JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE MINISTRY OF WATER,
THE GOVERNMENT OF THE UNITED REPUBLIC OF TANZANIA

THE STUDY ON THE GROUNDWATER DEVELOPMENT FOR HANANG, SINGIDA RURAL, MANYONI AND IGUNGA DISTRICTS IN THE UNITED REPUBLIC OF TANZANIA

FINAL REPORT

VOLUME THREE : APPENDICES

AUGUST 1998

SANYU CONSULTANTS INC. (JAPAN)
JAPAN ENGINEERING CONSULTANTS CO. LTD. (JAPAN)

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)
THE MINISTRY OF WATER,
THE GOVERNMENT OF THE UNITED REPUBLIC OF TANZANIA

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ON
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SCOPE OF WORK

FOR

THE STUDY

ON

GROUNDWATER DEVELOPMENT

FOR

HANANG, SINGIDA RURAL, MANYONI AND IGUNGA DISTRICT

IN

THE UNITED REPUBLIC OF TANZANIA

AGREED UPON BETWEEN

THE MINISTRY OF WATER

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

DAR ES SALAAM, November 8, 1996

Prof. Idris Mtulia
PrincipalSecretary,
Ministry of Water

丸尾祐治

Dr. Maruo Yuji
Leader of the Preparatory Study Team,
Japan International Cooperation Agency

Mr. Emmanuel Masanja
Commissioner for External Finance
and Debt Management,
Ministry of Finance

I. INTRODUCTION

In response to the official request of the United Republic of Tanzania (hereinafter referred to as "the Government of Tanzania"), the Government of Japan has decided to conduct the Study on Groundwater Development for Hanang, Singida Rural, Manyoni and Igunga District in the United Republic of Tanzania (hereinafter referred to as "the Study") in accordance with the relevant laws and regulations in force in Japan.

Accordingly, the Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of the technical cooperation programs of the Government of Japan, will undertake the Study in close cooperation with the authorities concerned of the Government of Tanzania.

The present document sets forth the Scope of Work for the Study.

II. OBJECTIVES OF THE STUDY

The objectives of the Study are:

(1) to formulate groundwater development plans for rural water supplies including rehabilitation plan of the existing facilities, operation and maintenance plan, and sanitation improvement plan

(2) to transfer technology on planning, operation & management methods and skills to counterpart personnel in the course of the Study.

III. STUDY AREA

The Study will cover Hanang district in Arusha region, Manyoni and Singida rural district in Singida region, and Igunga district in Tabora region.

IV. SCOPE OF THE STUDY

Phase I Preliminary Analysis and Field Survey

1. Collection, review and analysis of related data and information
   a. social and economic conditions
   b. aerial photos
   c. topographical and hydrogeological maps
   d. meteorological, hydrological, geological data
   e. existing well data and existing water supply services
   f. data on rural living conditions
   g. on-going and planned projects relevant to the Study
   h. laws, regulations and policies on water resource development and water supply services
   i. environmental conditions
   j. other relevant data and information

2. Survey on actual conditions in villages

a. topographical and geological investigation
b. hydrological and hydrogeological investigation
c. condition of water use
d. condition of existing water supply facilities
e. water quality analysis
f. public health and hygiene condition
g. social and economic aspects

3. Inventry of existing water points

4. Selection of villages for the pilot study

5. Plannig for pilot study

6. Conduct Initial Environmental Examination

Phase II : Pilot Study

1. Geophysical survey in the villages selected for pilot study

2. Test drilling, electric logging, pumping test, water quality analysis and instalation of model facilities

3. Pilot study for people's participation in planning, construction, operation and maintenance of water supply facilities and sanitary education

4. Monitoring of the Pilot Study
a. observation of changes in custom and behavior related to water use and hygiene
b. monitoring of operation and maintenance condition
c. evaluation of the pilot study and feedback for the development plan

Phase III : Planning and Evaluation

1. Formulation of basic strategy

2. Formulation of water supply plan

3. Planning for institutional reinforcement in operation and maintenance plan

4. Planning for improvement of sanitary condition

5. Cost Estimation

6. Evaluation
a. financial plan and evaluation

b. institutionalandtechnicalevaluation
c. socio-economicevaluation
d. environmentalimpactassessment
e. WIDevaluation

7. Formulation of implementation program and prioritization

V. SCHEDULE OF THE STUDY

The Study will be conducted in accordance with the tentative schedule attached in Appendix. The schedule is tentative and subject to change on the agreement of both parties when such necessity arises during the course of the Study.

VI. REPORTS

JICA will prepare and submit the following reports in English to the Government of Tanzania.

1. InceptionReport:

Twenty (20) copies at the commencement of the first work in Tanzania.

2. Progress Report :

Twenty (20) copies at about three month after the commencement of first work in Tanzania.

3. Interim Report:

Twenty (20) copies at the end of first work in Tanzania.

4. Draft Final Report:

Twenty (20) copies at the second work in Tanzania.
The Government of Tanzania shall submit its comments within one (1) month after the receipt of the Draft Final Report.

5. Final Report:

Forty (40) copies within two (2) months after the receipt of the comments on the Draft Final Report.

Ⅵ. UNDERTAKINGS OF THE GOVERNMENT OF TANZANIA

1. To facilitate the smooth conduct of the Study, the Government of Tanzania will take the following necessary measures:

(1) To secure the safety of the Japanese study team (hereinafter referred to as "the Team").

(2) To permit the members of the Team to enter, leave and sojourn in Tanzania for the duration of their assignment therein, and exempt them from foreign registration requirements and consular fees,

(3) To exempt the members of the Team from taxes, duties, fees and any other charges on equipment, machinery and other materials brought into Tanzania for the conduct of the Study,

(4) To exempt the members of the Team from income tax and charges of any kind imposed on or in connection with any emoluments or allowances paid to the members of the Team for their services in connection with the implementation of the Study,

(5) To provide necessary facilities to the Team for remittance as well as utilization of the funds introduced into Tanzania from Japan in connection with the implementation of the Study,

(6) To secure permission for the Team to enter into private properties or restricted areas for the implementation of the Study,

(7) To secure permission for the Team to take all data and documents (including photographs and maps) related to the Study out of Tanzania to Japan, and

(8) To provide medical services as needed, expenses for which will be chargeable to the members of the Team.

2. The Government of Tanzania shall bear claims, if any arise, against the members of the Team resulting from, occurring in the course of, or otherwise connected with, the discharge of their duties in the implementation of the Study, except when such claims arise from gross negligence or willful misconduct on the part of the member of the Team.

3. For the smooth implementation of the Study, the Ministry of Water shall act as a counterpart agency to the Japanese Study Team and also as a coordinating body in relation with other governmental and non-governmental organizations concerned.

4. The Ministry of water shall, at its own expense, provide the Team with the following, in cooperation with other organizations concerned:

(1) available data and information related to the Study
(2) counterpart personnel
(3) suitable office space with necessary equipment in respective district
(4) credentials or identification cards
(5) an appropriate number of vehicles with drivers.

Ⅷ. UNDERTAKINGS OF JICA

For the implementation of the Study, JICA shall take the following measures:

1. to dispatch, at its own expense, study teams to Tanzania,

2. to pursue technology transfer to counterpart personnel in the course of the Study.

Ⅸ. CONSULTATION

JICA and the Ministry of Water shall consult with each other in respect of any matter that may arise from or in connection with the Study.

MINUTES OF MEETINGS
ON
THE SCOPE OF WORK
FOR
THE STUDY
ON
GROUNDWATER DEVELOPMENT
FOR
HANANG, SINGIDA RURAL, MANYONI AND IGUNGA DISTRICT
IN
THE UNITED REPUBLIC OF TANZANIA

AGREED UPON BETWEEN

THE MINISTRY OF WATER

AND

THE JAPAN INTERNATIONAL COOPERATION AGENCY

DAR ES SALAAM, November 8, 1996

Prof. Idris Mtulia
Principal Secretary,
Ministry of Water

丸尾祐治

Dr. Maruo Yuji
Leader of the Preparatory Study Team
Japan International Cooperation Agency

Mr. Emmanuel Masanja
Commissioner for External Finance
and Debt Management,
Ministry of Finance

Based on the formal request of the United Republic of Tanzania (hereinafter referred to as "the Government of Tanzania"), the Government of Japan, through the Japan International Cooperation Agency (hereinafter referred to as "JICA"), has agreed to conduct the Study on Groundwater Development for Hanang, Singida Rural, Manyoni and Igunga District in the United Republic of Tanzania (hereinafter referred to as "the Study").

The JICA preparatory study team ,headed by Dr. MARUO Yuji, visited Tanzania from October 28th to November 15th, 1996, where they held a series of meetings with Ministry of Water and other authorities concerned of the Government of Tanzania. The attendants list is shown in the Appendix-1.

During the visit, both sides agreed to the Scope of Work for the Study, which defines the terms and conditions of this bilateral cooperation. The Minutes of Meetings has been prepared for the better understanding of the Scope of Work agreed upon between the Tanzanian representatives and the JICA preparatory study team on November 8, 1996, summarizing main points of the discussions made in the course of the preparation of the Scope of Work.

1. Development Study by JICA

The Tanzanian side understood of the scheme of Development Study which was explained by the JICA preparatory study team.The Tanzanian side also expressed their concern about implementation of the development plan formulated as a result of this study. Considering austerity budgetary condition of the government of Tanzania, Tanzanian side addressed that they were expecting the project to be implemented by Japanese assistance. The JICA preparatory study team said that they were not authorized to discuss anything about Japan's grant assistance, and they could only advise the Tanzanian side to submit formal proposal of implementation to Government of Japan upon the completion of the Study.

2. Project Working Committee

Both sides agreed to establish a Project Working Committee for the smooth and effective execution of the Study. Ministry of Water will act as a coordinating body to conduct the Project Working Committee. It will be comprised of the representatives from following organizations or staff:

The committee will meet to discuss on the reports submitted by the Study Team, and adhoc basis when necessity arises.

Ministry of Water
Regional Water Engineer in Arusha region
Regional Water Engineer in Singida region
Regional Water Engineer in Tabora region
District Water Engineer in Hanang district
District Water Engineer in Singida rural district
District Water Engineer in Manyoni district
District Water Engineer in Igunga district

3. Technology Transfer

The JICA preparatory study team explained that technology transfer would be realized through following three means:

- on the job training to the counterpart personnel in the course of the Study
- counterpart training in Japan
- workshops at an appropriate occasions during the Study

The Tanzanian side understood these means.

(1)Counterpart Training

The Tanzanian side requested counterpart training in Japan. The JICA preparatory study team agreed to convey this request to JICA H.Q. for consideration.

(2)Workshop

The Tanzanian side requested to perform the workshops at an appropriate occasions during the Study. The JICA preparatory study team agreed to convey this request to JICA H.Q. for consideration.

4. Target Villages

There are a large number of villages which are sparsely located in the vast extent of land. Motorable roads are very limited and they are all dirt and seasonal. Taking those conditions into consideration, maximum number of target villages should be not more than 300 for effective and fruitful execution of village inventory work during the limited period of time

In the meanwhile master plan studies have already done in Arusha and Tabora regions. To avoid duplication of work Hanang District selected 33 villages as target for the Study based on the master plan. As for Tabora district there are altogether 97 villages, out of which CARITAS has already elaborated development plan of rural water supply in 23 villages. Based on the master plan study 50 villages out of 74 remaining villages are to be selected as target for the Study.

On the other hand no master plan study has conducted so far, and NGO's or other donor's activities are limited to minimum level in Singida region. Therefore entire villages in Singida and Manyoni districts are decided to be the target for the Study except for several villages in Manyoni district on which UNICEF has already made development plan. Although this does not mean to formulate a master plan for the two districts within the Study.

Nineteen villages in Singida urban district which were requested to add by Singida region are not to be included in target villages.

5. Types of Rural Water Supply Facility

In the Study area following types of water supply facilities are identified:

- Gravity scheme
- Borehole with handpump
- Borehole with piped scheme (diesel engine and borehole pump)
- Borehole with windmill
- Dug well with handpump
- Dug well
- Charco (small dam)

Among those facilities borehole with piped schemes were introduced to the villages with about two to three thousand population during the previous regime, and most of them are out of operation in the moment. During the Study it's applicability must be carefully scrutinized from various aspects such as hydrogeological condition, readiness of village water committee, villager's affordability to cover running cost e.t.c.

The JICA preparatory study team expressed their basic idea that while development plans to improve rural water supply condition in the Study area are formulated, a scheme of borehole with handpump should be applied as the first option as far as the natural condition allows considering provision of hygienically safe water, easy and village level operation and maintenance of the facility and relatively low operation and maintenance cost.

In connection to the rural water supply facility the Tanzanian side repeatedly emphasized that a certain facility and water source for watering livestock should be considered near those water points where substantial number of livestock are raised.

6. Pilot Study

Geophysical exploration and test drillings will be conducted at selected two sites in the respective district to confirm the groundwater potential. As the geological configuration is more complicated in Hanang district compared to other districts, more than two test borings should be carried out to confirm groundwater availability in the district.

If these test wells are proved to yield sufficient amount of water, adequate types of facilities would be installed to convert them into production well.

When sufficient amount of water for installing facility is assured, mobilization of beneficiaries might be realized through health and sanitation education, various training for members of village water committee e.t.c.

Rehabilitation works of certain existing water supply facilities at selected sites will also be carried out to scrutinize the applicability of these types of facilities to the present natural and socio-economic situation of the village.

7. Reports

(1)The Tanzanian side agreed to make it open to the public in order to achieve maximum use of the Study results.

(2)The Tanzanian side requested the Japanese side that the Study Team should submit brief bi-monthly progress reports in addition to those mentioned in Scope of Works.

8. Undertakings of the Government of Tanzania

(1)The Tanzanian side will assign the adequate number of counterpart personnel which may be consisted mainly of respective Regional or District Water Engineer office's staff during the Study.

(2)The Tanzanian side will assist the Study Team in securing necessary office space (good for 10 persons) together with necessary office furniture, the

readily usable power/water supply. However, due to financial constraints, the Tanzanian side requested JICA to shoulder expenses to be incurred in renting and using facilities and services, such as office rental, office furniture, bills of power and water, and other office running cost.

(3)The Tanzanian side requested the Japanese side to provide adequate number of vehicles with drivers for the Study due to the limited budget. The Tanzanian side also requested the Japanese side to meet cost for data and information which are not available with the Ministry of Water or it's department. The JICA preparatory study team recognized this situation and promised to convey this request to JICA H.Q. for consideration.

(4)The Tanzanian side assured that respective authority would inform the people of the target villages through village chairman about the Study scheme before the commencement of the Study.

Appendix-1 Attendants List

(Tanzanian side)

Ministry of Water

Prof. Idris Mtulia	PrincipalSecretry
Mr. Christopher Sayi	AssistantCommissioner
Mr. Donatus Isheingoma	Head of Construction Section
Mr. Laurent M. Sechu	Head of Design Section
Mr. Jupiter Siwa	Counterpart for the Preparatory Study Team

Igunga District in Tabora Region

Mrs. Katiti Martha	RegionalAdministrativeSecretary
Mr. M. E. Kuzenza	ActingRegional WaterEngineer
Mr. Peter Mauto	Acting Regional Planning Officer
Mr. S. F. Sangija	Regional Hydrogeologist
Mr. Rajab S. Samatha	ActingDistrictAdministrativeSecretary
Mr. Shaaban A. Ntarambe	ActingDistrictExecutiveDirector
Mr. Rutta Merchades	DistrictWaterEngineer

Hananng District in Arusha Region

Mr. Jeremiah T. Akonaay	RegionalWaterEngineer
Mr. Gabriel G. Songay	DistrictCommissioner
Mr. Cyprian H.M. Minja	DistrictExecutiveEngineer
Mr. George C. Mfuko	DistrictWaterEngineer
Mr. Michael J. Ndesika	Acting DistrictPlanning Officer
Mr. Nicholaus J. Nyaki	WaterTechnician

Singida Rural District in Singida Region

Mr. Emmanuel P. Mazala	ActingRegionalAdministrativeSecretary
Mr. Richard M.C. Msengi	RegionalWaterEngineer
Mr. Akas A. Shao	Acting Regional Planning Officer
Mr. Peter H. Killewo	PlanningEngineer
Mr. Joel C. Mwaihojo	DistrictWaterEngineer

Manyoni District in Singida Region

Mr. T.Z. Kingu	DistrictCommissioner
Mr. A.K. Ombori	DistrictExecutiveDirector
Mr. A. Am Kusenha	DistrictWaterEngineer
Mr. M.A. Swedi	WaterTechnician

(Japanese side)

JICA Tanzania Office

Mr. Moronaga Hiroyuki	Assitant Resident Representative
Mr. Sungusia Debora	Assitant Director

JICA Preparatory Study Team

Dr. Maeuo Yuji	Leader/Groundwater Development Planning; Specialist on Water Resources, JICA
Mr. Sasadate koichi	Study Planning; Staff, Second Development Study Division, Social Development Study Department, JICA
Mr. KamiyaMitsuaki	Hydrogeology/Environment
Mr. Odagaki Masao	Boring Planning
Mr. Fujiyama Taketoshi	Facility Planning

MINUTES OF MEETING
CONCERNING
THE INCEPTION REPORT
FOR
THE STUDY
ON
GROUNDWATER DEVELOPMENT
FOR
HANANG, SINGIDA RURAL, MANYONI AND IGUNGA DISTRICTS
IN
THE UNITED REPUBLIC OF TANZANIA
AGREED BY AND BETWEEN
THE MINISTRY OF WATER
AND
THE STUDY TEAM,
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

DAR ES SALAAM, 25th April, 1997

Prof. Idris A. Mtulia
Principal Secretary
The Ministry of Water

Mr. Yoshikawa Mitsuru
Leader,
The Study Team, JICA

Dr. Maruo Yuji
Technical Advisor, JICA

Based on the Scope of Work agreed by and between the Ministry of Water of the Government of the United Republic of Tanzania (hereinafter referred to as "the Ministry") and the Preparatory Study Team of Japan International Cooperation Agency (hereinafter referred to as "JICA") in November, 1996, JICA organized another study team (hereinafter referred to as "the Study Team") and dispatched it to Tanzania in April 1997 to conduct the Study on Groundwater Development for Hanang, Singida Rural, Manyoni and Igunga Districs in the United Republic of Tanzania (hereinafter referred to as "the Study")

At the commencement of the Study, the Study Team submitted 20 copies of the Inception Report of the Study to the Ministry on 22nd April, 1997.
Prior to the meeting with the Project Working Committee, the Study Team called upon the Principal Secretary of the Ministry and briefed him about the objectives and the strategies of the Study. And in turn the Principal Secretary provided some guiding principles and policy guidelines to be observed during the implementation of the study, the importance of the study, provision of water to the beneficiaries in the study area, transfer of technology and training for the counterpart personnel of the Ministry.
The meeting for explanation and discussion on the contents of the Inception Report of the Study was held on 22nd ~ 24th of April, 1997 at the Head Office and at Ubungo Maji Office of the Ministry. The list of attendants is given in Appendix-1.

The Study Team explained the contents of the Inception Report in detail to the relevant officers of the Ministry and the Project Working Committee composed of Regional Water Engineers and District Water Engineers from the respective Regions and Districts, namely the background and objectives of the Study, the Study Area, scope of the Study, plan of approach, plan of operation and implementation plan of the Study. Both sides agreed on these subjects.

Major issues of the discussion were as below;

(1) In connection with the number of test drilling, the Ministry side expressed its concern that if two dry holes are encountered in the District where only two boreholes are allocated. The Study Team explained that the matter would be handled in accordance with the item 6 of the Minutes of Meeting of the Scope of Work. However, if such a case arises, the Study Team may submit a request for additional drilling to JICA Headquarters for consideration.

(2) The participants from the Tanzanian side in the meeting for explanation and discussion of the Interim Report called for the inclusion of Regional and District Water Engineers and other

related agencies in addition to the related officers of the Ministry (as per Item [29], page 9 of the Inception Report).

(3) In connection with the counterpart training in Japan, the Study Team suggested to the Ministry to make application to JICA Tanzania Office.

(4) In connection with counterpart personnel, the Ministry agreed to provide a specialist for each member of the Study Team as their counterpart personnel. Both sides confirmed that the allowance and expense necessary to the study works of counterpart personnel are to be subject to the Tanzania side.

(5) The Ministry requested JICA to donate the equipment which were purchased by JICA and provided to the Study Team, after the completion of the Study.

Appendix-1: List of Attendants in the Meeting

(Tanzanian side)

Ministry of Water	
Mr. B. E. Njau	Commissioner for Water Affairs
Mr. Laurent M. Sechu	Head of Design Section
Mr. M. A. Macha	Design Engineer
Mr. M. R. Rugaimukamu	Assistant Drilling Superintendent , Ubungo Office
Tabora Region	
Mr. T. M. Buzare	Regional Water Engineer
Mr. Rutta Merchades	District Water Engineer, Igunga District
Arusha Region	
Mr. Jeremiah T. Akonaay	Regional Water Engineer
Mr. George C. Mfuko	District Water Engineer, Hanang District
Singida Region	
Mr. Richard M. C. Msengi	Regional Water Engineer
Mr. Joel C. Mwaihojo	District Water Engineer, Singida Rural District
Mr. A. Ara Kusenha	District Water Engineer, Manyoni District

(Japanese side)

JICA Headquarters

Dr. Maruo Yuji	Development Specialist
Mr. Matsumoto Shigeyuki	Task Management, Second Development Study Division, Social Development Study Department

JICA Tanzania Office

Mr. Ohno Tadanobu	Assistant Resident Representative
Ms. Deborah Sungusia	Assistant Director

JICA Study Team

Mr. Yoshikawa Mitsuru	Team Leader / Groundwater Development
Mr. Ohta Kunio	O&M / User's Organization
Mr. Kawasaki Satoshi	Hydrogeology / Environment
Ms. Mandawa, Mercy J.	Social Analysis / WID
Dr. Bugengo, James	Hygiene Education
Mr. Ohta Kazuhisa	Team Coordination

MINUTES OF MEETING
ON
THE PROGRESS REPORT
FOR
THE STUDY
ON
GROUNDWATER DEVELOPMENT
FOR
HANANG, SINGIDA RURAL, MANYONI AND IGUNGA DISTRICTS
IN
THE UNITED REPUBLIC OF TANZANIA
AGREED BY AND BETWEEN
THE MINISTRY OF WATER
AND
THE STUDY TEAM,
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

In Dar es Salaam, on 12th June, 1997

Prof. Idris A~~s MTULIA~~
Principal Secretary,
Ministry of Water

Mr. YOSHIKAWA Mitsuru
Leader,
The Study Team, JICA

Witnessed by:

Dr. MARUO Yuji
Technical Advisor, JICA

Based on the Scope of Work agreed by and between the Ministry of Water of the Government of the United Republic of Tanzania (hereinafter referred to as "the Ministry") and the Preparatory Study Team of Japan International Cooperation Agency (hereinafter referred to as "JICA") in November, 1996, JICA organised another study team (hereinafter referred to as "the Study Team") and dispatched it to Tanzania in April 1997 to conduct the Study on Groundwater Development for Hanang, Singida Rural, Manyoni and Igunga Districts in the United Republic of Tanzania (hereinafter referred to as "the Study").

At the commencement of the Study, the Study Team paid courtesy calls to the administrative officials in both Regions and Districts in the Study Area as follows; Singida Region and Singida Rural District on 29th April 1997, Hanang District on 2nd May 1997, Arusha Region on 5th May 1997, Manyoni District on 5th May 1997, Igunga District on 6th May 1997 and Tabora Region on 13th May 1997. During these visits the Study Team briefed the officials on the objectives and strategies of the Study. And, in turn, the officials in the District and Regional Administration provided some guiding principle and policy to be observed during the implementation of the Study, the importance of the Study in provision of water to the beneficiaries in the Study Area, transfer of technology and training for the counterpart personnel.

The Study Team conducted a series of field surveys and studies in the Phase-One Study in close cooperation with the counterpart personnel of the Ministry and the related officers in the relevant Regions and Districts. Upon the termination of the Phase-One Study, the Study Team prepared and submitted twenty (20) copies of the Progress Report to the Ministry. Thereafter, a meeting with the Project Working Committee for the explanation and discussion on the contents of the Progress Report of the Study was held on 9th and 10th June, 1997 at Singida Town.
The list of participants in the meeting is given in Appendix-1 hereof.

The Study Team explained the contents of the Report in detail to the members of the Project Working Committee, namely the findings by surveys and studies conducted during the Phase-One Study, the model and pilot villages selected, proposed guideline for further pilot study and so forth. Through a series of discussion on some subjects, the Committee accepted and agreed on the content of the Report.
The Principal Secretary of the Ministry was briefed of the outcome of the Phase-One Study and meeting of the Project Working Committee held in Singida to discuss the Progress Report submitted by the Study Team. Thereafter, the minutes of meeting were

signed on 12th June 1997 in Dar es Salaam.

Major issues in the discussion were as below:

(1) The Meeting received, deliberated and agreed on the selection of proposed sites for the pilot study and possible types of construction.

(2) The Meeting agreed that the proposed sites and possible types of construction are tentative and subject to be changed depending on the results of geophysical survey, test drilling and when need arises.

(3) The Meeting was informed that the borehole which was serving Masakta Village before the split of the village into two villages, i.e. Lambo (a former sub-village of Masakta) and Masakta Villages, was now a part and parcel of Lambo. However, the pump and engine were vandalised immediately after the split; and it was observed that unforeseen conflict could erupt if the water source in Lambo would be improved to provide water to Masakta and not to Lambo.
In view of the said situation, the Meeting resolved to drop Masakta Village from the list of pilot villages in Hanang District.

(4) In connection with the measure to be taken in case that a borehole has been drilled in a pilot village and the water appears to be not good for human consumption, the Meeting was informed and agreed that the objectives of the pilot study shall have been achieved if one or two water facilities were realised in each district.

(5) The Meeting agreed to involve both Regional and District Water Engineers from the Study Area in the formulation of plan of operation and maintenance of water facilities.

(6) The Meeting agreed tentatively that the date and place of next meeting of the Project Working Committee be on 10th December 1997 in Dar es Salaam; and that copies of the Interim Report be distributed by 7th December 1997 so as to give participants enough time to read and digest the contents.

(7) In conclusion, the Leader of the Study Team thanked the Regional and District Water Engineers for their support and cooperation which assisted the Study Team to accomplish their model village survey in the shortest possible time.
Further the Team Leader requested the Regional and District Water Engineers to do

the needful so as to enable the Study Team to conduct the Village and Household Survey with the maximum success.

The members of the Project Working Committee reaffirmed their continuing support and assistance to the Study Team whenever need or exigency arises.

Appendix-1: List of Participants in the Meeting

(Tanzanian Side: The Project Working Committee):

Ministry of Water;

Mr. M. A. MACHA	Senior Design Engineer, Chairman of Meeting
Mr. L. R. E. KONGOLA	Head of Hydrogeology Section

Arusha Region;

Mr. Jeremiah T. AKONAAY	Regional Water Engineer
Mr. George C. MFUKO	District Water Engineer, Hanang District

Singida Region;

Mr. Richard M. C. MSENGI	Regional Water Engineer
Mr. P. H. KILLEWO	Senior Executive Engineer
Mr. Joel C. MWAIHOJO	District Water Engineer, Singida Rural District
Mr. A. Ara KUSENHA	District Water Engineer, Manyoni District

Tabora Region;

Mr. M. E. KUZENZA	Representing Regional Water Engineer
Mr. Rutta MERCHARDES	District Water Engineer, Igunga District

(Japanese Side):

JICA Headquarters;

Dr. MARUO Yuji	Development Specialist, Groundwater Development
Mr. SASADATE Koichi	Task Management, Second Development Study Division, Social Development Study Department

The Study Team:

Mr. YOSHIKAWA Mitsuru	Team Leader/ Groundwater Development
Mr. OHTA Kunio	O&M/User's Participation
Mr. OKAMOTO Sumitada	Rural Water Supply
Ms. Mercy J. MANDAWA	Social Analysis/WID
Dr. James BUGENGO	Hygiene Education

MINUTES OF THE MEETING
ON
THE INTERIM REPORT
FOR
THE STUDY
ON
GROUNDWATER DEVELOPMENT
FOR
HANANG, SINGIDA RURAL, MANYONI AND IGUNGA DISTRICTS
IN
THE UNITED REPUBLIC OF TANZANIA
AGREED BY AND BETWEEN
THE MINISTRY OF WATER
AND
THE STUDY TEAM,
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

In Dar es Salaam, on 12th December, 1997

Mrs. Olympia LIMIHAGATI
Ag. Principal Secretary,
The Ministry of Water

Mr. YOSHIKAWA Mitsuru
Leader,
The Study Team, JICA

Witnessed by:

Dr. MARUO Yuji
Development Specialist, JICA

Based on the Scope of Work agreed by and between the Ministry of Water of the Government of the United Republic of Tanzania (hereinafter referred to as "the Ministry") and the Preparatory Study Team of Japan International Cooperation Agency (hereinafter referred to as "JICA") in November, 1996, JICA organised another study team (hereinafter referred to as "the Study Team") and dispatched it to Tanzania in April 1997 to conduct the Study on Groundwater Development for Hanang, Singida Rural, Manyoni and Igunga Districts in the United Republic of Tanzania (hereinafter referred to as "the Study").

The Study Team conducted a series of field surveys and studies in the Phase-One and Two Studies in close cooperation with the counterpart personnel of the Ministry and the related officers in the relevant Regions and Districts. Upon the termination of the Phase-Two Study, the Study Team prepared and submitted twenty (20) copies of the Interim Report to the Ministry. Thereafter, a meeting with the Project Working Committee for the explanation and discussion on the contents of the Report of the Study was held on 8th and 10th December, 1997 at Dar es Salaam.

The list of participants in the meeting is given in Appendix-1 hereof.

The Study Team explained the contents of the Report to the members of the Project Working Committee, namely the findings by surveys and studies conducted during the Phase-One and Two Studies, the proposed basic strategy for project planning, the content of the further Phase-Three Study and so forth. Through a series of discussion on some subjects, the Committee accepted and agreed on the content of the Report.

The Acting Principal Secretary of the Ministry was briefed of the outcome of the Phase-One and Two Studies and the meeting of the Project Working Committee held to discuss the Interim Report submitted by the Study Team. Thereafter, present minutes of meeting were signed on 12th December 1997 in Dar es Salaam.

Major issues discussed were as below:

(1) The total number of target villages in Singida Rural district was disputed as 130 and not 129 as given in the Report. The meeting directed the District Water Engineer to liaise with DED who shall then confirm in writing to the Study Team.

(2) Since the JICA Guidelines for Environmental consideration of Groundwater Development was not presented in the report, it was agreed that a summary of the

Guidelines will be translated into English and attached as an Appendix to the Draft Final Report to be presented in May 1998.

(3) The presentation of the figure of Annual Household Income should be improved for clarity. It was stressed that the income level covering 80 % of households should be used for evaluation of affordability considering the distortion effects created by the few high income earners.

(4) In villages within the Study Area where there are other institutions and NGOs involved in similar work, efforts should be made to ensure complementarity of the various players.

(5) A schedule for the completion of the Pilot Study was presented and adopted as shown below:

Completion of drilling works	- Dec. 1997
Completion of civil works	- late Jan. 1998
Training	- Jan. 1998
Monitoring and Evaluation	- Feb. 1998

On the other hand, the schedule for submission of the Final Report is as follows:

Submission of the Draft Final Report	- Mar. 1998
Presentation and Discussion of the Draft Final Report	- May 1998
Submission of the Final Report	- July 1998

(6) The Study Team was advised to make additional monitoring and evaluation work of Pilot Study in May, 1998.
The results of this monitoring and evaluation work will be included in the Final Report.

(7) The meeting advised the Study Team to make a comprehensive O&M action plan which includes technical aspects such as recruitment and training of local mechanics, procurement of spare parts etc.

(8) In view of the required high technical skills and high running costs involved, the meeting advised that the criteria for L-2 systems be looked into more critically and their monitoring be extended.

(9) The meeting tentatively proposed to hold a workshop immediately after presentation and discussion of the Draft Final Report in May, 1998. It will be held in Singida and proposed eligible participants are as follows:

(i) Village Executive Officers of all Pilot villages
(ii) Project Working Committee
(iii) Ministry of Water
(iv) Representatives of related Ministries such as Health, MCDWC, PMO, Treasury and Planning Commission
(v) District Executive Directors for 4 districts
(vi) District Health Officers and DCDO for the 4 districts
(vii) District Planning and Coordination Officers for the 4 districts.

(10) The meeting agreed that more emphasis will be placed on capacity and capability building of the beneficiaries especially women during the planning and budgeting of resources.

(11) The Tanzanian side requested JICA to donate the equipment procured by JICA after completion of the study. The JICA delegation advised the Tanzania Government to submit a formal request to JICA in March, 1998.
The Tanzania side further requested JICA to donate equipment and materials procured by the Contractor for the drilling and other civil works at the end of Pilot Study. The JICA delegation advised that the Tanzania Government make a separate request to JICA in this regard at the same time the first request is made.

Appendix-1: List of Participants in the Meeting

(Tanzanian Side):

Ministry of Water;	
Mr. Gabriel LWAKABARE	Ag. Director of Rural Water Supply, Chairman of the Meeting
Mr. L. R. E. KONGOLA	Head of Groundwater Section
Dr. MOHAMED A. H.	Head of Drilling and Dam Construction Section
Mr. Ryubha MAGESA	Rural Water Supply Section
Mr. M. R. RUGAIMUKAMU	Assistant Drilling Superintendent, Ubungo
Arusha Region;	
Mr. M. B. LOISENGER	Representing Regional Water Engineer
Mr. George C. MFUKO	District Water Engineer, Hanang District
Singida Region;	
Mr. D. K. KAMARA	Regional Water Engineer
Mr. Joel C. MWAIHOJO	District Water Engineer, Singida Rural District
Mr. A. Ara KUSENHA	District Water Engineer, Manyoni District
Tabora Region;	
Mr. T. M. BUZARE	Regional Water Engineer
Mr. RUTTA Merchades	District Water Engineer, Igunga District
Ministry of Health;	
Mr. R. M. Kukula	Principal Health Officer

(Japanese Side):

JICA Headquarters;

Dr. MARUO Yuji	Development Specialist, Groundwater Development
Mr. ARAKI Yasumichi	Task Management, Second Development Study Division, Social Development Study Department

The Study Team;

Mr. YOSHIKAWA Mitsuru	Team Leader/ Groundwater Development
Mr. OHTA Kunio	O&M/User's Participation
Mr. KAWASAKI Satoshi	Hydrogeology/Environment
Mr. OKAMOTO Sumitada	Rural Water Supply
Ms. Mercy J. MANDAWA	Social Analysis/WID
Dr. James BUGENGO	Hygiene Education
Mr. ISHIBASHI Naomichi	Economy/Finance
Mr. OHTA Kazuhisa	Team Coordination

MINUTES OF MEETING
ON
DRAFT FINAL REPORT
FOR
THE STUDY
ON
GROUNDWATER DEVELOPMENT
FOR
HANANG, SINGIDA RURAL, MANYONI AND IGUNGA DISTRICTS
IN
THE UNITED REPUBLIC OF TANZANIA
AGREED BY AND BETWEEN
THE MINISTRY OF WATER
AND
THE STUDY TEAM,
JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

In Dar es Salaam, on 16 June, 1998

Prof. Idris A. MTULIA
Permanent Secretary,
The Ministry of Water

Mr. YOSHIKAWA Mitsuru
Leader,
The Study Team, JICA

Witnessed by:

Dr. MARUO Yuji
Senior Development Officer,
JICA

Based on the Scope of Work agreed by and between the Ministry of Water of the Government of the United Republic of Tanzania (hereinafter referred to as "the Ministry") and the Preparatory Study Team of Japan International Cooperation Agency (hereinafter referred to as "JICA") in November, 1996, JICA organised another study team (hereinafter referred to as "the Study Team") and dispatched it to Tanzania from April 1997 to January 1998 to conduct the Study on Groundwater Development for Hanang, Singida Rural, Manyoni and Igunga Districts in the United Republic of Tanzania (hereinafter referred to as "the Study").

The Study Team conducted a series of field works in the Phase-One and Phase-Two Studies; and a part of Phase-Three Study in Tanzania under the close cooperation with the counterpart personnel of the Ministry and the related officers in the relevant Regions and Districts. After the field works in Tanzania, the Study Team continued the Phase-Three Study in Japan; and prepared the Draft Final Report of the Study. The Team mailed 20 copies of the report to the Ministry on 22 May 1998.

Meanwhile, the Study Team conducted the second monitoring and evaluation of the operation and maintenance (O&M) activities in the pilot villages from 15th May to 8th June 1998. The findings will be incorporated in the Final Report of the Study.

Thereafter, a meeting with the Project Working Committee for the presentation and discussion on the contents of the Draft Final Report of the Study was held on 10 and 11 June 1998 at Singida.

The list of participants in the meeting is given in Appendix-I hereof.

The Study Team explained the contents of the Draft Final Report to the members of the Project Working Committee, namely the summary of findings by field survey, the project plan inclusive of the O&M plan, project cost, project implementation plan and project evaluation and so forth. Through a series of discussion on the subjects, the Committee accepted and agreed on the contents of the Draft Final Report.

Another meeting between the Study Team and Acting Director of Rural Water Supply of the Ministry and his staff was held in Dar es Salaam on 15 June 1998 to brief the outcome of the Study, the meeting on the Draft Final Report and other relevant subjects. The list of participants to this meeting is given in Appendix-II hereof.

The Permanent Secretary of the Ministry was also briefed on the outcome of the Study

and the meeting of the Project Working Committee and the Study Team on the Draft Final Report. Thereafter, these minutes of meeting were signed on 16 June, 1998 in Dar es Salaam.

Major issues in the discussions were as below:

(1) The Meeting agreed that the Ministry side will send, through JICA Tanzania Office, its written comments on the Draft Final Report, if any, to the Study Team within 30 days after the date of signing of Minutes of Meeting.

(2) The Meeting agreed that the Final Report will be composed of the following five volumes, namely the Summary of the Report, Main Report, Supporting Report, Appendices and Education Materials and that 40 copies of each volume be submitted through JICA Tanzania Office to the Ministry after the necessary finalisation is made based on the Ministry's comments.

(3) The Meeting agreed that the Final Report which will be submitted in mid-September 1998 be open to the public after it is received by the Ministry.

(4) Bearing in mind the duration of implementation of the project and the volume of new construction works after year 2006, the Tanzanian side requested the Study Team to consider another procurement package of equipment during the last phase (2007-2016) to complement the efforts of the District Water Engineers to fulfil their obligations in reference to Section 5.4 of the Main Draft Final Report.

(5) The Tanzanian side requested the Study Team that costs for activities to be undertaken by the District Water Engineers during implementation of the project be estimated in the Final Report. This will assist the Government of Tanzania to provide for this amount in its annual budgets.

In conclusion, the Tanzanian side appreciated the efforts of the Government of Japan to solve water supply problems in the Study area.

Appendix-I: List of Participants to the Meeting held in Singida

The Project Working Committee:

(Tanzanian Side)

Ministry of Water:

Mr. M. A. MACHA	Senior Design Engineer; Chairman of Meeting
Mr. L. R. E. KONGOLA	Head of Hydrogeology Section
Mr. I. A. G. MWAKA	Zonal Engineer (Central West), Rural Water Supply Department

President's Office:

Mr. S. S. A. MAGWAYA	Senior Economist, Planning Commission

Arusha Region;

Mr. J. T. AKONAAY	Regional Water Engineer
Mr. G. C. MFUKO	District Water Engineer, Hanang

Singida Region;

Mr. D. K. KAMARA	Ag. Regional Water Engineer
Mr. J. C. MWAIHOJO	District Water Engineer, Singida Rural
Mr. A. Ara KUSENHA	District Water Engineer, Manyoni
Mr. Y. L. HEMA	Technician, Regional Water Engineer's Office

Tabora Region;

Mr. T. M. BUZARE	Regional Water Engineer
Mr. M. S. MAGOLINYA	District Water Engineer, Igunga

(Japanese Side):

JICA Headquarters;

Dr. MARUO Yuji	Senior Development Officer

The Study Team:

Mr. YOSHIKAWA Mitsuru	Team Leader/ Groundwater Development
Mr. OHTA Kunio	Operation and Maintenance/User's Participation
Ms. Mercy J. MANDAWA	Social Analysis/Women In Development
Dr. James BUGENGO	Hygiene Education

Appendix-II: List of Participants to the Meeting held in Dar es Salaam

(Tanzanian Side)

Ministry of Water:

Mr. L. M. SECHU	Ag. Director, Rural Water Supply Department; Chairman of Meeting
Mr. M. A. MACHA	Senior Design Engineer
Mr. L. R. E. KONGOLA	Head of Hydrogeology Section
Mr. I. A. G. MWAKA	Zonal Engineer, Rural Water Supply Department
Mr. A. E. MUSILANGA	Zonal Engineer, Rural Water Supply Department

(Japanese Side):

JICA Headquarters;

Dr. MARUO Yuji	Senior Development Officer

The Study Team:

Mr. YOSHIKAWA Mitsuru	Team Leader/ Groundwater Development
Mr. OHTA Kunio	Operation and Maintenance/User's Participation

APPENDIX-1

Table 1.4.1-1 (1)

Rainfall

Singida Airport Meteorological Station : No. 2K/R10

(Unit: mm/month)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1981/82	0.0	0.0	0.0	0.0	18.1	60.3	107.0	83.3	104.5	27.4	3.5	0.0	404.1
1982/83	0.0	0.0	0.0	9.4	133.8	177.1	162.9	52.2	119.7	49.6	10.6	0.0	715.3
1983/84	0.0	0.0	0.0	0.0	46.0	190.8	178.1	142.1	29.0	128.8	1.9	0.0	716.7
1984/85	0.0	0.0	0.0	24.0	39.2	74.6	72.3	178.6	70.4	93.8	10.4	0.0	563.3
1985/86	0.0	0.0	0.0	0.0	54.5	138.6	156.7	31.4	119.1	73.5	28.0	0.0	601.8
1986/87	0.0	0.0	0.0	19.7	32.7	149.8	185.6	117.0	201.3	138.9	10.4	0.0	855.4
1987/88	0.0	0.0	0.0	0.0	86.5	21.3	117.6	71.5	174.7	67.0	0.0	0.0	538.6
1988/89	0.0	0.0	0.0	0.0	10.0	81.7	177.6	120.4	104.0	63.5	9.8	1.8	568.8
1989/90	0.0	0.0	1.9	0.0	18.7	238.3	122.7	111.6	142.4	88.3	0.0	0.0	723.9
1990/91	0.0	0.0	0.0	25.2	0.0	88.7	114.7	62.4	198.0	78.2	4.1	0.0	571.3
1991/92	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1992/93	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1993/94	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1994/95	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1995/96	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1996/97	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
AVERAGE	0.0	0.0	0.2	7.8	44.0	122.1	139.5	97.1	126.3	80.9	7.9	0.2	625.9

N.B. : NR indicates no record.

Table 1.4.1-1 (2)

Rainfall

Manyoni Meteorological Station : No. 2K/R12

(Unit: mm/month)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1981/82	0.0	0.0	0.0	0.0	18.0	139.0	142.9	189.5	114.3	87.1	8.6	0.0	699.4
1982/83	0.0	0.0	0.0	26.2	191.8	324.3	136.6	110.0	94.9	28.0	20.3	0.0	932.1
1983/84	0.0	0.0	0.0	8.5	52.0	193.1	119.6	NR	NR	NR	18.8	0.0	392.0
1984/85	0.0	0.0	0.0	0.0	0.0	176.7	71.5	237.5	81.8	67.5	15.0	NR	650.0
1985/86	0.0	0.0	0.0	0.0	101.8	160.9	179.6	23.2	66.4	86.2	26.9	0.0	645.0
1986/87	0.0	0.0	0.0	0.0	4.7	297.9	170.0	64.0	53.7	77.3	15.5	7.5	690.6
1987/88	0.0	0.0	0.0	0.0	40.2	50.6	291.9	106.2	167.5	18.8	0.0	0.0	675.2
1988/89	0.0	0.0	0.0	0.0	0.0	175.0	192.2	142.8	94.1	184.5	0.0	0.0	788.6
1989/90	0.0	0.0	0.0	0.0	18.9	138.6	44.6	NR	234.5	68.1	0.0	0.0	504.7
1990/91	0.0	0.0	0.0	0.0	0.0	44.8	99.6	74.6	59.8	25.1	0.0	0.0	303.9
1991/92	0.0	0.0	0.0	0.0	0.0	91.2	106.1	156.6	79.4	77.2	6.5	0.0	517.0
1992/93	0.0	0.0	0.0	0.0	53.6	209.7	131.2	179.4	78.8	64.2	0.0	0.0	716.9
1993/94	0.0	0.0	0.0	0.0	0.0	228.7	132.6	52.2	10.2	2.5	0.0	0.0	426.2
1994/95	0.0	0.0	0.0	0.0	18.5	162.7	87.8	119.8	88.4	6.8	9.6	0.0	493.6
1995/96	0.0	0.0	0.0	0.0	0.0	105.4	176.1	161.6	137.7	168.9	0.0	0.0	749.7
AVERAGE	0.0	0.0	0.0	2.3	33.3	166.6	138.8	107.8	90.8	64.1	8.1	0.5	612.3

N.B. : NR indicates no record.

Table 1.4.1-1 (3)

Rainfall

Sekenke Meteorological Station : No.2K/R11

(Unit: mm/month)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1986/87	0.0	0.0	2.5	37.9	120.6	203.3	176.1	134.5	120.9	172.1	46.0	7.2	1021.1
1987/88	0.0	4.8	3.6	13.5	121.2	96.1	154.0	NR	205.3	88.1	0.0	1.4	688.0
1988/89	0.0	6.6	0.0	54.9	42.4	172.1	345.6	137.8	300.0	230.2	0.0	0.0	1289.6
1989/90	0.0	0.0	NR	NR	75.5	197.0	162.6	114.8	260.4	97.2	86.0	0.0	993.5
1990/91	0.0	0.0	15.1	8.4	12.6	159.1	122.7	90.7	190.5	214.9	15.3	0.0	829.3
1991/92	0.0	0.0	3.2	59.0	142.3	143.3	94.1	51.2	45.7	93.3	26.6	1.8	660.5
1992/93	0.0	0.0	16.0	41.0	60.0	149.0	274.1	138.0	218.9	27.3	34.4	0.0	958.7
1993/94	0.0	0.0	0.0	0.0	42.4	5.8	170.1	142.1	176.3	NR	7.9	0.0	544.6
1994/95	0.0	0.0	0.0	9.8	93.3	211.1	122.7	138.2	145.2	31.7	80.0	11.7	843.7
1995/96	0.0	0.0	0.0	7.2	34.5	77.7	73.8	173.4	104.8	175.9	6.2	0.0	653.5
AVERAGE	0.0	1.1	4.5	25.7	74.5	141.5	169.6	124.5	176.8	125.6	30.2	2.2	876.3

N.B. : NR indicates no record.

Table-1.4.1-2 (1)

Mean Daily Temperature

Singida Airport Meteorological Station : No. 2K/R10

(Unit: Degree Centigrade)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1969/70	NR	NR	NR	NR	NR	23.5	21.2	20.6	21.8	21.6	NR	20.6
1970/71	20.8	19.8	20.9	22.5	20.3	22.0	20.8	NR	NR	21.4	21.2	20.1
1971/72	17.8	19.5	19.4	NR	21.2	20.8	21.3	20.2	NR	NR	NR	NR
1972/73	NR	NR	NR	NR	NR	NR	19.8	20.4	NR	18.9	15.4	22.4
1973/74	17.7	17.0	21.4	21.4	NR	NR	NR	NR	NR	NR	NR	NR
1974/75	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	23.1
1975/76	23.2	22.8	24.6	24.5	26.9	25.5	25.5	25.5	26.0	25.5	25.0	24.0
1976/77	24.0	24.0	25.0	27.0	27.0	24.9	25.0	25.2	26.0	24.1	24.0	NR
1977/78	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1978/79	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1979/80	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1980/81	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1981/82	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1982/83	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1983/84	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1984/85	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
AVERAGE	20.7	20.6	22.3	23.9	23.9	23.3	22.3	22.4	24.6	22.3	21.4	22.0

N.B.: NR indicates no record.

Table-1.4.1-2 (2)

Mean Daily Temperature

Manyoni Meteorological Station : No. 2K/R12

(Unit: Degree Centigrade)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1981/82	18.9	20.6	22.1	NR	24.5	23.1	23.2	23.0	22.2	21.6	21.0	20.2
1982/83	20.3	21.1	22.1	23.3	24.7	26.0	20.0	23.5	24.5	22.9	21.8	20.7
1983/84	20.0	20.5	22.0	23.3	22.7	24.1	20.3	18.9	19.0	19.6	20.7	23.3
1984/85	19.0	19.6	21.7	NR	23.2	22.4	22.6	21.4	21.8	20.6	21.5	19.5
1985/86	NR	19.5	22.8	24.2	25.1	NR	NR	NR	NR	NR	NR	NR
1986/87	NR	NR	NR	23.1	23.9	22.3	22.5	23.0	23.6	23.1	21.8	19.9
1987/88	19.9	23.2	23.0	24.2	24.4	24.8	23.6	23.4	22.9	22.6	21.2	20.1
1988/89	20.3	20.6	22.1	24.1	24.3	24.0	21.2	21.8	22.3	21.1	NR	18.8
1989/90	18.4	19.3	21.1	23.5	24.4	23.2	21.4	NR	22.0	22.2	20.9	19.2
1990/91	18.9	19.7	21.5	23.6	23.8	24.3	24.0	24.1	23.7	22.5	21.7	20.6
1991/92	19.1	20.3	22.2	23.7	24.9	23.9	24.5	23.1	23.3	22.8	21.5	20.6
1992/93	18.9	19.5	22.0	24.0	25.3	23.7	22.8	22.4	22.8	22.8	20.8	19.9
1993/94	18.5	20.0	21.6	NR	26.0	NR	23.7	22.8	23.2	22.4	21.4	19.6
1994/95	19.5	20.5	22.3	24.5	24.8	24.2	23.7	22.8	23.1	23.3	21.1	20.1
1995/96	19.5	20.9	22.4	24.0	24.6	24.7	23.4	23.0	23.6	21.0	20.6	19.9
AVERAGE	19.3	20.4	22.1	23.8	24.4	23.9	22.6	22.6	22.7	22.0	21.2	20.2

N.B. : NR indicates no record.

Table 1.4.1-2 (3)

Mean Daily Temperature

Sekenke Meteorological Station : No.2K/R11

(Unit: Degree Centigrade)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1970/71	22.7	24.0	24.6	26.3	25.7	23.4	22.8	22.6	23.4	23.5	22.4	22.9
1971/72	23.8	24.8	24.7	24.5	24.5	22.8	24.0	22.5	23.6	24.1	23.7	24.9
1972/73	24.1	24.8	26.6	26.2	25.1	23.7	23.2	24.3	25.0	25.3	24.2	24.3
1973/74	22.6	24.1	25.1	NR	NR	NR	NR	NR	NR	NR	NR	NR
1974/75	NR	NR	NR	NR	NR	NR	NR	NR	23.8	NR	NR	24.0
1975/76	23.3	23.6	24.6	26.0	26.0	23.0	25.0	23.0	24.0	23.9	24.4	23.0
1976/77	23.0	24.5	26.5	26.7	26.0	25.4	23.5	21.5	24.0	24.0	23.5	NR
1977/78	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1978/79	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1979/80	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
AVERAGE	23.3	24.3	25.4	25.9	25.5	23.7	23.7	22.8	28.8	24.2	23.6	23.8

N.B. : NR indicates no record.

Table 1.4.1-3 (1)

Relative Humidity

Singida Airport Meteorological Station : No. 2K/R10

(Unit: %)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1969/70	NR	NR	NR	NR	NR	67.4	78.8	76.0	74.6	73.0	NR	NR
1970/71	91.0	89.0	NR	60.0	65.0	77.0	NR	NR	94.0	75.9	71.0	78.0
1971/72	92.0	92.0	92.0	NR	92.0	93.0	93.4	91.5	NR	NR	NR	NR
1972/73	NR	NR	NR	NR	NR	NR	78.7	80.0	NR	NR	72.0	68.9
1973/74	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1974/75	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1975/76	65.0	64.5	62.5	60.0	56.0	74.0	71.0	74.0	77.0	75.0	70.0	71.0
1976/77	72.0	61.0	58.0	65.0	60.0	68.4	81.0	77.0	77.3	78.6	76.0	NR
1977/78	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1978/79	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1979/80	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1980/81	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1981/82	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1982/83	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1983/84	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1984/85	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
AVERAGE	80.0	76.6	70.8	61.7	68.3	76.0	80.6	79.7	80.7	75.6	72.3	72.6

N.B. : NR indicates no record.

Table 1.4.1-3 (2)

Relative Humidity

Manyoni Meteorological Station : No. 2K/R12

(Unit: %)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1981/82	70.0	69.0	67.0	NR	63.0	79.0	79.0	85.0	77.0	83.0	79.0	72.0
1982/83	69.0	85.0	93.0	94.0	93.0	98.0	95.0	78.0	82.0	82.0	82.0	76.0
1983/84	75.0	76.0	74.0	96.0	75.0	82.0	89.0	NR	NR	NR	79.0	75.0
1984/85	74.0	72.0	64.0	66.0	72.0	84.0	83.0	91.0	85.0	86.0	79.0	NR
1985/86	NR	76.0	68.0	68.0	76.0	80.0	84.0	84.0	84.0	90.0	94.0	92.0
1986/87	92.0	91.0	79.0	86.0	82.0	88.0	83.0	83.0	81.0	NR	NR	NR
1987/88	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1988/89	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1989/90	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1990/91	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1991/92	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1992/93	NR	NR	NR	NR	NR	89.0	84.0	NR	88.0	87.0	80.0	73.0
1993/94	70.0	76.0	77.0	NR	NR	87.0	88.0	92.0	84.0	81.0	80.0	75.0
1994/95	75.0	80.0	82.0	73.0	66.0	77.0	88.0	88.0	91.0	83.0	79.0	74.0
1995/96	62.0	89.0	NR	NR	73.0	74.0	82.0	87.0	85.0	90.0	86.0	NR
AVERAGE	73.4	79.3	75.5	80.5	75.0	83.8	85.5	86.0	84.1	85.3	82.0	76.7

N.B. : NR indicates no record.

Table 1.4.1-3 (3)

Relative Humidity

Sekenke Meteorological Station : No.2K/R11

(Unit: %)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1974/75	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	68.0
1975/76	65.0	64.0	62.0	60.0	56.0	74.0	71.0	74.0	77.0	75.0	70.0	71.0
1976/77	72.0	61.0	58.0	65.0	60.0	68.0	81.0	77.0	77.0	78.0	76.0	NR
1977/78	56.0	56.0	52.0	50.0	64.0	73.0	74.0	72.0	72.0	71.0	65.0	56.0
1978/79	58.0	55.0	NR	48.0	64.0	72.0	70.0	86.0	77.0	80.0	67.0	71.0
1979/80	58.0	59.0	52.0	47.0	63.0	NR	77.0	72.0	73.0	73.0	68.0	56.0
1980/81	55.0	55.0	52.0	52.0	62.0	72.0	71.0	75.0	71.0	74.0	74.0	58.0
1981/82	67.0	61.0	58.0	54.0	55.0	72.0	76.0	75.0	66.0	72.0	64.0	62.0
1982/83	62.0	58.0	62.0	62.0	75.0	NR	75.0	71.0	70.0	75.0	NR	66.0
1983/84	68.0	68.0	56.0	59.0	62.0	69.0	87.0	82.0	67.0	79.0	NR	NR
AVERAGE	62.3	59.7	56.5	55.2	62.3	71.4	75.8	76.0	72.2	75.2	69.1	63.5

N.B. : NR indicates no record.

Table 1.4.1-4 (1)

Pan Evaporation

Singida Airport Meteorological Station : No. 2K/R10

(Unit: mm/month)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1969/70	NR	NR	NR	NR	NR	243.5	133.8	157.5	157.3	140.7	NR	187.7	1020.5
1970/71	188.4	217.0	256.7	300.3	134.1	175.6	200.2	NR	164.1	157.3	142.5	165.8	2102.0
1971/72	169.6	202.9	230.0	NR	272.0	155.3	211.4	189.3	NR	NR	NR	NR	1430.5
1972/73	NR	NR	NR	NR	NR	NR	176.6	242.3	NR	238.9	197.1	191.4	1046.3
1973/74	204.9	227.6	248.0	306.7	NR	NR	NR	NR	NR	NR	NR	NR	987.2
1974/75	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	187.3	187.3
1975/76	303.3	165.8	237.3	247.3	275.7	207.0	189.8	153.8	174.3	150.8	196.4	188.1	2489.6
1976/77	148.0	196.4	182.0	225.2	223.6	187.9	176.6	148.1	190.1	85.3	62.5	NR	1825.7
1977/78	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1978/79	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1979/80	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1980/81	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1981/82	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1982/83	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1983/84	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1984/85	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
AVERAGE	169.0	201.9	230.8	269.9	226.4	193.9	181.4	178.2	171.5	193.3	199.5	184.1	2399.7

N.B.: NR indicates no record.

Table 1.4.1-4 (2)

Pan Evaporation

Manyoni Meteorological Station : No. 2K/R12

(Unit: mm/day)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1981/82	5.0	5.8	7.8	NR	10.0	6.7	6.2	5.8	7.0	4.2	4.2	5.1	67.8
1982/83	5.9	6.5	7.2	7.5	6.7	6.7	5.4	8.0	6.5	5.0	4.6	4.7	74.7
1983/84	4.9	5.4	6.7	6.7	7.3	6.4	4.1	NR	NR	NR	4.8	4.6	50.9
1984/85	4.5	4.7	5.0	6.4	6.2	5.2	6.5	2.8	5.6	5.1	5.3	NR	57.3
1985/86	NR	6.1	7.0	6.5	7.0	5.8	4.4	6.1	6.2	5.2	5.4	5.5	65.2
1986/87	6.0	5.5	6.0	6.2	6.1	NR	5.4	5.1	5.6	5.5	6.6	7.6	65.6
1987/88	7.1	6.6	6.3	7.1	7.1	6.9	5.8	7.2	5.1	6.1	6.1	4.6	76.0
1988/89	6.2	5.9	6.4	5.8	5.7	6.9	4.8	6.2	5.5	4.9	NR	6.1	64.4
1989/90	6.1	6.1	6.1	6.0	8.6	5.1	7.1	NR	6.0	5.5	6.2	5.6	68.4
1990/91	5.9	6.5	6.8	6.5	6.5	5.2	5.8	4.9	5.7	5.5	5.2	5.5	70.0
1991/92	5.8	5.7	6.1	6.4	5.5	4.7	4.9	3.5	5.3	5.2	5.6	5.8	64.5
1992/93	5.4	5.5	7.0	7.1	7.1	6.9	4.2	6.7	5.8	8.0	5.8	6.9	76.4
1993/94	6.0	6.4	7.5	8.2	NR	7.5	4.6	5.1	5.7	5.5	5.5	5.4	67.4
1994/95	5.6	4.9	6.8	6.5	7.0	5.2	5.5	4.4	4.5	5.8	5.4	4.9	66.5
1995/96	5.5	5.8	5.8	5.5	5.9	5.3	5.2	5.4	4.5	5.4	5.4	6.3	66.0
AVERAGE	5.7	5.8	6.6	6.6	6.9	6.0	5.3	5.5	5.6	5.5	5.4	5.6	70.6

N.B. : NR indicates no record.

Table 1.4.1-4 (3)

Pan Evaporation

Sekenke Meteorological Station : No.2K/R11

(Unit: mm/day)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	TOTAL
1973/74	7.4	9.4	8.5	NR	NR	NR	NR	NR	NR	NR	NR	NR	25.3
1974/75	NR	NR	NR	NR	NR	NR	NR	NR	5.0	NR	NR	7.4	12.4
1975/76	6.9	8.6	8.7	9.3	8.8	7.3	7.1	6.6	6.0	5.4	6.0	6.7	87.4
1976/77	7.3	8.7	9.7	10.0	8.6	7.0	5.2	5.4	6.0	5.0	4.3	NR	77.3
1977/78	6.8	7.8	10.2	12.2	8.0	5.8	5.3	5.7	5.5	4.3	6.3	6.8	84.7
1978/79	7.1	8.0	9.4	12.5	6.4	5.5	5.7	4.7	6.2	5.2	4.9	5.8	81.6
1979/80	5.8	7.7	9.4	8.0	7.2	4.5	5.6	6.7	5.3	5.1	6.0	6.7	77.9
1980/81	8.5	9.0	10.3	10.2	7.5	6.6	NR	NR	NR	NR	NR	NR	52.1
1981/82	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	0.0
1982/83	NR	9.3	9.6	9.9	6.3	4.2	NR	7.4	5.3	5.3	6.1	6.5	69.9
AVERAGE	6.2	8.5	9.5	10.3	7.5	5.8	5.8	6.1	5.6	5.1	5.6	5.7	81.8

N.B. : NR indicates no record.

Table 1.4.1-5 (1)

Sunshine Hours

Singida Airport Meteorological Station : No. 2K/R10

(Unit: Hours/day)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	AVERAGE
1981/82	9.4	9.4	9.3	9.5	8.5	7.8	7.3	6.8	7.6	6.6	6.1	8.7	8.1
1982/83	9.0	8.7	7.4	8.1	5.5	5.1	6.7	7.9	7.5	7.3	8.0	8.4	7.5
1983/84	9.3	8.6	8.8	8.3	8.0	5.6	4.6	NR	NR	NR	NR	NR	7.6
1984/85	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1985/86	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1986/87	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1987/88	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1988/89	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1989/90	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1990/91	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1991/92	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1992/93	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1993/94	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1994/95	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1995/96	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
1996/97	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	*
AVERAGE	9.2	8.9	8.5	8.6	7.3	6.2	6.2	7.4	7.6	7.0	7.1	8.6	7.7

N.B. : NR indicates no record.

Table 1.4.1-5 (2)

Sunshine Hours

Manyoni Meteorological Station : No. 2K/R12

(Unit: Hours/day)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1981/82	9.2	8.3	9.5	9.9	8.9	7.7	7.7	6.5	7.9	6.8	6.2	7.9
1982/83	8.7	9.1	7.8	8.4	6.2	6.2	7.5	8.8	7.9	8.2	6.8	8.4
1983/84	9.2	9.7	9.9	9.7	9.8	6.3	4.2	NR	NR	NR	7.9	7.8
1984/85	NR	NR	9.6	8.4	NR	NR	NR	NR	NR	NR	NR	NR
1985/86	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1986/87	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1987/88	NR	NR	NR	NR	NR	NR	NR	8.2	4.2	7.0	8.2	7.0
1988/89	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1989/90	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1990/91	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1991/92	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1992/93	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1993/94	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1994/95	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
1995/96	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR
AVERAGE	9.0	9.0	9.2	9.1	8.3	6.7	6.5	7.8	6.7	7.3	7.3	7.8

N.B. : NR indicates no record.

Table 1.4.1-5 (3)

Sunshine Hours

Sekenke Meteorological Station : No.2K/R11

(Unit: Hours/day)

YEAR	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN
1974/75	NR	NR	NR	NR	NR	NR	NR	NR	5.5	NR	NR	10.1
1975/76	7.7	NR	8.0	7.0	7.5	6.3	6.5	4.4	6.2	6.2	10.4	5.2
1976/77	9.2	6.5	9.1	8.1	6.5	7.2	5.1	NR	7.3	NR	NR	NR
1977/78	NR	NR	8.8	8.1	NR	NR	NR	NR	5.0	5.8	7.8	9.2
1978/79	9.6	9.5	NR	NR	NR	NR	NR	NR	NR	5.4	7.6	8.7
1979/80	9.5	NR	9.3	NR	NR	NR	3.5	7.9	6.1	6.2	6.5	9.1
1980/81	8.6	8.2	8.0	5.2	4.8	5.2	7.1	7.8	6.6	4.8	7.8	9.4
1981/82	9.3	8.5	8.3	8.3	7.8	8.0	7.2	6.8	7.2	5.9	6.7	8.4
1982/83	7.1	8.3	6.9	7.3	4.5	NR	7.2	7.8	7.6	6.7	7.7	8.6
1983/84	8.4	8.5	8.3	6.5	7.8	4.8	5.2	6.8	7.3	6.4	NR	NR
AVERAGE	8.7	8.3	8.3	7.2	5.6	6.3	6.0	5.9	6.5	5.9	7.8	8.6

N.B. : NR indicates no record.

Table 1.4.1-6 (1)

Wind Run

Singida Airport Meteo. Station : No.2k/R10

(Unit: km/day)

(Year:1985)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	6,066.8	2,863.5	6,404.4	8,802.6	9,254.2	9,221.8	10,863.1	11,830.2	13,378.9	12,417.3	6,786.4	4,914.2
Max.	353.4	270.2	370.9	493.0	383.0	493.4	452.0	485.5	872.9	600.0	778.5	456.1
Min.	77.0	59.6	10.3	71.2	173.1	92.1	228.5	228.5	291.1	166.2	89.1	13.5
Mean Daily	195.7	102.2	206.6	293.4	298.5	307.4	350.4	381.6	445.9	400.6	226.2	158.5

(Year: 1986)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	4,173.1	4,084.6	5,284.9	7,265.8	9,906.8	8,554.1	10,220.4	9,745.5	11,446.1	11,496.1	9,121.0	2,656.5
Max.	371.6	263.1	283.3	400.0	687.6	443.2	595.8	521.3	479.1	895.8	479.2	148.0
Min.	21.1	25.5	25.5	40.5	125.8	142.2	164.1	134.9	240.4	191.7	121.9	44.5
Mean Daily	134.6	145.9	176.2	242.3	319.2	285.1	329.7	314.4	381.5	370.8	304.0	85.7

(Year: 1987)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	2,285.9	2,827.7	4,972.0	4,574.8	6,368.9	5,247.5	7,857.4	10,764.9	9,691.5	9,422.5	6,161.8	3,150.8
Max.	176.9	304.4	252.9	375.3	375.5	320.4	434.6	710.0	464.0	457.7	522.0	253.2
Min.	19.0	30.3	26.3	36.7	38.1	13.4	89.0	221.3	170.7	148.9	43.6	6.4
Mean Daily	73.7	100.9	160.4	152.5	205.4	174.9	254.4	347.3	323.0	303.9	205.4	101.6

(Year: 1988)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	1,340.0	3,338.8	2,101.1	4,963.4	6,899.8	8,797.8	8,738.4	10,101.9	10,773.3	11,511.2	9,572.9	7,685.3
Max.	141.2	338.8	350.8	280.0	378.4	457.8	459.3	578.4	495.0	569.5	495.3	443.2
Min.	2.7	15.9	10.5	42.6	50.7	63.3	156.5	166.6	198.9	178.4	110.8	62.6
Mean Daily	43.2	115.1	67.8	165.4	222.6	293.3	281.9	325.9	359.1	371.3	319.1	247.9

(Year: 1989)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	2,857.9	3,261.6	5,424.7	7,937.2	9,803.5	10,537.9	11,438.3	12,722.1	9,811.6	NR	NR	NR
Max.	158.7	236.5	442.0	539.0	681.2	530.2	510.9	682.7	552.6	NR	NR	NR
Min.	39.8	22.7	67.1	78.2	113.1	179.6	195.7	152.3	180.0	NR	NR	NR
Mean Daily	92.2	116.5	175.0	264.6	316.2	351.3	369.0	410.4	392.5	NR	NR	NR

Table 1.4.1-6 (2)

Wind Run

Manyoni Meteorogical Station : No. 2RR12

(Unit: km/day)

(Year:1992)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	2,576.5	1,568.1	2,098.6	2,369.6	2,826.1	3,841.1	3,027.7	3,721.0	4,390.9	3,955.8	2,590.1	2,602.1
Max.	153.9	84.1	122.3	150.7	181.0	149.9	172.2	224.5	202.9	178.8	592.4	138.9
Min.	27.8	34.2	19.6	23.8	33.3	53.0	65.5	88.9	66.6	82.2	36.8	36.9
Mean Daily	85.9	54.1	67.7	79.0	91.2	94.7	97.7	120.0	146.4	127.6	80.9	86.7

(Year: 1993)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	2,509.1	1,478.8	1,462.4	2,262.7	2,391.8	2,686.6	3,219.1	3,639.2	4,304.5	4,674.9	Data Msng	4,114.4
Max.	592.4	89.2	86.1	115.5	131.1	178.4	156.3	335.9	190.1	233.1	ditto	239.0
Min.	36.8	24.0	22.5	20.5	41.6	24.2	47.1	70.7	100.7	22.5	ditto	37.5
Mean Daily	17.3	53.0	47.2	75.4	75.7	89.5	107.1	130.0	143.5	150.8	ditto	132.7

(Year: 1994)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	1,870.9	1,326.2	1,647.8	2,448.6	2,870.3	2,594.3	3,213.1	3,548.9	4,224.7	4,622.5	3,383.6	3,122.3
Max.	123.6	111.8	78.5	148.3	136.8	144.4	210.2	172.9	197.6	203.1	176.8	180.0
Min.	24.7	11.1	23.1	52.7	38.4	24.8	30.0	63.4	94.3	108.4	63.3	32.4
Mean Daily	60.4	47.4	53.2	81.6	92.6	86.5	103.7	114.5	140.8	149.1	112.8	100.7

(Year: 1995)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	1,812.5	1,576.3	2,063.9	2,591.9	2,869.6	2,556.2	3,037.0	4,206.6	3,842.5	4,019.7	3,756.4	3,330.8
Max.	121.5	142.8	319.0	149.1	144.0	163.1	142.4	220.3	272.1	180.0	183.0	192.4
Min.	22.3	30.4	25.5	34.9	38.0	65.6	17.7	70.8	30.1	32.3	40.0	15.8
Mean Daily	58.5	56.3	66.6	86.4	92.5	85.2	98.0	135.7	128.0	129.6	125.2	107.6

(Year: 1996)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	1,971.9	1,559.5	1,847.1	2,142.2	2,604.5	2,341.9	2,640.7	2,877.3	Data Msng	Data Msng	Data Msng	2,642.2
Max.	102.2	88.8	135.3	162.3	127.8	130.8	136.5	165.8	ditto	ditto	ditto	166.7
Min.	13.2	13.3	20.5	20.8	45.0	52.3	36.6	36.7	ditto	ditto	ditto	26.9
Mean Daily	63.6	53.8	59.6	71.4	84.0	78.1	85.2	92.8	ditto	ditto	ditto	85.2

Table 1.4.1-6 (3)

Wind Run

Sekenke Meteorological Station : No. 2RR12

(Unit: km/day)

(Year:1982)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	4,945.7	4,051.9	NR	NR	NR	NR	1,175.3	4,063.6	4,340.1	4,420.2	2,040.8	NR
Max.	273.7	247.8	NR	NR	NR	NR	162.9	209.9	249.1	232.1	103.0	NR
Min.	95.3	90.1	NR	NR	NR	NR	89.4	40.4	69.8	63.0	21.0	NR
Mean Daily	159.9	150.1	NR	NR	NR	NR	117.5	131.4	149.7	142.6	68.0	NR

(Year: 1983)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	NR	6,885.1	NR	NR	NR	NR	3,154.9	3,120.8	3,586.1	2,976.6	2,578.5	2,116.6
Max.	NR	580.6	NR	NR	NR	NR	158.8	170.6	234.9	190.1	171.6	163.6
Min.	NR	122.8	NR	NR	NR	NR	59.9	38.0	45.1	48.7	34.0	34.7
Mean Daily	NR	299.3	NR	NR	NR	NR	101.8	100.7	119.5	96.0	86.0	68.2

(Year: 1984)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	NR	NR	NR	2,320.8	NR	3,837.4	3,776.8	3,688.7	4,149.6	NR	2,422.7	2,002.7
Max.	NR	NR	NR	152.8	NR	215.8	194.2	260.9	242.1	NR	205.0	101.7
Min.	NR	NR	NR	32.4	NR	86.9	43.3	46.2	56.9	NR	47.7	24.9
Mean Daily	NR	NR	NR	78.0	NR	127.9	121.8	119.0	138.3	NR	86.5	61.3

(Year: 1985)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	1,557.2	993.7	1,724.0	1,316.7	1,928.8	2,246.5	3,063.3	4,343.6	4,165.2	4,401.4	2,738.2	1,745.0
Max.	90.3	64.7	111.3	121.4	111.2	138.3	166.8	209.5	230.8	336.5	168.8	89.4
Min.	21.7	10.1	21.2	19.1	24.4	36.0	37.4	93.6	83.0	67.8	32.5	34.4
Mean Daily	50.2	35.5	55.6	43.9	62.1	74.9	98.8	140.1	138.8	142.0	91.3	56.3

(Year: 1986)

Date	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Total	1,303.6	1,170.1	1,259.4	1,153.4	2,115.6	1,893.1	2,609.1	6,956.1	9,367.6	7,871.2	6,476.7	4,349.3
Max.	134.7	143.5	89.1	118.2	123.1	151.1	166.0	388.7	665.7	489.0	475.3	196.9
Min.	15.7	11.7	18.2	13.5	17.2	16.7	38.0	90.2	132.5	127.2	115.8	93.4
Mean Daily	42.1	43.3	40.6	52.4	68.2	65.3	84.1	248.4	312.3	253.9	205.9	140.3

Appendix-1 Table-1.6.1-2 (1) Borehole Inventory of theTarget Villages HANANG District

Village No.	Village	No.	Gride		Situation		Constructed	Depth	SWL	Yield	Water Struck	pH	EC	Geology	Remarks
			X	Y	Well	Pump	year	m	m	m^3/hr	m		mS/m		
2	Dang'aida	33/93					93	33.50	8.50	17.40	18.50				
5	Gawidu	115/79	728046	9508190	X	X	79	42.70	19.80		30.50			Cranite	
6	Garawja	27/93					93	41.00	7.65	8.40	28.00				
9	Hirbadaw	35/93					93	72.00							
17	Murero		761390	9483980			93	95.00	37.00	0.00				Volcanics/Granite	
20	Ishponga	50/67	734589	948963	X	X	67	66.00		1.67				Granite-Fault	
20	Ishponga	42/67			X	X	67	76.00							
22	Gidahababieg	29/89	784418	9505126			89						192.4		
26	Sirop	242/76	793063	9493766	O	O	78	57.90	9.90				63.3		HP
30	Masakta	60/88	781750	9522724	O	X	88	93.00	15.80	24.00	70.00			Ganite-Fau	L-2
30	Masakta	127/78	785210	9525371			78	75.76	7.88	2.40	12.12				
30	Masakta	78/78	782431	9525900			78	39.65	3.66		4.57				
30	Masakta	89/78	782615	9526810	X	X	78	91.50	1.20	7.30	55.00				
	Total							784.01	111.39	61.17					
	Number of borehole							12.00	9.00	6.00					
	Average I							65.33	12.38	10.20					
	Borehole located out of target village														
	Basotu	50/68					68	190.30			130.50				
	Basotu	9/69					69	222.70	127.20	6.60	173.00				
	Gehandu	20/69					69	128.60	102.20	12.27	108.60				
	Murumba	153/76					76	126.57	25.31	1.14	25.31				
	Murumba	241/76					76	112.85							
	Basotu	242/76					76	50.00	9.90	7.80					
	Murumba	56/79					79	76.25	13.72	2.70	9.15				
	Basotu	44/80					80	90.10		Dry					
	Basotu	45/80					80	30.50	4.90		16.80				
	Basotu	50/80					80	30.50	4.50	0.30	3.05				
	Basotu	51/80					80	35.07	20.74	0.40					
	Basotu	52/80					80								
	Basotu	61/80					80	41.17	20.00	0.23					

Village No.	Village	No.	Gride		Situation		Constructed	Depth	SWL	Yield	Water Struck	pH	EC	Geology	Remarks
			X	Y	Well	Pump	year	m	m	m^3/hr	m		mS/m		
	Basotu	62/80					80	30.45							
	Basotu	65/80					80	29.68							
	Basotu	67/80					80	30.50							
	Basotu	98/80					80	33.55	16.17	0.10	6.10				
	Basotu	252/81					81	40.56	6.10		7.62				
	Basotu	15/82					82	10.70	6.40	0.30	7.60				
	Basotu	53/82					82	192.15	12.81	4.36	176.90				
	Basotu	62/82					82	225.70	201.30		207.40				
	Endanyawish	83/90					90	112.20							
	Mongo wa Mo	31/92					92	65.80							

Appendix-1 Table-1.6.1-2 (2) Borehole Inventory of theTarget Villages of SINGIDA RURAL District (whole Boreholes)

village No.	Village	Borehole No. No.	Gride		Situation		Constructed Year	Depth	SWL	Yield	Water Struck	pH	EC (mS/m)	EL (m)	Geology	Remarks
			X	Y	well	pump										
1	Ikungi	27/58	696759	9430794	x	x	58	107.0	4.60	2.5	10.7			1398		
1	Ikungi	246/81					81	71.6	10.66	1.90	54.9					WP
3	Uliyampiti	144/88	697155	9424590	o	x	88	60.0	2.48	12	18.6		66.30	1396		
4	Matongo	33/68	691489	9426384	o	x	68	118.0	0.00	18.00	112.3		77.50	1325		L-2
8	Isuna	37/74	697162	9405932	x	x	74	140.0	15.37	6.19	122.0	7.00	300.00	1300		
9	Choda	12/65	695356	9392790	o	x	65	46.0	37.00	2.50	42.0			1335		HP Pilot V.
10	Mkiwa		684084	9386717	o	o	94	50.0		7.20		7.74	52.60	1315		WP
11	Nkuhi	109/73	694326	9410643	x	x	73	183.0	43.00	8.10	Various			1315		L-2 Pilot V
16	Mang'onyi	124/72	715552	9418666	o	x	72	31.0	12.00	13.60	7.6	7.02	250.00	1330		L-2 Pilot V
19	Sambaru	53/70	730219	9420736	x	x	70	128.0	12.00	7.27	54.0		103.80	1528		L-2
19	Sambaru	154/78			x		78	96.0		0.00						
19	Sambaru	155/78			x		78	79.0		0.00						
19	Sambaru	94/80			x		80	61.0								Dry
19	Sambaru 1	41/80			x		80	39.6	Nil							
19	Sambaru 2	77/80			x	x	80	102.1	26.00	4.90	36.6					
19	Sambaru 3	78/80					80	77.7	30.48	5.45	48.8					
20	Ihanja	53/70	685524	9442056			70	129.0	12.50	7.27	54.0					L-2
20	Ihanja	70/82	687277	9440300			82	102.0	15.70	6.00		7.40	131.40	1563		WP
27	Muhintil 1	1/67			o	x	67	47.2	17.07	6.00	21.0					
30	Matyuku	48/89					89	51.8	15.24		18.8	6.50	58.00			
30	Matyuku	1	688120	9454702	x	x	94					6.50	118.40	1558		HP
36	Wibia	24/88	699910	9447340	x	x	88	36.0	12.80	0.00	27.4	7.20	94.00			HP
36	Wibia	23/88					88	45.7	7.01	Not tas	10.7	6.80	60.00			
36	Wibia	25/88					88	64.0				6.50	30.00			
36	Wibia	26/88					88	43.4	12.19		24.4	7.70	90.00			
36	Wibia	27/88					88	39.6	13.11		35.1	7.60	70.00			
37	Musimi	209/74	669036	9474326	o	x	74	84.0		6.00	30.8			1510		
37	Msimi	196/74			o	x	74	166.1	0.00	2.27	88.4					
37	Msimi	213/74			x	x	74									
42	Mwaru	94/70	641760	9471858	o	o	70	67.7	2.00	2.00	46.9	6.50	163.40	1316		HP

village No.	Village	Borehole No. No.	Gride		Situation		Constructed Year	Depth	SWL	Yield	Water Struck	pH	EC (mS/m)	EL (m)	Geology	Remarks
			X	Y	well	pump										
46	Mgungira	30/54	612150	9445041	x	x	54	119.0	48.00	4.60				1040		
48	Iyumbu	28/66	608785	9434162	x		66	88.4	40.54	5.45	44.2					
49	Irisya	59/91					91									
49	Irisya	60/91					91	-				7.70	230.00			
49	Irisya	73/92	676410	9486406	o	x	92	42.7	20.20		21.3	7.90	1440.00	1445		HP
49	Irisya	74/92	676858	9486302	o	o	92							1460		HP
49	Irisya	75/92	677310	9484395	o	o	92	41.1	14.90		28.9	7.20	328.00	1438		HP
49	Irisya	76/92	676476	9483152	o	o	92	45.7					25.70	1430		HP
49	Irisya	7/92					92	48.5	27.00		37.8					HP
49	Irisya	21/92	675490	9483590			92	51.5	18.00		36.3					HP
49	Irisya	56/92	676500	9485000			92	42.7	22.45		35.5					HP
49	Irisya	57/92					92	48.8	25.00		37.1	6.70	150.00			HP
49	Irisya	58/92	676310	9487220			92	39.6	23.20		26.3	7.10	155.00			HP
49	Irisya	61/92					92	54.9	26.35		35.5	7.30	170.00			HP
49	Irisya	72/92	676810	9468690			92	48.8			29.0	7.50	200.00			HP
51	Ntinko		704323	9497356	o	o	88					7.51	125.60	1590		WP
54	Mpambaa	1/68	702665	9402119		x	68	92.0		8.42	1.5			1511		L-2
55	Kijota	19/65	706173	9495024	x	x	66	29.0	3.00	8.00	12.0			1558		L-2
59	Makuro	70/71	711594	9501406	x	x	71	68.0	7.00	10.00	5.2			1580		L-2
60	Ghalunyangu	192/81	718021	9503772	o	x	81	83.8						1618		L-2
60	Chalunyango	54/81			x	x	81	83.8								
61	Mpipiti		707283	9506433	x	x	69							1540		L-2
66	Ughandi 'B'	50/90	690260	9492481	o	o	90	42.7	4.75		6.4	7.70	195.70	1480		HP
67	Nkwae	23/70	684244	9490032	o	x	70	52.0	2.00	1.86	9.5			1390		HP
68	Laghanida	1	692553	9495602	o	o	93					7.06	123.10	1510		HP
69	Misinko Hosp.	104/90					90	39.6	6.95		3.7	7.50	130.00			
69	Misinko 1	121/90					90	50.3								
69	Misinko 2	122/90					90	60.4	50.29			8.20	140.00			
69	Misinko 3	125/90					90	48.8	3.51		6.1					
69	Misinko	1	694571	9487410	o	o	92					6.97	232.00	1525		HP
69	Misinko	1	694571	9487410	o	o	92									HP

village No.	Village	Borehole No. No.	Gride		Situation		Constructed Year	Depth	SWL	Yield	Water Struck	pH	EC (mS/m)	EL (m)	Geology	Remarks
			X	Y	well	pump										
70	Ntondo	1	681114	9492020	o	o	91					6.75	158.00	1380		HP
70	Ntondo	36/92					92	46.5	2.30		18.2					HP
70	Ntondo	37/92					92	46.5	19.40		25.8					HP
70	Ntondo	38/92					92	36.0	17.40		25.8					HP
70	Ntondo	39/92					92	39.5	17.90		25.9	7.60	54.00			HP
71	Msisi	109/70	684870	9485420	x	x	70	152.0	3.60	10.91	93.0					
71	Msisi Maduka	149/90					90	42.7	3.96		19.8	7.50	120.00			
71	Msisi Mailt Kum III	161/90					90	35.1			0.9	7.80	120.00			
71	Msisi Mailt Kum I	160/90					90	54.9								Dry
71	Msisi Mazidi	150/90					90	47.2	3.51		15.2					
72	Senene Mfuru	2	686816	9494832	o		93	50.0	20.00			6.81	183.50	1460		
73	Madamiga	28/59	707317	9482541	o	x	59	42.0	0.00	7.90	9.0	7.33	8.80	1510		L-2
73	Madamiga	1/82	707174	9483537	o	x	82	85.3	14.93	9.00	53.3	8.60	92.00	1530		L-2
73	Madamiga 2	9/82					82					7.90	89.00			
87	Merya	32/56			x		56	76.8	15.24	2.09	29.9					
87	Merya	64/74	716445	9478263	o	x	74	153.0	9.00	5.80	45.4		94.90	1565		L-2
87	Merya	96/74			x		74									
87	Merya	133/74					74	159.0	0.00	16.36	42.7					
88	Mvae	143/80			x		80	96.0	30.48	0.00	65.5					
88	Mvae	8/81	717070	9487677	o	x	81	77.7	3.05	6.54	35.4			1590		L-2
91	Mwanyonye	154/72					72	115.8	54.25	27.30	97.5					
92	Ikhanoda	66/81	718222	9493098	o	x	81	14.3	3.03	2.18	12.1			1620		
92	Ikanoda	53/81			x	x	81	71.6	6.10		24.4					
95	Mdilu	86/68	722505	9492197	o	x	68	78.5	0.00	3.02	10.5			1700		L-2
97	Ngamu	4/71			x		71	198.0	1.98	6.82	3.0					
98	Mipilo	42/81	723202	9480658	o	o	81	96.0	47.24	2.70	74.7	8.19	117.30	1600		L-2
98	Mhalala	238/81					81									
99	Mangida	73/68	732369	9483716	o	x	68	196.0	47.00	5.00	181.5	8.72	157.80	1600		L-2
102	Msange	35/81	725010	9486443	o	x	81	114.3	34.06	10.90	71.3	6.80	120.90	1590		L-2
102	Msange	26/81			x		81	65.5								
103	Mgori	35/68					68	186.5	0.92	9.09	180.0					

village No.	Village	Borehole No. No.	Gride		Situation		Constructed Year	Depth	SWL	Yield	Water Struck	pH	EC (mS/m)	EL (m)	Geology	Remarks
			X	Y	well	pump										
103	Mgori	169/74	717207	9463445	o	x	74	71.6	37.37	11.60	41.5			1360		L-2
108	Nduamughanga	215/81	745191	9448554	o	x	81	110.7	58.60	4.00	83.8			1328		
109	Ngimu	34/71			x		71	188.1	3.05	2.16	73.2					
109	Ngimu	108/73	730183	9473247	o	x	73	153.0	5.00	16.50	many			1430		
111	Itaja	32/68	732592	9482286	x	x	68	133.9	84.18	10.91	91.7			1630		L-2
111	Itaja	128/84					84	149.0								
111	Itaja	7/85					85									
113	Mungaa	32/65	708979	9449106	o	x	65	52.4	3.05	2.40	15.5			1610		L-2
117	Unyamighumbi	88/78	706268	9450683	o	x	78	59.9	9.29	6.70	38.1		36.30	1660		
117	Unyamighumbi	81/78	706128	9450968	o	o	78	71.6	10.00	4.00	38.1					
118	Misughaa	55/68	724907	9440649		x	68	93.0	0.00	13.64	89.2			1275		L-2
123	Siuyu	42/68	708814	9457292	x	x	68	213.0	1.00	18.18	43.1			1650		L-2
125	Mkunguakihendo	114/70	714417	9455206	o	x	70	113.0	59.00	8.20	107.0			1410		L-2
126	Ntuntu	63/73	718319	9431015	o	x	73	159.0	70.00	8.65	99.0		93.40	1555		L-2
126	Ntuntu	237/81			x		81	108.2								
129	Ligwa I	49/89					89	62.5	5.00		30.5	6.50	85.00			
129	Ligwa II	50/89					89	73.2	8.20		48.8	6.90	170.00			
	Total							7777.4	1353.44	390.03						
	number of borehole							94.0	76.00	52.00						
	Average I							82.7	17.81	7.50						
	Borehole located out of target village															
	Kindai(town)	91/74	692244	9467190			74	109.0	1.50	4.82	16.2					
	Kindai(town)	39/78	692149	9467350	o	o	78	126.4	6.86	6.14	81.1	7.14	91.60			
	Kititimo(town)	78/73	697239	9465704	x	x	73	137.2	0.70	22.72	Various					
	Kititimo(town)	17/74	697276	9495809			74	96.0	0.00	45.45	34.4					
	Kititimo(town)	18/74	697284	9465827			74	107.9	0.00							
	Kititimo(town)	19/74	697228	9465587	o	o	74	183.0	0.00	8.20	100.6					
	Kititimo(town)	31/74	697276	9465684	x	x	74	183.0	0.00	6.82	18.0					
	Kititimo(town)	155/77	697349	9465922	o	o	77	102.0	11.28	4.09	48.8	7.61	128.00			
	Kititimo(town)	157/77	697313	9465826	x	x	77	119.0	14.50	8.50						
	Kititimo(town)	73/91	697304	9465801	o	o	91	30.0		30.00		7.26	94.30			

village No.	Village	Borehole No. No.	Gride		Situation		Constructed Year	Depth	SWL	Yield	Water Struck	pH	EC (mS/m)	EL (m)	Geology	Remarks
			X	Y	well	pump										
	Mangwajuki(town)	157/87	692380	9470360	o	o	87	79.3	2.00		30.0	6.53	54.70			
	Mungu maji	31/90	699881	946490			90									
	Mwankoko	77/68	681530	9462197		x	68	122.8	0.00	13.63	106.7	7.14	164.00			
	Uhasibu(town)	31/79	692210	9469016		x	79	81.1	6.30	3.68	71.6					
	Uhasibu(town)	53/79	692182	9468894	o	o	79	59.4	10.95	17.22	36.6	6.12	49.70			
	Uhasibu(town)	145/78	692051	9468847	o	o	78	73.2	18.14	5.54	41.2	6.48	51.70			
	Unyanga	116/80	689326	9460381			80	61.0	10.66		33.5	6.24	45.20			
	Unyankindi(town)	93/72A	695722	9468218			72	153.3	1.28	15.60	Various	7.50	229.00			
	Utemini Booster	24/54	693169	9467579	o	o	54	52.1	0.90	6.36	10.1	6.25	99.50			
	Utemini Booster	102/78	693375	9467449	o	o	78	60.8	3.09	14.73	17.0	6.47	137.80			
	Utemini Booster	26/59	693353	9467310			59	48.8	0.00	7.20	3.0	6.32	110.80			
	Utemini Booster	22/61	693421	9467456	x	x	61	38.8	1.50	13.09	2.4	6.27	142.80			
	Singida town(TCRS	14/79A	693234	9466684	o	o	79	60.8	7.62	3.45	13.7	6.44	72.60			
	Puma	14/83					82	54.9	1.20	4.50	6.1					
	Puma 3	76/80			o	o	80	47.2	Nil	Nil	Nil					WP
	Puma	92/80			o	o	80	48.0	6.40	3.60						
	Total II							2234.9	104.88	245.34						
	borehole number II							25.0	23	21						
	Average II							89.40	4.56	11.68						
	Average I+II							84.14	14.73	8.70						

Appencix-1 Table-1.6.1-2 (3) Borehole Inventory of theTarget Villages of MANYONI District (whole boreholes)

Village		Borehole	Gride		Situation		Constructed	Depth	SWL	Yield	Water Struck	pH	EC	Geology	Remarks
No.	name	No.	x	y	well	pump	year	m	m	m^3/hr	m		(mS/m)		
1	Manyoni Ts	13/52			x		52	64.3	29.26	2.05	37.2	6.70	52.50		
1	Manyoni Minor S	13/59			o	o	59	59.0	10.00	3.50	15.0	6.80	55.70		
1	Manyoni	10/73			x		73					6.90	59.80		
1	Manyoni	41/73			x		73								
1	Manyoni	159/77	708380	9360046	o	o	77	120.4	64.61	13.40	69.1	7.13	81.60		L-2
1	Manyoni	15/83					83	36.6	5.18		6.1				
1	Manyoni	117/84	708380	9360046	o	o	84	62.0	29.56	16.80	48.8	7.06	62.00		L-2
1	Manyoni	11/85					85	32.0							
1	Manyoni R.C.Wompound	120/85					85								
1	Manyoni	121/92	702495	9365657	o	o	92	106.5	24.00	13.00		6.82	195.20		L-2
2	Kipondoda	5/52	703705	9362735	o	o	52	86.3	35.10	1.00	44.5	7.00	387.00		WP
4	Muhalala	125/72			x		72	146.0	55.47	28.50	65.0				MP
4	Muhalala	42/73			x		73					7.85	97.20		
4	Muhalala	112/74					74	158.0	48.16	7.27	99.1				
4	Muhalala	113/74					74	155.5	64.00	7.27	34.0				
4	Muhalala	124/74					74	110.0	44.20	1.40	93.0				
4	Muhalala	152/74					74	111.5	57.91	6.82	82.3				
4	Muhalala	153/74			x		74	105.8	59.43	6.82	93.0				
4	Muhalale	156/77			x		77	88.7		0.00					
4	Muhalale	157/77			x		77	103.6		0.00		7.10	60.00		
4	Muhalale	158/77			x		77	54.9		0.00					
4	Muhalala	142/80			x		80	87.5			No				
4	Muhalala	185/81					81	92.1	64.00	0.99	71.9				
6	Mitoo	108/85	702341	9370418	o	o	85	65.5	14.02	1.12	27.1	7.06	88.20		WP
6	Mitoo	49/88					88	65.5	14.02		20.4	6.80	60.00		
7	Mkwese	205/73	700025	9378513	o	o	73	116.7	0.00	23.00	112.0	6.95	50.80		L-2
9	Aghondi	32/73	687936	9363219	o	o	73	106.1	13.65	29.27		5.23	66.10		L-2 WP
9	Aghondi	50/74					74	131.1	20.42	3.00	100.6	7.85	67.80		
11	Njiri	117/73			x		73	198.8	5.00	0.23	116.0	7.89	67.80		

Village		Borehole	Gride		Situation		Construc ted	Depth	SWL	Yield	Water Struck	pH	EC	Geology	Remarks
No.	name	No.	x	y	well	pump	year	m	m	m^3/hr	m		(mS/m)		
13	Idodyandole	110/85	695480	9343627	o	o	85	63.3	21.34	2.70	42.0	6.87	327.00		WP
14	Mbugani	190/85	689291	9354365	o	o	85					5.55	206.00		
15	Kashangu	111/85	703779	9346040	o	x	85	62.3	30.48		44.5	5.70	165.20		WP
16	Itigi	12/42			x		42	37.8	20.40	11.36	24.4				
16	Itigi	1/44			x		44	51.2	21.90	6.00	24.4				
16	Itigi	19/54			x		54	41.8	19.20	2.00	27.4				
16	Itigi	2/64			x		64	35.1	18.28	5.00	22.9				
16	Itigi	16/70					70	107.0	22.00	2.91	28.0	6.60	70.00		
16	Itigi	28/71			x		71	15.2							
16	Itigi	37/73	669426	9369026	o	o	73	132.0	16.00	9.10	46.6	6.14	203.00		WP SP
16	Itigi	15/73					73	125.7	1.60	11.00	118.0				
16	Itigi	159/74			x		74	84.4	15.83	8.41	58.7				
16	Itigi Mission 1	69/81					81	42.0	23.00	7.20	24.0				
16	Itigi Mission 2	70/81					81	32.0	18.00	3.60	18.0				
16	Itigi Mission 3	79/81					81	42.0	21.00	7.20	22.0				
16	Itigi Mission 4	80/81					81	38.5	19.00	10.80	21.0				
17	Doroto	11/56	652710	9363373	o	o	56	99.0	40.00	1.00	56.0	6.70	146.60		WP
17	Doroto	57/69			o	x	69	180.9	37.00	1.14	53.9				
17	Doroto	43/73A	651602	9364165	o	x	73	216.0	34.00	3.30	30.4	7.21	224.00		L-2 Pilot
17	Doroto	43/73	652607	9362374	o	o	73	118.0	28.20	1.12	82.3	7.53	91.10		WP
18	Kitaraka	31/50					50	40.0	22.80	5.00	25.0				
18	Kitaraka	22/53					53	52.0	22.90	5.00	29.9				
18	Kitaraka	48/54					54	52.7	34.44	3.10	41.8				
18	Kitalaka	149/73					73	183.0	24.00	0.45	92.0	6.80	207.00		
19	Sanjaranda	115/73	668505	9375063	o	x	73	126.2	14.70	6.20		6.37	291.00		Mono P
19	Sanjaranda	48/74	669130	9375264			74	152.1	14.02	0.08	79.9	7.53	91.10		WP
20	Gurungu	116/73			x		73	186.0							
20	Gurungu	155/73					73	199.0	15.00	1.92	56.0				
20	Gurungu	43/74					74	154.5	18.30	0.50	30.5				
21	Kurungu	12/56			x		56	56.4		0.00					

Village		Borehole	Gride		Situation		Constructed	Depth	SWL	Yield	Water Struck	pH	EC	Geology	Remarks
No.	name	No.	x	y	well	pump	year	m	m	m^3/hr	m		(mS/m)		
21	Kurungu	1/58			x		58	72.0	25.00	0.75	34.0				
21	Kitopeni	151/73	674934	9367692	o	o	73	181.0	25.00	2.07	57.4	6.50	130.80		WP
21	Kitopeni	20/73			x		73	95.7							
21	Kitopeni	109/85					85	47.4	13.90	3.00	45.0	6.30	92.00		
21	Kitopeni		674879	9366305	o	o	94	106.0			60.0	6.50	81.70		WP
22	Ipande		673703	9358974	o	o	95	100.0				5.45	139.30		L-2 SP
23	Muhenga	1/66			x		66	35.4							
23	Muhanga	177/73	678126	9351300	o	o	73	192.0	12.00	1.35	92.0	5.42	203.00		WP
23	Muhanga	160/73					73	184.0	54.00	1.61	70.0				
23	Muhanga		675480	9350476	o	o	93					5.76	678.00		HP
24	Damwelu	112/85	665154	9362101	o	o	85	101.6	22.55	2.55	29.0	5.13	92.90		WP
25	Mgandu	8/73E					73	208.0	9.47	1.30	16.7				
25	Mgandu	8/73C			x		73	91.5							Dry
25	Mgandu	8/73A			x		73	117.3							
25	Mgandu	8/73B			x		73	131.5							
25	Mgandu	8/73			x		73	83.0							
25	Mgandu	8/73D			x		73	31.0							Dry
25	Mgandu	99/73					73	210.0	3.00	3.75	119.0				
25	Mgandu	100/73					73	215.0	7.00	0.64	92.0				
25	Mgandu	202/81					81	91.0	41.00	0.70	54.0				
25	Mgandu	44/82			x		82	76.0			45.0				
25	Mgangu/Makale	155/92					92								
25	Mgangu/Makale	156/92					92								
25	Mgandu		617020	9335317	o	o	93	39.0				5.10	142.30		HP
28	Kayui	8E/73	624885	9341845	o	o	73	208.0	9.47	13.00	16.7	5.20	66.50		WP
28	Kayui	16/93	621950	9339453	o	o	93	30.5	26.00			4.81	44.80		HP
29	Makale	16/93	617343	9338933	o	o	93	30.5	10.50			5.12	18.93		HP
30	Rungwa	15/70					70	115.3	4.88	11.32	110.0				
30	Rungwa	75/73					73	217.6	29.80	2.14					
30	Rungwa 2	75/73A					73	121.9	11.00	3.32	52.0				

Village		Borehole	Gride		Situation		Constructed	Depth	SWL	Yield	Water Struck	pH	EC	Geology	Remarks
No.	name	No.	x	y	well	pump	year	m	m	m^3/hr	m		(mS/m)		
30	Rungwa		557805	9232989	x	x	91					8.00	76.00		L-2
31	Mwamagembe	101/73	585270	9285250	x	x	73	111.2	2.13	7.70	64.0				L-2
31	Mwamagembe	2/73					73	183.0	20.72	2.11	82.3				
33	Maweni	96/72	735653	9348836	x	x	72	182.9		3.60		7.70	10.80		L-2
34	Mvume	8/74			x		74	249.0	6.80	2.27	106.7				
34	Mvume	9/74			x		74	ND	7.63	0.25	64.0				
35	Ngaiti	15/74			x		74	190.5	7.10	5.91	97.0				
36	Chikuyu	36/72	729226	9351515	o	o	72	82.8	4.00	7.50	6.1	6.70	376.00		WP
37	Mbwasa	82/74	726223	9358165	o	o	74	127.4	34.75	6.91	123.1	7.80	107.00		WP
39	Makatapora St	2/31			x		31	48.8	28.46	2.05	42.2				
39	Makatapora St	3/31			x		31	91.4	58.90	2.05	42.7				
39	Makatapora	25/60A			x		60	25.6	18.90	11.00	21.9				
40	Makanda	14/60	7537646	9371234	x	x	60	90.8	33.00	3.00	3.3	6.80	39.00		L-2
43	Kintinku	35/56			x		56	79.9	19.20	0.10	24.4				
43	Kintinku	59/57			x		57	36.6	14.30	3.00	22.9				
43	Kintinku	16/82					82	36.6	12.80	2.50	19.8				
43	Kintinku	113/85	746555	9350027	x	x	85	74.4	15.24	1.48	7.0	6.80	21.00		L-2
46	Nkonko	76/69					69	196.9	18.15	9.09	16.2				
46	Nkonko	84/79	717745	9297020	o	o	79	78.0			20.0	5.48	181.90		L-2
46	Nkonko	85/79			x		79	96.0							Dry
47	Mpola	106/71			x		71	124.0							
47	Mpola	89/72A			x		72								
47	Mpola	60/73	712534	9311502	o	o	73	121.9	65.00		73.0	6.20	10.80		L-2
49	Chikola	40/73	703239	9328094	o	x	73	152.0	12.00	4.50	40.0				L-2 Pilot V.
52	Heka	26/73	706956	9321826	o	o	73	122.0	2.40	1.50	103.7	5.36	16.41		WP
52	Heka	19/73					73								
52	Heka	70/88					88					7.20	95.00		
54	Chikombo	53/86	711300	9317954	o	o	86					5.91	433.00		WP
55	Isseke	26/60			o	x	60	46.3	31.10	0.55	33.0				WP
55	Isseke	118/73	723556	9288389	o	x	73	152.4	26.20	5.00	39.6	4.24	11.50		L-2

Village		Borehole	Gride		Situation		Constructed	Depth	SWL	Yield	Water Struck	pH	EC	Geology	Remarks
No.	name	No.	x	y	well	pump	year	m	m	m^3/hr	m		(mS/m)		
55	Isseke	86/73					73	152.4	9.80	0.40	20.7				
59	Sanza	185/73	744558	9296389	o	o	73	128.0	7.55	18.00	12.0	5.64	244.00		WP
62	Ikassi	36/54			x		54	45.7	1.98	16.36	15.2				
62	Ikasi	27/60			x	x	60	36.0	15.50	8.80	19.2				
62	Ikasi	132/73			x		73	144.5	ND		31.0				
62	Ikasi		744875	9303982			96	60.0	12.00			5.48	323.00		
63	Msemembo	128/79	717450	9390790	o	x	79	158.5				6.20	215.00		L-2
64	Saranda St	5/31			o	o	31	74.9	25.00	2.38	34.2				
64	Saranda	29/69	718449	9367980	o	x	69	141.0	23.00	3.90	134.0	6.90	57.20		WP
65	Londoni	184/73	730456	9410945	o	o	73	129.5	27.40	3.50	116.0	5.94	82.80		L-2
67	Kilimatinde	1/36			x		36	89.0	42.90	1.50	48.8				
67	Kilimatinde	12/49			x		49	33.0			16.8				
67	Kilimatinde	19/50			x		50	63.0	38.00	1.10	41.0				
67	Kilimatinde Msakili	90/74					74	138.7	55.00	14.09	104.0				
67	Kilimatinde Msakili	104/74					74	133.5	39.32	12.95	118.9				
67	Kilimatinde Msakili	105/74					74	103.0	28.35	15.80	91.4				
67	Kilimatinde Msakili	106/74			x		74	78.6	28.35	13.23	76.2				
68	Solya	199/73	715742	9354736	o	o	73	118.8	30.00	15.00	110.0	5.31	90.80		L-2
68	Solya Kilimatinde	1/80					80	117.4	30.48	5.40	61.0				
69	Sukamahela	76/72	720995	9357348	o	o	72	72.5	1.30	4.42	70.7	6.19	170.50		WP
69	Sukamahela	34/72			x		72	192.0	32.90	1.50	138.8				
70	Majiri	39/69			o	x	69	255.4	9.23	1.45	143.1				
70	Majiri	154/73			x		73	192.0			31.0				
71	Sasajila	11/66	712937	9343978	o	x	66	116.4	15.00	4.60	36.6	8.50	16.70		L-2
72	Makasuku	19/64	711243	9335373	x	x	64	123.7	70.00	2.40	83.5	6.50	19.05		
75	Chibumagwa	4/66	717467	9351004	o	o	66	106.7	42.67	10.64	46.0	6.80	156.80		L-2
	Total							14027.1	######	568.52					
	number of borehole							131.0	105.00	99.00					
	Average							107.08	24.39	5.74					

Appendix-1 Table-1.6.1-2 (4) Borehole Inventory of theTarget Villages of IGUNGA District

No.	Village	Borehole No.	Gride		Situation		Constructed year	Depth m	SWL m	Yield m3/hr	Water Struck m	Casing Dia mm	PH	EC (mS/m)	El (m)	Geology	Remarks
					Well	pump											
2	Buchenyo-Lege	74/80					80	30.5	-		-						
8	Chomachankola	111/70	538620	9554857	o	o	70	117.4	40.2	6.00		150	7.25	170.3	1125	Nz	HP
11	Ziba	247/95	545537	9529160	o	o		28.0				2250	6.9	171			HP
11	Ziba	144/73					73	59.4	-		-						
11	Ziba	137/78	540700	9533100	o	x	78	90.5	24.90			150				Gr	
11	Ziba	144/78	540800	9533100	o	x	78	58.5	25.30		57.6	150				Gr	
12	Ibologero	34/79	552143	9518680	o		79	118.6	0.9		35.7	200	7.17	145		Gr	
12	Iborogero	15/79	552400	9532300			79	85.3	2.80	0.90	8.2					Gr	
12	Iborogero	42/79	552200	9532300			79	35.0	0.60	5.70	19.4					Gr	
18	Nkinga	1/79	548263	9512020	o	o	79	73.8	2.44	13.00	21.0	2000	7.32	175.7	1265	Gr	
38	Nyandekwa	49/79	561300	9530100	x	x	79	29.9	-		-					Nz	Test
38	Nyandekwa	148/78	561300	9530100	o	x	78	70.5	20.00	2.00	31.7	150	6.98	101.9		Nz	
39	Ussongo	248/95	553790	9524987	o	x	95	40.0		24.00					1235	Gr	Hp
39	Ussongo	248/81					81	39.3	3.25	18.10	16.7					Gr	
39	Ussongo 1	203/81					81	36.6	4.27	8.37	15.2					Gr	
40	Itale	249/95	556074	9522508	o	o	95	31.0		8.00		2000	7.08	94.3	1250	Gr	Hp
41	Nanga	268/76			x	x	76	47.0	12.19	0.00	-					Nz	
	Kalexela	40/82					82	61.0	-		-						
	Mbutu	16/50			x	x	50	105.2	32.91	2.20	76.2					L	
	Total							1157.4	169.76	88.27							
	Number of borehole							19.0	12.00	10.00							
	Avarage							60.9	14.15	8.83							