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ESMAP
Energy Sector Management Assistance Program

Small Hydro Resource Mapping in Tanzania

SITE VISITS REPORT: EXISTING

April 2015

This report was prepared by SHER Ingénieurs-Conseils s.a. in association with Mhylab, under contract to The World Bank.

It is one of several outputs from the wind resource mapping component of the activity '*Renewable Energy Resource Mapping and Geospatial Planning – Tanzania*' [Project ID: P145287]. This activity is funded and supported by the Energy Sector Management Assistance Program (ESMAP), a multi-donor trust fund administered by The World Bank, under a global initiative on Renewable Energy Resource Mapping. Further details on the initiative can be obtained from the ESMAP website.

This document is an **interim output** from the above-mentioned project. Users are strongly advised to exercise caution when utilizing the information and data contained, as this has not been subject to full peer review. The final, validated, peer reviewed output from this project will be a Tanzania Small Hydro Atlas, which will be published once the project is completed.

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Washington DC 20433
Telephone: +1-202-473-1000
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***SHER** Ingénieurs-conseils s.a.*
Rue J. Matagne, 15
5020 Namur – Belgium
Phone : +32 81 32 79 80
Fax : +32 81 32 79 89
www.sher.be

Project Manager:	*Julien LEFEVERE*
Référence SHER :	*TNZ01*
Phone :	*+32 (0) 81 327 982*
Fax :	*+32 (0) 81 327 989*
E-mail :	*lefevere@sher.be*

Rev.n°	Date	Content	Drafted	Verified
0	02/2015	Site visit report - Interim	Thomas DUBOIS Giress MUNYANDEKWE Alice VANDENBUSSCHE	Pierre SMITS
1	04/2015	Site visit report - FINAL	Thomas DUBOIS Giress MUNYANDEKWE Alice VANDENBUSSCHE	Pierre SMITS

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1 GENERAL CONTEXT OF THE ESMAP – FWC PROJECT

The Energy Sector Management Assistance Program (ESMAP), a global knowledge and technical assistance program administered by the World Bank and supported by 11 bilateral donors, has launched, in January 2013, an initiative that will support country-driven efforts to improve RE resource awareness, put in place appropriate policy frameworks for RE development, and provide 'open access' to resource and geospatial mapping data. It will also support the IRENA Solar and Wind Atlas by improving the data availability and quality that can be accessed through the atlas on a modular basis.

This "Renewable Energy Mapping: Small Hydro Tanzania" study, is part of a technical assistance project, ESMAP funded, being implemented by Africa Energy Practice 1 (AFTG1) of the World Bank in Tanzania (the 'Client') which aims at supporting resource mapping and geospatial planning for small hydro. It is being undertaken in close coordination with the Rural Energy Agency (REA) of Tanzania, the World Bank's primary Client country counterpart for this study.

The "Provision of Small Hydropower Resource Data and Mapping Services" IDA 8004801 Framework contract was signed 29th May 2013, while the specific contract " Renewable Energy Mapping: Small Hydro Tanzania", n. 7169139, is dated 4th November 2013.

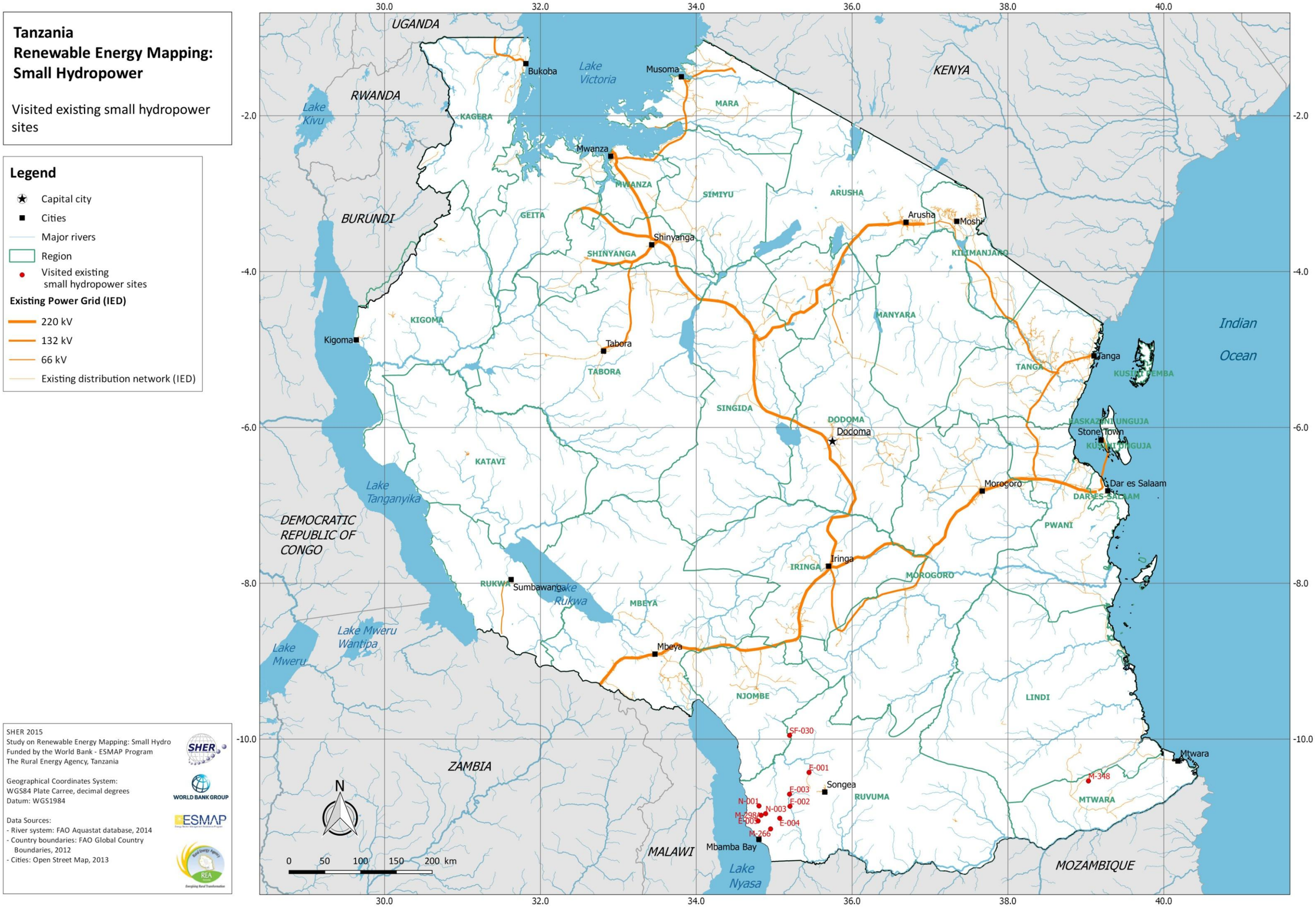
2 FRAMEWORK OF THE SITE VISITS REPORT IN TANZANIA

The Site Visits Report is the result of the consolidation of the primary and secondary data collected and processed during the site visits. This report comes with the Hydro Mapping report provided at the end of Phase 1 which established an inventory of existing and potential hydropower sites put into perspective in their socio-economic and natural environment.

The fact sheets, presented in this report, for the 11 hydropower existing visited sites contain some preliminary information for future improvement or rehabilitation.

Tanzania
Renewable Energy Mapping: Small Hydropower

Visited existing small hydropower sites



SHER 2015
Study on Renewable Energy Mapping: Small Hydro
Funded by the World Bank - ESMAP Program
The Rural Energy Agency, Tanzania

Geographical Coordinates System:
WGS84 Plate Carree, decimal degrees
Datum: WGS1984

Data Sources:
- River system: FAO Aquastat database, 2014
- Country boundaries: FAO Global Country Boundaries, 2012
- Cities: Open Street Map, 2013

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3 KINDIMBA EXISTING (N-003)

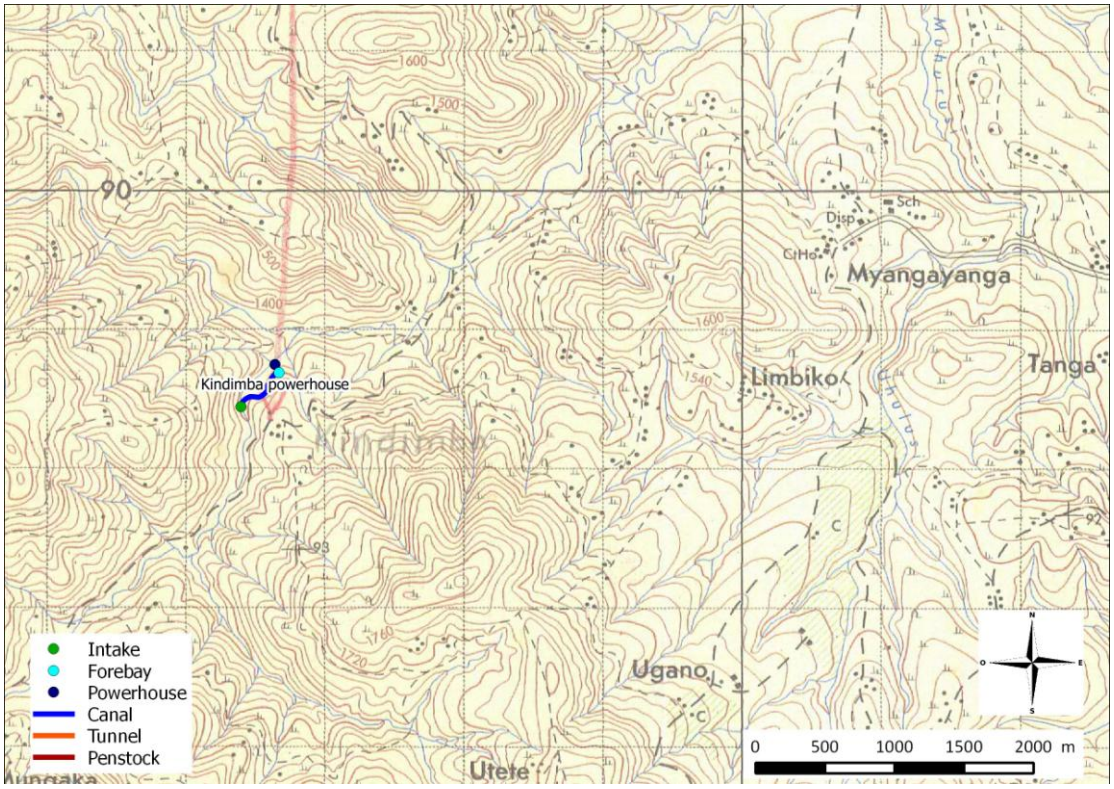

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	34.889	-10.957
Powerhouse	34.891	-10.954

1. Administrative and socio-economic data

Site code	N-003
Site name	Kindimba Existing
River	Mangaka
Village	Kindimba
Region	Ruvuma
Basin	Lake Nyasa
Topographical map reference	Topographical map n° 297/4 (scale 1/50,000)

2. Reference study

Study name : Field visit
Author : SHER
Edition year : 2014

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	0.04
Gross head [m]	25
Installed capacity [kW]	8

3. Technical data

Type of scheme: Run of the river
Type of connection: Off-grid
Scheme description :
Existing powerhouse (50 kw) including an option for mill turbine. The infrastructure (dam-canal-forebay-penstock-spillway-powerhouse) is in a good condition. The electrical system has been destroyed by a lightning. There is a currrent rehabilitation of the alternator and the transformer. During the rainy season, the removing of the sand takes 2 days per week. Due to the river basin deterioration, an improved desilting basin should be built.

Canal length [m]	442
Tunnel length [m]	0
Penstock length [m]	72
Dam type	Masonery dam
Dam height [m]	2
Dam width [m]	10
Measured turbidity [NTU]	300
Comments on solid transport	Important
Transmission line length [km]	0.0
Comments on accessibility	Difficult existing access to the infrastructures
Other comments	Existing site to be improved by a new desilting system. Existing isolated Grid - An extension of the local grid is under progress. -

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	0.02
$Q_{90\%}$ discharge [m³/s]	0.04
$Q_{50\%}$ discharge [m³/s]	0.14
$Q_{30\%}$ discharge [m³/s]	0.20
Design flood $P_{100\,yr}$ [m³/s]	0.84
Catchment area [km²]	21
Hydrological confidence indication	Medium

5. Representative pictures

Figure 2 : Dam site and intake (Tyrolean intake)

Figure 3 : Desilting basin (to be enlarged)

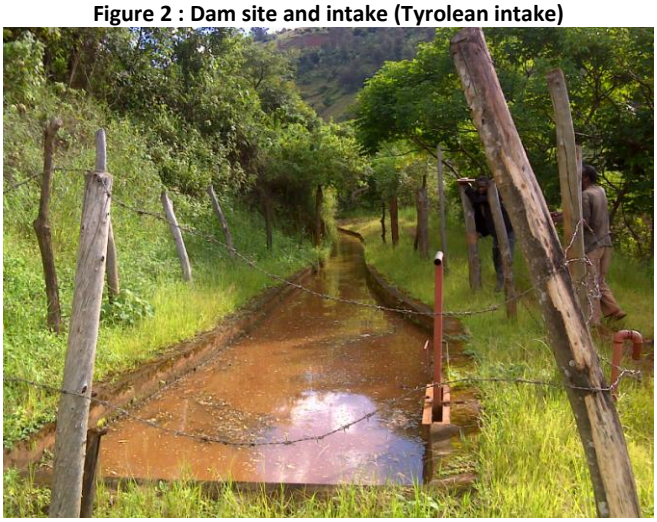

Figure 4 : Forebay

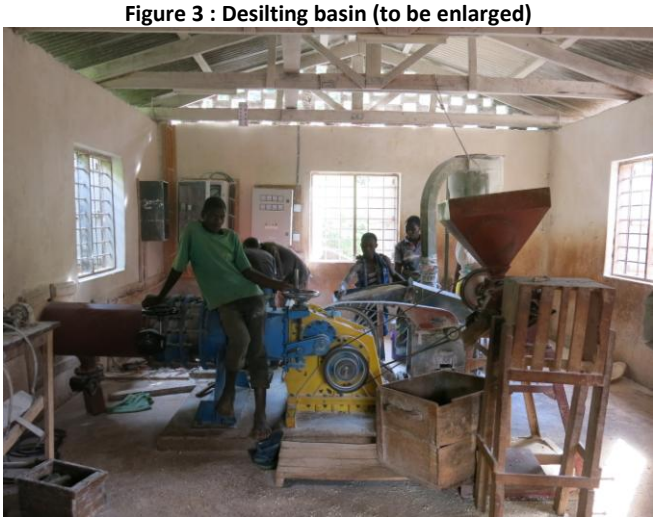

Figure 5 : Power house including crossflow turbine, watermill and alternator

4 KITAI (E-003)

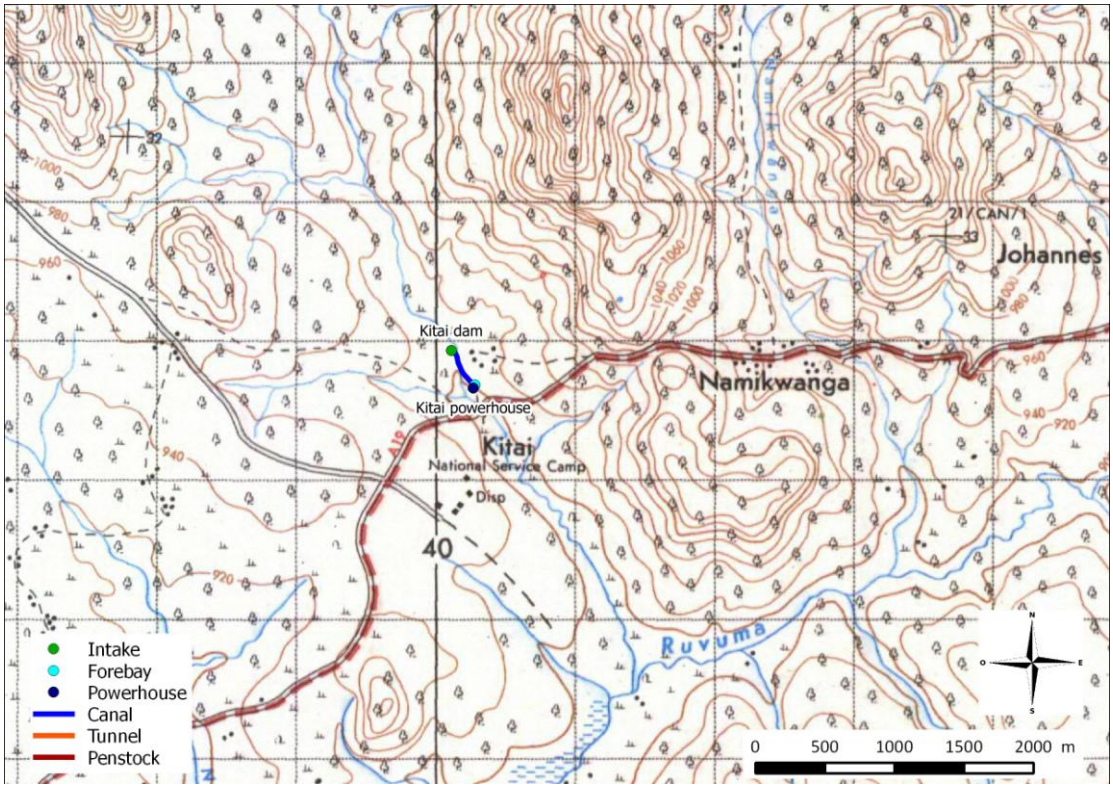

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	35.196	-10.706
Powerhouse	35.197	-10.709

1. Administrative and socio-economic data

Site code	E-003
Site name	Kitai
River	Likoyu
Village	Kitai Prison
Region	Ruvuma
Basin	Ruvuma and Southern Indian Ocean Coast
Topographical map reference	Topographical map n° 298/1 (scale 1/50,000)

2. Reference study

Study name : Field visit
Author : SHER
Edition year : 2014

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	0.10
Gross head [m]	10
Installed capacity [kW]	8

3. Technical data

Type of scheme: Run of the river
Type of connection: Off-grid
Scheme description :
The hydropower system has been created to supply the prison. The prison may have between 100 and 200 inmates. According to the prison's director, the plant was created in 1974 at the request of president Nyerere on visit at the site. He asked the assistence of the Peramiho Mission who was already experienced in this field. They took advantage of the artificial pond created for fishing purposes. However, this does not constitutes a reservoir for the power plant since the flow regulation is very light, and no water accumulation is possible for power generation. Concrete components consist in a gate in a backfilled dam and an unlined canal that diverts the outlet to the powerhouse. A head of 9.5m is created and an Ossberger turbine uses 600l/s to create 45kW of power.

Canal length [m]	352
Tunnel length [m]	0
Penstock length [m]	31
Dam type	Masonery dam
Dam height [m]	3
Dam width [m]	50
Measured turbidity [NTU]	80
Comments on solid transport	Non existent because of the pond.
Transmission line length [km]	1.0
Comments on accessibility	Weir access: Good: a kilometer from the main road Powerhouse access: Good: a few meters from the main road
Other comments	Existing site that feeds the prison. - No future infractructure is foreseen in the coming years. -

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	0.06
$Q_{90\%}$ discharge [m³/s]	0.10
$Q_{50\%}$ discharge [m³/s]	0.35
$Q_{30\%}$ discharge [m³/s]	0.51
Design flood $P_{100\,yr}$ [m³/s]	2.15
Catchment area [km²]	60
Hydrological confidence indication	Medium

5. Representative pictures

Figure 2 : Artificial pond for fishery

Figure 3 : Intake

Figure 4 : Forebay

Figure 5 : Powerhouse

5 KITANDAZI I (E-004)

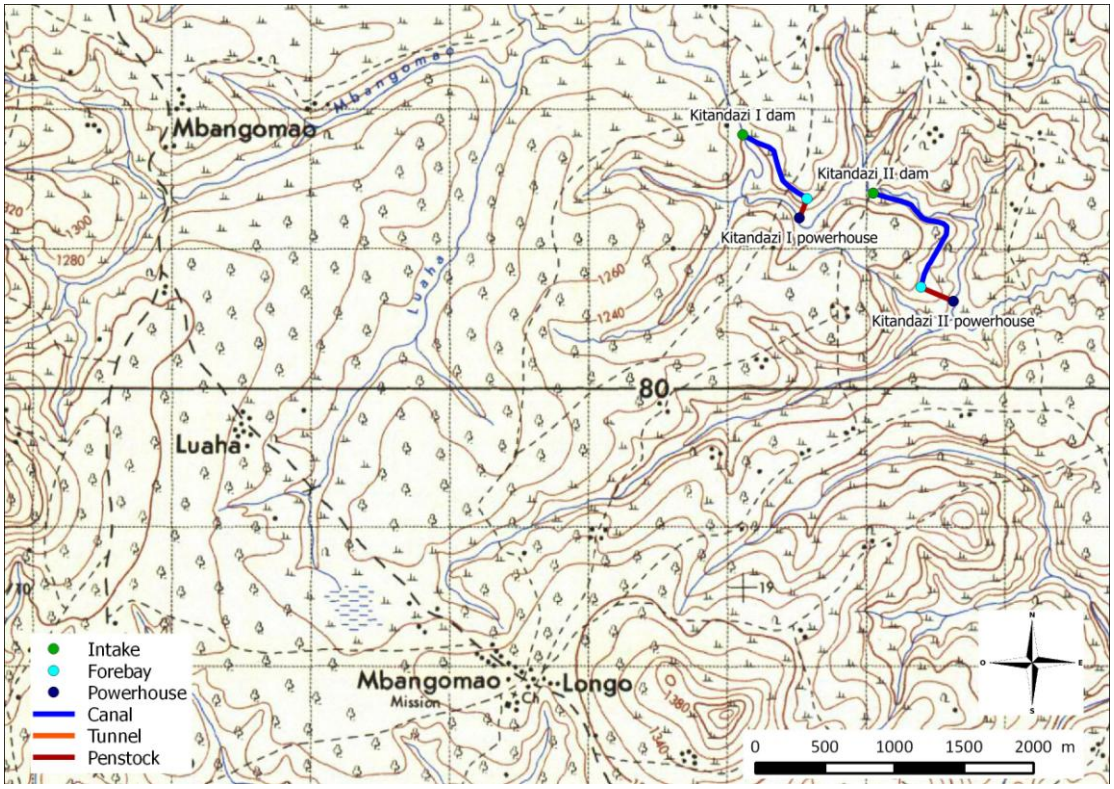

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	35.070	-11.016
Powerhouse	35.074	-11.021

1. Administrative and socio-economic data

Site code	E-004
Site name	Kitandazi I
River	Mbinga
Village	-
Region	Ruvuma
Basin	Ruvuma and Southern Indian Ocean Coast
Topographical map reference	Topographical map n° 310/1 (scale 1/50,000)

2. Reference study

Study name : Field visit
Author : SHER
Edition year : 2014

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	1.10
Gross head [m]	36
Installed capacity [kW]	330

3. Technical data

Type of scheme: Run of the river
Type of connection: Connected to a mini-grid
Scheme description :
This powerplant is currently being built by AHEPO (Andoya Hydropower Project), with part of the funds comnig from the WB and with some support from REA.
A concrete weir diverts water into the scheme; no reservoir is foreseen. The plant will be able to generate 1MW from 2 Francis turbines (constructor: ZECO). The head is 36m and the discharge is 3.8m³/s.
Mr Andoya is a private investor, who owned the hydro-mill on the site. He will sell the power to TANESCO.

Canal length [m]	792
Tunnel length [m]	0
Penstock length [m]	177
Dam type	Masonery dam
Dam height [m]	5
Dam width [m]	30
Measured turbidity [NTU]	30
Comments on solid transport	Limited but the watershed is very exposed to agriculture and solid transport might be significant during rainy weather.
Transmission line length [km]	14.0
Comments on accessibility	Weir access: Accessible by an unpaved road Powerhouse access: Accessible by an unpaved road.
Other comments	Site under construction that will be connected to the Mbinga minigrid. Lined canal. No future infractructure is foreseen in the coming years. The promotor and owner of the project is Andoya Hydropower Project (AHEPO).

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	0.20
$Q_{90\%}$ discharge [m³/s]	0.32
$Q_{50\%}$ discharge [m³/s]	1.13
$Q_{30\%}$ discharge [m³/s]	1.63
Design flood $P_{100\,yr}$ [m³/s]	6.91
Catchment area [km²]	176
Hydrological confidence indication	Medium

5. Representative pictures

Figure 2 : Global view of the site

Figure 3 : Concrete weir

Figure 4 : Intake

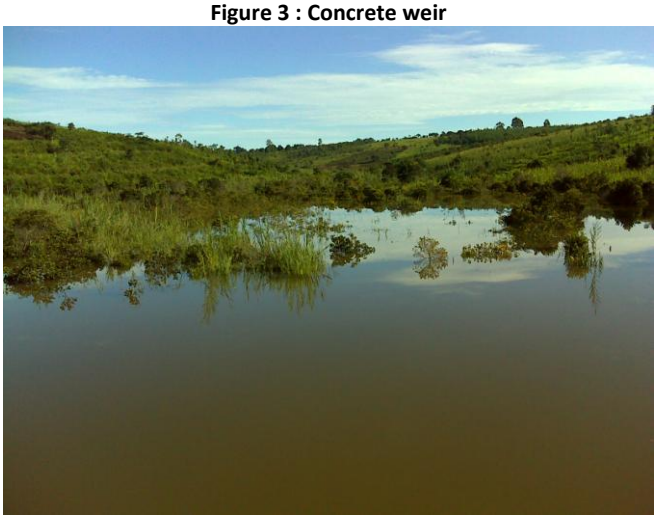

Figure 5 : Upstream area being flooded

6 LITEMBO EXISTING (M-298A)

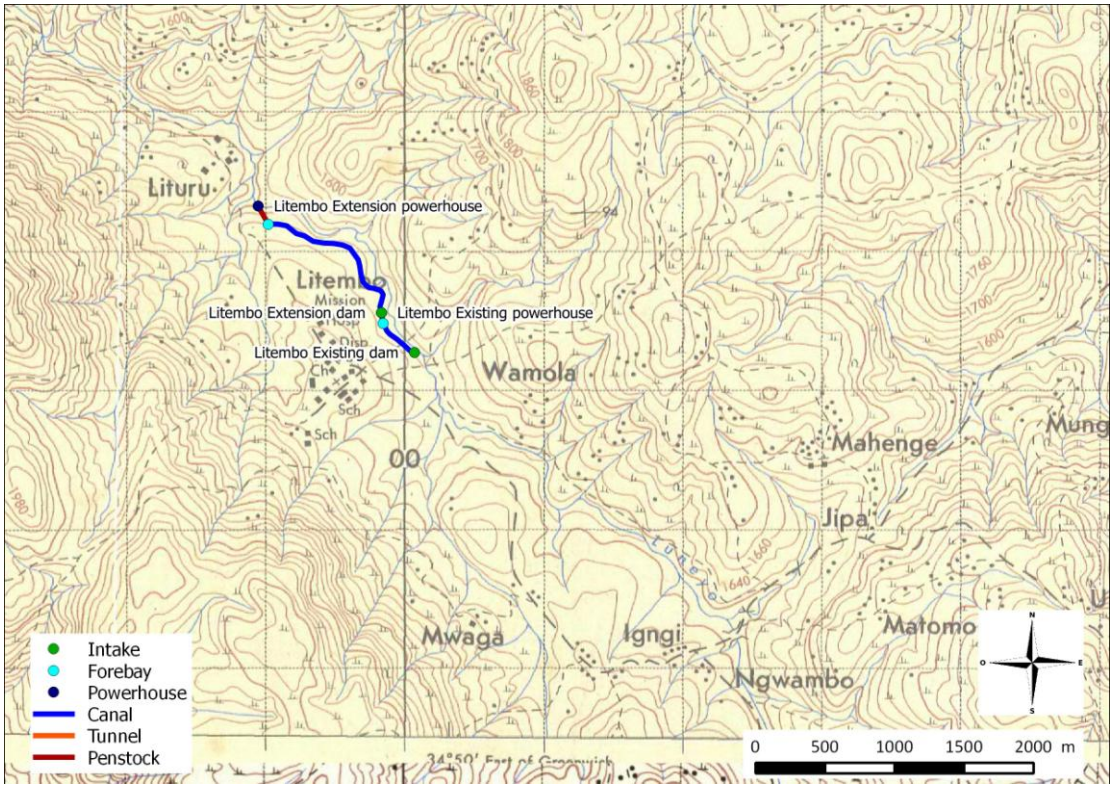

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	34.832	-10.977
Powerhouse	34.830	-10.975

1. Administrative and socio-economic data

Site code	M-298A
Site name	Litembo Existing
River	Ndumbi
Village	Litembo Mission
Region	Ruvuma
Basin	Lake Nyasa
Topographical map reference	Topographical map n° 297/4 (scale 1/50,000)

2. Reference study

Study name : IREP - GIS - base list
Author : IED
Edition year : 2013

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	0.06
Gross head [m]	12
Installed capacity [kW]	6

3. Technical data

Type of scheme: Run of the river
Type of connection: Off-grid
Scheme description :
Existing dam, power canal and penstock. A 94 kW Crossflow Turbine is fed by a concrete canal. The turbine is properly working since 1982 and feeds a mini-grid. The scheme is well designed, well maintained and in good operating condition. They face an increasing problem of sediment that must be flushed at the forebay with a higher frequency.

Canal length [m]	341
Tunnel length [m]	0
Penstock length [m]	81
Dam type	Concrete dam
Dam height [m]	6
Dam width [m]	25
Measured turbidity [NTU]	300
Comments on solid transport	Sand
Transmission line length [km]	0.0
Comments on accessibility	Existing access
Other comments	Existing site feeding the Mission minigrid. Canal on the left riverbank. No grid extention is foreseen in the coming years. -

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	0.04
$Q_{90\%}$ discharge [m³/s]	0.06
$Q_{50\%}$ discharge [m³/s]	0.22
$Q_{30\%}$ discharge [m³/s]	0.32
Design flood $P_{100\,yr}$ [m³/s]	1.33
Catchment area [km²]	34
Hydrological confidence indication	Medium

5. Representative pictures

Figure 2 : Intake

Figure 3 : Power canal

Figure 4 : Forebay and flushing gate

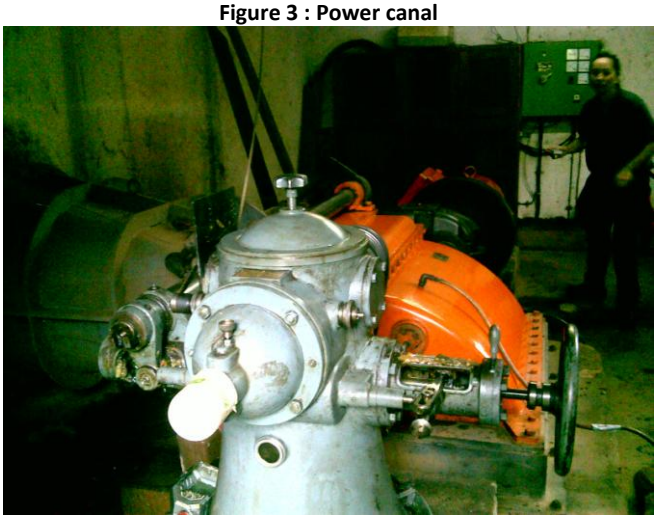

Figure 5 : Turbine

7 LUMEME (M-266)

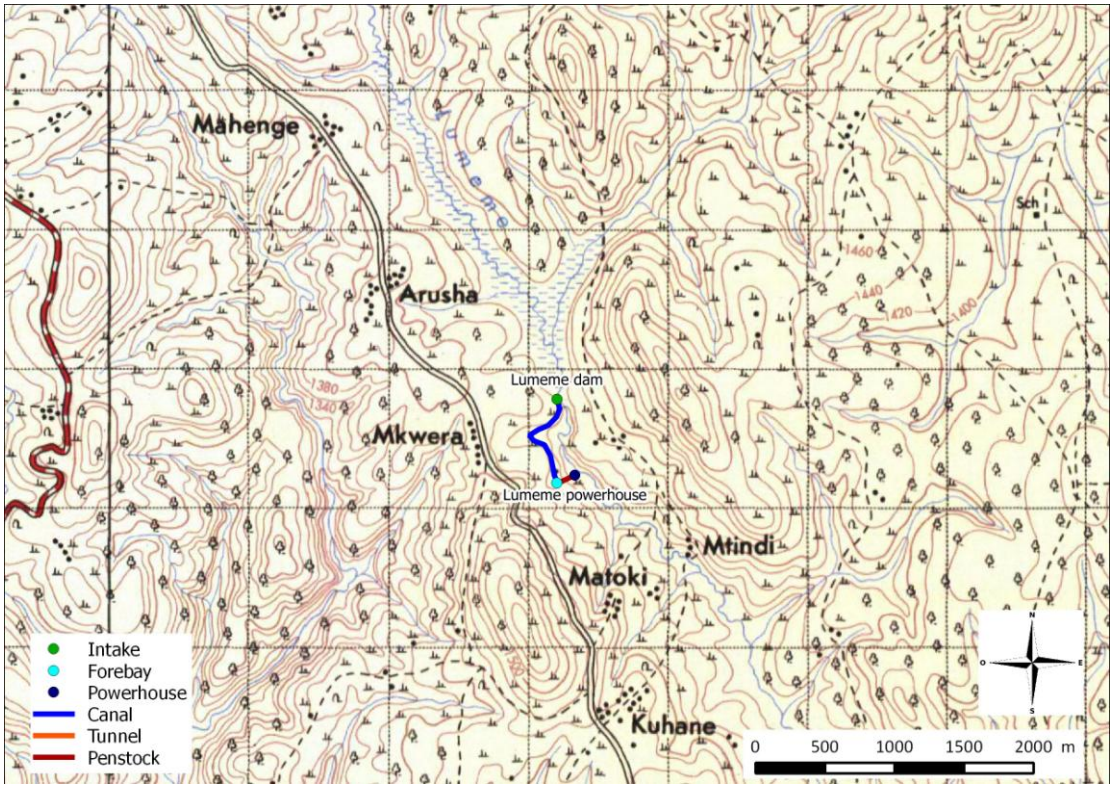

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	34.953	-11.152
Powerhouse	34.954	-11.157

1. Administrative and socio-economic data

Site code	M-266
Site name	Lumeme
River	Lumeme
Village	Several villages are located around the project scheme
Region	Ruvuma
Basin	Ruvuma and Southern Indian Ocean Coast
Topographical map reference	Topographical map n° 309/2 (scale 1/50,000)

2. Reference study

Study name : List for Feasibility Study
Author : REA
Edition year : 2009

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	0.20
Gross head [m]	26
Installed capacity [kW]	40

3. Technical data

Type of scheme: Run of the river
Type of connection: Off-grid
Scheme description :
The scheme benefits from the head created by waterfalls located on a reduced stretch of the river. The canal will be located on the right riverbank which is the most appropriate.
Part of the riverflow is currently diverted through a small canal on about 100m to feed an existing mechanical hydromill.

Canal length [m]	891
Tunnel length [m]	0
Penstock length [m]	164
Dam type	Masonery dam
Dam height [m]	5
Dam width [m]	25
Measured turbidity [NTU]	150
Comments on solid transport	Presence of sand in the water
Transmission line length [km]	10.0
Comments on accessibility	Weir access: Good: 1km from the road Powerhouse access: Good: 1km from the road
Other comments	The transmission line for this scheme could be developped together with that for the Kingilikiti scheme. Canal on the right riverbank. Mostly superficial soft grounds. No future infractructure is foreseen in the coming years. Kingilikiti scheme is located about 4km downstream of this site. A reservoir scheme is probably not appropriate given the size of the site.

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	0.12
$Q_{90\%}$ discharge [m³/s]	0.20
$Q_{50\%}$ discharge [m³/s]	0.69
$Q_{30\%}$ discharge [m³/s]	0.99
Design flood $P_{100\,yr}$ [m³/s]	4.20
Catchment area [km²]	106
Hydrological confidence indication	Medium

5. Representative pictures

Figure 2 : Vicinity of proposed weir location

Figure 3 : Detail of river downstream of weir position

Figure 4 : Existing hydro-mill

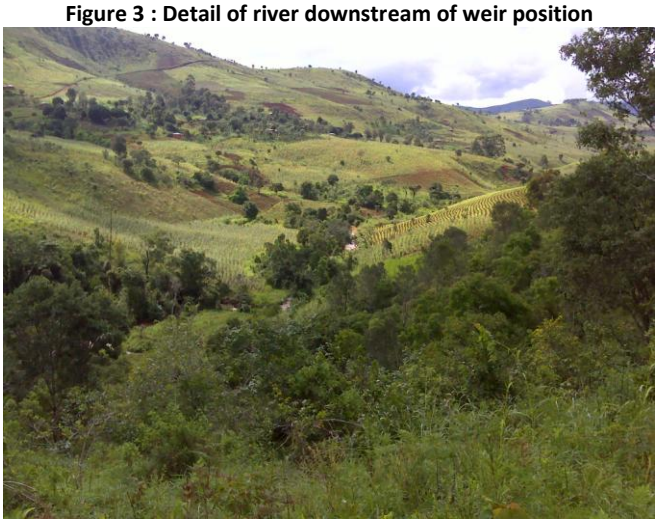

Figure 5 : View on the powerhouse proposed site

8 LUNDOMATO MISSION (N-001)

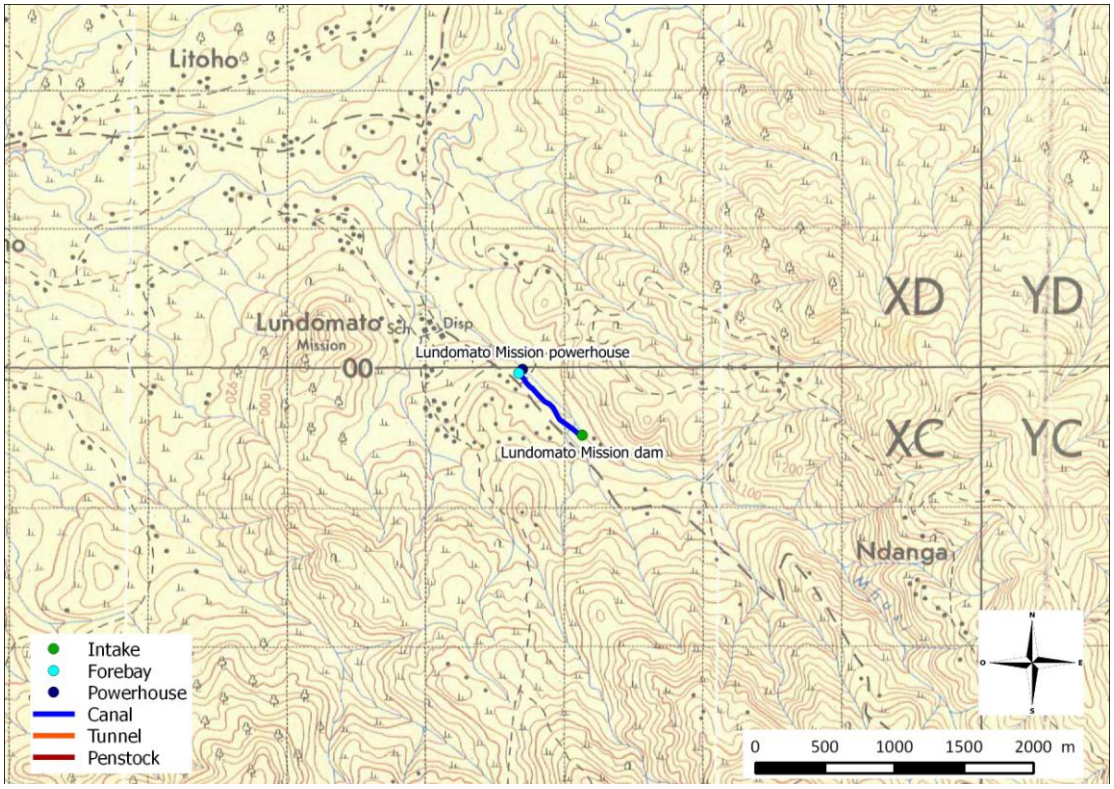

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	34.803	-10.858
Powerhouse	34.800	-10.853

1. Administrative and socio-economic data

Site code	N-001
Site name	Lundomato Mission
River	Mhusi
Village	Lundomato
Region	Ruvuma
Basin	Lake Nyasa
Topographical map reference	Topographical map n° 297/4 (scale 1/50,000)

2. Reference study

Study name : Field visit
Author : SHER
Edition year : 2014

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	0.02
Gross head [m]	10
Installed capacity [kW]	1

3. Technical data

Type of scheme: Run of the river
Type of connection: Off-grid
Scheme description :
Existing micro-site to be rehabilitate with a new dam, new power canal, new desilting system and new penstock and a turbine.The turbine mill and scheme is not operational. A reconditionning can be foreseen. The dam has to be rebuild and/or adapted. The power canal must be totaly rebuilt. A sand trap must be included in the scheme

Canal length [m]	710
Tunnel length [m]	0
Penstock length [m]	42
Dam type	Masonery dam
Dam height [m]	2
Dam width [m]	20
Measured turbidity [NTU]	100
Comments on solid transport	Sand and small stones (< 5cm).
Transmission line length [km]	2.0
Comments on accessibility	Existing access
Other comments	Existing site with an isolated grid for the Lundomato Mission. No grid extension is foreseen in the coming years. Topsoil with hard rock below. No future infractructure is foreseen in the coming years. -

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	0.01
$Q_{90\%}$ discharge [m³/s]	0.02
$Q_{50\%}$ discharge [m³/s]	0.10
$Q_{30\%}$ discharge [m³/s]	0.18
Design flood $P_{100\,yr}$ [m³/s]	1.57
Catchment area [km²]	19
Hydrological confidence indication	Low

5. Representative pictures

Figure 2 : Forebay - Problem of sediment

Figure 3 : Penstock and powerhouse

Figure 4 : Turbine mill

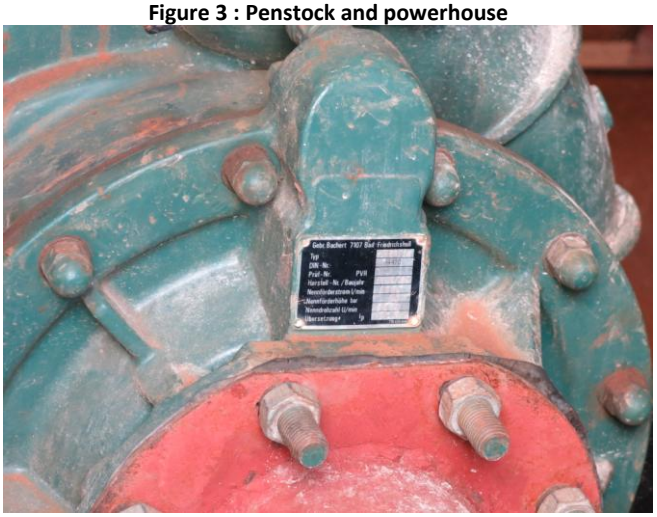

Figure 5 : Turbine detail

9 LUPILO (E-002)

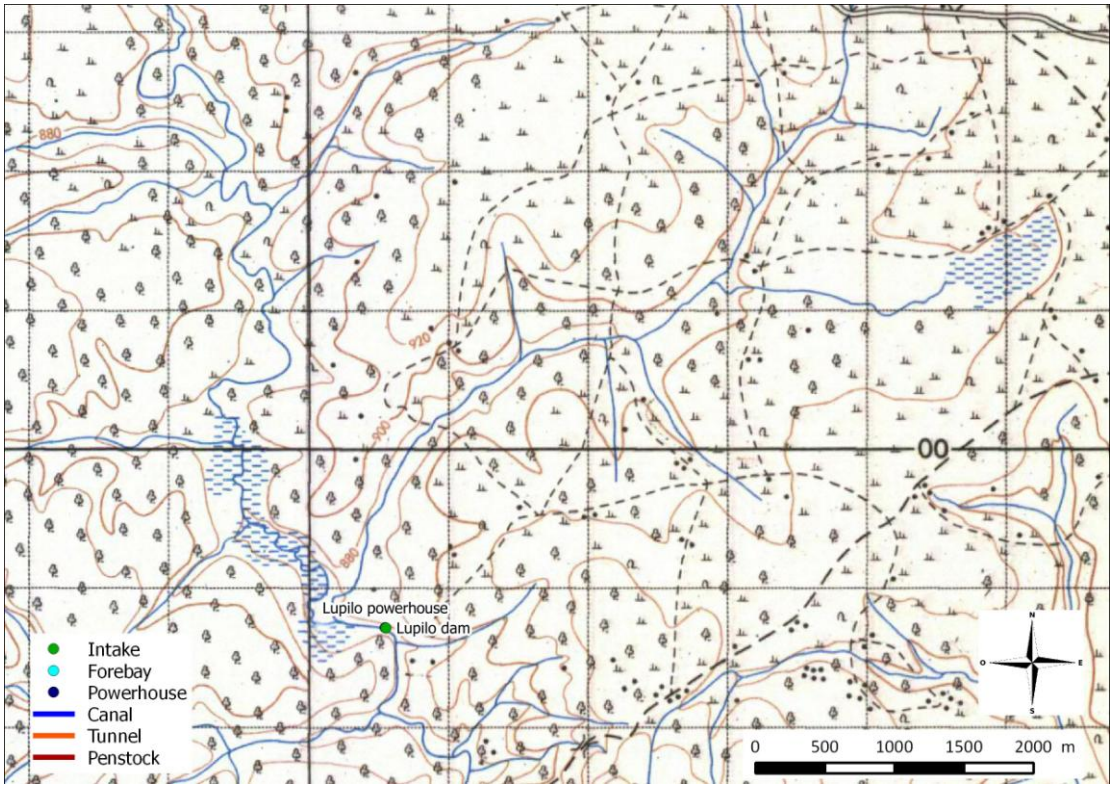

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	35.201	-10.863
Powerhouse	35.201	-10.863

1. Administrative and socio-economic data

Site code	E-002
Site name	Lupilo
River	Ruvuma
Village	Chipole Mission
Region	Ruvuma
Basin	Ruvuma and Southern Indian Ocean Coast
Topographical map reference	Topographical map n° 298/3 (scale 1/50,000)

2. Reference study

Study name : Field visit
Author : SHER
Edition year : 2014

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	11.40
Gross head [m]	8
Installed capacity [kW]	620

3. Technical data

Type of scheme: Daily reservoir
Type of connection: Off-grid
Scheme description :
A reservoir is created by a dam which floods the swamp. The dam is an earthfilled dam with a concrete spillway which creates an artificial head of about 8m. The intake is on the left embankment, and the penstock carries the water directly from the intake to the powerhouse.

Canal length [m]	0
Tunnel length [m]	0
Penstock length [m]	36
Dam type	Masonery dam
Dam height [m]	9
Dam width [m]	40
Measured turbidity [NTU]	500
Comments on solid transport	Because of the presence of the reservoir, the heaviest particles are trapped. However, the water quality seems very poor. The dredging requirements are unknown but will be doubtless significant on the long term.
Transmission line length [km]	10.0
Comments on accessibility	Weir access: Average: long unpaved road Powerhouse access: Average: long unpaved road
Other comments	Existing site that feeds the Chipole Mission. - No future infractructure is foreseen in the coming years. Unfortunately, access to the powerhouse has not been granted at the time of the visit. So no information on the production system is available.

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	1.77
$Q_{90\%}$ discharge [m³/s]	2.86
$Q_{50\%}$ discharge [m³/s]	10.04
$Q_{30\%}$ discharge [m³/s]	14.51
Design flood $P_{100\,yr}$ [m³/s]	61.50
Catchment area [km²]	1,663
Hydrological confidence indication	Medium

5. Representative pictures

Figure 2 : The dam. At the time of visit a significant discharge was observed. The water quality seems very poor for a scheme that includes a reservoir.

Figure 3 : View of the reservoir created by the dam.

Figure 4 : View on the powerhouse and the river from the dam.

Figure 5 : General view of the site

10 MAGUU (E-005)

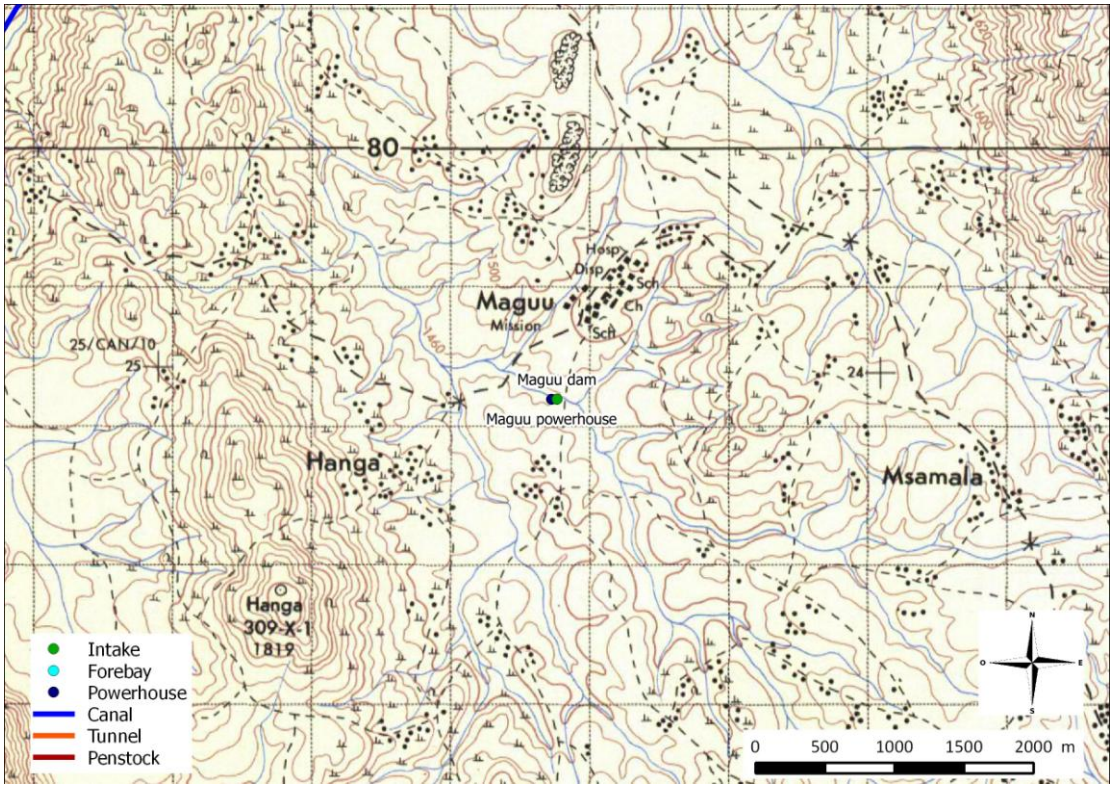

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	34.793	-11.050
Powerhouse	34.792	-11.050

1. Administrative and socio-economic data

Site code	E-005
Site name	Maguu
River	Unknown
Village	Maguu
Region	Ruvuma
Basin	Lake Nyasa
Topographical map reference	Topographical map n° 309/2 (scale 1/50,000)

2. Reference study

Study name : Field visit
Author : SHER
Edition year : 2014

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	0.07
Gross head [m]	8
Installed capacity [kW]	4

3. Technical data

Type of scheme: Daily reservoir
Type of connection: Off-grid
Scheme description :
A small reservoir is created by a weir that diverts water into a 1988 Ossberger turbine, 17.6 kW with 300 l/s, with a head of 7.5m.

Canal length [m]	0
Tunnel length [m]	0
Penstock length [m]	38
Dam type	Masonery dam
Dam height [m]	5
Dam width [m]	30
Measured turbidity [NTU]	50
Comments on solid transport	Limited by the reservoir upstream
Transmission line length [km]	1.0
Comments on accessibility	Weir access: Good: a passable dirt road goes to the site Powerhouse access: Good: a passable dirt road goes to the site
Other comments	Existing site that feeds the Mission. No canal: the intake leads to the penstock. No future infractructure is foreseen in the coming years. -

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	0.01
$Q_{90\%}$ discharge [m³/s]	0.02
$Q_{50\%}$ discharge [m³/s]	0.06
$Q_{30\%}$ discharge [m³/s]	0.09
Design flood $P_{100\,yr}$ [m³/s]	0.39
Catchment area [km²]	10
Hydrological confidence indication	Medium

5. Representative pictures

Figure 2 : Weir

Figure 3 : Pond created by the weir

Figure 4 : Intake

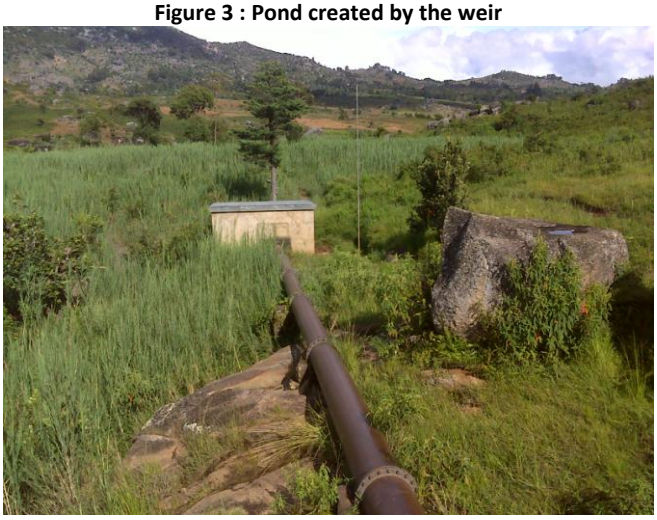

Figure 5 : Penstock

11 MASIGIRA (SF-030)

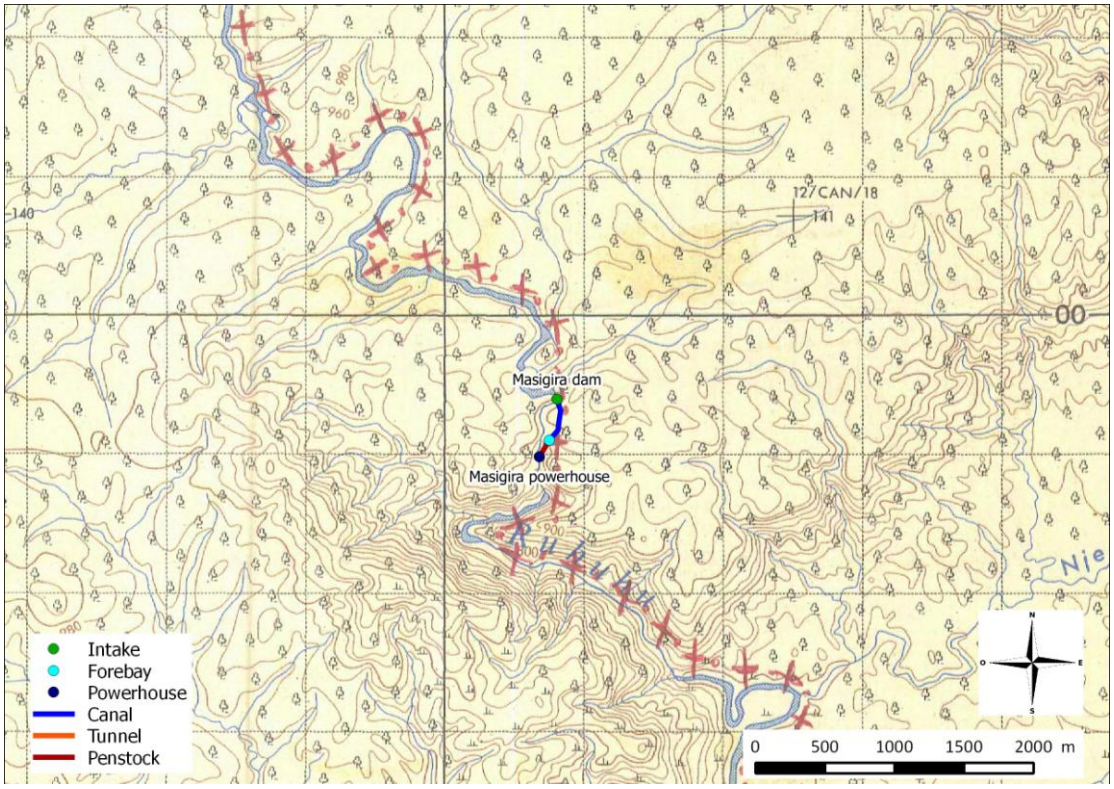

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	35.197	- 9.952
Powerhouse	35.196	- 9.956

1. Administrative and socio-economic data

Site code	SF-030
Site name	Masigira
River	Ruhuhu
Village	Mahanje (East)
Region	Njombe
Basin	Lake Nyasa
Topographical map reference	Topographical map n° 275/3 (scale 1/50,000)

2. Reference study

Study name : Field visit
Author : SHER
Edition year : 2014

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	15.80
Gross head [m]	30
Installed capacity [kW]	3,920

3. Technical data

Type of scheme: Run of the river
Type of connection: Off-grid
Scheme description :
The existing small hydropower scheme (Crossflow 80kW) is located on the Magisira potential site (big hydropower - 118 MW) called "site MH-02". The current powerplant is feeding an agro-industrial plantation and in particular a pumping station located a few km on a small tributary.

Canal length [m]	355
Tunnel length [m]	0
Penstock length [m]	155
Dam type	No dam
Dam height [m]	0
Dam width [m]	0
Measured turbidity [NTU]	200
Comments on solid transport	Moderate sand deposit
Transmission line length [km]	0.0
Comments on accessibility	-
Other comments	Existing small hydro site supplying an isolated grid. - This major site could be connected with the Backbone (400 kV) to Singida. MH-02 is a 118 MW large hydropower scheme (MASIGIRA) which is out of the scope of the present Atlas. Several investors, including a Chineese company, are interested in the major MH-02 project.

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	11.13
$Q_{90\%}$ discharge [m³/s]	15.77
$Q_{50\%}$ discharge [m³/s]	39.26
$Q_{30\%}$ discharge [m³/s]	51.29
Design flood $P_{100\,yr}$ [m³/s]	146.40
Catchment area [km²]	1,997
Hydrological confidence indication	High

5. Representative pictures

Figure 2 : Intake

Figure 3 : Security spillway

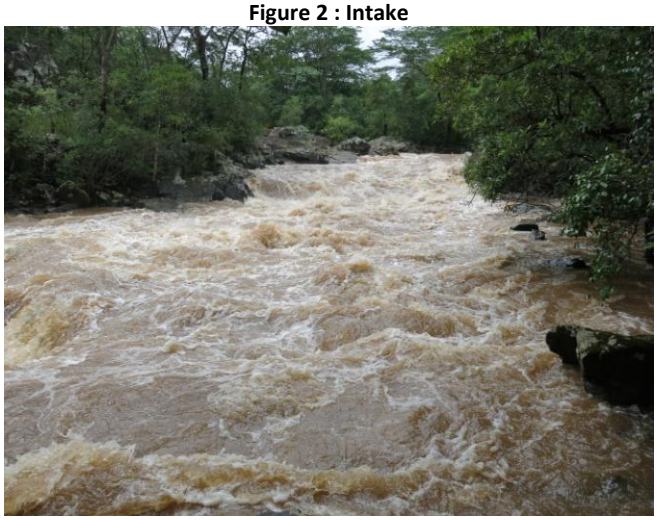

Figure 4 : Ruhuhu River at falls

Figure 5 : Powerhouse equipped with a Crossflow turbine

12 NDANDA (M-348)

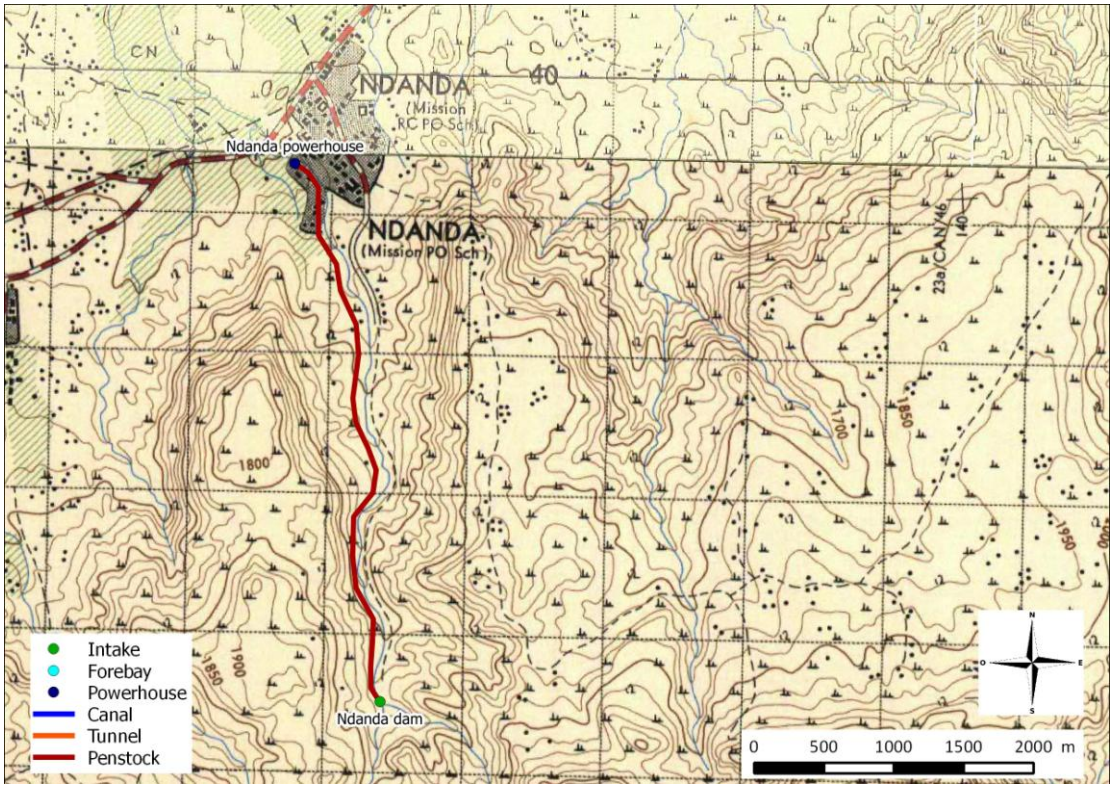

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	39.032	-10.537
Powerhouse	39.026	-10.502

1. Administrative and socio-economic data

Site code	M-348
Site name	Ndanda
River	Ndanda
Village	Ndanda
Region	Mtwara
Basin	Ruvuma and Southern Indian Ocean Coast
Topographical map reference	Topographical map n° 306/1 (scale 1/50,000)

2. Reference study

Study name : IREP - GIS - base list
Author : IED
Edition year : 2013

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	0.20
Gross head [m]	170
Installed capacity [kW]	310

3. Technical data

Type of scheme: Daily reservoir
Type of connection: Connected to the main grid
Scheme description :
Existing site with a small reservoir directly followed by the forebay. A headrace pipe brings water to the powerhouse.

Canal length [m]	0
Tunnel length [m]	0
Penstock length [m]	4,513
Dam type	No dam
Dam height [m]	0
Dam width [m]	0
Measured turbidity [NTU]	20
Comments on solid transport	None
Transmission line length [km]	0.2
Comments on accessibility	The powerhouse is located next to the asphalted road and a dirt road allows access to the intake.
Other comments	Existing site A pipe brings water from the forebay to the powerhouse. No future infractructure is foreseen in the coming years. Collected information : H=170m, Flow=60 l/s, P=1500-2000 Kwh, N=750 tr/sec, pression: 17 bar, Constructor: Mr.FUCHS, Year of construction: 1985-1986, turbine from Switzerland.

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	0.00
$Q_{90\%}$ discharge [m³/s]	0.01
$Q_{50\%}$ discharge [m³/s]	0.06
$Q_{30\%}$ discharge [m³/s]	0.10
Design flood $P_{100\,yr}$ [m³/s]	0.88
Catchment area [km²]	13
Hydrological confidence indication	Medium

5. Representative pictures

Figure 2 : General view of the site

Figure 3 : Detail view of the river flow, presence of pebbles

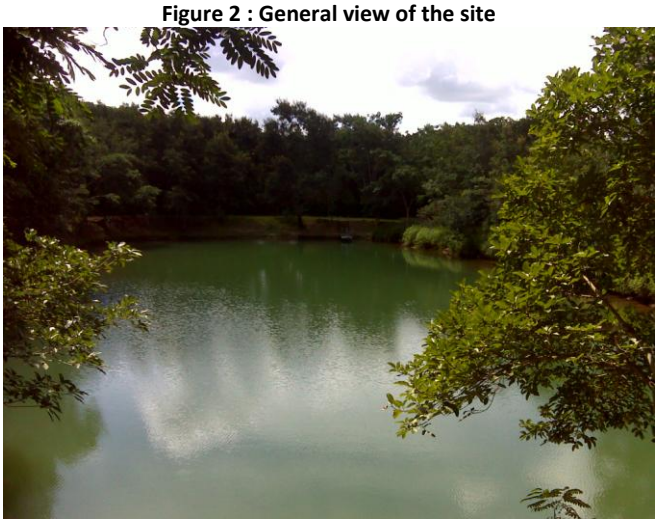

Figure 4 : Existing reservoir

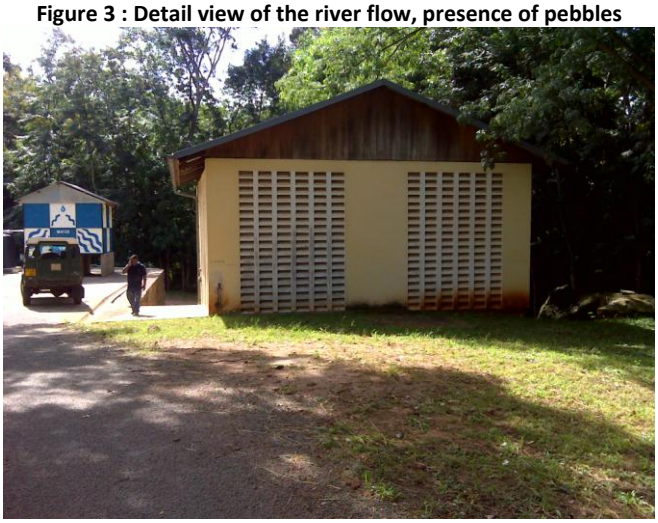

Figure 5 : Existing powerhouse

13 PERAMIHO - LIKINGO (E-001)

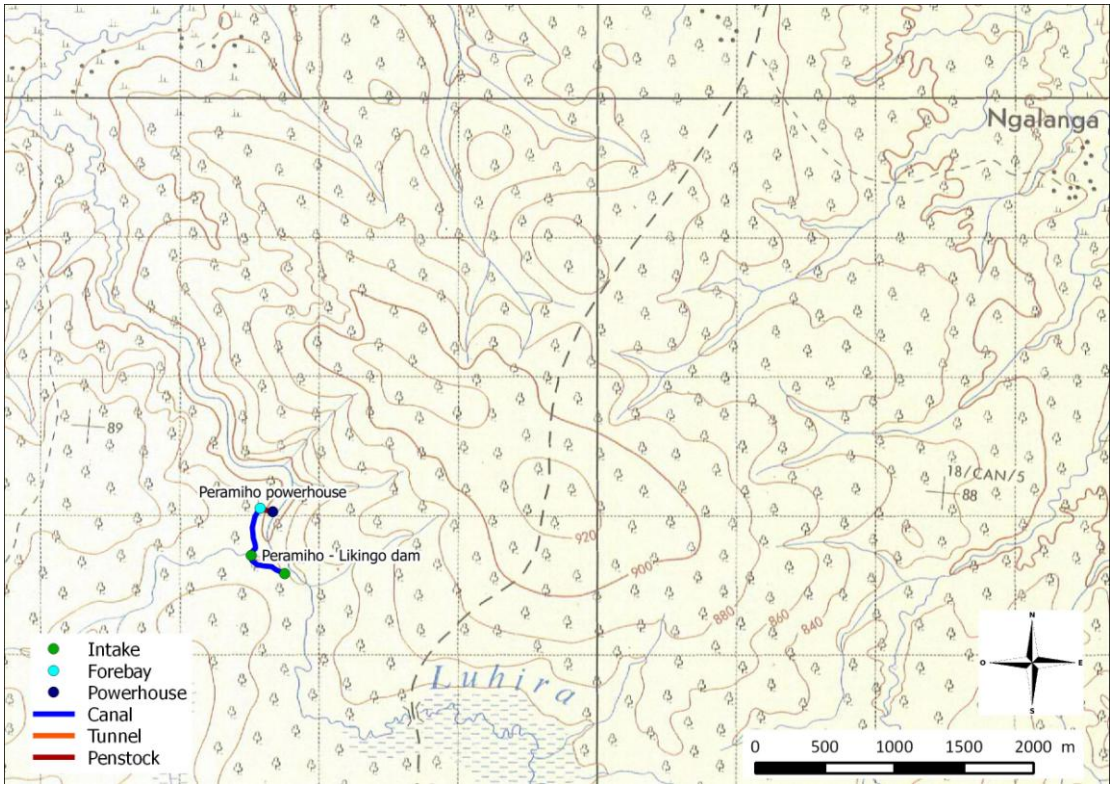

Figure 1 : Site layout

Geographic coordinates (WGS 84)	Easting [°]	Northing [°]
Dam	35.446	-10.427
Powerhouse	35.446	-10.423

1. Administrative and socio-economic data

Site code	E-001
Site name	Peramiho - Likingo
River	Luhira and Mkingazi
Village	Peramiho
Region	Ruvuma
Basin	Lake Nyasa
Topographical map reference	Topographical map n° 286/4 (scale 1/50,000)

2. Reference study

Study name : Field visit
Author : SHER
Edition year : 2014

	Estimated potential from Hydropower Atlas
Operating discharge [m³/s]	2.60
Gross head [m]	43
Installed capacity [kW]	940

3. Technical data

Type of scheme: Run of the river
Type of connection: Connected to a mini-grid
Scheme description :
The Likingo waterfall is located at the confluence of Mkingazi and Luhira rivers. Two weirs have been installed on the Luhira and the Mkingazi rivers and two ponds are created by the two concrete weirs. The water from the Luhira is deviated towards the Mkingazi and goes through a sand trap. Further away, it crosses the Mkingazi river in a waterduct inside the weir. The water of both rivers meet at the "left" end of the Mkingazi weir. The water passes then through a second sand trap. From the forebay, two penstocks (DN600) carry the water to the powerhouse. There, two crossflow turbines (Ossberger G62/12G 1984, each taking 0.8m³/s) generate a gross power of 271 kW each. The whole system is in very good condition and perfectly maintained.

Canal length [m]	737
Tunnel length [m]	0
Penstock length [m]	115
Dam type	Masonery dam
Dam height [m]	4
Dam width [m]	30
Measured turbidity [NTU]	250
Comments on solid transport	No sand was visible at the time of the visit. However, some dredging is reported to be necessary upstream of the weir.
Transmission line length [km]	0.0
Comments on accessibility	Weir access: Average: long unpaved road Powerhouse access: Average: long unpaved road
Other comments	Existing site already connected to the grid of Songea. Concrete canal. No future infractructure is foreseen in the coming years. The plant is supplying the Peramiho Mission since 1986 (70 monks, 300 employees), a hospital, 5 schools, including the seminary, electrical and mechanical workshops, and some private houses. The plant produces power in excess during the rainy season. For some unexplainable reason, Tanesco refused to synchronize the plant to their network, although the power production of Tanesco is achieved by a thermal plant, which costs the Company much more than buying the power from Likingo. During the dry season however, the plant does not produce enough power for the Mission, and the deficit is actually covered by importing power from Tanesco (in which case the hydropower plant has to be "switched off", since no synchronisation has been permitted), or by their own thermal plants and solar plants. A study is currently going on to assess the possibility of biomass generated power (Jathropha).

4. Hydrological data

These parameters were defined by regionalization. These preliminary values are only indicative. They might in no case be used for detailed design.

Firm discharge $Q_{95\%}$ [m³/s]	0.46
$Q_{90\%}$ discharge [m³/s]	0.75
$Q_{50\%}$ discharge [m³/s]	2.63
$Q_{30\%}$ discharge [m³/s]	3.80
Design flood $P_{100\,yr}$ [m³/s]	16.08
Catchment area [km²]	422
Hydrological confidence indication	Medium

5. Representative pictures

Figure 2 : Weir n°1

Figure 3 : Weir n°2

Figure 4 : Desilting basin n°1

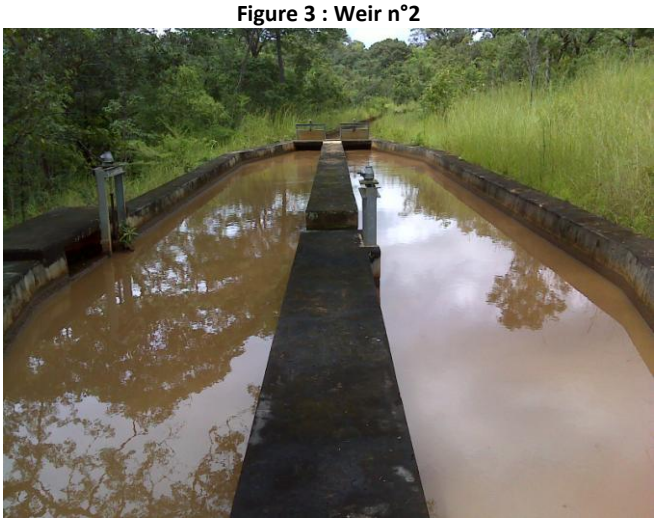

Figure 5 : Desilting basin n°2