe Community School	2,138	5	Project	
MAII-68	Mushitu Comm. School	845	6	Project	
MAII-34	Kapapa Community School	539	7	Project	
MAII-65	Kamipundu Comm. School	446	8	Project	
MAII-60	Kabulaya Musesha (Comm. School)	418	9	Project	
MAII-33	Shofi (Chansunsu Comm. School)	415	10	Project	
MAII-35	Chiwele Community School	393	11	Project	
MAII-24	Musaila Rural health Centre	341	12	Project	
MAII-08	Kasongo	3,000	13	Project	
MAII-16	Chitakwa	2,650	14	Project	Existing 1 BH
MAII-32	Chabala	3,600	15	Project	Existing 1 BH
MAII-61	Yasakwa (Bena Section)	1,776	16	Project	
MAII-78	Chimese Local Court	1,700	17	Project	
MAII-21	Chofwe	1,690	18	Project	
MAII-54	Eshon and Banda Area	1,920	19	Project	Existing 1 BH
MAII-02	Lukakula	1,200	20	Project	
MAII-13	Kunda Ndomi	1,104	21	Project	
MAII-27	Kalyondo	1,003	22	Project	
MAII-22	Chakaba	960	23	Project	
MAII-09	Chikuwe	720	24	Project	
MAII-19	Kalaba	720	25	Project	
MAII-42	Kasoma	596	26	Project	
MAII-43	Kachepeshi	576	27	Project	
MAII-89	Chabwe	576	28	Project	
MAII-28	Temfwe	800	29	Project	Existing 1 BH
MAII-53	Chisukulo	753	30	Project	Existing 1 BH
MAII-75	Saili	480	31	Project	
MAII-71	Mabumba Market	943	32	Project	Existing 2 BH
MAII-23	Kambalikila	432	33	Project	

Site Code	Site Name	Pop.	Priority	Short List	Remarks
MAII-38	Chansa(Kalukusha Area)	422	34	Project	
MAII-85	Motoka	379	35	Project	
MAII-64	Chipungu	374	36	Project	
MAII-30	Fipatauko	360	37	Project	
MAII-46	Kosamu	336	38	Project	
MAII-76	Lofoyi	576	39	Project	Existing 1 BH
MAII-31	Kalaba	310	40	Project	
MAII-67	Chief Mabumba's Palace	293	41	Project	
MAII-45	Matipa	288	42	Project	
MAII-47	Makunka	288	43	Project	
MAII-66	Chisumbu	288	44	Project	
MAII-74	Tubi	265	45	Project	
MAII-62	Chitungula	264	46	Project	
MAII-55	Kalungushi	259	47	Project	
MAII-26	Shamende	248	48	Project	
MAII-29	Kapu	245	49	Project	
MAII-07	Mutiti	240	50	Project	
MAII-36	Kombaniya	240	51	Project	
MAII-88	Mungulube	240	52	Project	
MAII-63	Mashikolo	235	53	Project	
MAII-17	Mwanachama	480	54	Project	Existing 1 BH
MAII-57	Sanofi	480	55	Project	Existing 1 BH
MAII-37	Sendapu	192	56	Project	
MAII-87	Kapaipi	189	57	Project	
MAII-73	Chibale Kalaliki	186	58	Project	
MAII-06	Milima/Sepe	432	59	Project	Existing 1 BH
MAII-83	Senseleni	172	60	Project	
MAII-48	Musela	168	61	Project	
MAII-58	Kapompole	144	62	Alternative	
MAII-90	Kale (Musenga)	144	63	Alternative	
MAII-80	Luka Ngosa	139	64	Alternative	
MAII-25	Kalungushi	384	65	Alternative	Existing 1 BH
MAII-40	Kapitolo	120	66	Alternative	

MANSA(continuation)

Site Code	Site Name	Pop.	Priority	Short List	Remarks
MAII-82	Kasanda Local Court	111	67	Alternative	
MAII-44	Kawama	101	68	Alternative	
MAII-50	Kapansa	101	69	Alternative	
MAII-84	Makeleta	96	70	Alternative	
MAII-86	Kalimwengo	96	71	Alternative	
MAII-18	Mibenge	92	72	Alternative	
MAII-41	Kabushi	86	73	Alternative	
MAII-77	Kalyongo	576	74	Alternative	Existing 2 BH
MAII-10	Kalibuku	72	75	Alternative	
MAII-79	Mabo's Village	317	76	Alternative	Existing 2 BH
MAII-20	Swala	288	77	Alternative	Existing 2 BH
MAII-70	Kapili	38	78	Alternative	
MAII-72	Nalwamba	38	79	Alternative	
MAII-04	Kasengu	No access			Cancelled
MAII-05	Mwalashi	No access			Cancelled
MAII-11	Lusaya	Low groundwater potential			Cancelled
MAII-12	Kalimba	Low motivation to form V-WASHE			Cancelled
MAII-14	Kampalala	Existing Water Facility is Sufficient			Cancelled
MAII-15	Kakuka	No access			Cancelled
MAII-39	Chief Kale Palace	Existing Water Facility is Sufficient			Cancelled
MAII-56	Katambala	No access			Cancelled
MAII-59	Lule Community School (Mwansa Mutale)	Existing Water Facility is Sufficient			Cancelled
MAII-69	Chofoshi Basic School	Existing Water Facility is Sufficient			Cancelled
MAII-81	Chikombola	Existing Water Facility is Sufficient			Cancelled

MILENGE

Site Code	Site Name	Pop.	Priority	Short List	Remarks
MLII-55	Matontola Basic School	1,856	1	Project	
MLII-31	Tande Basic School	1,016	2	Project	
MLII-32	Mlulu health Post	648	3	Project	
MLII-27	Mumbotuta Basic School	446	4	Project	
MLII-30	Mulungushi Basic School	337	5	Project	
MLII-58	Kabange Rural health Post	319	6	Project	
MLII-66	Chabuka Baushi Basic School	300	7	Project	
MLII-70	Kalaba Shitembeye Comm. Sch.	296	8	Project	
MLII-09	Riverside Comm. School	295	9	Project	
MLII-26	Changwe Lungo Basic S	295	10	Project	
MLII-59	Kabange	1,114	11	Project	
MLII-57	Moffat	960	12	Project	
MLII-01	Garden (A)	1,080	13	Project	Existing 1 BH
MLII-56	Chandika	720	14	Project	
MLII-51	Kachenge (A)	960	15	Project	Existing 1 BH
MLII-12	Chilufya Yamwela	672	16	Project	
MLII-68	Musongo	617	17	Project	
MLII-40	Chenga (B)	528	18	Project	
MLII-06	Chisensa	619	19	Project	Existing 1 BH
MLII-14	Chipundu (B) (Makole) Village	365	20	Project	
MLII-65	Kalubini	355	21	Project	
MLII-08	Sokontwe Old	336	22	Project	
MLII-07	Sokontwe New	307	23	Project	
MLII-38	Kabongo (B)	302	24	Project	
MLII-62	Chifwalo	300	25	Project	
MLII-47	Chamakapoli (A)	264	26	Project	
MLII-18	Kaputa (C)(Pa Gosteni Mumba) Village	260	27	Project	
MLII-13	Chipundu (A) (Kapu) Village	250	28	Project	
MLII-28	Changwe Lungo Village	250	29	Project	
MLII-39	Chenga (A)	250	30	Project	
MLII-52	Kachenge (B)	250	31	Project	
MLII-49	Mulumbi (A)	240	32	Project	
MLII-64	Itemba Local Court	240	33	Project	
MLII-53	Scheme (A)	235	34	Project	
MLII-41	Muyayi	230	35	Project	
MLII-67	Kapalamuna	230	36	Project	
MLII-20	Shitambuli (B)	216	37	Project	
MLII-25	Miyambo Village	192	38	Project	
MLII-69	Chibende	168	39	Project	
MLII-22	Alian Senga	154	40	Project	
MLII-23	Kaloko (A)	154	41	Project	
MLII-43	Vincent	154	42	Project	
MLII-37	Kabongo (A)	144	43	Project	
MLII-10	Musongo Mwewa	134	44	Project	
MLII-45	Alas	130	45	Project	
MLII-36	Kalali (B)	126	46	Project	
MLII-33	Musumali	125	47	Project	
MLII-29	Buyantashi Village	120	48	Alternative	
MLII-34	Mote	120	49	Alternative	
MLII-46	N'gomba	120	50	Alternative	
MLII-21	Shitambuli (C)	110	51	Alternative	
MLII-61	Kabayi	101	52	Alternative	
MLII-03	Munushi Compound	96	53	Alternative	
MLII-60	Itemba	96	54	Alternative	
MLII-35	Kalali (A)	91	55	Alternative	
MLII-63	Kakasu	91	56	Alternative	
MLII-04	Kamupapa	86	57	Alternative	
MLII-05	Kalotoli	77	58	Alternative	
MLII-02	Garden (B)	72	59	Alternative	
MLII-44	Kanono	70	60	Alternative	
MLII-11	Musongo Mwewa	Combined with site MLII-10			Cancelled
MLII-15	Chilufya Kabinda	Existing Water Facility is Sufficien			Cancelled
MLII-16	Kaputa (A)	Combined with site MLII-18			Cancelled
MLII-17	Kaputa (B)(Bupe Kabwe)	Combined with site MLII-18			Cancelled
MLII-19	Shitambuli (A)	Existing Water Facility is Sufficien			Cancelled
MLII-24	Kaloko (B)	Combined with site MLII-23			Cancelled
MLII-42	Mumanse	Existing Water Facility is Sufficien			Cancelled
MLII-48	Chamakapoli (B)	Combined with site MLII-47			Cancelled
MLII-50	Mulumbi (B)	Combined with site ML-49			Cancelled
MLII-54	Scheme (B)	Combined with site MLII-53			Cancelled

Annex-6 Number of Project Site in Each District

As a result of screening based on the results of the Survey on hydrogeology, geophysics and social conditions implemented under the Preparatory Survey and analysis in Japan, 216 sites will be the Project sites, 75 as alternative sites and 29 sites will be cancelled.

The distribution of sites per District will be proportional to the request from each District.

District	Requested Number (A)	Proportion per District (B)=(A)÷320	Number of Project Sites	Number of Alternative Sites	Number of Cancelled Sites
1) Nchelenge	95	29.7%	64	29	2
2) Mwense	65	20.3%	44	15	6
3) Mansa	90	28.1%	61	18	11
4) Milenge	70	21.9%	47	13	10
Total	320	100.0%	216	75	29
	Number of Sites with Possibility to Develop Groundwater		291		

TECHNICAL NOTES
ON
THE PREPARATORY SURVEY
ON
THE PROJECT FOR GROUNDWATER DEVELOPMENT IN LUAPULA PROVINCE PHASE 2 IN THE REPUBLIC OF ZAMBIA

In response to a request from the Government of the Republic of Zambia, the Government of Japan decided to conduct a Preparatory Survey on the Project for Groundwater Development in Luapula Province Phase 2 in the Republic of Zambia (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") and the Team is carrying out the field survey which will continue until 20 August, 2010.

As a result of the study up to 6 August, 2010, the following points described in the attachment were confirmed between the Team and the officials concerned of the Government of Zambia in addition to the Minutes of Meetings signed on 1 July, 2010.

Lusaka, 6 August, 2010

Shoichi Yokogi
Chief Consultant
Preparatory Survey Team
Japan Techno Co., Ltd.

Peter Lubambo
Director
Department of Housing and
Infrastructure Development (DHID),
Ministry of Local Government and
Housing (MLGH)
The Republic of Zambia

ATTACHMENT

1. Request from the Zambian Side

During the field survey at the target districts, Zambian side requested to replace some of the sites listed in the Minutes of Discussion signed on 1 July, 2010. The main reasons for the request are as follows:

i. Some sites proposed earlier have already boreholes drilled after the District Inventory.

ii. Problem of access road for heavy equipment such as drilling rig and trucks to the drilling point.

The details on the replaced sites are shown in Annex-1.

2. Project Sites

The target area of the Project is the selected villages in the Districts of Nchelenge, Mwense, Mansa and Milenge in Luapula Province.

The Team confirmed and finalized the candidate sites of the Project with the District Authorities in the target districts as per Annex-2.

3. Water Quality in the Project Area

The water quality of the existing water sources was tested in the project area during the field survey. The results of the test revealed low pH(acidic) in the majority of the boreholes and hand dug wells. A high iron content exceeding the guideline value of 1.0mg/l was also identified in many existing water points.

One of the reason that can cause high contents of iron in the pumped water may be related to the type of handpump that was installed. The Team explained to the Zambian side that, recommendations on the type of handpump to be used in the Project shall be given after conclusion of analysis of the data collected during the field survey.

Furthermore, both parties confirmed that measures to treat high level of iron in the groundwater might need to be considered in the Project in order to ensure safe and sustainable water supply.

1

Annex-1 List of Replaced Sites

Nchelenge District

Original requested site				Replaced site				Reason of Replacement
S/N	Site Name	Ward	No. of Borehole	Site No.	Site Name	Ward	No. of Boreholes	
12	Chomba Village	Shabo	1	NCII-12	Chilangoshi (B)	Nchelenge	1	Existing borehole is sufficient
19	Nile Village	Chilongo	1	NCII-19	St. Pauls Hospital (ZEN)	Kashikishi	1	Existing borehole is sufficient
31	Chinyanta Village	Mulwe	1	NCII-31	Nshoka Village	Mulwe	1	Existing borehole is sufficient
86	Kenani Basic School	Kashikishi	1	NCII-86	Lushiba Basic School	Kashikishi	1	Existing borehole is sufficient

Mwense District

Original site				Replaced site				Reason of Replacement
S/N	Site Name	Ward	No. of Borehole	Site No.	Site Name	Ward	No. of Boreholes	
13	Chebele North	Kalanga	1	MWII-13	Chebele East	Kalanga	1	Correction in the name
18	Musangati	Chachacha	1	MWII-18	Anas	Chibalashi	1	Existing borehole is sufficient
20	Chilengwe	Chachacha	1	MWII-20	Chilumbi	Chachacha	1	Existing borehole is sufficient
23	Kateta	Luche	1	MWII-23	James Chiwasa	Nkanga	1	Existing borehole is sufficient
30	Muchinga Village	Musonda	1	MWII-30	Chibunse	Pebekabesa	1	Existing borehole is sufficient
33	Mwashi A	Kalanga	1	MWII-33	Kapakala West	Kasengu	1	Existing borehole is sufficient
34	Mwashi B	Kalanga	1	MWII-34	Munkupa	Nsomfi	1	Existing borehole is sufficient
35	Kamboo	Kalanga	1	MWII-35	Chisheta	Nkonge	1	Existing borehole is sufficient
36	Nonga	Munwa	1	MWII-36	Muntati	Nkanga	1	Existing borehole is sufficient
42	Bulaki	Musonda	1	MWII-42	Mulubika	Nalupembe	1	Existing borehole is sufficient
52	Katuta Turn off	Nalupembe	1	MWII-52	Kambele	Nkonge	1	Existing borehole is sufficient
55	Chishinki B School	Mweshi	1	MWII-55	Loonga	Nkonge	1	Existing borehole is sufficient
63	Kalla Kokoto	Nalupembe	1	MWII-63	Bunda	Nkonge	1	Existing borehole is sufficient

Mansa District

Original site				Replaced site				Reason of Replacement
S/N	Site Name	Ward	No. of Borehole	Site No.	Site Name	Ward	No. of Boreholes	
16	Mwana Chama	Mansa	1	MAII-16	Chitakwa	Mansa	1	Existing borehole is sufficient
17	Chitakwa	Kaole	1	MAII-17	Mwanachama	Kaole	1	Existing borehole is sufficient
18	Mibenge	Kaole	1	MAII-18	Mibenge	Kaole	1	Existing borehole is sufficient
32	Chilumba	Luapula	1	MAII-32	Chabala	Luapula	1	Existing borehole is sufficient
38	Chansa	Mushipashi	1	MAII-38	Chansa(Kalukusha Area)	Mushipashi	1	Existing borehole is sufficient
42	Chibemba	Katangashi	1	MAII-42	Kasoma Village	Katangashi	1	Existing borehole is sufficient
43	Chipense	Lukola	1	MAII-43	Kachepeshi	Lukola	1	Existing borehole is sufficient
60	Kabulaya Musesha Comm. School	Chansunsu	1	MAII-60	Musesha Comm. School	Chibeleka	1	Correction in the name
61	Yasakwa	Chansunsu	1	MAII-61	Yasakwa (Bena Section)	Chansunsu	1	Existing borehole is sufficient
65	Kamipundu Comm. School	Misakalala	1	MAII-65	Kamipundu Comm. School	Kaole	1	Correction in the Ward
82	Kasanda	Lukangaba	1	MAII-82	Kasanda Local Court	Lukangaba	1	Existing borehole is sufficient

Milenge District

Original site				Replaced site				Reason of Replacement
S/N	Site Name	Ward	No. of Borehole	Site No.	Site Name	Ward	No. of Boreholes	
17	Lungu Mukuta & Muke	Nsunga	2	MLII-25	Miyambo Village	Sokontwe	1	No access for drilling rig
				MLII-26	Changwe Lungo Basic School	Mumbotuta	1	
18	Kashila	Nsunga	2	MLII-27	Mumbotuta Basic School	Mumbotuta	1	No access for drilling rig
				MLII-28	Changwe Lungo Village	Mumbotuta	1	
19	Lungu Mukuta Basic School	Nsunga	1	MLII-29	Buyantashi Village	Kapalala	1	No access for drilling rig
20	Lupiya	Nsunga	1	MLII-30	Mulungushi Basic School	Nsaka	1	No access for drilling rig
21	Lupiya Community School	Nsunga	1	MLII-31	Tande Basic School	Mulumbi	1	No access for drilling rig

Annex-2 List of Requested Sites

NCHELENGE DISTRICT

Site No.	Site Name	Ward	No. of Boreholes
NCII-1	Mangamu Basic School	Katofyo	1
NCII-2	Mutono Basic School	Kashikishi	1
NCII-3	Miba Community School	Mwatishi	1
NCII-4	Mweru Basic School	Kashikishi	1
NCII-5	Munsa Basic School	Kabuta	1
NCII-6	Kafutuma Clinic	Mwatishi	1
NCII-7	Kefulwa Clinic	Kabuta	1
NCII-8	Mutono Village (1)	Kashikishi	1
NCII-9	Kandeke Village	Kabuta	1
NCII-10	Chofwe Kabila Village	Mwatishi	1
NCII-11	Chebele Village	Shabo	1
NCII-12	Chilangoshi(B)	Nchelenge	1
NCII-13	Kasalaulo Village	Mofwe	1
NCII-14	Mutampuka Village	Mwatishi	1
NCII-15	Belu Village	Mwatishi	1
NCII-16	Kasonso Village	Katofyo	1
NCII-17	Seketeni Village	Kasamba	1
NCII-18	Chisukulu Village	Nchelenge	1
NCII-19	St. Pauls Hospital(ZEN)	Kashikishi	1
NCII-20	Chishipula Village	Kabuta	1
NCII-21	Chipanta Village	Kabuta	1
NCII-22	Luswili Village	Mofwe	1
NCII-23	Mwanda Village	Katofyo	1
NCII-24	Shimutambala Village	Nchelenge	1
NCII-25	Kanguluma Village	Mofwe	1
NCII-26	Chokolo Village	Nchelenge	1
NCII-27	Holland Village	Mulwe	1
NCII-28	Kapambwe Village	Shabo	1
NCII-29	Musanda Village	Mofwe	1
NCII-30	Mwanamweshi Village	Kashikishi	1
NCII-31	Nshoka Village	Mulwe	1
NCII-32	Shimalita	Kashikishi	1
NCII-33	Mukeya Village	Kabuta	1
NCII-34	Kaseka Village (near Rd)	Nchelenge	1
NCII-35	Kasamba B. School	Mulwe	1
NCII-36	Kanengwa B. School	Mofwe	1
NCII-37	Chofwe Mulenga Village	Mwatishi	1
NCII-38	Block 5	Mwatishi	1
NCII-39	Fwengeni Village	Mwatishi	1
NCII-40	Shikapambwe	Nchelenge	1
NCII-41	Pingwila Village	Chilongo	1
NCII-42	Kabeke Village	Kabuta	1
NCII-43	Kanama Village	Kabuta	1
NCII-44	Shanyemba Village	Shabo	1
NCII-45	Chibwili Village	Shabo	1
NCII-46	Mushingo Village	Shabo	1
NCII-47	Sela Village	Chilongo	1
NCII-48	Chansa Village	Chilongo	1
NCII-49	Nabwendo Village	Chilongo	1
NCII-50	Mutepuka Village	Chilongo	1
NCII-51	Kalwe Comm. School	Mwatishi	1
NCII-52	Kaseketi Village	Kasamba	1
NCII-53	Mushili Village	Kasamba	1
NCII-54	Chapita Village	Kasamba	1
NCII-55	Shimwense Village	Mwatishi	1
NCII-56	Lembati Village	Mwatishi	1
NCII-57	Chinkobwe Village	Mwatishi	1
NCII-58	Chimba Village	Mwatishi	1
NCII-59	Mutabwa Village	Mwatishi	1
NCII-60	Chilamba Village	Munkombwe	1
NCII-61	Munkombwe Village	Munkombwe	1
NCII-62	Chungu Village	Munkombwe	1
NCII-63	Kaputo Village	Munkombwe	1
NCII-64	Mwaba Village	Munkombwe	1
NCII-65	Felushi Village	Kabuta	1
NCII-66	Chomba Village	Kabuta	1
NCII-67	Diamond Village	Kabuta	1
NCII-68	Kaputo Village	Kabuta	1
NCII-69	Kapempe Village	Katofyo	1
NCII-70	Katuna Village	Kashikishi	1
NCII-71	Sonka Village	Kashikishi	1
NCII-72	Mutono Village (2)	Kashikishi	1
NCII-73	Toka Village	Mofwe	1
NCII-74	Chabilikila Village	Shabo	1
NCII-75	Mulonda B. School	Kabuta	1
NCII-76	Mofwe B. School	Mofwe	1
NCII-77	Kambwali Clinic	Kasamba	1
NCII-78	Lukokesha Basic School	Mofwe	1
NCII-79	Kapepele Village	Mofwe	1
NCII-80	Chisambo Village	Mofwe	1
NCII-81	Chiminaula Village	Mwatishi	1
NCII-82	Chikuni Village	Mwatishi	1
NCII-83	Shimpundu Village	Mwatishi	1
NCII-84	Labani Village	Mwatishi	1
NCII-85	Shinjoni Village	Nchelenge	1
NCII-86	Lushiba Basic School	Kashikishi	1
NCII-87	Kanyembo Basic School	Mofwe	1
NCII-88	Kasheta Village	Mwatishi	1
NCII-89	Mukanda Village	Chilongo	1
NCII-90	Chishimba Luwi Village	Kabuta	1
NCII-91	Samashi Village	Kabuta	1
NCII-92	Chile	Kabuta	1
NCII-93	Kabosha Village	Kashikishi	1
NCII-94	Shindoni Village	Kashikishi	1
NCII-95	Kanyembo Clinic	Mofwe	1
Total Number of Boreholes			95

☐ Sites that has been replaced by the District during the site survey.

MWENSE DISTRICT

Site No.	Site Name	Ward	No. of Boreholes
MWII-1	Chitasu	Kaombe	1
MWII-2	Kabengele	Kaombe	1
MWII-3	Chilolo	Nkanga	1
MWII-4	Polo Kankomba Village	Katiti	1
MWII-5	Lubunda Basic School	Katiti	1
MWII-6	Kawama Joe Village	Nkanga	1
MWII-7	Lumfwe Village	Nkaombe	1
MWII-8	Kawama Village	Kasengu	1
MWII-9	Shimaria	Kasengu	1
MWII-10	Mutonta	Katiti	1
MWII-11	Kapamba Basic School	Luche	1
MWII-12	Mporokoso Village	Luche	1
MWII-13	Chebele East	Kalanga	1
MWII-14	Kateule Village	Kasengu	1
MWII-15	Kangomba Community School	Kaombe	1
MWII-16	Kakusa B. Village	Pebekabesa	1
MWII-17	Nyengele	Kattiti	1
MWII-18	Anas	Chibalashi	1
MWII-19	Chembe Community School	Chachacha	1
MWII-20	Chilumbi	Chachacha	1
MWII-21	Kalasa	Kaombe	1
MWII-22	Chansa Village	Kasengu	1
MWII-23	James Chiwasa	Nkanga	1
MWII-24	Chisulo	Katuta	1
MWII-25	Chibondo Basic School	Chibenbe	1
MWII-26	Katebula	Musonda	1
MWII-27	Sichama Community School	Kalanga	1
MWII-28	Losa Mukukuntu	Musonda	1
MWII-29	Mutima	Munwa	1
MWII-30	Chibunse	Pebekabesa	1
MWII-31	Chalata	Lundashi	1
MWII-32	Kafwimbi	Kalanga	1
MWII-33	Kapakala West	Kasengu	1
MWII-34	Munkupa	Nsomfi	1
MWII-35	Chisheta	Nkonge	1
MWII-36	Muntati	Nkanga	1
MWII-37	Mweshi Village	Chibembe	1
MWII-38	Fyansuno	Mpasa	1
MWII-39	Sungubungu	Mpasa	1
MWII-40	Kaoma	Mpasa	1
MWII-41	Chalwe Chiwe	Lundashi	1
MWII-42	Mulubika	Nalupembe	1
MWII-43	Sepe	Musonda	1
MWII-44	Mwense East Farm	Kalanga	1
MWII-45	Kapesha	Mpasa	1
MWII-46	Chibwe Village	Chibalashi	1
MWII-47	Kamami Village	Nkonge	1
MWII-48	Nshi ndano	Nsenga	1
MWII-49	Chipepa	Nsenga	1
MWII-50	Chikubi	Nalupembe	1
MWII-51	Mutipula B. School	Nkonge	1
MWII-52	Kambele	Nkonge	1
MWII-53	Pibelibe	Nsenga	1
MWII-54	Mulunda B. School	Mweshi	1
MWII-55	Loonga	Nkonge	1
MWII-56	Bund Chunsu B School	Chibalashi	1
MWII-57	Kapalaula	Chibalashi	1
MWII-58	Chifuntwe	Mweshi	1
MWII-59	Chilolo	Mweshi	1
MWII-60	Kane	Nkonge	1
MWII-61	Moba	Mumbwe	1
MWII-62	Tambalala	Mumbwe	1
MWII-63	Bunda	Nkonge	1
MWII-64	Lelo	Nalupembe	1
MWII-65	Musango	Nkonge	1
Total Number of Boreholes			65

☐ Sites that has been replaced by the District during the site survey.

MANSA DISTRICT

Site No.	Site Name	Ward	No. of Boreholes
MAII-1	Chitamba Basic School	Mulenshi	1
MAII-2	Lukakula	Mulenshi	1
MAII-3	Mantumbusa	Chilyapa	1
MAII-4	Kasengu	Mushipashi	1
MAII-5	Mwalashi	Mushipashi	1
MAII-6	Filima	Mansa	1
MAII-7	Mutiti	Mansa	1
MAII-8	Kasongo	Muchinka	1
MAII-9	Chikowe	Muchinka	1
MAII-10	Kalibuku	Lukola	1
MAII-11	Lusaya	Lukola	1
MAII-12	Kalimba	Misakalala	1
MAII-13	Kunda Ndomi	Misakalala	1
MAII-14	Kampalala	Misakalala	1
MAII-15	Kakuka	Mushipashi	1
MAII-16	Chitakwa	Mansa	1
MAII-17	Mwanachama	Kaole	1
MAII-18	Mibenge	Kaole	1
MAII-19	kalaba	Myulu	1
MAII-20	Swala	Myulu	1
MAII-21	Chofwe	Kaole	1
MAII-22	Chakaba	Katangashi	1
MAII-23	Kambalikila	Katangashi	1
MAII-24	Musaila Rural Health Centre	Katangashi	1
MAII-25	Kalungushi	Lukangaba	1
MAII-26	Shamende	Lukangaba	1
MAII-27	Kalyondo	Lukangaba	1
MAII-28	Temfwe	Luapula	1
MAII-29	Kapu	Luapula	1
MAII-30	Fipatauko	Chansunsu	1
MAII-31	Kalaba	Chansunsu	1
MAII-32	Chabala	Luapula	1
MAII-33	Shoti (Chansunsu Comm. School)	Chansunsu	1
MAII-34	Kapapa Community School	Lukangaba	1
MAII-35	Chiwele Community School	Chansunsu	1
MAII-36	Kombaniya	Lwingishi	1
MAII-37	Sendapu	Lwingishi	1
MAII-38	Chansa (Kalukusha Area)	Mushipashi	1
MAII-39	Chief Kale Palace	Lwingishi	1
MAII-40	Kapitolo	Katangashi	1
MAII-41	Kabushi	Misakalala	1
MAII-42	Kasoma Village	Katangashi	1
MAII-43	Kachepeshi	Lukola	1
MAII-44	Kaoma	Mutuna	1
MAII-45	Matipa	Mutuna	1
MAII-46	Kosamu	Chibeleka	1
MAII-47	Makunga	Chibeleka	1
MAII-48	Musela	Mutuna	1
MAII-49	Kalasakando Basic School	Chibeleka	1
MAII-50	Kapansa	Mutuna	1
MAII-51	Fibale	Mulenshi	1
MAII-52	Mupofwe Community School	Chansunsu	1
MAII-53	Chisukulo	Lukangaba	1
MAII-54	Eshon and Banda Area	Chansunsu	1
MAII-55	Kalungushi	Mushipashi	1
MAII-56	Katambala	Misakalala	1
MAII-57	Matelo	Mushipashi	1
MAII-58	Kapompole	Kaole	1
MAII-59	Lule	Myulu	1
MAII-60	Musesha Comm. School	Chibeleka	1
MAII-61	Yasakwa (Bena Section)	Chansunsu	1
MAII-62	Chitungula	Mushipashi	1
MAII-63	Mashikolo	Lukangaba	1
MAII-64	Chipungu	Lukangaba	1
MAII-65	Kamipundu Comm. School	Kaole	1
MAII-66	Chisumbu	Misakalala	1
MAII-67	Chief Mabumba Palace	Chansunsu	1
MAII-68	Mushitu Comm. School	Chibeleka	1
MAII-69	Chofoshi	Mansa	1
MAII-70	Kapili	Misakalala	1
MAII-71	Mabumba Market	Chansunsu	1
MAII-72	Nalwamba	Misakalala	1
MAII-73	Chibale Kalaliki	Chansunsu	1
MAII-74	Tubi	Myulu	1
MAII-75	Saili	Kaole	1
MAII-76	Lofoyi	Chibeleka	1
MAII-77	Kalyongo	Chibeleka	1
MAII-78	Chimese Local Court	Kaole	1
MAII-79	Sub Chief Mbao Palace	Chibeleka	1
MAII-80	Luka Ngosa	Chibeleka	1
MAII-81	Chikombola	Lukangaba	1
MAII-82	Kasanda Local Court	Lukangaba	1
MAII-83	Senseleni	Lukangaba	1
MAII-84	Makeleta	Lukangaba	1
MAII-85	Motoka	Lukangaba	1
MAII-86	Kalimwengo	Lukangaba	1
MAII-87	Kapaipi	Lukangaba	1
MAII-88	Mungulube	Lukangaba	1
MAII-89	Chabwe	Lukangaba	1
MAII-90	Kale (Musenga)	Chansunsu	1
Total Number of Boreholes			90

☐ Sites that has been replaced or corrected by the District during the site survey.

MILENGE DISTRICT

Site No.	Site Name	Ward	No. of Boreholes
MLII-1	Garden (A)	Mikula	1
MLII-2	Garden (B)	Mikula	1
MLII-3	Munushi Compound	Mikula	1
MLII-4	Kamupapa	Mikula	1
MLII-5	Kalotoli	Mikula	1
MLII-6	Chisensa	Mikula	1
MLII-7	Sokontwe New	Sokontwe	1
MLII-8	Sokontwe Old	Sokontwe	1
MLII-9	Riverside Comm. School	Sokontwe	1
MLII-10	Musongo	Sokontwe	1
MLII-11	Mwewa	Sokontwe	1
MLII-12	Chilufya Yamwela	Sokontwe	1
MLII-25	Miyambo Village	Sokontwe	1
MLII-13	Chipundu (A)	Chipundu	1
MLII-14	Chipundu (B)	Chipundu	1
MLII-15	Chilufya Kabinda	Chipundu	1
MLII-16	Kaputa (A)	Mumbotuta	1
MLII-17	Kaputa (B)	Mumbotuta	1
MLII-18	Kaputa (C)	Mumbotuta	1
MLII-19	Shitambuli (A)	Mumbotuta	1
MLII-20	Shitambuli (B)	Mumbotuta	1
MLII-21	Shitambuli (C)	Mumbotuta	1
MLII-22	Allan	Mumbotuta	1
MLII-26	Changwe Lungo Basic School	Mumbotuta	1
MLII-27	Mumbotuta Basic School	Mumbotuta	1
MLII-28	Changwe Lungo Village	Mumbotuta	1
MLII-23	Kaloko (A)	Kapalala	1
MLII-24	Kaloko (B)	Kapalala	1
MLII-29	Buyantashi Village	Kapalala	1
MLII-32	Mllulu Health Post	Lusumbwe	1
MLII-33	Musumali	Lusumbwe	1
MLII-34	Mote	Lusumbwe	1
MLII-35	Kalali (A)	Lusumbwe	1
MLII-36	Kalali (B)	Lusumbwe	1
MLII-37	Kabongo (A)	Fibalala	1
MLII-38	Kabongo (B)	Fibalala	1
MLII-39	Chenga (A)	Fibalala	1
MLII-40	Chenga (B)	Fibalala	1
MLII-41	Muyayi	Fibalala	1
MLII-42	Mumanse	Fibalala	1
MLII-43	Vincent	Fibalala	1
MLII-44	Kanono	Fibalala	1
MLII-45	Alas	Nsaka	1
MLII-46	Ngomba	Nsaka	1
MLII-47	Chamakapoli (A)	Nsaka	1
MLII-48	Chamakapoli (B)	Nsaka	1
MLII-30	Mulungushi Basic School	Nsaka	1

Site No.	Site Name	Ward	No. of Boreholes
MLII-31	Tande Basic School	Mulumbi	1
MLII-49	Mulumbi (A)	Mulumbi	1
MLII-50	Mulumbi (B)	Mulumbi	1
MLII-51	Kachenge (A)	Mulumbi	1
MLII-52	Kachenge (B)	Mulumbi	1
MLII-53	Scheme (A)	Mulumbi	1
MLII-54	Scheme (B)	Mulumbi	1
MLII-55	Matontola Basic School	Chiswishi	1
MLII-56	Chandika	Chiswishi	1
MLII-57	Moffat	Chiswishi	1
MLII-58	Kabange Rural Health Post	Chiswishi	1
MLII-59	Kabange	Chiswishi	1
MLII-60	Itemba	Itemba	1
MLII-61	Kabayi	Itemba	1
MLII-62	Chifwalo	Itemba	1
MLII-63	Kakasu	Itemba	1
MLII-64	Itemba Local Court	Itemba	1
MLII-65	Kalubini	Milambo	1
MLII-66	Chabuka Baushi Basic School	Milambo	1
MLII-67	Kapalamuna	Milambo	1
MLII-68	Musongo	Milambo	1
MLII-69	Chibende	Milambo	1
MLII-70	Kalaba Shitembeye Comm. Sch.	Milambo	1
	Total Number of Boreholes		70

☐ Sites that has been replaced by the District during the site survey, due to access problem in the original sites.

Appendix-6 Soft Component(Technical Assistance) Plan

Software-Component Programme Plan

1. Background

This project will be implemented to improve the access rate to stable and safe water by constructing boreholes fitted with handpump in targeting 216 sites in four districts (Nchelenge, Mwense, Mansa, Milenge) in Luapula province in Zambia and strengthening capacity of concerned authorities and communities in operation and maintenance of constructed facilities.

1-1. Basic policy on Operation and Maintenance in RWSS sector

In Zambia, based on the "National Water Policy (established in 1994, revised in 2010), the basic policy for water sector in Zambia, establishment of Community-Based Management has been advocated through community participation to rural water supply and sanitation service.

The strategy and action plan of Water, Sanitation and Hygiene Education (WASHE), which the government introduced into the rural water supply and sanitation sector in 1997, shows the basic strategy and approach for implementation of rural water supply and sanitation programme. It focuses on organising institution as a main actor in the water supply and sanitation programme in the local government and community, and on integration of approaches and methods of capacity building for problem resolution through participatory methods. This method is called "WASHE activities", systematised to some degree, based on the support from donor agencies and on the feedback of lesson learnt from past experiences in the rural water supply and sanitation project with assistance from the donor agencies, and the government of Zambia has encouraged all the projects for improving rural water supply and sanitation to introduce this method, including each target district in the Luapula Province.

In addition, "National Rural Water Supply and Sanitation Programme 2006-2015" (NRWSSP), as a strategy for development of rural water and sanitation sector, lists up the following basic principles in order to secure the sustainable operation and maintenance of rural water supply facilities.

- Cost sharing by beneficiaries: Bearing all the costs of operation and maintenance, cost of 1.5 million kwacha for construction of water supply facilities with borehole fitted with handpump, district government's assistance for rehabilitation of the facilities which exceeds 0.5 million kwacha
- Sustainable supply chain: Service stock of spare parts, setting appropriate price for

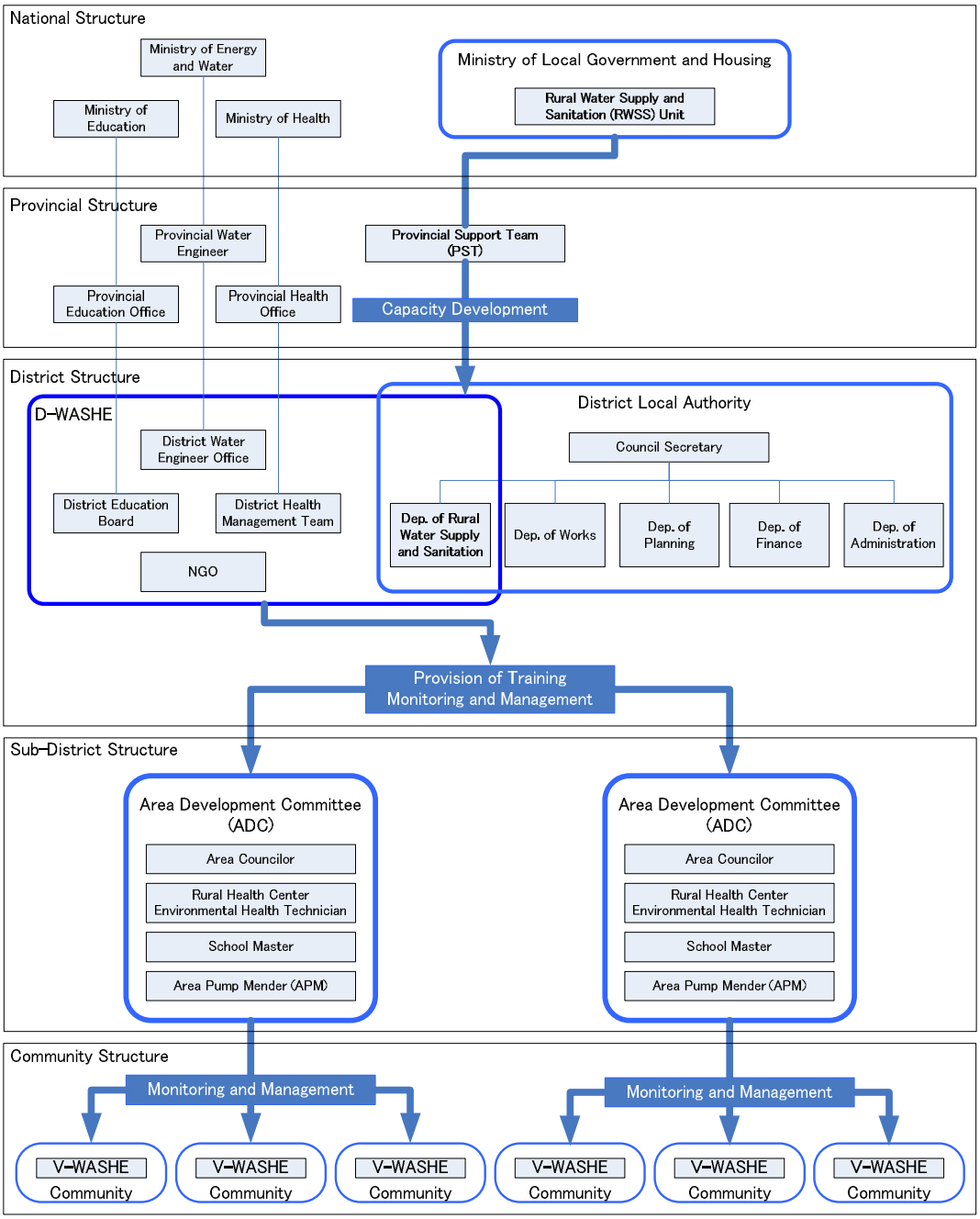
beneficiaries, and establishment of operation system to assure sustainability

- Ownership for operation and maintenance by beneficiaries: Management of water supply facilities by community, delegation of authority to appropriate level in terms of operation and maintenance, participation of all the stakeholders, and equal commitment by each gender
- Selection of appropriate technology: Selection of (handpump) technology depending on hydrogeological hydro geologic condition, capability of cost sharing for initial cost and operation cost, and decay durability of facilities
- Capacity building: Setting the legal policy framework for assisting the community-owned operation and maintenance system, enlightenment activities and community participation promotion, and skill development of stakeholders (local authorities, community) in the aspect of management, finance and technology necessary for maintenance of the water supply facilities

The structure of operation and maintenance in the Project is established on a framework of both community participation and the support service to facilitate it provided by the local authorities (especially district and Ward level), based on the basic policy of Zambia's National Water Policy and NRWSSP.

As it is necessary for establishing such structure to encourage a district authority to enhance capacity building and mobilisation of both the Area Development Committees (ADCs) and the Area Pump Menders (APMs), NRWSSP[1] advocates the multilayered and comprehensive structure of operation and maintenance ranging from district to community level (refer to figure below).

[1] Including the "National Guidelines for Sustainable Operation and Maintenance of Hand Pump in Rural Areas (2007)" and "RWSS O&M Implementation Manual and User Guide (2010)" established under NRWSSP



Organisations and Institutions of Zambia's Rural Water Supply and Sanitation

The Ministry of Local Government and Housing (MLGH) holds administrative responsibilities regarding rural water supply and sanitation promotion services, and the Rural Water Supply and Sanitation Unit of MLGH handles policy planning at national level, policy and technical support to each province and district, and coordination with relevant Ministries and Cooperating Partners. MLGH functions as the responsible agency in the Project on operation and maintenance at national level, while the District Rural Water and Sanitation Plan containing district's action plan of operation and maintenance is prepared and implemented under each district government's responsibilities.

ADCs are formulated at Ward level in each district, which support establishment and implementation of community's development plans and coordinate between a district government and communities. ADCs are mainly composed of traditional local leaders, district ex-officers, Area Pump Menders (APMs), Environment Health Technicians (EHTs), Agriculture Assistant and Community Development Assistant, which are recognized and registered under the district authority[2]. APMs, who are selected from plasterers or bicycle menders in a community, receive technical transfer through trainings of repair works and rehabilitation skills conducted mainly by a district local authority (or through support by Cooperating Partners), and provide fare-paying services of repair works of hand pumps which cannot be handled by a community. On the other hand, V-WASHE Committees, which are formulated at village level as a community-based organisations, take responsibilities for management, and daily operation and maintenance of water supply facility as its owner. The Project formulates the plan of operation and maintenance based on the above structure.

1-2 Issues on operation and maintenance in the target area

Thorough the Preparatory survey, the issues pertaining to water use and operation and maintenance activity in target area were identified as below. In drawing up the Software Component Programme, both appropriate approach and necessary areas of cooperation were examined to address these issues.

(1) The capacity of community in operation and maintenance

V-WASHE committees have been formulated in 171 (53.4%) out of 320 target sites of the Survey, and 120 (55.6%) out of 216 target sites targeted under the Project. However, the members of these committees do not have the systematic knowledge, skill and experience to manage the committees, to promote water supply and sanitation in the village, and to promote operation and maintenance, so the other community members do not understand nor responsibility and role of the members. Although V-WASHE committees established and trained in the Phase I Project are expected to influence these communities by some means, capacity development on the operation and maintenance is required for the communities which have and don't have V-WASHE targeted under this Phase 2 Project since systematic training and capacity development have not been planned and implemented.

[2] ADCs are facilitated to be formulated as a part of capacity strengthening of district government based on the Decentralisation Implementation Plan (2006 – 2010). However, the Plan is not completely institutionalised as it has not received a cabinet approval, but it became an conventionalisation in each district.

Concerning cost sharing for operation and maintenance, it is revealed under the Survey that communities which currently don't have any protected water supply facilities and reserved fund for maintenance do have willingness to pay for the maintenance cost of the borehole fitted with handpump when constructed, however, because of lack of information about expense necessary for maintenance, there are some cases where willingness to pay does not reach the level to cover the necessary expense. Even though community have borehole fitted with hand pump and reserved fund for maintenance cost, they do not set the amount of the reserved fund by calculating the necessary expense.

In terms of maintenance of existing hand pumps, as the community do not have any knowledge and skill for preventive maintenance and repairs, 34% of all hand pumps in target communities under the Survey are not in use and most of them have been left for a considerable period.

As is clear from the present status of the target area, so as to encourage the community members to be proactive in operation and maintenance of the constructed water supply facility, further commitment of 13 WASHE facilitators trained in the phase I project is required not only to organise V-WASHE in the community where not existing, but also, motivate community and pariculary V-WASHE committee to operate and maintain the facilities, and reconfirm the appropriateness and fairness of membership in the community where V-WASHE is formulated. In terms of operation and maintenance, V-WASHE is required to acquire the knowledge and skill for leadership, problem/needs assessment, preparation and implementaton of action plan for problem solution, consensus building within community, organizational management, setting and financial management of maintenance cost, prevention of the water supply facility and handling in failure, and monitoring activity. In addition, it is indispensible to enhance community understandings on significance on payment of water fee for bearing operation and maintenance cost of the supply facilities, through providing community members appropriate information on operation and maintenance in order to recognise necessary cost for them.

(2) Awareness on and Practice related to "Water and Sanitation" of Beneficiaries

Most people in target site obtain domestic water from unsanitary water sources such as river/stream and unprotected shallow well. 93% of target site of Survey have ever held health and sanitation programme on water-born disease provided by Educational Health Technician (EHT) or health worker, however, the condition of health and sanitation is still poor in these sites. Diarrhoea and malaria account for 66% (in dry season) - 88% (in rainy season) out of all disease, only 1.3% of community members have VIP latrine and 77% use traditional latrine there.

For prevention of water-borne disease, they need to improve in consciousness, action and practice of individuals, households and public health such as safety handing of drinking water, food sanitation, promotion of washing hands, appropriate use of latrine, and conservation of environmental sanitation. Moreover raising awareness on health and sanitation can lead to heightening the sense of participation in operation and maintenance of facility and willingness to pay, provision of training and guidance for the communities is required to accelerate undersitandings of appropriate knowledge and sanitary practices on “water and sanitation”.

(3) Lack of human resource with skills and experiences for repairing water supply facility fitted with handpump and iron removal plant

In the communities where existing hand pump are left to be failed, the reason for the situation is in halves both “Try to repair by community themselves but failed” and “Asked private plumber for repair works and still waiting”. In the target sites of the project, lack of human resources that can provide technical support and guidance for the communities in daily preventive maintenance and repair work is one of major issues in operation and maintenance. Targeting care takers in the community, phase I Project provided training on repair work and daily preventive maintenance of facility in range that community can handle, while APMs, who were selected from plasterers or menders of bicycles in a community, received technical transfer through provision of trainings and tool kit for repair work. As a result, one trained APM is deployed in each Ward, being able to provide repair work that community can not manage, Afterwards, since another APM was trained and allocated through districts’ own effort or assistance of Cooperating Partners, there are two APMs in each Ward in Mwense and Milenge district. On the other hand, Mansa and Nchelenge district, where still one APM is deployed in each ward, is considering to add another APM in each Ward to satisfy the needs.

In the software component programme, operation and maintenance system in community level will be organized by utilizing trained APMs mentioned above. In Mansa and Nchelenge district, considering geographical range and number of borehole fitted with hand pump which is to be increased in this project, it is required to train and allocate another APM to cope with increasing number of these new facilities. Moreover, in Milenge and Mwense district where two APMs are allocated in each Ward, these APMS except for trained in phase I project,don’t have repair skills,and knowledge in operation and maintenance for Afridev hand pump as well as iron removal plant which is to be introduced under the Project, so that provision of training on these newly introduced facilities is essential for them.

2. Objectives and Approach

The project objective is to realize sustainable supply of safe and stable water from borehole fitted with hand pumps which are to be constructed in the target communities. Aiming at encouraging the establishment of community-based operation and maintenance system as a basis of project objective, software component is to be implemented for early realisation of expected effect of this project. In the target communities, V-WASHE which operates and maintains the facility in a participatory manner in the village will be organized or reorganized, capacity development of V-WASHE on systematic knowledge and technique on operation and maintenance, and management of organization will be encouraged.

In addition, in order to establish Community-Based-Management, administrative supports by district authority especially District RWSS Unit, which takes administrative responsibility in planning and implementation of rural water supply and sanitation project within the district, and its technical advisory committee "D-WASHE" is indispensable. The supports include provision of trainin/retraining and guidance for APMs and WASHE facilitators, monitoring and follow-up activities. In Zambia, multilayered operation and maintenance structure has been introduced which means that trained APMs and WASHE facilitators repair and maintain the hand pump which can't be handled by community, and enhance formulation and capacity development of V-WASHE committee to operate and maintain the facility. By utilizing district authority officers, as well as APMs and WASHE facilitators trained in phase I project effectively, this component aims at establishing their knowledge and technique firmly, and further enhancing the outputs produced in phase I project. In order to achieve this, by sharing the lesson and knowledge learnt from the activities of phase I project, and through the problem findings and analysis, the project will confirm the needs of retraining and provide if necessary. Under the consideration of geographical range and number of borehole fitted with hand pump, new APMs will be trained and allocated where it is required.

3. Output of Software-Component Programme

The direct effects of outputs anticipated through the realisation of the Software-Component Programme are explained below.

Output 1

The skills and knowledge of the human resources at the District and Ward are improved and firmly established for capacity development and facilitation of hygiene education required to improve water supply and create an appropriate operation and maintenance system with communities' initiative.

Output2
The system of monitoring and evaluation for water supply and sanitation improvement programme at District and Ward level is improved

4. The way to verify achieved output

Indicator to verify outputs above and the way of evaluation are explained below

(1) The skills and knowledge of the human resources at the district and sub-district are improved and firmly established for capacity building and facilitation of hygiene education required to improve water supply and create an appropriate operation and maintenance system with communities' initiative.

【Indicator 1-1】
Regarding issues on the capacity development, based on the activities of phase I project, D-WASHE trainers, WASHE facilitators and Area Pump Menders who received retraining on the skills necessary for proper operation and maintenance of water supply facilities will be re allocated in the district. Also new APMs will be trained and be allocated.

① D-WASHE trainers
District trainers appointed from district RWSS unit or D-WASHE (three staff in each district) are provided with re-training, of which contents are developed by identification of training need through problem findings and analysis in provided skills under Phase 1 in installation and repair of hand pump and facilitation of community awareness for their roles and responsibilities, as well as measures to train APMs. The examination to verify the achievement is held and evaluated in completion of the training. Also through On-the-Job Training such as actual field training of the APMs, the achievement in acquisition of skills is verified and ensured.

② APM
New APM is appointed from each ADC, considering the geographical and social situation of the target area. Through skill examination, On-the-Job Training in hand pump construction and monitoring and in the training of hand pump caretakers, APM is also evaluated.

③ WASHE facilitators
Reflecting the activities in phase I project, problem findings and analysis on sensitization of community is made, and necessary training on the identified needs will be provided. The

achievement in acquisition of necessary skills of WASHE facilitator is verified through the process of instructing communities in target sites about planning, operation, maintenance, monitoring and hygiene education with participation of community members.

【Indicator 1-2】

V-WASHE is formed in every target community through the promotion activity by WASHE facilitators.

Prior to the commencement of the construction works, V-WASHEs are required to be organised at the 216 target communities with facilitation by the WASHE facilitators. In the villages where V-WASHEs are organised, the project reorganises V-WASHEs in case of necessity determined by consultation with community members, with attention to balance of members and performance of activity. In the organisation and training of V-WASHEs, attention is to be paid at the verification of achievement of this indicator whether the methodologies to promote the discussions and time for the community meetings are decided to facilitate women's participation and contribution of their opinions in actual decision making.

【Indicator 1-3】

Through instruction from WASHE facilitators and APM, V-WASHE at every target community achieves skills for maintenance of water supply facility and for hygiene promotion.

① Operation and maintenance skill

Skills to be equipped to the V-WASHEs for operation and maintenance are categorized into the technical issues such as preventive maintenance, replacement of the consumables, and measures to protect environmental sanitation around the water point and the management issues related to action planning for maintenance activities, provision of advices to the users on proper use of water facility, collection and management of the maintenance fund, and access to the support services of the D- WASHE and Sub-WASHE. Also skills for operation and maintenance of the iron removal plant especially cleaning of filter are necessary where it is settled.

These issues are to be dealt in training of WASHE facilitators and APM, and to be reflected in the V-WASHE action plans. Moreover, it is verified the understanding of maintenance cost and cooperation with APM, status of record of maintenance cost and management of water supply facilities.

② Hygiene promotion method

To enhance health and sanitation aspect by use of safe and sustainable water from borehole water supply facilities, it is indispensable for users to acquire appropriate knowledge about sanitation, to translate it to action and to make it a habit. Thus training for V-WASHE about the methods of participatory activities for sanitation improvement is to be organised to keep promoting activities for sanitation improvement at village level. It is to be verified through monitoring that after completion of training, V-WASHE conduct the activities for sanitation improvement in cooperation with Environmental Health Technicians, Community Health Committees and birth attendants by utilising the achieved knowledge and methods. In those activities PHAST (Participatory Health and Sanitation Transformation), which is the method in the field of rural water supply and sanitation in Zambia, is utilised to promote improvement of sanitation at the level of individuals, households and publics. In the village with large-size domestic livestock, it is verified to build the fences with the expense of community to reserve sanitation environment around the water source.

(2) The system of monitoring and evaluation for water supply and sanitation improvement programme at district and sub-district level is improved.

【Indicator2-1】

The results of monitoring on water and sanitation improvement activities at the village level will be recorded and accumulated by sub-district and district.

At the commencement of the project goals to be achieved in each activity under the Software-Component Programme as well as the objective and outputs of the project will be shared by the D-WASHE and ADC (WASHE facilitators and APM). Further, the plans for monitoring and evaluation will be formulated by these parties to measure the implementation process, achievements and impacts of the interventions. Each actor will conduct the monitoring activities based on this monitoring and evaluation plan by utilising the monitoring forms to be elaborated by theme in the project. Therefore, results of these monitoring activities filled in the forms are to be periodically collected and filed at the sub-district and district.

【Indicator2-2】

WASHE annual action plans in each target district are updated by reflecting upon the monitoring results.

Each district reviews implementation status of annual water and sanitation activities at the end of fiscal year, and formulates implementation plan of the activities for the next year as WASHE annual action plans. As the monitoring results of implementation status of the activities are

considered as the water and sanitation activities of each district, the district government and D-WASHE are to review the monitoring results of implementation status of the activities through ① mentioned above, and WASHE annual action plans are to introduce the necessary follow-up activities.

5. Intervention (Inputs) Plan

Comparison list between the outputs of Software-Component and the group of activities is shown below. The contents of the activities are shown in the Appendix 1.

Comparison List Between the Outputs and Activities

Outputs	Activities	Stages
Output 1	1. Review of existing WASHE manuals, consultation with MLGH, and revision of the documents with reference to RWSS O&M Implementation manual & user guide	Shortly after the start of the project
	2. Project orientation and preparation of detail implementation plan of activities at the district level	After the end of activity 1
	3. Strengthening capacity of WASHE facilitators at sub-district level in facilitation of participatory operation and maintenance of water supply facility and hygiene promotion activities	
	3-1. Problem finding and analysis of WASHE activities in the Phase 1, establishment of plan of refresher training of WASHE facilitators and action plan	After the end of activity 2
	3-2. Assistance of WASHE facilitators in implementation of WASHE activities at the target sites	
	1) Sensitising the community leaders in the roles and responsibilities in the rural water supply and sanitation projects and briefing of the project	After the end of activity 3-1
	2) Project orientation at the village level	After the end of activity 3-2.1)
	3) Situation analysis on present water supply & sanitation environment and pre-sitting for the planed water supply facility	After the end of activity 3-2.2)
	4) Formation/ re-activation of V-WASHE and signing a memorandum of understanding regarding project implementation	After the end of activity 3-2.3)
	5) Training of V-WASHEs on their roles and responsibilities and implementation of hygiene promotion activities	After the end of activity 3-2.4)
	6) Training of caretakers in management of hygiene conditions of the water points (To be conducted together with Activity 4-3.2))	After completion of installation of handpump
	7) Follow up of progress of the activities to be conducted by V-WASHE and utilisation status of the constructed facilities, implementation of additional training	After handover of the facility at target district
	4. Capacity building in operation and maintenance of hand pump	
	4-1. Training of District Trainers responsible for capacity building of APMs (including training in operation and maintenance of iron removable plant)	1-2 months before the start of construction at target district
	4-2. Training of APMs in skills in repair and maintenance of hand pumps and Iron Removal Plant	After the end of activity 4-1.
	4-3. On the Job Training of APMs	

	1) Technical training through involvement in installation of hand pump during the construction works	During installation of handpump
	2) Training of caretakers in daily operation and maintenance of hand pump	After completion of installation of handpump
	3) Training of V-WASHEs (including caretakers) in maintenance methods of Iron Removal Plant	After installation of the iron removal plant
Output 2	5. Review of progress of the activities and evaluation of achievement of the programme and action planning for O&M of the constructed facilities	
	5-1. Monitoring of Software-Component Programme activities【Cost Borne by Zambian Side】	With Activity 3-2, 4-3
	5-2. Review on progress of activities, evaluation of results of outputs and establishing the action plan on maintenance【Cost Borne by Zambian Side】	At the end of every year

The project considered on the point shown below in establishing implementation plan.

(1) Ensuring consistency with upper level plan

The contents of assistance is considered, particularly, with attention to the consistency with the approaches noted in NRWSSP and "RWSS O&M Implementation Manual and User Guide 2010", and based on the framework for the system of operation and maintenance of rural water supply facilities. In the training plan of capacity development of each actor in charge of operation and maintenance activities, the project established the action plan based on SOMAP guideline, the other guidelines which are normally referred, WASHE activity manual, and the experience of the similar activities implemented, in particular of Phase 1 project.

(2) Utilizing human resources trained in phase I project

The actors in charge of implementing Software-Component Programme at villages level WASHE facilitators and APMs trained by district RWSS Unit and/or D-WASHE. Under the technical assistance by local consultant / NGO, the personnel of RWSS Unit and WASHE facilitators trained in phase I project will receive necessary re-training, based on the identified re-training needs. The contents of retraining will be established by reflecting the result of problem findings and analysis of phase I project by participants. Also in order to promote firm establishement of aquired skills and knowledge at district and sub-district level, the project will provide activites and OJT opportunities for communty sensitizing, organising V-WASHE, hygiene promotion, and training community members on operation and maintenance. Moreover, the project is planned to streamline the activities in terms of minimizing the number of new trainees and required days by leveraging human resources who received training in phase I project.

In the target sites, trainers from local consultant / NGO will accompany with trainees to 70% of the target community, implementing facilitation and training of activities, and through the activities status of achieving skills of WASHE facilitators and APM will be verified and they

will be offered the advice and training for improvement. Thus at not less than 2 sites per a personnel the project is able to verify the status of achieving the skills for facilitation and training, it is useful to verify the effects of training and status of achieving the output.

6. The way to procure the resource for implementation

Information of distribution of expected personnel for implementation is shown below.

List of distribution of personnel for Software-Component Programme

Personnel		No.	Activities in charge
Japanese consultant	O&M / public health	1	Planning of Software-Component Programme General supervision of implementation plan and the programme Skill training for implementing agency and local consultant / NGO Contact and report to client and Japanese organisation Consultation and coordination with each actor in the programme Coordination with construction plan Supervision of activities in cooperation with personnel in charge of training for maintenance of iron removal device He/She is to have work experience in the field of social development.
Local consultants / NGO	Programme director	1	General management of the activities in commission of Software-Component Programme Management of input, method, output and progress of each activities Report of activities to implementing agency and Japanese consultant He/She is to have work experience as programme director in similar project.
	Social development expert	1	Assistant to programme director Establishment of implementation plan of capacity development of community organisation based on WASHE concept and hygiene promotion Development of manuals Training of WASHE facilitators He/She is to have work experience in similar project and also knowledge of method of participatory planning, monitoring and evaluation, participatory hygiene promotion, and operation and financial management of community organisation.
	Facilitator (participatory water supply and sanitation)	4	Training skills necessary in installation and rehabilitation, operation and maintenance of water supply facilities with borehole with handpump to D-WASHE trainers and APM On-the-Job Training of WASHE facilitators and APM in the activities of mobilising of community and strengthening of V-WASHE He/She is to have work experience especially in the training of operation and maintenance of water supply facilities with borehole with handpump
Implementing agency	Project manager	1	Distributed from implementing agency as a counterpart of the project Supervision of activities in cooperation with Japanese consultant and local consultant / NGO Coordination and request of cooperation with local government of target district, and other relating ministries and donors on rural water and sanitation project

District government	Water supply and sanitation	1 for each district	Distributed as a contact person for the project at district level by each district government The present district government has no staff belong exclusively for water supply and sanitation division, so planning division or public works division is now in charge of coordination with WASHE activities. Each district selects him/her with consultation with D-WASHE
WASHE facilitator, APM			Activities at village level in cooperation with local consultant / NGO

7. Implementation plan of the Software-Component Programme

The Implementation plan of the Software-Component Programme is listed as Appendix 2.

8. Output goods

Main output goods from the activities are shown below.

① Completion report of Software-Component Programme
② Revised maintenance manual of water supply facilities with handpump (for APM and V-WASHE)
③ Revised maintenance manual of iron removal device
④ Training manual of capacity development of operation and maintenance by V-WASHE
⑤ Report of activities by WASHE facilitators
⑥ V-WASHE action plan

9. Responsibility of Implementing Agency

In this Software-Component Programme the cost borne either Zambia or Japan is arranged as below. As the district has large limitation in its financial resources, implementing agency is required to utilise basket fund effectively which is introduced in rural water supply and sanitation sector, and to support expense cost borne by Zambian side necessary for project implementation at target district.

List of division of burden of expense between Zambia and Japan

Activity	Japanese burden	Zambian burden
1. Review of existing WASHE manuals, consultation with MLGH, and revision of the documents with reference to RWSS O&M Implementation manual & user guide	・Remuneration of local consultant / NGO, vehicle cost ・Manual development cost	・Remuneration of MLGH-RWSS Unit and staffs from related office
2. Project orientation and preparation of detail implementation plan of activities at the district level	・Remuneration of local consultant / NGO, vehicle cost ・Transportation fee for D-WASHE ・Holding cost of workshop ・Photocopying and stationery cost	・Remuneration of staff from provincial office of implementing agency ・Remuneration of D-WASHE

3. Strengthening capacity of WASHE facilitators at sub-district level in facilitation of participatory operation and maintenance of water supply facility and hygiene promotion activities		
3-1. Problem finding and analysis of WASHE activities in the Phase 1, establishment of plan of refresher training of WASHE facilitators and action plan	・Remuneration of local consultant / NGO, vehicle cost ・Transportation fee for participants ・Holding cost of workshop ・Photocopying and stationery cost	・Remuneration of D-WASHE trainer ・Remuneration of Participants (WASHE facilitators)
3-2. Assistance of WASHE facilitators in implementation of WASHE activities at the target sites		
1) Sensitising the community leaders in the roles and responsibilities in the rural water supply and sanitation projects and briefing of the project	・Remuneration of local consultant / NGO, vehicle cost ・Photocopying and stationery cost 【148 target sites of OJT accompanied with local consultant / NGO out of 216 sites】 ・Remuneration of local consultant / NGO, vehicle cost ・Photocopying and stationery cost 【Remaining 68 sites】 ・Fuel fee for the vehicle of D-WASHE	・Remuneration of D-WASHE and WASHE facilitators 【148 target sites of OJT accompanied with local consultant / NGO out of 216 sites】 ・Remuneration of D-WASHE trainer 【Remaining 68 sites】 ・Remuneration of WASHE facilitator and D-WASHE trainer ・Distribution of existing vehicle within district (support for facilitator by D-WASHE)
2) Project orientation at the village level		
3) Situation analysis on present water supply & sanitation environment and pre-sitting for the planed water supply facility		
4) Formation/ re-activation of V-WASHE and signing a memorandum of understanding regarding project implementation		
5) Training of V-WASHEs on their roles and responsibilities and implementation of hygiene promotion activities		
6) Training of caretakers in management of hygiene conditions of the water points (To be conducted together with Activity 4-3.2))		
7) Follow up of progress of the activities to be conducted by V-WASHE and utilisation status of the constructed facilities, implementation of additional training	None	【216 target sites and alternative sites】 ・Remuneration of WASHE facilitators and D-WASHE trainer ・Distribution of existing vehicle within district (support for facilitator by D-WASHE) ・Fuel fee for vehicle
4. Capacity building in operation and maintenance of handpump		
4-1. Training of District Trainers responsible for capacity building of APMs (including training in operation and maintenance of iron removable plant)	・Remuneration of local consultant / NGO, vehicle cost ・Transportation fee for participants ・Holding cost of workshop ・Photocopying and stationery cost ・Tool for maintenance	・Remuneration of D-WASHE trainer
4-2. Training of APMs in skills in repair and maintenance of handpumps and Iron Removal Plant	・Remuneration of local consultant / NGO, vehicle cost ・Transportation fee for participants ・Holding cost of workshop ・Photocopying and stationery cost	・Remuneration of D-WASHE trainer
4-3. On the Job Training of APMs		

1) Technical training through involvement in installation of handpump during the construction works	【216 sites with successful borehole】 ・Remuneration of APM ・Photocopying cost	-
2) Training of caretakers in daily operation and maintenance of handpump	【216 sites with successful borehole】 ・Remuneration of local consultant / NGO, vehicle cost ・Remuneration of APM ・Photocopying and stationery cost	【Same as on the left】 ・Remuneration of WASHE facilitator
3) Training of V-WASHEs (including caretakers) in maintenance methods of Iron Removal Plant	【39 sites with iron removal device】 ・Remuneration of local consultant / NGO, vehicle cost ・Remuneration of APM ・Photocopying cost	【Same as on the left】 ・Remuneration of WASHE facilitator
5. Review of progress of the activities and evaluation of achievement of the programme and action planning for O&M of the constructed facilities		-
5-1. Monitoring of Software-Component Programme activities【Cost Borne by Zambian Side】	None	・Remuneration of D-WASHE ・Distribution of existing vehicle within district ・Fuel fee for vehicle
5-2. Review on progress of activities, evaluation of results of outputs and establishing the action plan on maintenance【Cost Borne by Zambian Side】	None	・Remuneration of D-WASHE ・Holding cost of workshop ・Stationery and report cost

- Implementation of Activity 3-2.1) - 5) at 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, district authority takes responsibilities in project orientation to community members at the alternative site, organising V-WASHE, and cost sharing necessary for implementation of training.

- Implementation of additional training 【Activity 3-2.(7)】 for V-WASHE at target and alternative sites

  When it is acknowledged that additional capacity development for operation and maintenance by V-WASHE and community according to monitoring and review of activities mentioned below, the district and D-WASHE establish plan for additional training and implement the activity at the expense of Zambian side.

- Monitoring of activities by district / D-WASHE (2 days per month per district)

  The district and D-WASHE manage the activities at village level implemented by ADC (WASHE facilitators) and APM through the report of activities submitted from these personnel. In addition, as a part of the regular monitoring by D-WASHE, the district and D-WASHE add the target sites to regular site visited, and verify the progress of activities and skill settlement of WASHE facilitators and APM. As it is impossible to visit all the V-WASHE in the district with protected water source every month, they visit sample

village randomised every month.

In the monitoring they are to use checklist based on monitoring and evaluation plan established at the beginning of Software-Component Programme, and to verify whether each activity implements appropriately and comes to realise outputs. D-WASHE writes up the results from these monitoring into reports, and submits to project manager from implementing agency. Also D-WASHE utilises the results as primary source for consultation in the workshop (Activity 5-2) for review of activities and evaluation.

On the site where the water supply facility is in service, the district and D-WASHE monitor status of use of the facility by community members and that of maintenance by V-WASHE. As follow-up of the water supply facilities after in service is beyond the Japanese cooperation, it is expected to implement the activities shown below at the expense of Zambian side.

- ☐ Continuing promotion activities for use of water supply facilities, hygiene promotion, and improvement of sanitation facilities
- ☐ Verifying and direction of implementation of daily maintenance check work by caretakers
- ☐ Verifying and direction of implementation of meeting of V-WASHE, status of reserve and management of the cost for operation and maintenance
- ☐ Verifying the progress of coordination between V-WASHE and other actors (village head, health committee, birth attendants, ADC, and district / D-WASHE)
- ☐ Verifying status of appropriate use and maintenance of the device, and status and purpose of use of alternative water source in the target sites with iron removal device
- ☐ Establishing action plan and promoting follow-up activities, and feedback to the project through report to the implementing agency (will be used for improvement of activities in other district), about problems and countermeasure identified from the point mentioned above

- Establishment of action plan for review of progress of activities, evaluation of achieved outputs, and maintenance

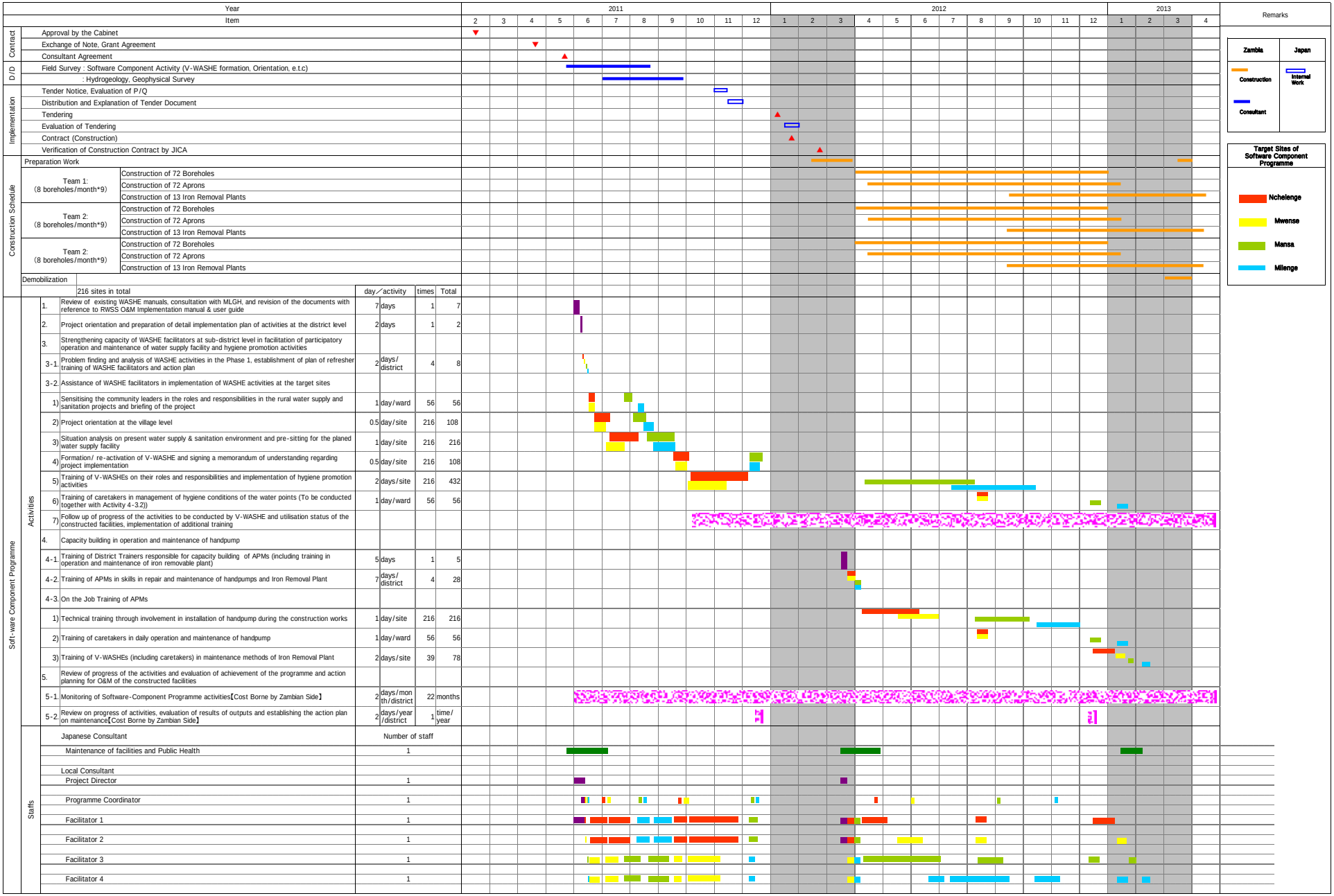
  Under NRWSSP the implementing agency certifies the WASHE annual action plan established by each district, and then ministry of finance distribute budget for implementation of the rural water and sanitation project to district government. In the establishment of the action plan, each district analyse the present status of water supply and sanitation, reviews all the ongoing projects for water supply and sanitation, and verifies project plan to be implemented by district next year based on action plans at each level

established by V-WASHE and ADC. Therefore, the project by Japanese cooperation needs to review under the process mentioned above in each district, to evaluate achieved outputs, and to reflect necessary follow-up activities by district to the action plan.

The Project for Groundwater Development in Luapula Province Phase 2
Summary of Software Component Activities

Activities	Target Group	Responsible Person/ Organisation	Method of Activity	Venue	Required Period (Approx.)	Total Period		Expected Output from the Activity	Guidelines, Manuals, Reports to be Prepared in the Activity
						Time	Total No. of Days		
1 Review of existing WASHE manuals, consultation with MLGH, and revision of the documents with reference to RWSS O&M Implementation manual & user guide	MLGH-RWSSU, PLGO,PST,DWA, Ministry of Health	Japanese Consultant, Local Consultant/ NGO	Discussion with implementation agency, (Japanese consultant provides technical support for the Consultant/ NGO), Confirmation on needs for trainings based on the field visit to the sites of Phase 1, decision of the contents of the trainings, review of the exsiting guidelines and manuals prepared in the Phase 1	Lusaka, Mansa	7 days	1	7	- Guidelines and manuals prepared in the Phase 1 are reviewed through verification of RWSS O&M Implementation Manual & User Guide established as a part of NRWSSP. Especially, based on lessons learnt in the Phase 1, training methods of maintenance of water supply facilty including Iron Removal Plant must be improved. - Implementation plan of the WASHE activities is agreed with the implementing agency. - RWSS O&M Implementation manual & User Guide, 2010, MLGH and the manual which was finalised through the WASHE activities of phase I project are reviewed. - Based on the result of review, manuals and guidelines on field activities to be conducted by the extension staff at the sub-district level are revised. - Draft monitoring and evaluation plan of activities is formulated.	Drafts of revised outputs prepared in the Phase 1 - Implementation guideline of WASHE Activities - M&E plan - Training manuals for V-WASHE and visual aids, which are to cover the following issues; * Formation/ reactivation of V-WASHE * Participatory problem analysis and action planning * PHAST method and tools * Operation and maintenance of borehole with handpump * Operation and maintenance of iron removal plant * Financial management for O&M * Leadership skills and conflict resolution
2 Project orientation and preparation of detail implementation plan of activities at the district level	Representatives of D-WASHEs in 4 districts (including RWSSU or FPP) [approx. 2 participants/ district:8 persons in total]	PLGO and/or PST, Japanese Consultant, Local Consultant/ NGO	Workshop with participation of representatives of all the 4 target districts (Japanese consultant provides technical support for the Consultant/ NGO and D-WASHE)	Mansa	2 days	1	2	- Implementation plan of the project and WASHE activity are agreed among the D-WASHEs. - Problem finding and analysis are made for the WASHE activities in the Phase 1. - Based on the revised implementation guidelines, monitoring & evaluation plans parepared in Activity 1, and the result of problem findings above, the action plans of each district are finalised.	- Implementation guidelines and monitoring & evaluation plans of the WASHE activity to agreed with districts - Action Plans of each district - Workshop Report
3 Strengthening capacity of WASHE facilitators at sub-district level in facilitation of participatory operation and maintenance of water supply facility and hygiene promotion activities									
3-1 - Problem finding and analysis of WASHE activities in the Phase 1, establishment of plan of refresher training of WASHE facilitators and action plan	WASHE facilitators who were trained in the Phase 1 and conduct activities in the target areas of the Phase 2 (Area Development Committee members (e.g. Environmental Health Technician, School Teachers) [Approx. 1 participant/ ward: 56 persons in total]	Local Consultant/NGO, D-WASHE participated in Activity 2	Workshop (lectures, role plays and field practices)	Each district	3 days / district	4	12	- (Refresher) Training needs are verified through problem finding and analysis of community sensitisation activities, formulation of V-WASHEs and hygiene promotion activities. - Facilitation skills in community sensitisation activities, assisting formulation of V-WASHEs and their trainings, and hygiene promotion activities are equipped with WASHE facilitators with a purpose of improvements in water supply and sanitation conditions based on the verified (refresher) training needs. - Implementation plans for activities (Activity 3-2. 1)-7)) at the village level are established.	- Workshop reports - Implementation plans of activities established by the participants
3-2 Assistance of WASHE facilitators in implementation of WASHE activities at the target sites									
1) Sensitising the community leaders in the roles and responsibilities in the rural water supply and sanitation projects and briefing of the project	Representatives of the villages which covers the target sites (village heads, members of village development committee), traditional leaders, councilors	Local Consultant/NGO, Facilitators trained in Activity 3-1	Meeting	Centre point of the Ward which covers the target sites	1 day / Ward	56	56	- The community leaders' understandings of NRWSSP, project purpose, and implementation plan are facilitated. - Consensus formulation in the community leaders' roles and responsibilities of WASHE activities at the village level is facilitated. - Representatives' understandings are facilitated in order to promote participations of women in activities at the village level. - Rapport with the community leaders is initiated.	- Field reports to be prepared by the WASHE facilitators
2) Project orientation at village level	Community members in the target sites	ditto	Meeting targeted for whole community members. Utilisation of visual aids and facilitation of understanding of community members. If the target site is a school or PHC, participation of community members around the	Each target site	0.5 day / site	216	108	- Understanding of project purpose, implementation plan and responsibilities of the community members is facilitated.	ditto
3) Situation analysis on present water supply & sanitation environment and pre-sitting for the planed water supply facility	Community members in the target sites	ditto	Field study in the village, workshop utilising group works and discussions	ditto	0.5 day / site	216	108	- Consensus on the desirable points for the community members in constructing water supply facility in accordance with social conditions of the target sites is formulated.	- Field reports to be prepared by the WASHE facilitators - Maps of community which describes existing water supply and sanitation environment and nominated points for the facilities
4) Formation/ re-activation of V-WASHE and signing a memorandum of understanding regarding project implementation	Community members in the target sites	ditto	Meeting targeted for whole community members.	ditto	0.5 day / site	216	108	- V-WASHEs are formed or reactivated in the sites where the agreements on villages' responsibilities discussed in the Activity 3-2. 1) are confirmed. - Responsibilities and roles of community leaders confirmed in the Activity 3-2 1) are agreed by village members	- Field reports to be prepared by the WASHE facilitators - Member lists of V-WASHEs - Contracts of Operation of V-WASHEs - Memorandum of understanding on maintenance signed by the target communities
5) Training of V-WASHEs on their roles and responsibilities and implementation of hygiene promotion activities	V-WASHE including caretakers (approx. 10 members/committee)	ditto	Workshop utilising group works and discussions and workshop for V-WASHE (1.5 days) Meeting targeted for whole community member (0.5 day) for presentations and agreements on the V-WASHE action plan	ditto	2 days / site	216	432	- Understanding on functions of V-WASHE, roles and responsibilities of each member, and points of considerations in operation and maintenance is facilitated. - Methods of promotion of imrovements in hygiene awareness, behaviours and practices are trained. - Cooperation is formulated with NHC and TBA, who act in the same area for health and hygiene promotion. - V-WASHE action plan is formulated for OM activities.	- Field reports to be prepared by the WASHE facilitators - V-WASHE action plans for O&M
6) Training of caretakers in management of hygiene conditions of the water points (To be conducted together with Activity 4-3.2))	Caretakers in the target sites (2 persons/ site)	ditto	Orientations, discussions and field works utilising the maintenance manual	Centre points of Ward	1 day / Ward	56	56	- Understanding of caretakers is facilitated on methods of improving management of environmental sanitation at the surroundings of water supply facilities - Caretakers achieve skills for promotion and training for the community members on appropriate use of the	- Field reports to be prepared by the WASHE facilitators
7) Follow up of progress of the activities to be conducted by V-WASHE and utilisation status of the constructed facilities, implementation of additional training	V-WASHE	D-WASHE, WHASE facilitators (Cost borne by Zambian Side)	Lectures and field practices on site	Centre points of districts, each target site	/			- Settlement and strengthening of capacity of V-WASHE on operation and maintenance	- Field reports to be prepared by the WASHE facilitators and D-WASHE
4 Capacity building in operation and maintenance of handpump									
4-1 Training of District Trainers responsible for capacity building of APMs (including training in operation and maintenance of iron removable plant)	3 participants each from D-WASHE (who were trained in the Phase 1) in the 4 districts: total 12 participants	Local Consultant/NGO, Provincial Trainers such as staffs from MLGH	Workshop (lectures, field practices and skill tests for verification of learning status) : 2 days Field practice to the Phase 1 site where the Iron Removal Plant is introduced : 5 days	Mansa	7 days / Workshop	1	7	- (Refresher) Training needs are verified through reflection of trainings and instructions of APMS in the Phase 1 and status of their follow-ups, problem finding and analysis. - Based on the (refresher) training needs, instruction methods of handpump installation, repair and maintenance are verified and improved. - Instruction methods of maintenance of Iron Removal Plants are equipped among the participants. - Necessary revision is made to the manuals for APMs and caretakers based on the situation of its utilisation.	- Workshop report - Revised training manuals for APM & caretakers - Plan of training of APMs to be prepared by the participants - Results of test which is to be done for the participants to check understanding of what they learn in the training
4-2 Training of APMs in skills in repair and maintenance of handpumps and Iron Removal Plant	APMs from each Ward (Approx. 14 participants each in 4 districts: total 56 participants)	Local Consultant/ NGO, D-WASHE trainer participated in Activity 4-1	Workshop (lectures, field practices and skill tests for verification of learning status) : 2 days Field practice to the Phase 1 site where the Iron Removal Plant is introduced : 5 days	Each district	7 days / district	4	28	- Repair of handpumps, improvements in understanding of APMs' roles and responsibilities regarding maintenance, and necessary skills are facilitated. - APMs' understanding of functions and efectiveness of Iron Removal Plant is facilitated. - Maintenance methods of Iron Removal Plant (especially about the cleaning of filters) are instructed for APMs.	- Workshop reports - Plan of training of caretakers to be prepared by the participants - Results of test which is to be done for the participants to check understanding of what they learn in the training
4-3 On the Job Training of APMs									
1) Technical training through involvement in installation of handpump during the construction works	APMs from each Ward trained in the Activity 4-2, caretakers from each water point	Contractor for construction works, local consultant/NGO	Direct involvement in the installation of handpump under instruction by the contractor	Each target site	2 days / site	216	432	- APMs are capable to practice what they learnt in Activity 4-2 in the actual installation of handpump.	- Field reports to be prepared by APMs
2) Training of caretakers in daily operation and maintenance of handpump	Caretakers in the target sites (2 participants/ site)	Local consultant/NGO, APMs trained in Activity 4-2	Instruction, discussion and field practice based on the maintenance manual	Centre points of Ward	1 day / ward	56	56	- Skills and knowledge on daily maintenance activities are equipped with caretakers. (In case that the Afridev handpump is installed, they also need to learn skills for installation and repair of handpump in addition to the daily maintenance.)	- Field reports to be prepared by APMs
3) Training of V-WASHEs (including caretakers) in maintenance methods of Iron Removal Plant	V-WASHE and caretakers in the target sites, the community members	Local Consultant/NGO, APMs participated in Activity 4-2	Field practices on site	Sites where Iron Removal Plants are installed	2 days / site	39	78	- Community members' understanding of relationship between safe water utilisation and prevention of water borne diseases is facilitated. - Understanding of APMs and community members on functions and efectiveness of Iron Removal Plant is facilitated.	- Field reports to be prepared by APMs
5 Review of progress of the activities and evaluation of achievement of the programme and action planning for O&M of the constructed facilities									
5-1 Monitoring of WASHE activities	WASHE facilitators in the 4 target districts, APMs	WASHE trainers in the 4 target districts	Interview (with WASHE facilities, APMs, V-WASHE, caretakers and the community members), direct observation of WASHE activities and sites of water supply	Target sites (random sampling every time)	2 day / month / district			- D-WASHE trainers verify the progress of WASHE activities, and settlement of skills of WASHE facilitators and APMs - Monitoring of construction of water supply facilities - Monitoring of status of use of water supply facilities in service and maintenance by V-WASHE	- Monitoring report to be prepared by D-WASHE
5-2 Review on progress of activities, evaluation of results of outputs and establishing the action plan on maintenance		District governments, D-WASHEs	Annual review meeting by each district	Centre of each district	2 days / month / district			- The districts acknowledge the status of implementation process and achieved outputs based on the result of monitoring above and make policy proposal on review and improvement of the way of implementation of activities - Necessary points of follow-up are reflected to WASHE annual action plan	- WASHE annual action plan

Implementation Schedule of Software Component Programme (Tentative)



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/Jun
21	National Water Policy、2010	Print	Copy	Ministry of Energy and Water Development	2010/Feb

MLGH: Ministry of Local Government and Housing

Appendix-8 Water Quality Analysis Result of Existing Water Sources

District	No.	Site Name	ID Number	Type of Water Source	Type of Handpumps	Temp. (° C)	EC (mS/m)	pH	Fe (mg/lit)	Mn (mg/lit)	F (mg/lit)	E.Coli (cfu)	Bacteria (cfu)	Donors etc.	Const. Year	Altitude (m)	depth (m)	WL (m)
NCHELENGE	1	Mangam Basic School	NCII-01	OP		23.0	11.64	6.97	ND	ND	ND							
	2	Mutono Clinic	(NCII-02)	HDW	IM	24.5	4.66	5.26	0.2	ND	ND					982		
	3	Kaburu Village	(NCII-04)	BH	IM	24.5	5.81	5.57	2	ND	0.4-0.8					970		
	4	Kafutuma Clinic	NCII-06	BH	IM	22.0	54.90	7.34	0.5	ND	0.4	-	-			953	50	
	5	Kefulwa Clinic	NCII-07	RSL		20.1	3.25	6.99	0.2	ND	ND							
	6	Kefulwa Basic School	(NCII-07)	BH	IM	25.2	37.10	7.22	ND	ND	ND				2003	960		
	7	Chilongoshi (A)	NC-25	BH	Ad	26.2	4.63	5.39	ND	ND	ND			JICA	2010	959		
	8	Chilongoshi (B)	NCII-12	HDW		26.0	12.03	5.79	ND	ND	ND							
	9	FTC Compound	(NCII-12)	BH	IM	25.6	12.65	5.69	5	ND	0.4-0.8					963		
	10	Mutampuka Village	NCII-14	Sp		23.7	2.34	4.99	ND	ND	ND					867		
	11	Seketeni Village	NCII-17	BH	IM	24.3	3.72	5.22	ND	ND	ND	-	-	JICA		955		
	12	Chisukulu Village	NCII-18	OP		25.6	3.49	5.03	ND	ND	ND	38	28			928		
	13	Chishipula Village	NCII-20	BH	IM	26.3	4.50	6.21	ND	ND	ND							
	14	Mwanda Village	NCII-23	HDW		26.1	2.32	5.46	0.2	ND	ND					947	8	7.4
	15	Holland Village	NCII-27	OP		21.0	3.69	4.95	0.2	ND	0.4	+++	32			891		
	16	Mwanamweshi Village	NCII-30	HDW		25.9	12.85	5.94	ND	ND	ND					937	11	8.9
	17	Nshoka Village	NCII-31	HDW		24.1	3.56	5.22	ND	ND	ND					1,001	8	
	18	Kaseka Village	NCII-34	HDW		25.5	3.99	5.58	ND	ND	ND					927		
	19	Chofwe Mulenga Village	NCII-37	OP		25.5	2.60	5.98	ND	ND	ND					933		
	20	Fwengeni Village	NCII-39	HDW		23.8	13.18	6.23	ND	ND	ND					948	9	7
	21	Shikapambwe	NCII-40	Sp		25.2	5.21	4.80	ND	ND	ND					962		
	22	Pingwila Village	NCII-41	Sp		23.4	2.09	5.19	0.2	ND	ND					973		
	23	Kabeke Village*	NCII-42	OP		18.1	3.80	7.47	0.5-1	ND	ND					932		
	24	Kabeke Village	NCII-42	HDW		25.5	12.93	5.91	ND	ND	ND					939	5.8	4.9
	25	Sela Village	NCII-47	Sp		22.9	1.86	5.60	ND	ND	ND					999		
	26	Mushili Village	NCII-53	HDW		25.4	10.53	6.32	ND	ND	ND					938		
	27	Chapita Village	NCII-54	HDW		26.0	25.70	6.16	ND	ND	ND					949	15	14.5
	28	Chinkobwe Village	NCII-57	Sp		24.6	5.54	5.20	ND	ND	ND					966		
	29	Chilamba Village*	NCII-60	RSL		18.9	2.21	6.26	ND	ND	ND							
	30	Munkonbwe Village	NCII-61	OP		24.3	3.15	5.27	ND	ND	ND					947		
	31	Munkombwe Basic School	(NCII-61)	BH	IM	25.8	116.60	7.07	1	ND	1.5							
	32	Kaputo Village	NCII-63	HDW		26.0	19.04	5.80	ND	ND	ND	+++	+++	ESP	2006	962	12	
	33	Chomba Village	NCII-66	Sp		24.4	19.37	6.33	ND	ND	ND			RD		990		
	34	Kaputo Village	NCII-68	Sp		23.8	5.08	5.72	0.2	ND	ND							
	35	Mulanga Basic School	(NCII-68)	BH	IM	25.4	13.19	6.30	10	ND	0.4				2004			
	36	Toka Village	NCII-73	RSL		24.1	5.37	6.74	ND	ND	ND							
	37	Chabilikila Village	NCII-74	HDW		26.4	6.12	4.85	ND	ND	ND	+++	+++			941	6	
	38	Chabilikia Basic School	(NCII-74)	BH	IM	25.9	3.06	5.41	5	ND	0.4-0.8			UNICEF	2004		21	
	39	Mulonda Basic School	NCII-75	HDW		25.0	5.08	5.51	ND	ND	0.4					976	18	
	40	Kambwali Clinic	NCII-77	HDW	IM	26.0	7.74	5.31	5	ND	0.4			DAP		963		
	41	Chisambo Village*	NCII-80	RSL		19.6	1.36	5.67	2	ND	0.4							
	42	Chikuni Village	NCII-82	Sp		25.3	3.82	5.14	ND	ND	0.4					933		
	43	Chikuni Village	NCII-82	HDW		25.5	6.22	4.87	ND	ND	0.4	22	-			960	10	
	44	Shindoni Village	NCII-85	BH	Ad	26.5	13.31	4.56	ND	ND	ND					946		
	45	Kanyembo Basic School	NCII-87	BH	IM	24.0	3.14	5.41	1	ND	0.4				2008		28	
	46	Kasheta Village	NCII-88	BH	IM	25.7	10.94	5.83	0.5-1	ND	0.4			FAO	1984	956	151	
	47	nearby Kasheta Village	(NCII-88)	HDW		25.3	13.36	5.19	ND	ND	ND					956		
	48	Chishimba Luwi Village	NCII-90	Sp		24.8	15.38	6.29	ND	ND	ND			RD		1,035		

District	No.	Site Name	ID Number	Type of Water Source	Type of Handpumps	Temp. (° C)	EC (mS/m)	pH	Fe (mg/lit)	Mn (mg/lit)	F (mg/lit)	E.Coli (cfu)	Bacteria (cfu)	Donors etc.	Const. Year	Altitude (m)	depth (m)	WL (m)
MWENSE	1	Chililo	MWII-03	HDW		26.9	5.38	5.80	0.2-0.5	ND	ND					938	9	9.2
	2	Lubunda Basic School	MWII-05	HDW	IM	26.2	5.39	5.86	0.2	ND	ND	+++	+++			948		
	3	Kawama Village	MWII-08	HDW		25.3	3.57	5.29	0.2	ND	ND	17	97			962	13	
	4	Mutonta	MWII-10	HDW		26.0	3.41	5.33	ND	ND	ND					959	21	
	5	Kapamba Basic School	MWII-11	HDW		25.2	2.74	5.27	ND	ND	ND					1,041	10	7.2
	6	Mporokoso Village	MWII-12	HDW		25.7	24.90	6.73	ND	ND	ND					941	11	10.6
	7	Chebele	(MWII-13)	RSL		20.6	1.95	6.75	ND	ND	ND					1,037		
	8	Kateule Village*	MWII-14	RSL		18.0	3.72	6.80	ND	ND	ND					963		
	9	Kangomba Community School	MWII-15	BH	IM	25.9	41.80	6.80	ND	ND	0.4-0.8	-	-			945		
	10	Kakusha B Village	MWII-16	BH	IM	26.1	9.78	5.87	0.5-1	ND	ND				2009	955	54	
	11	Kankonba Village	(MWII-17)	BH	IM	26.6	8.84	5.71	1	ND	ND				2009	984	54	
	12	Chansa Village	MWII-22	HDW	IM	26.6	9.12	5.42	ND	ND	0.4-0.8	+++	+++			962		
	13	Chibondo Clinic	(MWII-25)	BH	IM	26.0	51.10	6.91	0.5-1	ND	0.8-1.5				2008	1,020	42	
	14	Chibondo Village	(MWII-25)	HDW		24.6	32.70	7.07	0.5-1	0.5	0.4-0.8	37	38			1,024		
	15	Katebula	MWII-26	RSL		20.2	2.41	7.48	ND	ND	ND					1,069		
	16	Grand Palm Lodge*	(MWII-27～32)	HDW		17.4	8.23	5.84	ND	ND	ND	90	120					
	17	Losa Mukukuntu	MWII-28	RSL		23.8	5.20	6.46	0.2	ND	0-0.4					1,042		
	18	Kasuma Village	(MWII-29)	BH	IM	27.5	9.16	6.05	10	ND	0.4				2007	970	48	
	19	Chalata	MWII-31	RSL		22.9	6.29	7.62	ND	ND	ND					957		
	20	Shichama West	MW-1	BH	Ad	26.1	7.52	5.71	ND	ND	ND			JICA	2010	961		
	21	Kafwinbi	MWII-32	HDW		26.1	6.56	5.38	0.2-0.5	ND	0-0.4	16	61			961	12	
	22	Chisheta	MWII-35	HDW		24.1	1.50	5.23	ND	ND	ND					1,178	7	5.6
	23	Chalwe Clinic	MWII-41	RSL		22.3	4.07	6.24	ND	ND	0.4							
	24	Chalwe Basic School	(MWII-41)	BH	IM	25.4	29.90	7.14	ND	ND	0.4-0.8				2010	986	24	
	25	Kamami Village	MWII-47	OP		23.6	2.51	5.15	ND	ND	ND					1,188		
	26	Mutipula Basic School	MWII-51	HDW		23.0	3.31	5.41	ND	ND	ND							
	27	Mutipula Village	MW-49	BH	Ad	24.5	2.55	5.02	ND	ND	ND			JICA	2010	1,191		
	28	Bund Chunsu Basic School	MWII-56	HDW	IM	23.8	5.45	5.70	2-5	ND	0.8			AC	2010	1,306	20	
	29	Kashiba Village	(MWII-56～51)	BH	IM	23.3	46.30	5.47	10	ND	0.4				1998	1,213	18	
	30	Kane (Chisenga Village)	MWII-60	HDW		22.7	3.97	5.71	ND	ND	ND					1,192	8	
	31	Musalango Basic School	(MWII-65)	BH	IM	24.3	16.63	6.45	>10	ND	0.8				2004	1,290	21	
	32	Musalango Clinic	(MWII-65)	BH	IM	23.1	4.79	5.35	10	ND	0.4-0.8				2009	1,292	21	

* : Cheked water stored in house

BH : Borehole
HDW: Hand Dug Well
RSL : River, Stream or Lake (Lagoon)
OP : Open Pit
Sp : Spring

Ad: Afridev
IM: India Mark II
Cs: Consallen
PP: Play Pump

ND: not detected

\- : negative
+++: positive

JICA: Japan International Cooperation Agency
WA: Water Aid (NGO)
Plan: Plan International (NGO)
ESP: Environmental Sanitation Programe
UNICEF: The United Nations Children's Fund
AC: Anglican Church
USAID: United States Agency for Intenational Development
DAP: DAPPCHILL AID UNI-WATER
RD: Rose Doctor
FAO: Food and Agriculture Organization

District	No.	Site Name	ID Number	Type of Water Source	Type of Handpumps	Temp. (° C)	EC (mS/m)	pH	Fe (mg/lit)	Mn (mg/lit)	F (mg/lit)	E.Coli (cfu)	Bacteria (cfu)	Donors etc.	Const. Year	Altitude (m)	depth (m)	WL (m)
MANSA	1	Mantumbusa	MAII-03	HDW		22.9	1.28	5.53	ND	ND	ND							
	2	Kasongo	MAII-08	HDW		23.7	1.97	5.12	ND	ND	ND					1,255	8	7.4
	3	Chikowe	MAII-09	HDW		23.7	2.51	5.53	0.3	ND	ND					1,234	8	7.5
	4	Lusaya	MAII-11	HDW		23.5	2.27	5.23	ND	ND	ND							
	5	Ntoposhi Basic School	(MAII-13)	HDW		22.9	3.41	5.42	ND	ND	ND							
	6	Ntoposhi Basic School	(MAII-13)	HDW	PP	23.1	5.16	6.06	10	ND	0.8-1.5	-	-	USAID				
	7	Kampalala	MAII-14	HDW		23.9	1.36	5.15	ND	ND	ND					1,262		
	8	Mwanachama	MAII-17	HDW	IM	22.7	5.18	5.87	0.4	ND	ND					1,221	9	7.5
	9	Mibenge	MAII-18	HDW		23.3	3.10	5.59	ND	ND	ND							
	10	Kalaba	MAII-19	HDW		23.6	3.69	5.39	ND	ND	ND							
	11	Chimfula Basic School	(MAII-20)	BH	IM	24.0	12.39	6.51	ND	ND	1.5	-	1					
	12	Chofwe	MAII-21	HDW		23.4	5.45	5.59	ND	ND	ND							
	13	Chakaba	MAII-22	HDW		24.4	1.75	5.07	ND	ND	ND					1,209	13	10.6
	14	Kambalikila	MAII-23	HDW		24.4	2.01	5.06	ND	ND	ND					1,206	9	7.8
	15	Musaila RHC	MAII-24	BH	IM	23.8	8.73	6.27	10	ND	0.8-1.5					1,211		
	16	Kalungushi	MAII-25	HDW		24.4	1.55	5.00	0.2	ND	ND					1,256	10	8.4
	17	Shamende	MAII-26	HDW		21.6	1.67	5.27	ND	ND	ND					1,347	8	6.9
	18	Kalyondo	MAII-27	HDW		23.9	1.99	5.31	0.1	ND	ND					1,301	10	6.5
	19	Temfwe	MAII-28	HDW		24.3	2.24	5.27	ND	ND	ND					1,137	10	7.6
	20	Kapu	MAII-29	HDW		23.2	3.20	5.63	0.2	ND	ND					1,092	8	6.2
	21	Kalaba	MAII-31	HDW		22.4	2.08	5.62	ND	ND	ND							
	22	Chabala	MAII-32	BH	IM	24.1	8.23	5.95	5	ND	0.8	-	-	PI	2009	1,097		
	23	Chabala	MAII-32	BH	IM	24.9	47.30	7.38	ND	ND	ND	-	-	PI	2008	1,083		
	24	Chabala (Kabanshi Section)	MAII-32	HDW		23.6	6.65	5.30	0.5	ND	ND					1,100	7	6.9
	25	Chabala	MA-14	BH	Ad	24.3	12.20	6.11	ND	ND	ND	-	-	JICA	2010	1,092		
	26	Shoti (Chansunsu Com. Sch.)	MAII-33	OP		20.1	3.17	5.59	0.5-1	ND	ND							
	27	Sendapu	MAII-37	HDW		24.7	3.00	5.39	ND	ND	ND					1,221		
	28	Chansa (Kalukusha Area)	MAII-38	HDW		25.5	2.51	5.20	ND	ND	ND					1,063	8	5.8
	29	Chief Kale Palace	MAII-39	HDW		23.8	1.62	4.96	ND	ND	ND							
	30	Kapitolo	MAII-40	HDW		23.3	1.63	5.36	ND	ND	ND					1,206		
	31	Kabushi	MAII-41	RSL		27.5	3.18	6.14	ND	ND	ND							
	32	Kasoma Village	MAII-42	HDW		24.1	1.87	5.34	ND	ND	0-0.4					1,199		
	33	Kachepeshi	MAII-43	HDW		23.1	6.13	5.87	ND	ND	ND					1,173	13	10.5
	34	Matipa	MAII-45	OP		21.3	1.70	5.30	ND	ND	ND							
	35	Kosamu	MAII-46	HDW		25.3	2.54	5.20	ND	ND	ND					1,091	10	6.6
	36	Chisukulo	MAII-53	BH	IM	22.7	5.11	5.79	0.2-0.5	ND	0.5	3	-	PI	2010			
	37	Matelo	MAII-57	BH	IM	24.5	7.38	5.89	8	ND	0.4-0.8					1,187		
	38	Lule Basic School	(MAII-59)	BH	IM	24.5	19.75	6.62	ND	ND	0.8-1.5	2	-					
	39	Yasakwa	MAII-61	HDW		24.5	1.82	5.18	ND	ND	0-0.4					1,259	10	9
	40	Chipungu	MAII-64	HDW		22.9	1.60	5.20	ND	ND	ND					1,331	10	6.5
	41	Musavila Village	(MAII-66)	HDW		23.5	1.99	5.13	ND	ND	ND					1,324		
	42	Mushitu Comm. School	MAII-68	BH	IM	24.9	33.80	6.72	ND	ND	0.4			PI		1,065	55	
	43	Chofoshi Basic School	(MAII-69)	HDW		23.6	2.15	5.41	ND	ND	ND					1,215		
	44	Mabumba Market	MAII-71	HDW	IM	23.5	3.17	6.06	ND	ND	ND					1,248		
	45	Nalwamba	MAII-72	HDW		23.7	1.95	4.97	ND	ND	ND							
	46	Tubi Community School	(MAII-74)	BH	IM	23.8	5.77	5.87	0.5	ND	0.8-1.5	-	-	PI	2010	1,256	50	
	47	Lofoyi	MAII-76	BH	IM	25.4	40.20	6.98	ND	0.5	0.4				2010			
	48	Chimese Local Court	MAII-78	HDW		23.2	2.37	5.49	ND	ND	ND					1,230	8	7.2
	49	Sub-Chief Mbao Palace	MAII-79	BH	IM	25.4	15.17	6.21	0.2	ND	0.4-0.8					1,073		
	50	Senseleni	MAII-83	HDW		23.2	14.50	6.44	0.2	ND	ND							
	51	Makeleta	MAII-84	HDW	IM	20.7	8.10	5.87	>10	ND	1					1,270	10	10.1
	52	Motoka*	MAII-85	RSL		18.5	4.74	6.67	ND	ND	ND							
	53	Kapaipi	MAII-87	HDW		22.6	1.28	5.03	ND	ND	ND					1,366	13	9.95
	54	Mungulube	MAII-88	HDW		23.3	1.53	5.14	0.2-0.5	ND	ND					1,276	10	8.6
	55	Chabwe	MAII-89	HDW		22.4	2.88	5.60	ND	ND	ND						8	6.1

District	No.	Site Name	ID Number	Type of Water Source	Type of Handpumps	Temp. (° C)	EC (mS/m)	pH	Fe (mg/lit)	Mn (mg/lit)	F (mg/lit)	E.Coli (cfu)	Bacteria (cfu)	Donors etc.	Const. Year	Altitude (m)	depth (m)	WL (m)
MILENGE	1	Garden (A)	MLII-01	BH	IM	24.9	9.97	6.33	>10	ND	0.4-0.8			WA	2009	1,190	54	
	2	Garden	MLII-01	HDW		24.5	6.45	5.60	ND	ND	ND					1,198		
	3	Garden	ML-8	BH	Ad	24.1	30.80	6.82	ND	ND	ND	-	-	JICA	2010	1,189		
	4	Munishi Turnoff	ML-9	BH	IM	24.1	8.93	6.03	5	ND	0.4-0.8	-	-	JICA	2010	1,194		
	5	Talavi B	ML-25	BH	IM	24.1	17.26	6.34	0.5	ND	0.4	-	-	JICA	2010	1,179		
	6	Munushi Coumpound	MLII-03	HDW		23.1	10.08	6.13	ND	ND	0.4	19	20			1,179	8	4.1
	7	Munushi Coumpound	MLII-03	HDW		23.1	10.08	6.13	<0.2	ND	ND	19	20			1,179	8	4.1
	8	Chipe	(MLII-03～29)	BH	IM	23.0	13.02	6.14	0.5-1	ND	0.4	-	-		2009	1,171	54	
	9	Kamupapa	MLII-04	HDW		24.2	3.39	5.52	ND	ND	ND					1,185	8	7.1
	10	Kalotoli	MLII-05	HDW		24.1	2.40	5.41	ND	ND	ND					1,189	13	9.8
	11	Chisensa	MLII-06	BH	IM	25.1	67.20	7.44	ND	ND	0-0.4			JICA		1,175		
	12	Chisensa	MLII-06	HDW	IM	24.8	8.62	6.28	10	ND	0.8	-	-			1,178		
	13	Sokontwe Clinic	(MLII-07)	BH	IM	24.6	2.19	5.34	0.2	ND	ND	-	-			1,199		
	14	Riverside Community School	MLII-09	HDW		22.2	30.10	6.95	0.5-1	ND	ND					1,182		
	15	Maputa	(MLII-09～12)	BH	IM	23.6	24.20	6.95	0.5	ND	0.8	-	-	WA	2008	1,175	50	
	16	Musongo Mwea	MLII-10,11	HDW		23.5	2.51	5.39	ND	ND	ND					1,183		
	17	Chiufya Yamwela	MLII-12	BH	IM	23.2	28.20	8.02	ND	ND	ND	4	-	WA	2008	1,179	54	
	18	Chipundu (Kapu Village)	MLII-13	HDW		22.4	6.58	6.14	ND	ND	ND					1,188		
	19	Muntu	ML-12	BH	Ad	24.2	20.20	7.42	ND	ND	ND	-	-	JICA	2010	1,178		
	20	Chilfya Kabinda	MLII-15	BH	IM	23.3	4.63	5.69	2	ND	0.4-0.8	-	-	WA	2009	1,176	14	
	21	Musolo	ML-15	BH	Ad	23.8	48.40	7.27	ND	ND	ND	-	-	JICA	2010			
	22	Musolo Wani	(ML-15～MLII-27)	BH	IM	24.2	42.20	7.16	0.2	ND	ND	-	-		2009	1,162	60	
	23	Kaputa	MLII-16	HDW		23.7	3.03	5.35	ND	ND	ND					1,178	5	
	24	Kamanda	ML-17	BH	Ad	24.0	10.69	6.17	ND	ND	ND	-	-	JICA	2010			
	25	Malenga Turnoff	ML-18	BH	Ad	23.3	5.71	5.80	ND	ND	ND	-	-			1,182		
	26	Malenga Turnoff	(ML-18)	HDW		22.7	2.77	5.45	ND	ND	ND							
	27	In front of the Shop in Milenge	(ML-25)	BH	IM	23.3	5.45	7.34	ND	ND	ND				2007	1,172		
	28	Shitambli	MLII-21	BH	IM	24.7	35.10	7.10	ND	ND	ND	4	5		2009	1,161	50	
	29	Shitambli	MLII-21	HDW		21.7	8.55	5.99	0.5-1	ND	ND					1,165		
	30	Miyambo Village	MLII-25	RSL		20.1	2.71	6.57	ND	ND	ND	18	7			1,160		
	31	Buyantashi Village*	MLII-29	RSL		14.3	4.67	6.08	ND	ND	ND					1,186		
	32	Kubi / Katena Village	(MLII-29～ML-10)	HDW	IM	23.8	20.20	6.53	2	ND	0.8	-	2		2009	1,177	18	
	33	Katena Community School	ML-10	BH	Ad	23.3	30.60	6.81	ND	ND	ND	-	-	JICA		1,185		
	34	Milulu Health Post	MLII-32	BH	IM	23.9	6.83	6.17	10	ND	0.8	-	-			1,200		
	35	Musumali	MLII-33	HDW		23.4	1.42	5.12	ND	ND	ND					1,195	9	5.1
	36	Moti	MLII-34	HDW		23.9	2.04	5.03	ND	ND	ND					1,206		
	37	Mote	MLII-34	HDW		24.0	1.21	5.03	ND	ND	ND					1,199	12	7
	38	Kalari*	MLII-35	OP		18.0	4.44	6.03	ND	ND	ND					1,155		
	39	Kabongo	MLII-37	BH	IM	24.7	3.04	5.61	2-5	ND	0.8	-	-		2007			
	40	Chenga	MLII-39	HDW		23.1	1.50	5.23	ND	ND	ND					1,171		
	41	Muyayi	MLII-41	HDW		24.4	1.30	5.00	ND	ND	ND					1,179		
	42	Mumanse	MLII-42	HDW		24.2	1.83	5.57	ND	ND	ND					1,185	8	dry
	43	Vincent	MLII-43	HDW		24.0	1.48	4.97	ND	ND	ND					1,180		
	44	Mulumbi Clinic	(MLII-49,50)	BH	IM	23.9	11.63	6.45	1	ND	ND	7	2			1,120		
	45	Scheme (A)	MLII-53	HDW		23.0	4.81	6.19	0.2	ND	ND					1,145	12	10
	46	Matontola Basic School	MLII-55	HDW		23.9	1.56	5.28	ND	ND	ND					1,305	12	9.6
	47	Chandika	MLII-56	OP		20.3	2.43	5.19	ND	ND	ND					1,212		
	48	Mophat	MLII-57	BH	Cs	24.1	3.81	5.54	ND	ND	ND					1,236		
	49	Kabange	MLII-59	HDW		23.1	1.77	5.13	ND	ND	ND					1,312	9	6.6
	50	Itemba	MLII-60	OP		24.2	5.18	6.01	ND	ND	ND					1,098		
	51	Chifwalo	MLII-62	HDW		23.6	1.52	5.22	ND	ND	ND					1,120	13	10
	52	Kakasu	MLII-63	HDW		24.4	2.33	5.26	ND	ND	ND					1,128	13	10.8
	53	Chabuka Baushi Basic School	MLII-66	HDW		24.2	2.72	5.49	ND	ND	ND					1,089		
	54	Musongo	MLII-68	HDW		25.3	2.52	5.44	ND	ND	ND					1,095	12	9.3
	55	Chibende	MLII-69	HDW		23.9	6.94	5.96	0.2-0.5	ND	ND					1,083	6	5.7

Appendix-9 Results of pH and iron(Fe) Monitoring of Phase I Project sites

District	ID Number	Site Name	Date			Fe			pH			Pump Type
			Construc.	Monitoring	Phase2	Construc. By field Kit (mg/lit)	Monitoring	Phase2	Construction	Monitoring	Phase2	
NCHELENGE	NC-4	Nakafwaya Village	09/09/15	10/02/18		<0.2	<0.2		5.39	5.02		Afridev
	NC-6	Kashita Village	09/05/01	09/07/19		<0.2	<0.2		7.14	6.60		IM-II
	NC-9	Chipayeni Village	09/04/29	09/07/19		<0.2	0.2		7.32	6.58		IM-II
	NC-13	Mulwe Village	09/04/27	09/07/19		<0.2	1		7.32	6.47		IM-II
	NC-14	Mukange Village	09/04/25	09/07/19		<0.2	1		7.41	6.41		IM-II
	NC-16	Mumba Village	09/04/21	09/07/19		<0.2	1		7.09	7.06		IM-II
	NC-17	Mukumbwa Village	09/09/14	10/02/18		<0.2	<0.2		5.47	5.08		Afridev
	NC-18	Kalimbwa Comm. School	09/04/23	09/07/19		<0.2	0.2		7.48	6.75		IM-II
	NC-19	Mutiwanama Village	09/04/19	09/07/19		<0.2	2		7.00	6.55		IM-II
	NC-22	Chintakwa Village	09/04/11	09/07/19		<0.2	1		7.00	6.79		IM-II
	NC-23	Kaseka Village	09/04/17	09/07/19		<0.2	1		6.67	6.32		IM-II
	NC-26	Mulumba Village	09/04/09	09/07/19		<0.2	0.2		6.43	6.03		IM-II
	NC-27	Shikapande Village	09/04/15	09/07/19		<0.2	0.5		7.00	6.67		IM-II
	NC-28	Kwama Comm. School	09/04/13	09/07/18		<0.2	2		6.87	6.36		IM-II
	NC-30	Kamwangila Village	09/04/07	09/07/18		<0.2	<0.2		6.58	6.53		IM-II
	NC-31	Malulu Village	09/09/14	10/02/18		<0.2	<0.2		4.48	4.35		Afridev
	NC-32	Yenga Village	09/04/05	09/07/18		<0.2	1		6.63	6.42		IM-II
	NC-33	Mulambi Village	09/09/12	10/02/18		<0.2	<0.2		5.11	4.86		Afridev
	NC-34	Mumpundu Village	09/04/01	09/07/19		<0.2	<0.2		7.66	7.40		IM-II
	NC-39	Seketi Village	09/03/26	09/07/18		<0.2	0.2		6.73	6.60		IM-II
	NC-40	Chifwalo Village	09/03/30	09/07/18		<0.2	<0.2		6.59	6.59		IM-II
	NC-41	Chishima Village	09/03/28	09/07/18		<0.2	<0.2		6.86	6.56		IM-II
	NC-42	Kayope Village	09/04/03	09/07/18		<0.2	<0.2		7.64	6.89		IM-II
	NC-43	Kapela Village	09/03/24	09/07/18		<0.2	<0.2		6.72	6.59		IM-II
	NC-46	Chafuma	09/03/21	09/07/18		0.2	<0.2		7.81	7.08		IM-II
	NC-47	Mukeya Comm. School	09/03/19	09/07/18		0.2	0.2		7.52	7.05		IM-II
MWENSE	MW-1	Shichama West	09/06/08	09/09/24	10/07/12	<0.2	<0.2	<0.2	6.44	6.02	5.71	Afridev
	MW-2	Kenyemba	09/06/09	09/09/24		<0.2	<0.2		6.49	6.44		Afridev
	MW-5	Laula	09/06/12	09/09/24		<0.2	<0.2		6.48	6.01		Afridev
	MW-6	Chintole	09/06/11	09/09/24		<0.2	<0.2		6.46	5.88		Afridev
	MW-8	Nkomba	09/06/14	09/09/24		<0.2	<0.2		6.45	6.08		Afridev
	MW-10	Chafwa	09/06/16	09/09/24		<0.2	<0.2		6.49	5.94		Afridev
	MW-11	Mukomansala	09/06/18	09/09/24		<0.2	<0.2		6.47	6.00		Afridev
	MW-12	Shibesa	09/06/20	09/09/24		0.2	1		6.67	6.38		IM-II
	MW-13	Mitamba B	09/06/22	09/09/24		<0.2	<0.2		6.39	5.93		Afridev
	MW-22	Katuta RHC	09/06/24	09/09/24		<0.2	<0.2		9.57	9.28		IM-II
	MW-26	Shingwe West	09/06/07	09/09/24		<0.2	<0.2		7.48	7.02		IM-II
	MW-31	Kabosha	09/06/05	09/09/24		<0.2	<0.2		6.41	5.95		Afridev
	MW-32	Chiposa	09/06/01	09/09/24		0.5	2		6.86	6.54		IM-II
	MW-33	Loto	09/06/03	09/09/24		<0.2	2		6.46	6.44		IM-II
	MW-34	Mulonga	09/05/27	09/09/24		<0.2	<0.2		7.40	6.45		Afridev
	MW-35	Saini	09/05/25	09/09/24		<0.2	<0.2		7.42	6.51		IM-II
	MW-37	Musangu Filling Station	09/05/16	09/09/25		<0.2	<0.2		6.44	5.84		Afridev
	MW-38	Musangu Station	09/05/14	09/09/25		<0.2	0.2		7.00	6.53		IM-II
	MW-39	Kapena	09/05/29	09/09/29		<0.2	<0.2		7.49	5.83		Afridev
	MW-41	Chisopa	09/05/11	09/09/25		<0.2	0.5		7.28	6.57		IM-II
	MW-42	Kasonge	09/05/09	09/09/25		<0.2	0.5		7.40	6.73		IM-II
	MW-45	Chifita	09/05/07	09/09/25		<0.2	<0.2		7.61	6.92		IM-II
	MW-49	Mutipula	09/07/06	09/09/29	10/07/14	<0.2	<0.2	<0.2	6.42	5.86	5.02	Afridev
	MW-50	Kanshimba	09/07/02	09/09/29		<0.2	<0.2		6.38	5.86		Afridev
	MW-51	Mwenda	09/06/27	09/09/29		<0.2	0.5		6.66	6.89		IM-II
	MW-53	Mukanga	09/06/28	09/09/29		<0.2	<0.2		6.42	5.99		Afridev
	MW-54	Chipeleme	09/07/08	09/09/29		<0.2	<0.2		6.38	5.87		Afridev
	MW-55	Lupososhi	09/07/11	09/09/29		<0.2	<0.2		6.42	6.39		Afridev
	MW-56	Munganga	09/06/30	09/09/29		0.5	<0.2		6.39	5.79		Afridev
	MW-58	Kaomamakasa-B	09/07/04	09/09/22		<0.2	<0.2		6.38	6.07		Afridev

District	ID Number	Site Name	Date			Fe			pH			Pump Type
			Construc.	Monitoring	Phase2	Construc.	Monitoring	Phase2	Construction	Monitoring	Phase2	
						By field Kit (mg/lit)						
MANSA	MA-5	Kasanga Village(A)	09/09/28	10/02/19		<0.2	2		6.51	6.59		IM-II
	MA-7	Luo Village(Chipense)	09/09/29	10/02/19		<0.2	2		6.60	6.53		IM-II
	MA-12	Chiswishi/Jereman	09/12/22	10/04/15		<0.2	2		6.75	6.68		IM-II
	MA-14	Chabala Village	09/12/22	10/04/15	10/07/30	<0.2	<0.2	<0.2	6.06	6.25	6.11	Afridev
	MA-16	Kale Village(A)	09/10/19	10/04/16		1.5	<5		5.99	5.87		Afridev
	MA-17	Kale Village(B)	09/10/19	10/04/16		<0.2	<10		5.98	6.02		Afridev
	MA-22	Mutipula Village	09/10/24	10/02/20		<0.2	<0.2		6.88	6.79		IM-II
	MA-23	Chisongo(A)	09/10/22	10/02/20		<0.2	0.5		6.59	6.55		IM-II
	MA-25	Kaseke Village	09/12/19	10/04/16		<0.2	<0.5		6.60	6.74		IM-II
	MA-26	Chisongo(B)	09/10/25	10/02/20		<0.2	<0.2		7.20	6.81		IM-II
	MA-28	Chisamba Village	09/10/21	10/04/16		<0.2	<0.2		6.01	6.23		IM-II
	MA-30	Kaseya/Kampalala 2	09/10/01	10/02/19		7	7		6.91	6.57		IM-II
	MA-32	Mano/Kabengele	09/12/04	10/04/17		2	1		6.57	6.52		IM-II
	MA-39	Mibenge RHC	09/10/16	10/05/04		<0.2	<0.2		5.76	5.76		Afridev
	MA-42	Kalyongo Village(A)	09/09/25	10/02/19		<0.2	1		6.60	6.06		IM-II
	MA-43	Kalyongo Village(B)	09/09/25	10/02/19		<0.2	0.5		6.53	6.01		IM-II
	MA-45	Musaila Comm. School	09/10/14	10/04/29		1.5	0.5		5.88	5.91		Afridev
	MA-46	Mabumba West	09/12/16	10/04/16		2	1		6.70	6.75		IM-II
	MA-48	Kafuula Comm. School	09/10/17	10/05/04		<0.2	<0.2		5.75	5.66		Afridev
	MA-50	Sepe Community	09/10/04	10/04/29		1.5	<0.2		6.04	6.23		Afridev
MILENGE	ML-1	Lunga Village(A)	09/12/12	10/04/27		<0.2	<0.2		7.84	7.63		IM-II
	ML-3	Chisensa Village	09/12/13	10/04/27		<0.2	<0.2		7.53	6.99		IM-II
	ML-4	Nyembe Village	10/01/07	10/04/27		<0.2	1		6.20	5.97		Afridev
	ML-6	chalyafya-Kapande	10/01/07	10/04/27		<0.2	<0.2		6.20	5.89		Afridev
	ML-8	Garden Village	10/01/09	10/04/27	10/07/21	<0.2	<0.2	<0.2	6.48	6.33	6.82	Afridev
	ML-9	Mununshi Turn Off	10/01/08	10/04/27	10/07/21	<0.2	1	5	6.71	6.77	6.03	IM-II
	ML-10	Katena Comm. School	10/01/10	10/04/27	10/07/21	<0.2	<0.2	<0.2	6.44	6.45	6.81	Afridev
	ML-11	Kubi Village	09/01/10	10/04/27		<0.2	<0.2		6.42	6.40		Afridev
	ML-12	Muntu (Kapala/Milenge TO)	10/01/12	10/04/27	10/07/21	<0.2	<0.2	<0.2	6.49	6.43	7.42	Afridev
	ML-15	Musoolo Village	10/01/13	10/04/27	10/07/19	<0.2	<0.2	<0.2	6.32	6.55	7.27	Afridev
	ML-17	Kalebaila Village	10/01/13	10/04/27	10/07/19	<0.2	<0.2	<0.2	6.03	6.34	6.17	Afridev
	ML-18	Malenga Turn Off	09/10/12	10/04/27	10/07/19	0.2	<0.2	<0.2	6.02	6.16	5.80	Afridev
	ML-19	Kulelwa Village	10/01/14	10/04/27		<0.2	<0.2		6.01	5.76		Afridev
	ML-20	Issac Chifukula Village	10/01/14	10/04/27		<0.2	<0.2		6.31	6.46		Afridev
	ML-21	Mashika Basic School	10/01/16	10/04/27		<0.2	<0.2		5.90	5.89		Afridev
	ML-22	Changwe Neti Village	10/01/17	10/04/27		<0.2	<0.2		6.40	6.26		Afridev
	ML-23	Lunga Village(B)	10/01/05	10/04/27		<0.2	<0.2		7.17	7.02		IM-II
	ML-24	Tola Village	10/01/15	10/04/27		<0.2	<0.2		7.65	7.69		IM-II
	ML-25	Talayi Village(B)	10/01/04	10/04/27	10/07/21	<0.2	<1	0.5	7.66	7.44	6.34	IM-II
	ML-32	Kachenje Village	10/01/20	10/04/21		<0.2	<0.2		6.53	6.72		IM-II
	ML-35	Misenga Health Post	09/12/24	10/05/03		0.5	1		6.60	6.75		IM-II
	ML-36	Lwela Basic School	09/12/29	10/05/03		<0.2	0.2		7.35	7.55		IM-II
	ML-38	Chintu Village	09/12/20	10/05/03		3	2		6.57	6.44		IM-II
	ML-39	Springa Village	09/12/28	10/05/03		8	2		6.43	6.22		Afridev
	ML-42	Buyantashi Village	09/12/23	10/04/15		10<	<5		6.80	6.87		IM-II
	ML-43	Kalaba Shitembeya	09/12/23	10/04/15		<0.2	2		6.16	6.23		Afridev

Appendix-10 Survey Concerning Natural Conditions

1) Geographical Features / Topography

Luapula Province, the target area of the Project have land surface area of approximately 30,600km^2, of which lakes, swamps and associated wetlands covers up to 43.5%. The major bodies of water are Lake Bangweulu in the south-eastern corner and Lake Mweru in the north-western corners of the Province. The Luapula river begin from Lake Bangweulu, flowing towards south about 100 km long via smaller lakes and a broad swampy area, and finally flows into Lake Mweru forming the southern and the western border with the Democratic Republic of the Congo (DRC). Its extension is about 500 km long, winding through the swamps, marshes and lagoons. The topography of the area forms gently undulating plains and hills by these river-systems pouring into the main river, lakes and swamps. Figure A10-1 shows the Topographic Map of Luapula Province. The major part of the Province is at an altitude of 900 to 1,300m, consisting of undulating plateau area at over 1,200 m in the middle to southern part and relatively flat plains at 900 and 1,200m along the main rivers and lakes.

The Project target district is four (4) of seven (7) districts in the Luapula Province, which are Nchelenge District situating in the southern coast area of Lake Mweru, Mansa District where the capital of the Province is located, and Mwense and Milenge Districts where are northern and southern sides of Mansa. These districts face to the Luapula River.

Lake Bangweulu and surrounding broad swamps are dammed up area by sediment derived from Chambeshi River, of which the main basin has a mean depth of 4.7 m and a maximum known depth of 10.4 m.

Lake Mweru, of which average length is 96 km and average width is 45 km, shapes near rectangular. The main affluent streams are the Luapula River from southward and Kalungwishi River from eastward, while effluent stream is Luvua River to northward in DRC which enters the Lualaba River and eventually the Congo River. The surface area of the lake is approximately 4,920km^2. Its elevation is 917 m above sea level (absl) in average and the annual fluctuation in level is 1.7 m with seasonally highs in May and lows in January. A mean depth of 3 m, with a maximum depth of 10 m is recorded in the southern sector, but towards the north, the mean depth increases to about 10 m, with a maximum of 37 m.

The graben of Lake Mweru-Luapula River is a branch of African Great Rift Valley. The western shore of the lake in DRC exhibits the steep escarpment typical of a rift valley, rising to the Kundelungu Mountains, but the shore of Zambian side slopes rather gentle.

The land surface area and the altitude of the project area (4 districts in Luapula Province) are shown in the following table.

Table A10-1 Area and altitude of target districts

District	Area (km^2)	Altitude (m absl)
Nchelenge	4,090	900 - 1,100
Mwense	6,718	900 - 1,250
Mansa	9,900	1,200 - 1,350
Milenge	6,261	1,100 - 1,250

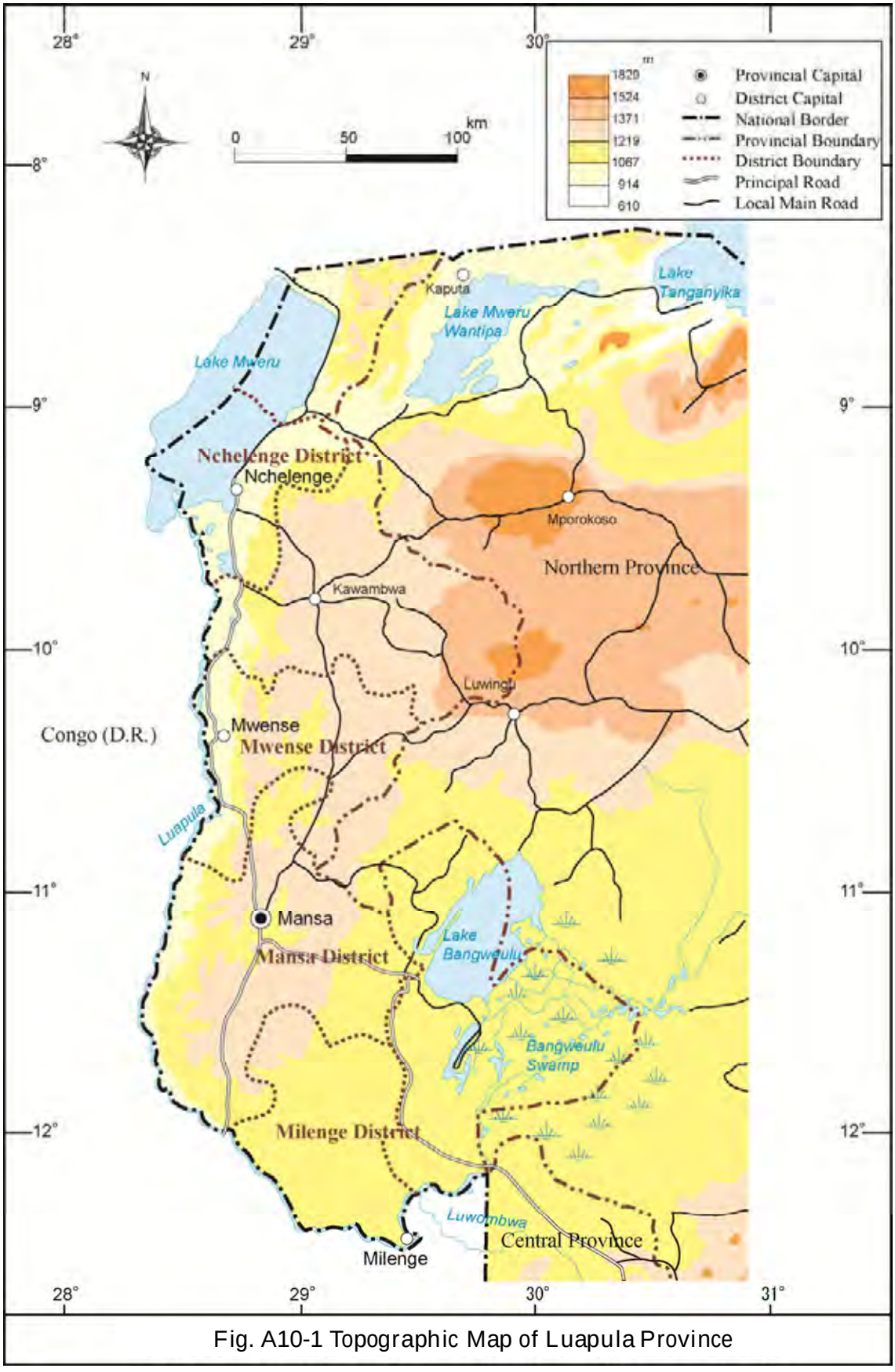


Fig. A10-1 Topographic Map of Luapula Province

2) Climate and Hydrology

(1) Climate

Zambia is situated in the tropical zone between the latitude 8°and 18° south of the equator. However, its altitude locating in high plateau at 900 and 1,500 m absl modifies it to moderate subtropical or tropical savannah. In the Köppen climate classification, most of the country is classified as humid subtropical (*Cfa, Cwa*) or tropical wet and dry or tropical savannah (*Aw*). The country has largely three seasons as followings:

Hot dry season	: from August to October,	temperature 26 to 38 degree Celsius
Warm rainy season	: from November to April,	temperature 27 to 34 degree Celsius
Cool dry season	: from April to August,	temperature 13 to 26 degree Celsius

The coldest month is June, and the hottest is October.

During the dry season, rainfall is absolutely absent, and December and January / February are the wettest months.

In the country, after the September equinox winds tend to become northerly or north-westerly, and by October warm humid air from the Congo Basin moves south and begins to occur showers and thunderstorms in northern area, but rain does not become general. Rainfall arises after this air flow from Congo coincided with the humid flow of the south east trade winds emanating from the Indian Ocean. The region where those air flows meets, is referred to as the Inter-Tropical Convergence Zone (ITCZ). The movement pattern of the ITCZ vary year from year, which affects the precipitation of the year.

The rain normally begin from the north and move south across the country, as the ITCZ retreats southwards, with precipitation decreasing from north to south.

The highest rainfalls are recorded in the northern mountainous area, where mean annual precipitation may reach 2,000 mm. And the northern and most highlands, experiences mean annual falls of 1,000 to 1,500 mm, the central falls of 750-1,000 mm, and the southern falls of 500-750 mm.

The rainfall type of the country is unimodal and is mainly influenced by the ITCZ with variations due to altitude, latitude, temperature, relative humidity and control of air masses.

After the March equinox, cool southerly winds prevail over Zambia and displace the warm humid air, starting the dry season. In July, the coolest month, temperatures may fall to 10 degree

Celsius, and there may be night time frosts in the mountains area. Annual rainfall is variable, but less so in the northern part, where there are relatively abundant rainfall in general.

As mentioned above, the annual mean precipitation in the northern part where the project area locates is about 1,000mm to 1,500mm. Rainy season from November to April is warm and wet, but the highest temperature in the daytime is a little lower than that of the hot dry season.

Temperature, rainfall, and wind in the area are respectively as followings.

Temperature – it is a little higher at lower elevations along the Luapula River and the shore area of the Lake Mweru than the mean value of the whole country in general

Rainfall - The distinction between rainy and dry seasons is very clear, with mostly no rain at all in June, July and August. The rains are brought by the ITCZ with thunderstorms, occasionally severe, with many lightning and sometimes hail. This area is especially influenced by the position of the ITCZ more than the other part of the country. A factor of particular influence on inter-annual variability in rainfall is El Niño/ Southern Oscillation (ENSO) phenomenon, where in this area experiences significant rainfall, while, the reverse pattern occurs with La Niña.
North-eastern of the province has rich rainfall comparing to south-western part in the Luapula Province. Western part of Mansa and Mwense has annual mean rainfall of 1,100 to 1,200mm, while the mountainous area in north-eastern part has some area of more than 1,500mm. Figure A10-2 shows “Annual mean rainfall distribution in Luapula Province”. Mean annual precipitation is received over about 175 days a year. Rain is spread fairly evenly over the months January-March, but January is generally the wettest month, sometimes having total falls in excess of 300 mm per month.

The precipitation of the country shows the tendency of decreasing gradually for the past thirty years, but in Luapula Province that kind of tendency can not be observed and annual precipitation of less than 1,000mm is very rare. Annual mean temperatures and rainfalls in the project area are shown in the following table.

Table A10-2 General Climate of the Project Area

District	Temperature (℃)	Rainfall (mm/year)
Nchelenge	22.5 - 25.0	1,200 - 1,500
Mwense	20 - 22.5	1,100 - 1,300
Mansa	20 - 22.5	1,100 - 1,300
Milenge	20 - 22.5	1,200 - 1,300

Wind - The prevailing winds in the dry season are generally moderate. In the rainy season, winds are localized with thunderstorms and may be destructive but usually confined to small areas. Zambia is landlocked and has no experiences of severe damages from tornados or cyclones.

(2) Hydrology

The hydrology in the project area is as follows:

The main river in the project area is Luapula River, which originates from Chambeshi River in the Northern Province, and its total catchments area occupies 173,396km^2 (Zambian side 113,323 km^2, DRC side 60,073 km^2). It runs meandering through broad area of swamps and marshes along the distance of 615km from the Lake Bangweulu to the Lake Mweru.

Lake Bangweulu has a large area of permanent swampland and seasonally inundated floodplain toward NE and SE side, covering some 7,000 km^2. Its capacity may reach 11,250 km^3 at high water, and mean annual evaporation from the lake surface is estimated as 1,642 mm/year. The mean discharge rate from the Lake Bangweulu and swamps into the Luapula River is 441m^3/sec averaged over several years, and the flow rate of the Luapula River is highest in March/May, and lowest in October/November.

The area of flood plains (including swamps) along the Luapula River in Zambian side is approximately 3,000 km^2 and the open water surface area of the Lake Mweru in Zambian side is also approximately 3,000 km^2 (4,920 km^2 including DRC side). Annual mean evaporation from surface of the Lake Mweru has been estimated as 1,700 mm/year. The annual fluctuation in the level of the Lake water surface is 1.7 m with seasonal highs in April to July and lows in October to February.

References:

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- Forestry Outlook Studies in Africa　Ministry of Resources and Tourism of Zambia
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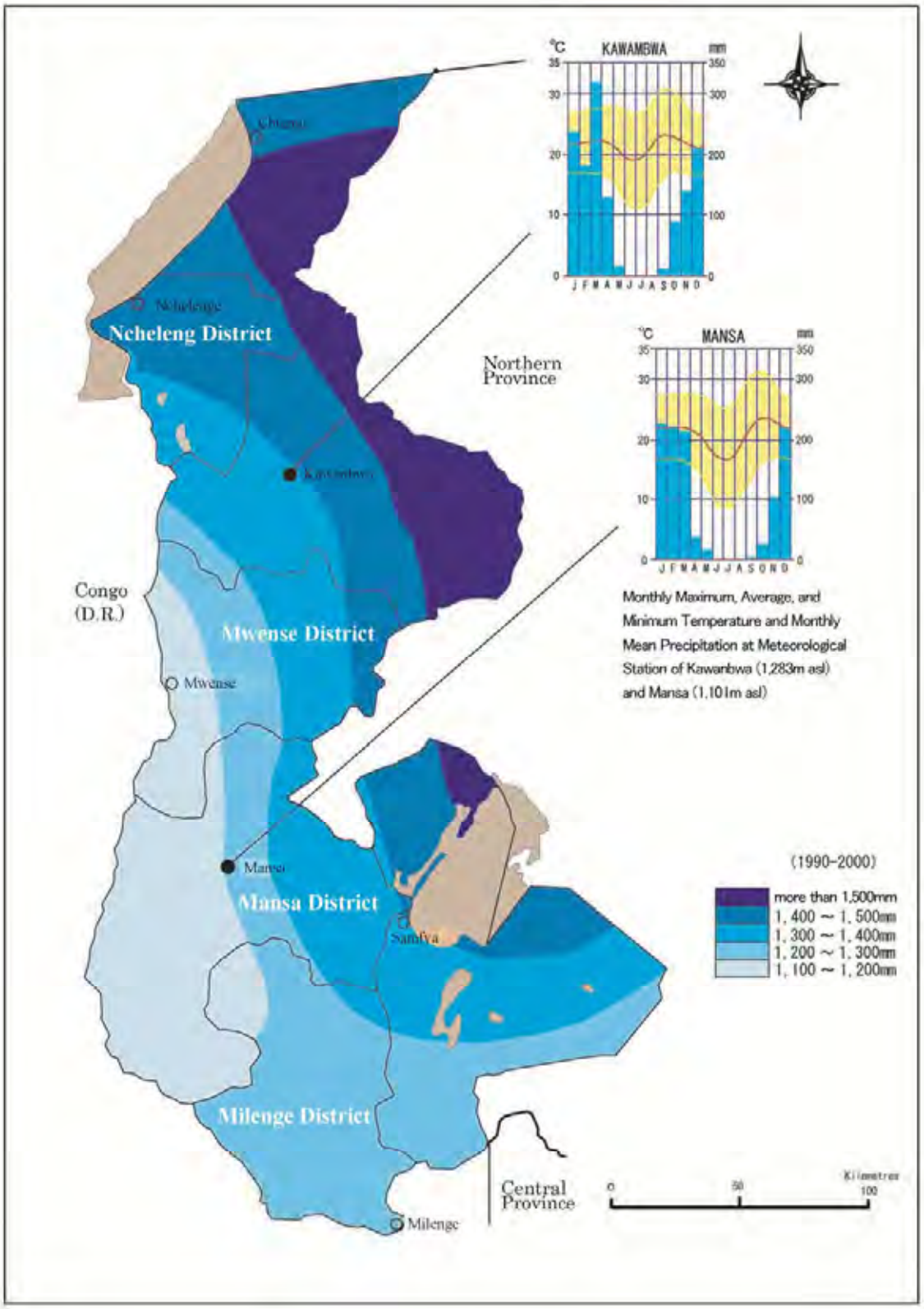

Fig. A10-2 Annual Mean Rainfall Distribution in Luapula Province

3) Geology

The general geology in Zambia is as follows.

The oldest sequence of rocks in the country, the Basement Supergroup, consists mostly of Granitic and Gneissose-rocks, and partly of Metamorphosed sedimentary rocks. This Supergroup comprises the stable block in the northern part of the country (Craton: Bangweulu Block). Their age is from Archean to Paleo-Proterozoic around 2,000 Ma.

The overlying Muva Supergroup comprises the main sequence in central and eastern Zambia of commonly meta-pelite and meta-quartzites. Within the Bangweulu block of northern Zambia, the sedimentary sequence is very different, comprising of continental sediments (rudites, arenites, quartzites and argillites) - the Mporokoso Group. This sedimentation commenced around 1,800Ma and ended 1,200Ma (from Paleo to Meso-Proterozoic).

The Katanga Supergroup of Neo-Proterozoic to Early Paleozoic overlies the basement and Muva sequences. The rocks are exposed throughout Copperbelt and north-western of Zambia, partially overlie the southern to western edge of the Bangweulu block in the northern part of the country. The lower part of the almost exclusively sedimentary sequence is Mine Series Group. The upper part is called Kundelungu Group exposed in the Luapula Province comprising mainly psammite and shales, and conglomerate, rudite, and partly carbonaceous rocks.

Rocks of the Karoo Supergroup (late Carboniferous to Jurassic) occupy the rift troughs. This Supergroup is characterized by coal-bearing strata, and comprises basalt, conglomerate, sandstone, carbonaceous siltstone and mudstones. This Supergroup maybe is not encountered in Luapula Province.

And the others are of Cenozoic as the aeolian sediments around Kalahari Desert in the western part of the country, and the alluvial deposits of rivers, swamps, and lakes. And in the older times, there were a lot of tectono-thermal events in this region, where can be found many rocks derived from these events.

The rocks in the project area are composed of “the Basement Supergroup”, “the Muva Supergroup”, “the Katanga Supergroup”, and the Recent Alluviums etc. among the above mentioned. Recent Alluviums consist of the sediments along rivers, swamps, and lakes such as the Luapula River and the Lake Mweru.

Katanga Supergroup is found along the Luapula River with the range of width 5 to 20km in

Nchelenge, Mwense, and Mansa Districts. It forms a little lower altitude area of 900 and 1,200m along the Luapula River. This Supergroup exists also in the southern and the eastern part of Milenge District. It is dominantly composed of sandstones and shales.

Muva Supergroup is found from the northern part of Mansa District through the middle of Mwense and Kawambwa Districts to Northern Province widely along the direction NNE-SSW or NE-SW forming a large syncline. The rocks of this Supergroup in the area are dominantly sandstones and quartzites in the most area, but shales become dominant in some areas. Those are of Kundelungu Group. Hard sandstones and quartzites form hilly ranges, while shales form relatively low land within some streams.

Basement Supergroup is mainly composed of granitic rocks. Granitic rocks exist in the zone of 100 km wide area directing NE-SW in the eastern half of Mansa District and in the western third of Milenge District. They also are scatter along the Luapula River and the Lake Mweru. Volcanics or meta-volcanics overlie on these granitic rocks sometimes in the area.

Basement Supergroup and Muva Supergroup situate as block generally in the area forming large synclinal structure. The area composed of these rocks forms generally high plateau surrounded by a little lower altitude area composed of Katanga Supergroup. Further in the lowland along the rivers, swamps, and lakes, Alluviums covers the area.

Figure A10-3 shows the “Geology of the Project Area”.

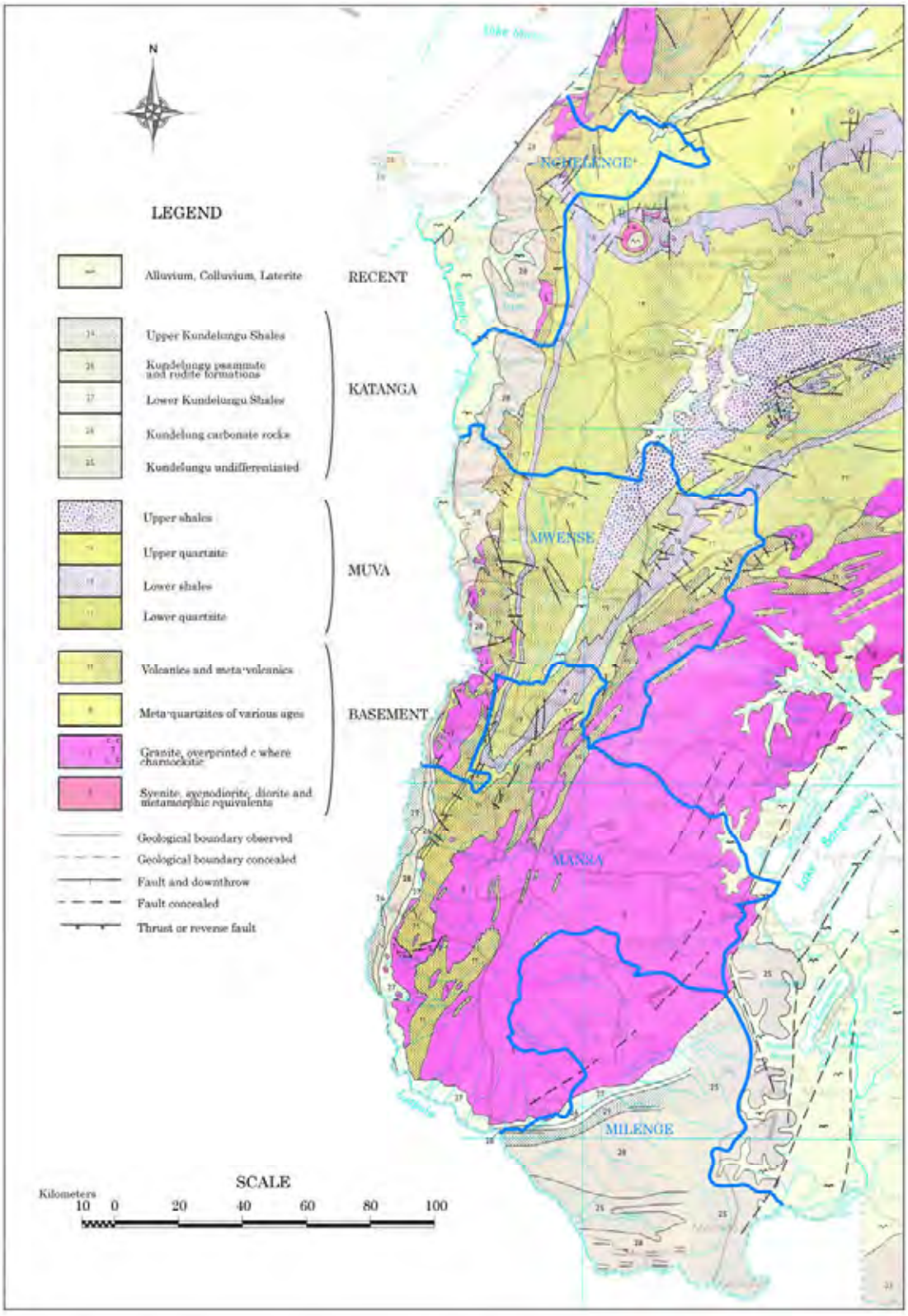

Fig. A10-3 Geology of the Project Area

4) Hydrogeology

Under the Project for Groundwater Development in Luapula Province (hereinafter referred to as “Phase 1 Project”), 200 boreholes with hand-pumps were installed in all the 7 Districts. Among of them, 112 boreholes were constructed in this Phase 2 Project’s Districts. These boreholes have the description of formation judged from drilling debris (112 data) and borehole loggings such as resistivity, gamma ray, and spontaneous potential (67 data).
Pumping test and water quality analyses were done for all the Phase 1 Project boreholes, including the monitoring of iron contents after the construction.
During the field survey of this Phase 2 Project, geoelectrical prospecting was done at selected 100 candidate sites. Simultaneously, water quality tests using field kits were done at domestic water source in the villages (190 samples).

The detail for the result of geoelectrical prospecting and water quality test will be mentioned later.

Hydrogeology in the project area is as below based on the above survey.

i) Basement Supergroup (Granitic rocks, meta-volcanic and meta-quartzite)

The main extents granitic rocks distributed in the project area are in the eastern two-third of Mansa District, and in the north-western half of Milenge District. The others are scattered around the south-eastern periphery and along the Luapula River of Mwense District, and around the northern shore of the Lake Mweru in Nchelenge District.

The ground resistivity is mostly less than two-digit numbers up to the depth of 20 and 30m in these areas, so that they may become remarkably decomposed to clay and sand.
The water sources for domestic use developed in the areas as hand dug wells or open pits are often turbid and low pH. The ground resistivity tends to be higher from three- to four-digit numbers at the depth more than 20 and 30m. If the resistivity shows between 200 and 400 ohm-m, it is considered to be decomposed sand showing relatively high permeability and expected to be good aquifer. However, if these values are for shallow formation, it is recommended not to tap water from this point due to possibility of contamination or has the effect of climate conditions. The rocks more than the resistivity of 500ohm-m or four-digit numbers are usually low permeable as it is. Then, careful surveys to prospect fracture zones are necessary to develop groundwater in these areas. Partly there are some area with very hard rocks and widely outcrops. The key point to develop groundwater in those areas is to find out some fractured zones. During the Phase 1 project, the boreholes drilled in granitic formation showed 8 to 10 % of groundwater with iron contents above the Zambia standard(1.0mg/lit). Therefore, water quality also needs to be considered during the drilling in this area.

Meta-volcanic rocks are distributed in between granitic rocks and Muva Supergroup according to the geological map (Fig. A10-3). In Mansa are located in western side, in Mwense is located in few kilometers width zone area around the middle area of the district, and in the zone with width of few kilometers directing N-S in the eastern side of Nchelenge District. In Milenge district, it is not identified.

Meta-quartzite is distributed in Munkombwe ward, in the north-eastern of Nchelenge District. From the geoelectric prospecting, relatively higher resistivity layers exist near ground surface. Then, to find the groundwater, the fracture zones will be an important target. Vertical sounding curve analysis shows some low resistivity layers existing around the depth of 20 and 30m, and horizontal profiles have undulation with high and low resistivity. Therefore, fracture zones may exist as it is, but to find them at some specific area, the probability become lower to develop groundwater.

ii) Muva Supergroup

Muva Supergroup are distributed widely in the project area, such as the northern part of Mansa District, the major part of Mwense District, and eastern zone with width of few kilometres in Nchelenge District, except north-eastern part. There is no Muva Supergroup in Milenge District.

It is composed of sandstone to quartzite, shales, and their alternations. In sandstones and quartzites, form hilly exposed range due to their hard properties, while shales form relative lowland and develop some streams due to its erosionability.

Both rocks have low permeability, but many fault-lineaments can be seen in the area. Therefore, maybe many fissures or fracture zone can be developed, and maybe decomposed to sand can become as good aquifer. Sandstones and quartzites have a high probability to develop groundwater, while shales have a low probability. In some area, the resistivity of weathered sandstones and quartzite become lower to 10 and 20 ohm-m.

iii) Katanga Supergroup

This Supergroup are developed along the Luapula River with the width of few kilometres to 10 kilometres and in the southern and the eastern two-third of Milenge District. Generally, sandstones and conglomerates (or rudites) are dominant, but along the Luapula river of Mansa District, shales are dominant.

The hydrogeological characteristics of Katanga Supergroup in each district are shown below.

- In the northern part of Nchelenge District: The stratified sandstones and conglomerate are lying over granitic outcrop on the slope to the Lake Mweru. Their total thickness is 10 or more meters. It was confirmed that these layers form good aquifers. The resistivity of these rocks range from 500 to 2,000 ohm-m.
- In the middle to the southern part of Nchelenge District and in the northern part of Mwense District along the Luapula River: there is no outcrop of rocks, so that the formations are highly weathered and relatively deep. One example in this area is, the layers with the resistivity of 200 to 1,000 ohm-m exist up to the depth around 30m, and very low resistivity, with few ohm-m lies after the 30m depth. Upper part is weathered sandstone and conglomerate, and the lower part maybe shale or its weathered clay. In these areas, there is higher possibility to develop groundwater from sand formation aquifers rather than in the fissures of rocks.
- Along the Luapula River in the middle of Mwense District: it is mainly composed by hard and massive sandstones and rudite. Because these rocks is very less permeable and with less fractures, success ratio for groundwater development is considered to be lower. For groundwater development, careful prospecting is recommended.
- Along the Luapula River in the middle of Mwense District and in Mansa District: generally shales are dominant component inter-bedding some sandstone. Because the probability to develop groundwater from shales is generally low, it is better to prospect fissures in sandstone strata. Therefore, the success ratio in this area is also considered to be low, and careful prospecting is necessary.
- 10 to 20 kilometres width along the Luapula River in the southern side of Milenge District: it is dominantly composed of hard but layered sandstones, dipping gently. Permeability of these rocks is low, therefore careful prospecting to find the groundwater in the fissures is necessary.
- A few northern sides from the above mentioned area in Milenge District: there is no outcrop of rock, and probably sandy layers of which the resistivity are less than 100 ohm-m or at the most up to around 200 ohm-m continues up to the depth of some tens meters. In this area, groundwater will be developed mainly in these sandy layers. But in case the resistivity is very low, they may include much impermeable clays, which is note recommended for drilling.
- In the north-eastern part of Milenge District: except the dry portion near surface (up to the depth around 10 m), the layers up to the depth around 40m show the resistivity around 50 ohm-m lying over the layers of the resistivity over 1,000 ohm-m. Because deeper portion may be considered to be granitic rocks or others some sound rocks, groundwater will be developed in the low resistivity layers up to the depth around 40m. However, if these are low permeable clayey material, groundwater will become difficult to be developed.

iv) Alluvial deposits

Alluvial deposits are located along rivers, swamps, and marshes such as Luapula River and the Lake Mweru. In case sands and/or gravel layers are in between, usually there is a possibility to be a good aquifer. Maybe only few Project sites are located in places of alluvial deposits.

Fig. A10-4 shows the “Hydrogeological Map of Luapula Province”.

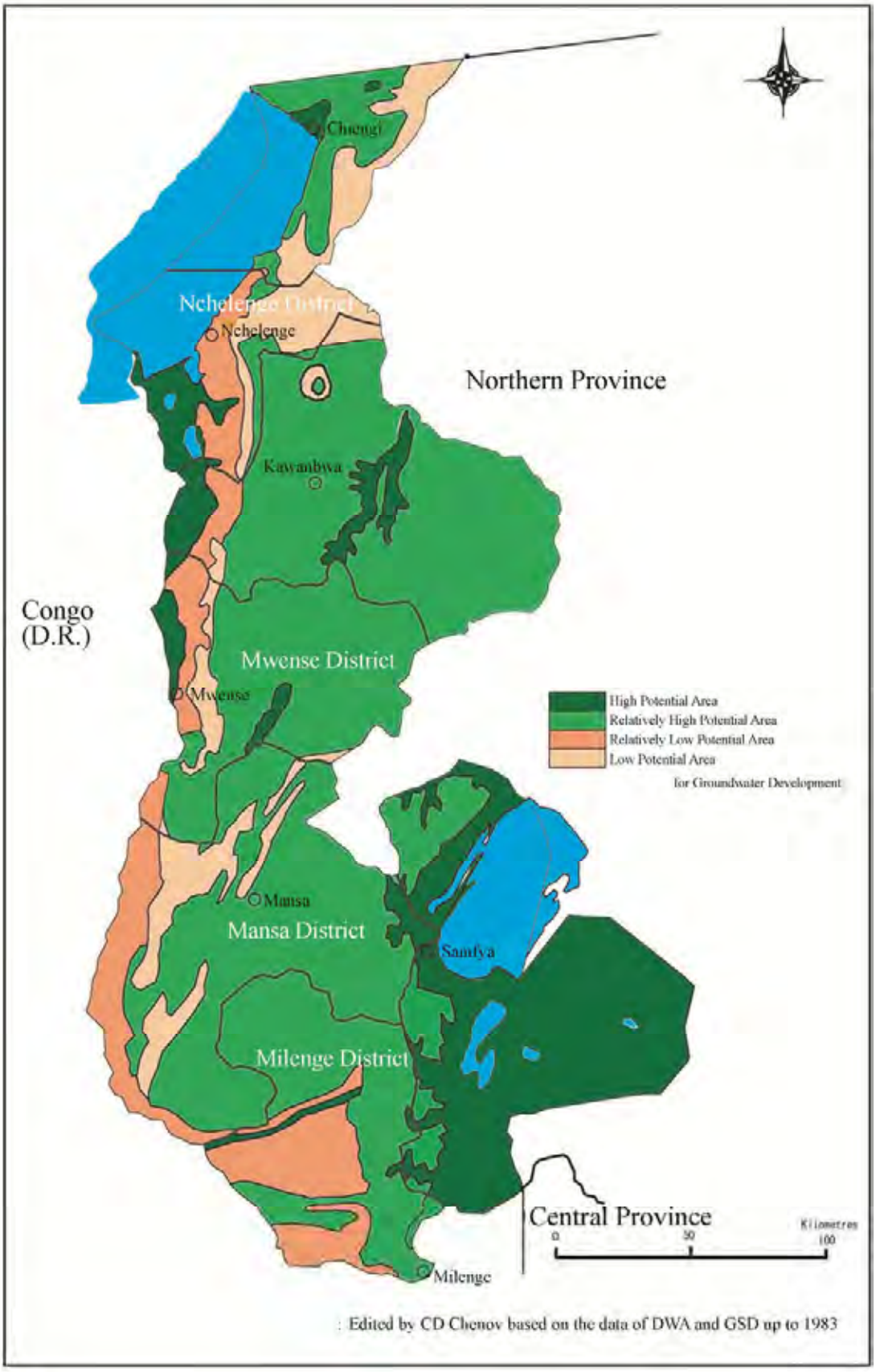

Fig. A10-4 Hydrogeological Map of Luapula Province

5) Result of Natural Condition Survey

In this preparatory survey, geophysical survey and water quality test using field kits for existing water source were conducted at or around the target sites.

i) Purpose of the survey

To check the hydrogeological properties around the requested 320 sites in 4 Districts in Luapula Province. From the point of efficiency, borehole data from the Phase 1 Project also were analysed additionally to the field survey.

ii) Items of the survey

- Survey: Geophysical survey, water quality survey
- Items: Geoelectrical prospecting, water quality tests using field kits.
- Method and sample sites:

Geoelectrical Prospecting

- Vertical Electrical Soundings (VES) and Horizontal Electrical Profiles (HEP).
- The sounding method was selected according to the geological condition of the target site.
- Both VES and HEP were executed by Wenner's Electrode Arrays which is easily comprehensive the geophysical distribution by direct observation at the graph.
- Equipment: Geotron, Model G41 Resistivity Meter
- No. of sites: Nchelenge x 25 sites, Mwense x 20 sites, Mansa x 28 sites, Milenge x 27 sites (Total 100 sample sites)

Water Quality Tests using field kits

- Sampled from the actual water source in the Project site or its surrounding area.
- Measuring electric conductivity (EC) and hydrogen ion concentration (pH) by portable measuring equipment.
- Measuring the concentration of total-iron (Fe), manganese (Mn), and fluoride (F) by field pack test.
- Measuring E. Coli and bacteria by field paper sheet.
- No. of sites: 190 sites

Water Quality tests; 190