Mpatamanga Hydropower Project

Environmental & Social Impact Assessment

Volume II – Main ESIA Report

Sub-volume 3: Chapter 5 – Annexes 1 to 16

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Making Sustainability Happen

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Annex 5-1: References

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Annex 5-2: Social Qualitative Survey

Summary of the 2023 Qualitative Social Investigations (Focus Group Discussions)

Date	District	Traditional Authority	GVH	Village	Total Number of Persons Met	Number of Men	Number of Women
26/09/2023	Blantyre	Kunthembwe	Kaliati	Inosi	11	5	6
26/09/2023	Blantyre	Kunthembwe	Kaliati	Chaswanthaka	10	5	5
26/09/2023	Blantyre	Kunthembwe	Gwadani	Gwadani	10	5	5
27/09/2023	Blantyre	Kunthembwe	Kaliati	Chilaulo	11	8	3
27/09/2023	Blantyre	Kunthembwe	Kaliati	Chaswanthaka	12	6	6
27/09/2023	Blantyre	Kunthembwe	Kaliati	Kaliati	11	5	6
27/09/2023	Blantyre	Kunthembwe	Kaliati	Lisangwi	6	6	0
27/09/2023	Blantyre	Kunthembwe	Kaliati	Lisongwe	6	0	6
29/09/2023	Blantyre	Kunthembwe	Namputu	Chikira and Chimphanda	26	11	15
29/09/2023	Blantyre	Kunthembwe	Namputu	Chinkwinya	10	5	5
29/09/2023	Blantyre	Kunthembwe	Namputu	Namputu	14	7	7
30/09/2023	Blantyre	Kunthembwe	Dzikupi	Dzikupi	15	8	7
30/09/2023	Blantyre	Kunthembwe	Kaliati	Mbwinja	13	8	5
01/10/2023	Blantyre	Kunthembwe	Kadikira	Kadikira	11	5	6
01/10/2023	Neno	Mlauli	Feremu	Kambalame	10	5	5
01/10/2023	Blantyre	Kunthembwe	Chikumbu	Mbanda	11	6	5
02/10/2023	Neno	Mlauli	Nsalawatha	Jonathan	10	5	5
02/10/2023	Neno	Symon	N/A	N/A	6	4	2
02/10/2023	Neno	Mlauli	Nsalawatha	Nsalawatha	10	5	5
03/10/2023	Blantyre	Kunthembwe	Namputu	Mzingala	4	0	4
04/10/2023	Blantyre	Kunthembwe	Namputu	Baluwa	6	6	0
03/10/2023	Neno	Mlauli	Nsalawatha	Daelo	10	5	5
03/10/2023	Neno	Mlauli	Feremu	Kambalame	12	6	6
03/10/2023	Neno	Mlauli	Nsalawatha	Kwazunga	9	4	5
03/10/2023	Neno	Mlauli	Feremu	Nkhwali	10	5	5
04/10/2023	Neno	Mlauli	Feremu	Feremu	6	4	2
04/10/2023	Neno	Mlauli	Feremu	July	10	5	5
04/10/2023	Neno	Mlauli	Feremu	Kambalame	6	6	0
04/10/2023	Neno	Mlauli	Feremu	N/A	10	4	6
04/10/2023	Neno	Symon	Zalewa	Salafosi	9	4	5
05/10/2023	Neno	Symon	Ngwenyama	Nkoka	10	5	5
05/10/2023	Neno	Symon	Ngwenyama	Joseph	8	4	4
05/10/2023	Neno	Symon	Ngwenyama	Liyenda	9	5	4
05/10/2023	Neno	Symon	Ngwenyama	Mbemba	9	4	5
06/10/2023	Balaka	Phalula	Ntengula	Kaligwejere	18	8	10
06/10/2023	Balaka	Phalula	Phombeya	Phombeya	11	3	8
06/10/2023	Neno	Symon	Somisomi	Somisomi	10	5	5
06/10/2023	Balaka	Phalula	Phombeya	Yonamu	10	5	5

Date	District	Traditional Authority	GVH	Village	Total Number of Persons Met	Number of Men	Number of Women
09/10/2023	Chikwawa	Kasisi	Kasisi	Njereza	10	5	5
09/10/2023	Chikwawa	Kasisi	Kasisi	Maganga 1	10	5	5
09/10/2023	Chikwawa	Kasisi	Kasisi	Chipula	10	5	5
09/10/2023	Neno	Symon	Chavara	Kandeu	10	5	5
09/10/2023	Neno	Mlauli	Nsalawatha	Liwonde	12	5	7
09/10/2023	Chikwawa	Kasisi	Kanjala	Kanjala	5	5	0
09/10/2023	Chikwawa	Kasisi	Kasisi	Nyozelera	5	0	5
10/10/2023	Chikwawa	Katunga	Kapasule	Kapasule	10	5	5
10/10/2023	Chikwawa	Makhwira	Chakambutuka	Chakambutuka	11	6	5
10/10/2023	Chikwawa	Masea	Joseph	Joseph	11	6	5
10/10/2023	Chikwawa	Chikwawa	Mbenderana	Mbenderana 4	10	5	5
10/10/2023	Chikwawa	Makhwira	Makhwira	Mhakula and Jana	10	5	5
10/10/2023	Chikwawa	Katunga	Mpokonyola	Mpokonyola	10	6	4
11/10/2023	Chikwawa	Lundu	Biasi	Biasi 1	10	5	5
11/10/2023	Chikwawa	Makhwira	Kalima	Kalima	11	5	6
11/10/2023	Chikwawa	Lundu	Malemia	Malemia	10	5	5
08/11/2023	Blantyre	Kunthembwe	Kaliati	Mpindo	5	2	3
16/11/2023	Blantyre	Kunthembwe	Kaliati	Lisangwi	7	4	3
24/11/2023	Neno	Mlauli	Feremu	Kalibu Ranch	2	2	0
30/11/2023	Neno	Mlauli	Nsalawatha	Chinere Ranch	6	6	0
Grand Total					565	289	276
Percentage of Total					100%	51%	49%

Summary of the 2023 Qualitative Social Investigations (Key Informant Interview)

Date	Name	District	Traditional Authority	GVH	Village	Total number of Persons Met	Number of Men	Number of Women
26/09/2023	Ranch Chiyabi & Ranch Mwangalika	Blantyre	Kunthembwe	Kaliati	Chaswanthaka	6	4	2
04/10/2023	Zagaf Ranch	Neno	Mlauli	Feremu	Feremu	2	0	2
14/11/2023	Interview with a teacher working in Chaswanthaka School	Blantyre	Kunthembwe	Kaliati	Chaswanthaka	1	1	0
01/12/2023	Mulomba Ranch	Neno	Mlauli	Feremu	Nkhwali	1	1	0
01/12/2023	Mstafa Mussa and Chisomo Piteti	Neno	Mlauli	Nsalawatha	Musa Ranch	2	1	1
01/12/2023	Martios Masache	Neno	Mlauli	Nsalawatha	Kuphedi Ranch	1	1	0
01/12/2023	Emmanual Black	Neno	Mlauli	Nsalawatha	Titani Ranch	1	1	0
04/12/2023	Piason Msiska	Neno	Mlauli	Nsalawatha	Mulipa Ranch	1	1	0
04/12/2023	Lenard Biliati; Masavtso Karonga	Neno	Mlauli	Nsalawatha	Kaphuka Ranch	2	2	0
04/12/2023	Ganizeni Lpiya	Neno	Mlauli	Nsalawatha	Kamwendo Ranch	1	1	0
05/12/2023	Patricia William	Blantyre	Kunthembwe	Kaliati	Chaswanthaka	1	0	1
05/12/2023	Max Mlomba	Neno	Mlauli	Feremu	Mlomba Ranch	1	1	0
05/12/2023	Catherine Kaphuka	Neno	Mlauli	Nsalawatha	Kaphuka Ranch	1	0	1
06/12/2023	Pirilan Nedisini	Blantyre	Kunthembwe	Kaliati	Chaswanthaka	1	1	0
06/12/2023	Petro Millioni	Blantyre	Kunthembwe	Kaliati	Chaswanthaka	1	1	0
06/12/2023	Ganizani Yesaya	Blantyre	Kunthembwe	Kaliati	Mpindo	1	1	0
07/12/2023	Yesaya Uche Sellasie	Blantyre			Blantyre City	1	1	0
07/12/2023	Jennifer Khistofa	Blantyre	Kunthembwe	Kaliati	Inosi	1	0	1
07/12/2023	Fulaki Fonersi	Blantyre	Kunthembwe	Kaliati	Chaswanthaka	1	0	1
07/12/2023	David Mulipa	Neno	Mlauli	Nsalawatha	Mulipa Ranch	1	1	0
08/12/2023	Francis Baluwa (farmer)	Blantyre	Kunthembwe	Namputu	Chikira	1	1	0
08/12/2023	Dorica Tiyese / Nedison Naledzo / Damiano Blessings (farmers)	Neno	Mlauli	Feremu	Feremu	3	2	1
09/12/2023	Jossam Mahilazi (farmer)	Blantyre	Kunthembwe	Namputu	Chinkwinya	1	1	0
09/12/2023	Felister Swetala (farmer)	Blantyre	Kunthembwe	Namputu	Kwapita	1	0	1
11/12/2023	Mphatso Rafael (farmer)	Neno	Mlauli	Feremu	Kambalame	1	0	1
12/12/2023	Sonic Thomas (farmer)	Neno	Mlauli	Feremu	Kambalame	1	0	1
12/12/2023	Patricia Simeon (farmer)	Neno	Mlauli	Feremu	Kambalame	1	0	1
13/12/2023	Jelisa Paulo (farmer)	Neno	Mlauli	Feremu	Feremu	1	0	1
13/12/2023	Elinafa Bonongoi (farmer)	Neno	Mlauli	Feremu	Feremu	1	0	1
16/12/2023	Eric Kabambe(farmer)	Neno	Symon	Ngwenyama	Liyenda	1	1	0
18/12/2023	Methuselah Mwangalika	Blantyre	Kunthembwe	Blantyre City	Blantyre City	1	1	0
Grand Total						41	25	16
Percentage of Total						100%	61%	39%

Summary of the 2023 Qualitative Social Investigations (Informal Discussions)

Date	District	Traditional Authority	GVH	Village	Total number of persons met	Number of men	Number of women
26/09/2023	Blantyre	N/A	N/A	N/A	1	1	0
01/10/2023	Neno	Symon	Zalewa	Zalewa	1	1	0
03/10/2023	Neno	Symon	Ngwenyama	Liyenda	1	0	1
03/10/2023	Neno	Symon	Ngwenyama	Ngwenyama	1	1	0
03/10/2023	Neno	Symon	Ngwenyama	Liyenda	3	3	0
04/10/2023	Neno	Symon	Ngwenyama	Liyenda	1	1	0
04/10/2023	Blantyre	Kunthembwe	Namputu	Chikira	1	1	0
04/10/2023	Blantyre	Kunthembwe	Chileka	Chileka	1	1	
06/10/2023	Neno	Symon	Zalewa	Zalewa	1	1	0
09/10/2023	Chikwawa	N/A	N/A	N/A	2	2	0
04/12/2023	Blantyre	Kunthembwe	Blantyre City	Blantyre City	1	1	0
08/12/2023	Neno	Mlauli	Feremu	Feremu	1	0	1
09/12/2023	Blantyre	Kunthembwe	Namputu	Chikira	1	1	0
12/12/2023	Neno	Mlauli	N/A	Chifunga	3	2	1
13/12/2023	Neno	Mlauli	Feremu	Feremu	1	1	0
Grand Total					20	17	3
Percentage of Total					100%	85%	15%

Summary of the 2023 Qualitative Social Investigations (Institutional Meetings)

Date	Name	District	Traditional Authority	GVH	Village	Total Number of Persons Met	Number of Men	Number of Women
28/09/2023	NGO Save the Poor Foundation	Blantyre	Blantyre	Blantyre	Blantyre	1	0	1
28/09/2023	NGO Hands of Hope	Blantyre	Blantyre	Blantyre	Limbe	1	1	0
28/09/2023	NGO Gender Support Program	Blantyre	Blantyre	Blantyre	Blantyre	1	1	0
28/09/2023	Blantyre DC Social Welfare Service	Blantyre DC	N/A	N/A	N/A	3	1	2
28/09/2023	Blantyre DC Land Service	Blantyre DC	Blantyre City	Blantyre City	Blantyre City	3	1	2
28/09/2023	Blantyre DC Agriculture Service	Blantyre	Blantyre	Blantyre	Blantyre	1	0	1
28/09/2023	Area Development Committee - TA Kuntaja	Blantyre	Kuntaja	N/A	N/A	5	3	2
28/09/2023	Area Development Committee - TA Kapeni	Blantyre	Kapeni	N/A	N/A	4	3	1
02/10/2023	Victim Support Unit (Chileka Police Station)	Blantyre	Blantyre	Chileka	Chileka	4	1	3
02/10/2023	Mlauli Area Development Committee and TA	Neno	Mlauli	N/A	N/A	5	3	2
02/10/2023	Agnes Napwanga, Gender officer at District Office	Blantyre	Blantyre	Blantyre	Blantyre	1	0	1
05/10/2023	Mary Malunga, Acting Gender Officer of the Neno District Council	Neno	Neno	Neno	Neno	1	0	1
05/10/2023	Neno DC Social Welfare Service	Neno	Neno	Neno	Neno	1	0	1
11/12/2023	Egenco Tedzani Dam	Blantyre	Kunthembwe	Namputu	Mzingala	9	7	2
14/12/2023	Mark Tandaude (Neno EPA)	Neno	Symon	Zalewa	Zalewa	1	1	0
14/12/2023	Jones Chiteka (Evangelical association of Malawi)	Blantyre	Blantyre City	Blantyre City	Blantyre City	1	1	0
15/12/2023	Olive Vokhiwa (District Project Coordinator of Malawi Watershed Services Improvement Project (MWASIP)	Blantyre	Blantyre City	Blantyre City	Blantyre City	1	0	1
15/12/2023	Cliffora Malupga (EPA Aedo)	Blantyre	Kunthembwe	Kunthembwe	Kunthembwe	1	1	0
18/12/2023	Egenco staff	Chikwawa	Kasisi	Chikwawa	Chikwawa	8	3	5
Grand Total						52	27	25
Percentage of Total						100%	52%	48%

Summary of Health Facility Assessments

Date	Facility Name	Informant	Designation
03/10/2023	Chikowa Health Centre	Davie Chithila	Clinician
03/10/2023	Chimemebe Health Centre	Pearson Pafupi	Clinician
04/10/2023	QECH	Edina Nkogala	Chief Nursing Officer
05/10/2023	Neno District Hospital	Listern Tengatenga	Senior Medical Officer
06/10/2023	Chifunga Health Centre	Diana Chipondeponde	Senior Nurse
06/10/2023	Luwani Health centre	Cecilia Makungwa	Nurse
06/10/2023	Tedzani Health Centre	Davis Mulaphi	Clinical Officer
09/10/2023	Dziwe Health Centre	Cephas Sabe	Clinician

Summary of 2023 Qualitative Health Investigations (KII)

Date	Name	Position	Interview Type
02/10/2023	Chetimilia Saudi	Blantyre DHO (acting)	Introductory meeting - Blantyre DHO
	Lizy Masoko	Blantyre DHMT Member	
	Loncy Sajeni	Blantyre DHMT Member	
	Gerald Mwale	Blantyre DHMT Member	
	Symon Goliath	Blantyre DHMT Member	
	Kondwani Chisi	Blantyre DHMT Member	
03/10/2023	Davie Chithila	Clinician	KII – Chikowa Health Centre
	Pearson Pafupi	Clinician	KII – Chimemebe Health Centre
04/10/2023	Edina Nkogala	Chief Nursing Officer	KII – QECH
	Ernest Matapura	Head of Programmes	KII – Development Aid from People to People NGO
05/10/2023	Dr. Enoch Ndarama	Neno DHO	Introductory meeting - Neno DHO
	Listern Tengatenga	Senior Medical Officer	KII – Neno District Hospital
	Martha Kutsamba	District Nursing Officer	
	Mathews Chikonlehola	Environmental Health Officer	
	Basimenye Nhlema	PIH Chief Operating Officer	KII – PIH NGO
06/10/2023	Diana Chipondeponde	Senior Nurse	KII – Chifunga Health Centre
	Cecilia Makungwa	Nurse	KII – Luwani Health Centre
	Kalifah Sikiza	HSA	
	Davis Mulaphi	Clinical Officer	KII – Tedzani Health Centre
	Nastanzia Ngwali	Nurse	
	Chimwemwe Kamanga	HSA	
09/10/2023	Abednego Banda	Neno DHMT Member	Roundtable KII – Neno DHMT
	Esnart Macheka	Neno DHMT Member	
	Brazilia Mose	Neno DHMT Member	
	Noria Chikunda	Neno DHMT Member	
	Jonas Matope	Neno DHMT Member	
	Dr. Enoch Ndarama	Neno DHMT Member	
	Manason Mwangama	Neno DHMT Member	
	Francis Phiri	Neno DHMT Member	
	Johnathan Kalia	Neno DHMT Member	
	Maggie Chatwa	Neno DHMT Member	
	Fatima Kamdola	Neno DHMT Member	

Date	Name	Position	Interview Type
	Brian Uludi	Neno DHMT Member	
	Cephas Sabe	Clinician	KII – Dziwe Health Centre
10/10/2023	Pauline Tonde	Blantyre DHMT Member	Roundtable KII – Blantyre DHMT
	Martin Mwale	Blantyre DHMT Member	
	Chetimilia Saudi	Blantyre DHMT Member	
	Kondwani Chisi	Blantyre DHMT Member	
	Yohane Chiteya	Blantyre DHMT Member	
	Chindikoni Mkandawire	Blantyre DHMT Member	
	Jackson Gama	Blantyre DHMT Member	
	Lizy Maseko	Blantyre DHMT Member	
	Paul Chilemba	Blantyre DHMT Member	

Summary of 2023 Qualitative Health Investigations (FGD)

District	TA	Village or GVH	Total Number of Persons Met	Number of Men	Number of Women
Blantyre	Kunthembwe	Chaswanthaka	6	0	6
		Inosi	7	0	7
		Chikowa	6	0	6
		Kunthembwe	6	0	6
		Chikira	5	0	5
		Mzigala	9	0	9
		Commercial Sex Workers: Chikuli Marketplace	8	0	8
Neno	Mlauli	Kambalame	6	0	6
		July	6	0	6
		Jonathan	9	0	9
		Daelo	4	0	4
Grand Total			72	0	72
Percentage of Total			100%	0%	100%

Summary of Fisheries Surveys in Lower and Midde Shire

Date	Survey Site	Coordinates	Number of Interviews	Gender
Lower Shire				
13 July 2023	Mbenderani	-	1 (ad hoc)	Male
14 July 2023	Gumbwa	15°59'33"S, 34°48'20"E	10	All men
14 July 2023	Lisuli Lagoon	16°2'15"S, 34°50'28"E	10	All men
14 July 2023	Yolodani Beach	-	2 (ad hoc)	All men
15 July 2023	Mthyola	16°19'37"S, 35° 0'53"E	10	All men
Middle Shire				
13 Sept 2023	Chaswanthaka	15°42'42.18"S 34°44'13.25"E	13	2 Men 11 Women
14 Sept 2023	Kambalame	15°42'23.71"S 34°43'20.74"E	15	5 Men 10 Women
14 Sept 2023	Zalewa	15°26'35.40"S 34°51'50.87"E	1 (ad hoc)	Male
14 Sept 2023	Chipolongwe	-	1 (ad hoc)	Male
15 Sept 2023	Katchakwara	-	1 (ad hoc)	Male

Annex 5-3: Social Quantitative Survey Questionnaires

Households SocioEconomic Form

Field	Question	Answer
intro	Mpatamanga HPP - 2023 Socio-economic survey Please select your name in the next screen, then the Project area you are working in. *With a swipe you can get to the next question*	
enumerator_ *(required)*	Enumerator: Please select your name or enter it	
survey_team *(required)*	What is your survey team?	1 RLRAP 2 ESIA
note_consent1	Thank you for the opportunity to speak with you. My name is [Enumerator, please state your name]. I am a member of a research team from C12 and SLR Consulting. We are conducting a socioeconomic survey on behalf of the Mpatamanga HPP project. This socioeconomic survey aims at updating the socioeconomic data collected previously in 2020-2021, in order to better understand the project impacts and design appropriate mitigation measures. We are collecting information about your households, such as number of members, level of education, sources of income and means of livelihoods, and other information. We also ask to take pictures, as well as GPS coordinates. The survey includes questions about the household generally, and questions about individuals within your household, if applicable. It should take about 1 hour to complete all the questions. Your participation in this study is completely voluntary and you are free to choose whether to be in it or not. If you agree to participate, you can choose to stop at any time or to skip any questions you do not want to answer. If you choose not to consent, or to withdraw from the interview at any time, there will not be any consequence or loss of benefits to which you would be otherwise entitled. Your study data will be handled with confidentially. If results of this study are published or presented, individual names, and other personally identifiable information will not be used and no identifying information will be shared with any third party. The information will be utilized only for the development of the Socioeconomic studies for the Mpatamanga Project, and confidentiality of the information will strictly be adhered.	
note_consent2	Thank you for the opportunity to speak with you. My name is [Enumerator, please state your name]. I am a member of a research team from C12 and SLR Consulting. We are conducting a socioeconomic survey on behalf of the Mpatamanga HPP project. This socioeconomic survey aims at understand the project impacts and design appropriate mitigation measures. We are collecting information about your households, such as number of members, level of education, sources of income and means of livelihoods, and other information. We also ask to take	

Field	Question	Answer
	pictures, as well as GPS coordinates. The survey includes questions about the household generally, and questions about individuals within your household, if applicable. It should take about 1 hour to complete all the questions. Your participation in this study is completely voluntary and you are free to choose whether to be in it or not. If you agree to participate, you can choose to stop at any time or to skip any questions you do not want to answer. If you choose not to consent, or to withdraw from the interview at any time, there will not be any consequence or loss of benefits to which you would be otherwise entitled. Your study data will be handled with confidentially. If results of this study are published or presented, individual names, and other personally identifiable information will not be used and no identifying information will be shared with any third party. The information will be utilized only for the development of the Socioeconomic studies for the Mpatamanga Project, and confidentiality of the information will strictly be adhered.	
Consent *(required)*	Do you consent to be interviewed?	yes Yes no No
consentobtained		
gps *(required)*	Take the GPS waypoint of the survey where you are doing the interview *GPS coordinates can only be collected when outside.*	
district *(required)*	District :	Ba Balaka Bl Blantyre Ne Neno Chi Chikwawa OTH Other
district_other	If other disctrict, please specify	
traditional_authority *(required)*	Traditional Authority:	Ph Phalula OTH_Ba Other Ku Kunthembwe Kj Kuntaja OTH_Bl Other Ml Mlauli Sy Symon OTH_Ne Other Ka Kasisi Ka2 Katunga Ma2 Maseya Lu Lundu Ma Makhwira OTH_Chi Other
traditional_authority_spec1	Please specify the Traditionnal Authority	

Field	Question	Answer
gvh *(required)*	Group Village Head :	Pho Phombeya other1 Other (Specify) Mzi Mzigala Nam Namputu Kal Kaliati Kun Kunthembwe Gwa Gwadani Kad Kadikira Mak Makunje Stk Stande Kumbirina Chik Chikumbu Mba Mbanda Imb Imbwa Maj Majola Maka Makajira Mbv Mbvundula other2 Other (Specify) Fer Feremu Nsa Nsalawatha other3 Other (Specify) Ngw Ngwenyama Kasa Kasamba Mui Muingitsa Nte Ntengula Som Somisomi Zal Zalewa other4 Other (Specify)
other_gvh_1 *(required)*	Please specify group village head	
other_gvh_2	Please specify group village head	
other_gvh_3 *(required)*	If other group village head, please specify	
village	Village :	Yonamu Yonamu Phombeya Phombeya other1 Other (Specify) Mzigala Mzigala Baluwa Baluwa other2 Other (Specify) Chikira Chikira Namputu Namputu Chimphanda Chimphanda Kwapita Kwapita Chinkwinya Chinkwinya other3 Other (Specify) Chaswanthaka Chaswanthaka Lisangwi Lisangwi

Field	Question	Answer	
		Inosi	Inosi
		Mpindo	Mpindo
		Divala	Divala
		Chilaulo	Chilaulo
		Kaliyati	Kaliyati
		other4	Other (Specify)
		Zikuyenda	Zikuyenda
		Mphwiniza	Mphwiniza
		Gumeni	Gumeni
		Kudziko	Kudziko
		Dzikupi	Dzikupi
		Ziwachi	Ziwachi
		Imbwa	Imbwa
		Kabuluzi	Kabuluzi
		Ntengereni	Ntengereni
		other5	Other (Specify)
		Kambalame	Kambalame
		Feremu	Feremu
		July	July
		Nkhwali	Nkhwali
		other6	Other (Specify)
		Msalawatha	Msalawatha
		Jonathan	Jonathan
		Kazunga	Kazunga
		Daelo1	Daelo 1
		Daelo2	Daelo 2
		Petulo	Petulo
		Chikaya	Chikaya
		Liwonde	Liwonde
		other7	Other (Specify)
		Liyenda	Liyenda
		Nkoka	Nkoka
		Mathotho	Mathotho
		Mbemba	Mbemba
		Ndelema	Ndelema
		Ngwenyama	Ngwenyama
		Nkoka Mchingala	Nkoka Mchingala
		Pajo	Pajo
		Phokoso	Phokoso
		other8	Other (Specify)
		Chathamanga	Chathamanga
		other9	Other (Specify)
		Chikwekwe	Chikwekwe

Field	Question	Answer	
		other10	Other (Specify)
		Nkwinda	Nkwinda
		other11	Other (Specify)
		Chikapa	Chikapa
		other12	Other (Specify)
		Kammwamba	Kammwamba
		other13	Other (Specify)
		Chavara	Chavara
		other14	Other (Specify)
		Adikachina	Adikachina
		Chiotha	Chiotha
		Chisembwere	Chisembwere
		Chitambuli	Chitambuli
		Dawa	Dawa
		Jelasi	Jelasi
		Kaliati	Kaliati
		Malire	Malire
		Ntenje	Ntenje
		Mtenje Duwa	Mtenje Duwa
		other15	Other (Specify)
		Gomani	Gomani
		Gomani Namputu	Gomani Namputu
		Issa	Issa
		Kanyanda	Kanyanda
		Katunga	Katunga
		Kubalaza	Kubalaza
		Mabuleni	Mabuleni
		Simon	Simon
		Twaya	Twaya
		Kesinala	Kesinala
		Ngoleka	Ngoleka
		Gilbert	Gilbert
		other16	Other (Specify)
		Mulandu	Mulandu
		Nkhumba	Nkhumba
		Mkwezalamba	Mkwezalamba
		Chinkhandwe	Chinkhandwe
		other17	Other (Specify)
		Chaperuka	Chaperuka
		Chasokera	Chasokera
		Mbwinja	Mbwinja
		Mlongoti	Mlongoti
		Tabiya	Tabiya

Field	Question	Answer
		Kuthawira Kuthawira other18 Other (Specify) Jumbe Jumbe Kankhonde Kankhonde Kutama Kutama Mwitha Mwitha Galufu Galufu Kumbilina Kumbilina Kamowa Kamowa Thanganyika Thanganyika Mang'ani Mang'ani other19 Other (Specify) Chuma Chayenda Chuma Chayenda Makanda Makanda other20 Other (Specify) Andiseni Andiseni Chilembwe Chilembwe Magombo Magombo Mkumbachiri Mkumbachiri other21 Other (Specify) Chatembenuka Chatembenuka Chigunkha Chigunkha Kanthumkako Kanthumkako Mwaiwala Mwaiwala Mwazilinga Mwazilinga Mapondera Mapondera Rhoda Dagalasi Rhoda Dagalasi Alichiona Alichiona Ziyenda Ziyenda Kamoyo Kamoyo Mpakuleni Mpakuleni Namwina Namwina other23 Other (Specify) Chazemba Chazemba Chimpango Chimpango Ganda Ganda Kusena Kusena Lubaili Lubaili other24 Other (Specify)
other_village1 *(required)*	If other village, please specify	
other_village2 *(required)*	If other village, please specify	
other_village3 *(required)*	If other village, please specify	
other_village4 *(required)*	Please specify village	

Field	Question	Answer
other_village5 *(required)*	Please specify village :	
censused_yesno *(required)*	ENUMERATOR: Has this household already been registered in the census dataset?	yes Yes no No
note0	ENUMERATOR: Go back to the Census From, register the household and then come back to this form.	
check_2021_survey *(required)*	Has this household been surveyed in 2020-2021?	yes Yes no No
consentobtained > Find the household member		
find_hh *(required)*	Choose the household member	id hh_details
consentobtained > Find the household member > Confirm		
find_hh_note	Details ID: [find_hh] Name: [pull_name] Age: [pull_age] Phonenumber: [pull_phonenumber] Gender: unknown Village: [pull_village_label]	
find_conf *(required)*	Confirm that this is the right household member.	yes Yes no No
consentobtained > A. Information about respondent		
respondentHHH *(required)*	Is the interviewee the household head?	yes Yes no No
HHHwhi *(required)*	If not, name the household head	
relationshiptoHHH *(required)*	If not, relationship to household head? *Only continue this survey if the interviewee is part of the household*	HHH HHH spouse Spouse of HHH son/daughter Son/daughter of HHH son/daughter-in-law Son/daughter-in-law of HHH parent Parent of HHH parentinlaw Parent-in-law of HHH brother/sister Brother/sister of HHH grand-father/-mother-of-HHH Grandparent of HHH grandchild Grandchild of HHH stepchild Adopted/foster/ stepchild of HHH other Other (specify)
relationshiptoHHHother *(required)*	If other relation to the household head, please specify here	
First_name *(required)*	First name of respondent	
Last_name *(required)*	Last name of respondent	
gender_respondent *(required)*	Gender of respondent	female Female

Field	Question	Answer
		male Male
phone_resp	Mobile phone number of the respondent *If no, please enter 0; If don't know please enter 88*	
consentobtained > B. Household demographics		
numberinhh *(required)*	How many members are there in your HH in total (INCLUDING the household head)? *Household = Living in same house and eating from same pot Please answer the fololowing question for each member of the households, starting with the Household head.*	
into_hh_roster	We will now ask questions about each member of your household. We are starting with the household head.	
consentobtained > B. Household demographics > HH member names (1)		(Repeated group)
name *(required)*	What is the name of household member #1?	
relationtohhh *(required)*	What is the relation to the HHH of household member: [name]?	HHH HHH spouse Spouse of HHH son/daughter Son/daughter of HHH son/daughter-in-law Son/daughter-in-law of HHH parent Parent of HHH parentinlaw Parent-in-law of HHH brother/sister Brother/sister of HHH grand-father/-mother-of-HHH Grandparent of HHH grandchild Grandchild of HHH stepchild Adopted/foster/stepchild of HHH other Other (specify)
gender_hhmember *(required)*	What is the gender of household member: [name]?	female Female male Male
agehhh *(required)*	What is the age in years of household member: [name]? *If less than one year old put "0"*	
maritalhhh *(required)*	What is the marital status of the houshold member [name]?	married Married single Single widow Widow / Widower seperateddivorce Seperated / Divorced cohabiting Cohabiting child16 Child under the age of 16
educationalhhh *(required)*	What is the level of education of[name]?	no No schooling someprimary Some Primary primary Completed Primary

Field	Question	Answer
		somesecondary Some Secondary secondary Completed Secondary vocational Vocational training morethansecondary More than secondary (e.g. College or university) dont_know Don't know baby The household member is a baby under 3 years old
disability *(required)*	Disability of the household member: [name]?	sight Sight (blind/severe visual limitation) hering Hearing (deaf/profoundly hard of hearing) comm Communication (speech impairment) physical Physical (e.g. needs wheelchair, crutches or prosthesis; limb, hand usage limitations) intellectual Intellectual (serious difficulties in learning) emotional Emotional (behavioural, psychological) none No disability other Other
disability_specify	If other, please specify	
live_member_allyear	Does this household member: [name] live in the household all year round?	yes Yes no No
nationality	Nationality of [name]?	malawian Malawian other Other
nationalityother	If other, please specify.	
Religion	Religion of [name]?	none None Christianity Christianity Islam Islam Traditional Traditional na No answer other Other
Religionother	If other, please specify.	
Ethnicity	Tribe of [name]?	Chewa Chewa

Field	Question	Answer
		Ngoni Ngoni Lomwe Lomwe Yao Yao Tumbuka Tumbuka Nyanja Nyanja Sena Sena Tonga Tonga Ngonde Ngonde Manganja Manganja other Other
Ethnicityother	If other, please specify.	
livehhh_allyear	Does the HH head live all year long in the HH house?	1 yes 2 no 99 do not know 0 No answer
nolivehhh	If no, where is the HH head living when not living in the HH house?	otherspouse In his other spouse house agricultur In his/her agricultural field compani In the company that employs him/her parents In his/her parent's house country In another country region In another region district In another district other other
consentobtained > Economic activites of the household members		
number_working_age	How many households members of working age are providing subsistance or income for the household?	
consentobtained > Economic activites of the household members > Please answer the following questions for each family member of working age who is earning some income and/or subsistance for the household. (1)		(Repeated group)
Occupation	What is the occupation of the household member #1? What occupy most of the time of this person *Only for +16 years old HH members*	govt 1. Employed in Government/Civil service ngo 2. Employed by NGO industry 3. Employed in industrial / manufacturing service retail 4. Employed in retail

Field	Question	Answer	
		agriculture	5. Employed in agriculture by other entity
		office	6. Employed in office
		cattle	7. Employed in cattle farming
		farming	8. Self-employed in crop farming
		animalherder	9. Self-employed in animal husbandry / herder
		sellanimalproducts	10. Self-employed in selling animal products
		charcoal	11. Self-employed in charcoal making
		fishing	12. Self-employed in fishing
		sand	13. Self-employed sand farming
		terrazzo	14. Self-employed in terrazzo stone mining
		searching	15. Not employed and looking for employment
		unemployed	16. Not employed and not looking for job
		pensioned	17. Pensioner
		housewife	18. Housewife
		ganyu	19. Ganyu labour
		other	20. Other specify
occupation_spec	If other please specify		
Firstmainincome	What is the main source of income household member #1? The activity that generate more money	agri_crops	Agricultural crops
		agri_products	Transformed agricultural products
		migr	Migrant remittances
		plants	Selling Wild Plants
		timber	Selling Timber
		livestock	Livestock
		fishing	Fishing
		hunting	Hunting

Field	Question	Answer
		charcoal Charcoal Selling firewood Selling firewood bricks Brick Making Sand Sand Mining business Small Business employed Employed (State job) employedpri Employed (private job) piece Piece work (Ganyu) 0 No income other Other
firstmainincome_specify	Please speciify	
tempofirstmainincone	Is this activity permanent or seasonal?	permanent Permanent seasonal Seasonal
monthsfirstmainincome	If seasonnal, please select the months during which the activity is done	January January February February March March April April May May June June July July August August September September October October November November December December
averagefirstmainincome	Select the average monthly income generated by this activity	
Secondmainincome	What is the SECOND main source of income of household member #1? The second activity that generate more money	agri_crops Agricultural crops agri_products Transformed agricultural products migr Migrant remittances plants Selling Wild Plants timber Selling Timber livestock Livestock fishing Fishing hunting Hunting charcoal Charcoal Selling firewood Selling firewood bricks Brick Making Sand Sand Mining business Small Business employed Employed (State job) employedpri Employed (private job) piece Piece work (Ganyu) 0 No income

Field	Question	Answer
		other Other
secondmainincome_specify	Please speciify	
temposecondmainincone	Is this activity permanent or seasonal?	permanent Permanent seasonal Seasonal
monthssecondmainincome	If temporary please select the months during which the activity is done	January January February February March March April April May May June June July July August August September September October October November November December December
averagesecondmainincome	Select the average monthly income generated by this activity	
thirdmainincome	What is the THIRD source of income of household member #1? The third activity that generate more money	agri_crops Agricultural crops agri_products Transformed agricultural products migr Migrant remittances plants Selling Wild Plants timber Selling Timber livestock Livestock fishing Fishing hunting Hunting charcoal Charcoal Selling firewood Selling firewood bricks Brick Making Sand Sand Mining business Small Business employed Employed (State job) employedpri Employed (private job) piece Piece work (Ganyu) 0 No income other Other
thirdmainincome_specify	Please speciify	
tempothirdmainincone	Is this activity permanent or seasonal?	permanent Permanent seasonal Seasonal
monthsthirdmainincome	If seasonal please select the months during which the activity is done	January January February February March March April April

Field	Question	Answer
		May May June June July July August August September September October October November November December December
averagethirdmainincome	Select the average monthly income generated by this activity	
consentobtained > C. Complementary information on the household		
Language *(required)*	Main language that is spoken at home?	English English Chichewa Chichewa Chiyao Chiyao Chinyanja Chinyanja Chinsena Chinsena Chilomwe Chilomwe Chitumbuka Chitumbuka Chitonga Chitonga other Other
Languageother *(required)*	If other, please specify.	
residedinvillage *(required)*	Has the household always resided in the village?	yes Yes no No
residedinvillage_no *(required)*	If No, from where did the household move from?	country From another country district From another district village From another village within the same district gvh From another GVH within the same district othervillage Other village in Blantyre / Neno Districts otherta Other TA otherdistrict Other district otherregion Other region
residedinvillage_no_1	Please specify, if other TA	
residedinvillage_no_2	Please specify, if other district	
residedinvillage_no_3	Please specify, if other region	
residedother *(required)*	Does the household live anywhere else at other times of the year?	yes Yes no No
residedotheryes *(required)*	If Yes, Where	
residedotheryeswhsn	If Yes, which months are you generally living there?	January January February February March March April April

Field	Question	Answer
		May May June June July July August August September September October October November November December December
unableto workyn *(required)*	Since january 2023, has the head of household been unable to work and/or carry out your livelihood activities and/or support yourself and your family due to mental or physical disability, chronic illness or old age?	yes Yes no No
consentobtained > Section D. Amenities and access to energies		
electricity *(required)*	Is your house connected to electricity?	yes Yes no No
electricitycost	If yes, what is the monthly cost? *(If free, indicate 0)*	
light	what do you use for lightning?	oil Oil/kerosene Gas Gas Candles Candles torch Battery/ Torch / flashlight solar Solar Electricity Electricity Paraffin Paraffin Firewood Firewood Grass Grass generator Generator / private sources other Other
lightother	If other, please specify	
cook	What do you use for cooking?	Firewood Firewood Charcoal Charcoal Electricity Electricity generator Generator / private sources Gas Gas oil Oil/kerosene Animal Animal residual (dried cattle dung) Crop Crop husks/remains Paraffin Paraffin solar Solar Saw Saw dust other Other

Field	Question	Answer
cookother	If other, please specify	
cookwhere *(required)*	Where do you normally prepare food during the dry season?	insidehouse Inside the house outsidehouse Outside the house outsidekitchen Outside the house in the kitchen
cookwhere2 *(required)*	Where do you normally prepare food during the wet season	insidehouse Inside the house outsidehouse Outside the house outsidekitchen Outside the house in the kitchen
water	Is your house connected to water?	yes Yes no No
watercost1	If yes, what is the monthly cost? *If free, indicate 0*	
drink	What water do you use for drinking?	tap Tap water borchlo Borehole water with chlorine bor Borehole water without chlorine bottle Bottle rivertre River water with treatment river River water witout treatment other Other
drinkother	If other, please specify	
watercost2	If community borehole, what is the monthly cost? *If free, indicate 0*	
watercollect *(required)*	How long does it take to collect water (walk from home, collect water and return home)?	1 Less than 5 minutes 2 Between 5 minutes and 30 minutes 3 Between 30 minutes and 1 hour 4 Over 1 hour 5 Other (Specify)
otherwatercollect *(required)*	If other, please specify	
watertratyn *(required)*	Do you treat your water before use?	1 yes 2 no 99 do not know 0 No answer
watertratmetho *(required)*	If "yes", which method is used?	1 Boiling 2 Letting it stand 3 Adding purifying agent 4 Other (specify)
otherwatertratmetho *(required)*	If other treatment method, please specify	
watertreatment *(required)*	Why do you not treat your water?	safe The water is safe, it does not need to be treated notrust I do not trust the purifying agents provided

Field	Question	Answer
		notavailable There was no purifying agent available noanswer Do not want to answer
sanitation	What sanitation system are you using?	Nature In the nature (forest, riverbank, etc) outhouse Traditional pit latrine (toilets outside the house) impouthouse Improved pit latrine (toilets outside the house) inhouse In house (toilets in the house) other Other
sanitationother	If other, please specify	
rubbish	How do you dispose of household rubbish?	burn 1.= Burn landfill 3. = Municipal landfill throwriver 4. = Throw in river other 5. Other: specify
rubbish_spec	If other, please specify	
items	Please select the items owned by the household.	0 none 1 radio 2 phone land line 3 mobile phone 4 internet 5 fridge 6 motorbike 7 bicycle 8 car 9 tv 10 cooker 11 other
item_spec	If other, please specify	
transport	What are the means of transport used by your HH?	Foot Foot Bicyle Bicycle Moto Motocycle car Private car taxi Taxi bus Bus other Other
howlonghc *(required)*	How long does it take to get to the nearest Health centre?	1 Less than half an hour 2 Between half an hour and an hour 3 Between 1 and 2 hours 4 Between 2 and 4 hours

Field	Question	Answer
		5 More than 4 hours
howlongedu *(required)*	How long does it take to get to the nearest Educational / Vocational Training facility?	1 Less than half an hour 2 Between half an hour and an hour 3 Between 1 and 2 hours 4 Between 2 and 4 hours 5 More than 4 hours
howlongpolice *(required)*	How long does it take to get to the nearest Police Station?	1 Less than half an hour 2 Between half an hour and an hour 3 Between 1 and 2 hours 4 Between 2 and 4 hours 5 More than 4 hours
howlongrelig *(required)*	How long does it take to get to the nearest Religious centre (e.g. Church or Mosque)?	1 Less than half an hour 2 Between half an hour and an hour 3 Between 1 and 2 hours 4 Between 2 and 4 hours 5 More than 4 hours
consentobtained > E. Household's expenditure		
note11	Please indicate your 5 largest household's expenditure items in the last 12 months For each sources of expenditure please specify the average monthly expense	
inc3_1t *(required)*	Please indicate your largest household expenditure in the last 12 months	0 No additional expense 1 Food (including baby food) 2 Personal Items (toiletries, washing powder, diapers etc.) 3 Transport (bus fares, taxis fees) 4 Clothes 5 Taxes (Gov.) 6 Lighting (paraffin, gas, candles etc.) 7 Charcoal 8 Firewood 9 Telephone (cellular) 10 Water (transport or pumping costs) 11 Rental (housing/accommodation) 12 Agricultural expenses - crops 13 Agricultural expenses - livestock 14 New buildings or building improvements 15 Debt repayment 16 School fees, uniforms, books/equipment 17 Medical Expenses

Field	Question	Answer
		18 Other
inc3_1t_cost	How much per month does your household spend on [first_expense]?	
inc3_2t *(required)*	Please indicate your second largest household expenditure in the last 12 months	0 No additional expense 1 Food (including baby food) 2 Personal Items (toiletries, washing powder, diapers etc.) 3 Transport (bus fares, taxis fees) 4 Clothes 5 Taxes (Gov.) 6 Lighting (paraffin, gas, candles etc.) 7 Charcoal 8 Firewood 9 Telephone (cellular) 10 Water (transport or pumping costs) 11 Rental (housing/accommodation) 12 Agricultural expenses - crops 13 Agricultural expenses - livestock 14 New buildings or building improvements 15 Debt repayment 16 School fees, uniforms, books/equipment 17 Medical Expenses 18 Other
inc3_2t_cost	how much per month does your household spend on [second_expense]	
inc3_3t *(required)*	Please indicate your third largest household expenditure in the last 12 months	0 No additional expense 1 Food (including baby food) 2 Personal Items (toiletries, washing powder, diapers etc.) 3 Transport (bus fares, taxis fees) 4 Clothes 5 Taxes (Gov.) 6 Lighting (paraffin, gas, candles etc.) 7 Charcoal 8 Firewood 9 Telephone (cellular) 10 Water (transport or pumping costs) 11 Rental (housing/accommodation) 12 Agricultural expenses - crops

Field	Question	Answer
		13 Agricultural expenses - livestock 14 New buildings or building improvements 15 Debt repayment 16 School fees, uniforms, books/equipment 17 Medical Expenses 18 Other
inc3_3t_cost	how much per month does your household spend on [third_expense]	
inc3_4t *(required)*	Please indicate your fourth largest household expenditure in the last 12 months	0 No additional expense 1 Food (including baby food) 2 Personal Items (toiletries, washing powder, diapers etc.) 3 Transport (bus fares, taxis fees) 4 Clothes 5 Taxes (Gov.) 6 Lighting (paraffin, gas, candles etc.) 7 Charcoal 8 Firewood 9 Telephone (cellular) 10 Water (transport or pumping costs) 11 Rental (housing/accommodation) 12 Agricultural expenses - crops 13 Agricultural expenses - livestock 14 New buildings or building improvements 15 Debt repayment 16 School fees, uniforms, books/equipment 17 Medical Expenses 18 Other
inc3_4t_cost	how much per month does your household spend on [fourth_expense]	
inc3_5t *(required)*	Please indicate your fifth largest household expenditure in the last 12 months	0 No additional expense 1 Food (including baby food) 2 Personal Items (toiletries, washing powder, diapers etc.) 3 Transport (bus fares, taxis fees) 4 Clothes 5 Taxes (Gov.) 6 Lighting (paraffin, gas, candles etc.)

Field	Question	Answer
		7 Charcoal 8 Firewood 9 Telephone (cellular) 10 Water (transport or pumping costs) 11 Rental (housing/accommodation) 12 Agricultural expenses - crops 13 Agricultural expenses - livestock 14 New buildings or building improvements 15 Debt repayment 16 School fees, uniforms, books/equipment 17 Medical Expenses 18 Other
inc3_5t_cost	how much per month does your household spend on [fifth_expense]	
inc41 *(required)*	Have you taken a loan in the last 12 months to cover any expenses?	1 yes 2 no 99 do not know 0 No answer
borrow	If yes, how much did you as a household borrow?	
creditorg	If yes, from what kind of credit facility did you borrow?	bank Bank microcred Micro credit project villagebank Village Bank friend Friends family Family other Other
creditorg_other *(required)*	If other, please specifiy	
loanreason *(required)*	What was the main reason for the loan?	health To cover health costs repay To repay loan food To buy food education To cover education related costs repair To construct or repair house clothing To purchase clothing other Other
loanreasonother *(required)*	If other, please specifiy	
accountyesno	Does your household have a bank account?	1 yes 2 no 99 do not know 0 No answer

Field	Question	Answer
accountname	If yes, is this bank account to your name and your spouse name or only one of you?	Hhname HH name only bothname Both spouse name other Other
moneysyst	When you have to receive money, what system do you use?	Otheraccount Use someone else account myaccount Use my bank account cashtrasnfer Use cash transfer system (Western Union or similar) phonetransfer Use mobile phone money transfer system (Mpamba - TNM, Airtel money - Airtel, or similar) other Other
moneysyst_spec	If other, please specifiy	
consentobtained > F. Food security & social support		
fies6 *(required)*	On average, how many meals are you eating every day?	0 0 1 1 2 2 3 3 99 do not know 77 No answer
fies9 *(required)*	In the past 4 weeks (30 days), did you or any household member go a whole day and night without eating anything because there was not enough food?	1 yes 2 no 99 do not know 0 No answer
socyn *(required)*	Has your household received any food assistance in the last 12 months?	1 yes 2 no 99 do not know 0 No answer
socfood *(required)*	If yes, What is type of food assistance was it?	Foodcoupon Food coupon Schoolfeeding School feeding/ supplementary feeding Foodforwork Food for work/ for assets Cashvoucher Cash voucher/ cash Foodbasket Food basket other Other
socfood_spec	If other, please specifiy	
socprovider *(required)*	Who has provided this support ?	philantropic Philanthropic individual ngo NGO/ Charity Bodies government Government agency

Field	Question	Answer
		other Other
bus8 *(required)*	How would you evaluate your family's social conditions?	affordeverything 1. Money suffices for everything. We can afford whatever we want and save money regularly. surficeallsave 2. Money suffices both for food and clothing and we can even save some. surficeallnosave 3. Money suffices both for food and clothing requirements but we aren't able to save anything. minimum 4. Money suffices only for minimum food and clothing requirements. strugglemeal 5. We struggle to have three basic meals per day dontknow 6. Don't know.
consentobtained > G. Land use Land rights		
ownlandyn	Are you the owner of the plot you are living in?	rent 1. I rent it own 2. I own it (I can sell it without the consent of anyone) coown 3. I own it with my wife/husband wife 4. It belongs to my wife/husband family family 5. It belongs to my family free 6. I occupy it for free and it's not mine other 7. Other
ownother	If other, please specify	
rentamount	How much do you pay every month?	
paytousespec	If so, who does the household pay to use this land?	chief Chief of Village landlord Landlord (tenant farmer) employer Employer districtgov District government other Other (specify)
ownerdocument	Do you have any document with your name on it/your wife's name on it proving that?	1 yes 2 no

Field	Question	Answer
		99 do not know 0 No answer
documenttype	If yes, what kind of document it is?	formal Formal document (from the District authorities, or land deed) informal Informal document (from the village head) other other document
documenttype_spec	If other, please specifiy	
rightoccup	Please specify who give you the right to occupy this plot	custom Inherited from parents (customary) chief Chief of Village employ Employer distric District government other Other (specify)
numbotherplot	How many other plots do you have? (in addition to the house plot and the main agricultural plot)	
hhcomuse *(required)*	Does the household make use of communal land?	yes Yes no No
hhcomuseyes *(required)*	If yes, for what does the household use the land?	graze communal grazing food foraging for food materials foraging for materials for housing materialsuse foraging for materials for household use naturalres foraging for natural resources for sale other other (specify):
hhcomuseyes_spec	If other, please specifiy	
consentobtained > H. Agriculture & trees		
nbragriplots	How many agricultural plots do you use? *If none enter '0'*	
consentobtained > H. Agriculture & trees > Agricultural plots (1)		(Repeated group)
fieldsize *(required)*	What is the approximate size of field #1? *ENUMERATOR: if the person does not know put 0*	
fielunitmeasure *(required)*	Specify unit of measure for the field #1	Acres Acres Hectares Hectares other Other (specify)
otherfieldunit *(required)*	If other unit of measure, please specify	
fieldown *(required)*	Plot ownership for the land field #1?	withtitle 1 = Plot with Title Deed/ Certificate of Ownership signedlease 2 = Plot with Signed Lease

Field	Question	Answer
		traditional 3 = Traditional or customary land rights rentedsharecropper 4 = Not owned but rented or used as a sharecropper
plotsamelochouse	Is this plot #1 in the same village as your house?	yes Yes no No
fieldlocation2 *(required)*	Travel time from homestead plot (minutes): field #1?	lessthan15min 1 = 1-15 min 16minto30 2 = 16-30 min 31to45 3 = 31-45 min 46to60 4 = 46-60 min morethan1h 5 = over 1 hour
fieldcrop *(required)*	If cultivated, primary crop/vegetable grown on field #1	Cassava Cassava Maize Maize Groundnuts Ground nuts Rice Rice Potato Irish potato sweetpotato Sweet Potato Plantain Plantain Yams Yams Beans Beans Peas Peas Cabbage Cabbage Onion Onion Tomato Tomato Coffee Coffee Tea Tea Cotton Cotton Sunflower Sunflower Sesame Sesame Tobacco Tobacco Sorghum Sorghum other Other (specify) notinuse Not in use
fieldcropother	If other, please specifiy	
fieldnotused	If field #1 "not in use" Why?	soil The land is not fertile hyppo Too many hyppos/crocodiles far Too far money No money to grow crops water No enough water time No time/ no capacity to go and cultivate

Field	Question	Answer
		conflict Conflicts on this land other Other
fieldcultivation	Is the plot #1 cultivated by yourself or others?	myself By myself others By others
cropused *(required)*	What proportion of crops produced is used for household consumption ? *Indicate the share of crops used for self-consumption*	All All Most Most Some Some None None
fieldproducelimits *(required)*	What limits the quantity of crops grown?	nolimit There is no limitation of crops grown Poorsoilquality Poor soil quality Lackofirrigation Lack of irrigation Priceofseeds Price of seeds priceoffertiliser price of fertiliser Lackofland Lack of land Lackofrain Lack of rain Lackoftools Lack of tools Lackofknowledge Lack of knowledge Theftpeoplestealing Theft / people stealing Conflictwithwildanimals Conflict with wild animals Conflictwithanimalherders Conflict with animal herders other Other dnk Do not know
labour *(required)*	Who do you use as labour for your plots of land?	family Family only nonpaid Neighbours (non paid) hired Hired labour (paid)

Field	Question	Answer
		famandnonpaid Family and non paid labour famandhired Family and paid labour other Other (specify)
labourother *(required)*	If other, please specifiy	
bus5 *(required)*	How many person on average do you pay on your plots of land for agricultural activities? *If none enter '0'*	
tillage *(required)*	What method of tillage do you use?	manual Hand hoe or other type of equipment cows Cows donkey Donkey tractor Tractor other Other (specify)
tillageother *(required)*	If other, please specifiy	
fertilizeryn	Do you use fertilizer?	1 yes 2 no 99 do not know 0 No answer
fertilizertype	If yes, what type?	urea Urea booster Booster npk NPK can CAN (Calcium Ammonium Nitrate) manure Manure cooked_manure Cooked manure other Other
fertilizertype_spec	If other please specify	
pesticideyn	Do you use pesticide?	1 yes 2 no 99 do not know 0 No answer
pesticidetype	If yes, what type?	actellic Actellic cypermethrin Cypermethrin snowcron Snowcron 500 EC rogor Rogor diethyl Diethyl ether dimethyl Diméthyl dithane Dithane M-45 other Other
pesticidetype_spec	If other please specify	
irigatyesno	Are you irrigating your crops?	1 yes 2 no

Field	Question	Answer
		99 do not know 0 No answer
watersource	Type of water source for the irrigation ?	rainprecip Rain-fed shire_river Shire river other_river Other river than shire commborehole Village well/borehole homeborehole private well/borehole Rainwater Rain harvesting and storage other Other
watersourceother	If other, please specifiy	
watertype	Type of irrigation technique?	bucket Manually, with a bucket hand_pump Hand driven pump treadle_pump Treadle pump generator Generator pump solar Solar pump pivot Pivot sprinkler Sprinkler other Other (specify)
watertype_spec	If other please specify	
waterfreq	Frequency of irrigation?	onceweek Once a week twiceweek Twice a week everysec every second day onceaday once a day twiceaday twice a day three three times a day morethan more than three times a day
waterreliab	Reliability?	low low high high
waterquant	Quantity?	sufficient sufficient insufficient insufficient
waterqual	Quality?	good good notgood not good
watercost	Cost?	affordable Affordable notaff not affordable free Free (the water is not paid for)
crops_note	For each crop/vegetable, could you please provide us with the following information (for all plots the household has access to)?	
consentobtained > H. Agriculture & trees > For each crop/vegetable, could you please provide us with the following information (for all plots the household has access to)?		

Field	Question	Answer
dry_production_note	Dry season (yield in kg) for the last 12 months for the crop or vegetable	
beans_dry	Beans (Nyemba)	
Cassava_dry	Cassava (Chinangwa)	
cowbeans_dry	Cow beans (Nkhungudzu)	
groundnut_dry	Ground nut (Mtedza)	
Maize_dry	Maize (chimanga)	
pigeonpeas_dry	Pigeon peas (Nandolo)	
sugarcane_dry	Sugar cane (Mzimbe)	
consentobtained > H. Agriculture & trees > And during the wet season?		
wet_production_note	Wet season (yield in kg) for the last 12 months for the crop or vegetable	
beans_wet	Beans (Nyemba)	
Cassava_wet	Cassava (Chinangwa)	
cowbeans_wet	Cow beans (Nkhungudzu)	
groundnut_wet	Ground nut (Mtedza)	
Maize_wet	Maize (chimanga)	
pigeonpeas_wet	Pigeon peas (Nandolo)	
sugarcane_wet	Sugar cane (Mzimbe)	
consentobtained > H. Agriculture & trees > Proportion of crops sold		
production_sold_note	What proportion is sold for cash?	All All Most Most Some Some None None
beans_sold	Beans (Nyemba)	All All Most Most Some Some None None
Cassava_sold	Cassava (Chinangwa)	All All Most Most Some Some None None
cowbeans_sold	Cow beans (Nkhungudzu)	All All Most Most Some Some None None
groundnut_sold	Ground nut (Mtedza)	All All Most Most Some Some None None
Maize_sold	Maize (chimanga)	All All Most Most

Field	Question	Answer
		Some Some None None
pigeonpeas_sold	Pigeon peas (Nandolo)	All All Most Most Some Some None None
sugarcane_sold	Sugar cane (Mzimbe)	All All Most Most Some Some None None
agri_program_yesno	Do you benefit from an agricultural program?	1 yes 2 no 99 do not know 0 No answer
agri_program_list	From which one do you benefit?	mwasip Mwasip cadecom Cadecom umodzi Umodzi wwv World wide vision african_parks African Parks other Other
agri_program_pther	If other, please specify which one(s)	
agri_selling	Do you sell your crops as an individual or collectively with other farmers (cooperative)?	individual As an individual other_farmers With other farmers notselling I do not sell crops 99 do not know 0 No answer
consentobtained > H. Agriculture & trees > trees_group		
tree_grow *(required)*	Does your household grow trees?	yes Yes no No
tree *(required)*	Type of tree grown	Banana Banana Pawpaw Pawpaw Plantain Plantain Mango Mango Citrus Citrus coconut Coconut Avocado Avocado Eucalyptus Eucalyptus Firtree Fir tree other Other (specify)
treeother *(required)*	If other, please specifiy	
challenges_activity	Are there challenges related to this activity?	yes Yes no No
ifyes_challenges	If yes, what challenges?	

Field	Question	Answer
treeusage *(required)*	Do you make use of trees for firewood or charcoal production?	1 Charcoal 2 Firewood 3 None 99 Do not know 0 No answer
treeusagearea *(required)*	For Charcoal making, are the trees in your private areas, someone else's private area, or in communal areas? Please identify the general area	privateu Your Private Land privateother Someone Else Private Land communal Communal Land
consentobtained > I. Livestock and grazing		
animal_grow *(required)*	Does your household have livestock (cattle, goats, chicken, …)?	1 yes 2 no 99 do not know 0 No answer
consentobtained > I. Livestock and grazing > Livestock_		
CowNumber	Number of cattle (cows) owned by the household *If none enter '0'*	
Cow_rearing	Rearing Method	Nograzing No grazing Grazing_rb Grazing in the riverbank Grazing_village Grazing in the village close-by lands Grazing_mountain Grazing in the mountains Pastoralism Pastoralism
Cow_sold	What proportion is sold for cash?	All All Most Most Some Some None None
cow_water	What is the cow's main water source ?	rainprecip Rain-fed shire_river Shire river other_river Other river than shire commborehole Village well/borehole homeborehole private well/borehole Rainwater Rain harvesting and storage other Other
cow_medicine_yesno	Do you use medicine or vaccine for cows?	1 yes 2 no 99 do not know 0 No answer
GoatNumber	Number of goat owned by the household *If none enter '0'*	

Field	Question	Answer
Goat_rearing	Rearing Method	Nograzing: No grazing Grazing_rb: Grazing in the riverbank Grazing_village: Grazing in the village close-by lands Grazing_mountain: Grazing in the mountains Pastoralism: Pastoralism
goat_sold	What proportion is sold for cash?	All: All Most: Most Some: Some None: None
goat_water	What is the goat's main water source ?	rainprecip: Rain-fed shire_river: Shire river other_river: Other river than shire commborehole: Village well/borehole homeborehole: private well/borehole Rainwater: Rain harvesting and storage other: Other
goat_medicine_yesno	Do you use medicine or vaccine for goats?	1: yes 2: no 99: do not know 0: No answer
ChickenNumber	Number of chicken owned by the household *If none enter '0'*	
chicken_sold	What proportion is sold for cash?	All: All Most: Most Some: Some None: None
chicken_water	What is the chicken's main water source ?	rainprecip: Rain-fed shire_river: Shire river other_river: Other river than shire commborehole: Village well/borehole homeborehole: private well/borehole Rainwater: Rain harvesting and storage other: Other
chicken_medicine_yesno	Do you use medicine or vaccine for chickens?	1: yes 2: no 99: do not know 0: No answer
PigNumber	Number of pig owned by the household *If none enter '0'*	

Field	Question	Answer
pig_sold	What proportion is sold for cash?	All All Most Most Some Some None None
pig_water	What is the pig's main water source ?	rainprecip Rain-fed shire_river Shire river other_river Other river than shire commborehole Village well/borehole homeborehole private well/borehole Rainwater Rain harvesting and storage other Other
pig_medicine_yesno	Do you use medicine or vaccine for pigs?	1 yes 2 no 99 do not know 0 No answer
SheepNumber	Number of sheep owned by the household *If none enter '0'*	
Sheep_rearing	Rearing Method	Nograzing No grazing Grazing_rb Grazing in the riverbank Grazing_village Grazing in the village close-by lands Grazing_mountain Grazing in the mountains Pastoralism Pastoralism
Sheep_sold	What proportion is sold for cash?	All All Most Most Some Some None None
Sheep_water	What is the sheep's main water source ?	rainprecip Rain-fed shire_river Shire river other_river Other river than shire commborehole Village well/borehole homeborehole private well/borehole Rainwater Rain harvesting and storage other Other
sheep_medicine_yesno	Do you use medicine or vaccine for sheeps?	1 yes 2 no 99 do not know 0 No answer
GuineafowlNumber	Number of guineafowls owned by the household *If none enter '0'*	

Field	Question	Answer
Guineafowl_sold	What proportion is sold for cash?	All All Most Most Some Some None None
gf_water	What is the guineafowl's main water source ?	rainprecip Rain-fed shire_river Shire river other_river Other river than shire commborehole Village well/borehole homeborehole private well/borehole Rainwater Rain harvesting and storage other Other
gf_medicine_yesno	Do you use medicine or vaccine for guineafowls?	1 yes 2 no 99 do not know 0 No answer
PigeonNumber	Number of pigeons owned by the household *If none enter '0'*	
Pigeon_sold	What proportion is sold for cash?	All All Most Most Some Some None None
Pigeon_water	What is the Pigeon's main water source ?	rainprecip Rain-fed shire_river Shire river other_river Other river than shire commborehole Village well/borehole homeborehole private well/borehole Rainwater Rain harvesting and storage other Other
pigeon_medicine_yesno	Do you use medicine or vaccine for pigeons?	1 yes 2 no 99 do not know 0 No answer
RabbitNumber	Number of rabbits owned by the household *If none enter '0'*	
Rabbit_sold	What proportion is sold for cash?	All All Most Most Some Some None None
Rabbit_water	What is the Rabbit's main water source ?	rainprecip Rain-fed shire_river Shire river other_river Other river than shire commborehole Village well/borehole

Field	Question	Answer
		homeborehole private well/borehole Rainwater Rain harvesting and storage other Other
rabbit_medicine_yesno	Do you use medicine or vaccine for rabbits?	1 yes 2 no 99 do not know 0 No answer
DuckNumber	Number of ducks owned by the household *If none enter '0'*	
Duck_sold	What proportion is sold for cash?	All All Most Most Some Some None None
Duck_water	What is the Duck's main water source ?	rainprecip Rain-fed shire_river Shire river other_river Other river than shire commborehole Village well/borehole homeborehole private well/borehole Rainwater Rain harvesting and storage other Other
duck_medicine_yesno	Do you use medicine or vaccine for ducks?	1 yes 2 no 99 do not know 0 No answer
livestock_other	Any other livestock?	1 yes 2 no 99 do not know 0 No answer
livestock_other_specify	if yes, please specify	
livestock_other_rearing	Rearing Method for #{livestock_other_specify}	Nograzing No grazing Grazing_rb Grazing in the riverbank Grazing_village Grazing in the village close-by lands Grazing_mountain Grazing in the mountains Pastoralism Pastoralism
livestock_other_sold	What proportion of #{livestock_other_specify} is sold for cash?	All All Most Most Some Some None None

Field	Question	Answer
graze1	Does anyone in your household use grazing areas for livestock?	yes Yes no No
graze3	If yes, how often are the grazing areas used?	everyday 1 = every day onceweek 2 = once a week oncemonth 3 = once a month lessoncemonth 4 = less than once a month
graze4	If yes, is there enough food for the animals?	yes Yes no No
graze5	If yes, do you compete with other people for good grazing areas?	yes Yes no No
graze6	Are you able to sell these animals or some animal products or is it only for self-consumption?	sell It is only for selling eat It is only for self consumption both1 It is both for selling and for self consumption if some left both2 It is both for self consumption and for selling if some left
graze7	Who do you sell your livestock to ?	not_selling Not selling any livestock villagers To villagers butchers To butchers at the local market companies To companies other Other (specify)
livestock_sell_spec	if other , please specify	
consentobtained > J. Business		
bus1 *(required)*	Do you have a business?	1 yes 2 no 99 do not know 0 No answer
bus1b *(required)*	If yes, where?	house Near my house village Elsewhere in the village outvillage Elsewhere outside the village other Other
busrentown	If yes, Do you own the business place or do you rent it?	own I own rent I rent free I do not own it but use it for free other Other
busrentownspe	If other, please specify	
bus2 *(required)*	What type of Business is it?	1 Small shop / grocery 2 Transport (moto) 3 Transport (bycile)

Field	Question	Answer
		4 Transport (minibus) 5 Hawker 99 Other
bus2_spec	if other , please specify	
bus3 *(required)*	What are the average revenues of the business over a year (after taxes and salaries payments)? MWK	
bus4 *(required)*	Do you have documentation showing the revenue?	yes Yes no No
employees_perm	How many persons do you employ permanently over a year ? *If none = 0*	
employees_perm_female	how many women amongst these permanent employees?	
employees_perm_wage	average monthly wage of these permanent employees?	
employees_temp	How many persons do you employ temporally over a year? *If none = 0*	
employees_temp_months	how may months during the years do you have these temporary employees?	
employees_temp_female	how many women amongst these temporary employees?	
employees_temp_wage	average monthly wage of these temporary employees?	
consentobtained > K. Ecosystem services & river use		
medplantyn	Are you collecting medicinal herbs or plants?	1 yes 2 no 99 do not know 0 No answer
medplantw	If yes, where?	house Near my house shirey In the Shire riverbank river Another riverbank village Elsewhere in the village outvillage Elsewhere outside the village other Other
firewoodyn	Are you collecting firewood?	1 yes 2 no 99 do not know 0 No answer
firewoodw	If yes, where?	house Near my house shirey In the Shire riverbank river Another riverbank village Elsewhere in the village outvillage Elsewhere outside the village other Other
hayyn	Are you collecting hay?	1 yes 2 no 99 do not know

Field	Question	Answer
		0 No answer
hayw	If yes, where?	house Near my house shirey In the Shire riverbank river Another riverbank village Elsewhere in the village outvillage Elsewhere outside the village other Other
woodyn	Are you collecting wood for construction?	1 yes 2 no 99 do not know 0 No answer
woodw	If yes, where?	house Near my house shirey In the Shire riverbank river Another riverbank village Elsewhere in the village outvillage Elsewhere outside the village other Other
charcoalyn	Are you doing charcoal?	1 yes 2 no 99 do not know 0 No answer
charcoalw	If yes, where?	house Near my house shirey In the Shire riverbank river Another riverbank village Elsewhere in the village outvillage Elsewhere outside the village other Other
potteryyn	Are you doing pottery?	1 yes 2 no 99 do not know 0 No answer
potteryw	If yes, where do you collect the clay?	house Near my house shirey In the Shire riverbank river Another riverbank village Elsewhere in the village outvillage Elsewhere outside the village other Other
brickyn	Are you doing bricks?	1 yes 2 no 99 do not know

Field	Question	Answer
		0 No answer
brickw	If yes, where do you collect the sand?	house Near my house shirey In the Shire riverbank river Another riverbank village Elsewhere in the village outvillage Elsewhere outside the village other Other
huntyn	Does someone in the houshold hunt?	1 yes 2 no 99 do not know 0 No answer
huntw	If yes, where do you hunt?	house Near my house shirey In the Shire riverbank river Another riverbank village Elsewhere in the village outvillage Elsewhere outside the village other Other
hunt_frequency	How often do you hunt?	onceweek 1 = once a week oncemonth 2 = once a month lessoncemonth 3 = less than once a month
huntwhat	Select the animals you hunt	antelopes Impala/antelopes Rat Rat Crocodile Crocodile Monkey Monkey Hare Hare Rabbit Rabbit Partridge Partridge/quail Wildpigs Wild pigs/Warthogs other Other please specify
huntother	If other please specify	
huntuse	What do you do with the animals you hunt?	Skins Skins Rituals Rituals Food Food Other Other
terrazzoyn	Are you collecting Terrazzo stone ?	1 yes 2 no 99 do not know 0 No answer
terrazzow	If yes, where do you collect it?	house Near my house shirey In the Shire riverbank

Field	Question	Answer
		river Another riverbank village Elsewhere in the village outvillage Elsewhere outside the village other Other
sandyn	Are you collecting sand to sell?	1 yes 2 no 99 do not know 0 No answer
sandw	If yes, where do you collect it?	house Near my house shirey In the Shire riverbank river Another riverbank village Elsewhere in the village outvillage Elsewhere outside the village other Other
riverfishyn	Are you using the river to fish?	1 yes 2 no 99 do not know 0 No answer
riverfishw	If yes, which river?	1 Lisungwe 2 Shire 3 Makale 4 Nkalazi 5 Nkujidi 6 Midati 7 Mulanga 8 Other 0 Madzimaela
mostfishedfishes	If yes, what are the 5 most important fish species that you fish	Chambo Chambo Utaka Utaka Mcheni Mcheni Usipa Usipa Matemba Matemba Kampango Kampango Mlamba Mlamba other Other (please specify)
otherfishedfish	If other please specify	
fishingmeans	Please indicate the means used to fish	gillnets 1 = Gillnets seine 2 = Seine nets drag 3 = Drag nets cast 4 = Cast nets scoop 5 =Scoop nets basket 6 = Basket traps

Field	Question	Answer
		fixed 7 = Fixed traps handline 8 = Handline lomgline 9 = Longlines troll 10 = Troll lines spear 11 = Spear, stick poison 12 =Poison fishing, dynamite 13 = Dynamite fishing other 14 = Other
fishingmeans_spec	If other please specify	
fishingplace	Are you fishing from the river bank or from a boat?	boat From a boat bank From the river bank both Both other Other
fishfishedeaten	What is the proportion of fish sold vs self-consumed? *Indicate in % the proportion of fish self-consumed*	1 None 2 25% 3 50% 4 75% (most) 5 All 99 dot not know 77 no anwser
rivercattleyn	Are watering your cattle in the river?	1 yes 2 no 99 do not know 0 No answer
rivercattlew	If yes, which river?	1 Lisungwe 2 Shire 3 Makale 4 Nkalazi 5 Nkujidi 6 Midati 7 Mulanga 8 Other 0 Madzimaela
riverceremonyyn	Are you doing any cultural or religious ceremony in the river?	none No batpism Baptism initboy Initiation ceremony for boys initgirl Initiation ceremony for girls other Other
rivercermonyother	If other, please specify	
riverceremonywher	If yes, which river?	1 Lisungwe 2 Shire 3 Makale 4 Nkalazi

Field	Question	Answer
		5 Nkujidi 6 Midati 7 Mulanga 8 Other 0 Madzimaela
riverclothesyn	Are you washing clothes in the river?	1 yes 2 no 99 do not know 0 No answer
riverclothesw	If yes, which river?	1 Lisungwe 2 Shire 3 Makale 4 Nkalazi 5 Nkujidi 6 Midati 7 Mulanga 8 Other 0 Madzimaela
riverdishesyn	Are you washing dishes in the river?	1 yes 2 no 99 do not know 0 No answer
riverdishesw	If yes, which river?	1 Lisungwe 2 Shire 3 Makale 4 Nkalazi 5 Nkujidi 6 Midati 7 Mulanga 8 Other 0 Madzimaela
riverbathyn	Are you bathing in the river?	1 yes 2 no 99 do not know 0 No answer
riverbathw	If yes, which river?	1 Lisungwe 2 Shire 3 Makale 4 Nkalazi 5 Nkujidi 6 Midati 7 Mulanga 8 Other

Field	Question	Answer
		0 Madzimaela
riverfishfarmyn	Are you doing fish farming?	1 yes 2 no 99 do not know 0 No answer
riverfishfarmw	If yes, which river?	1 Lisungwe 2 Shire 3 Makale 4 Nkalazi 5 Nkujidi 6 Midati 7 Mulanga 8 Other 0 Madzimaela
fishfarmeaten	If yes, what is the proportion of fish sold vs self-consumed? *Indicate in % the proportion of fish self-consumed*	1 None 2 25% 3 50% 4 75% (most) 5 All 99 dot not know 77 no anwser
consentobtained > L. Health		
healthsuff	What are the five most common diseases in this community?	1 Malnutrition 2 Sexually transmitted infections (including HIV) 3 Diarrhoea (all types) 4 Bilharzia (or other forms of Schistosomiasis) 5 Malaria 6 Upper respiratory infection (colds and flu) 7 Pneumonia 8 High blood pressure (hypertension) 9 Cholera 99 Other (Specify)
healthsuffother	If other, please specifiy	
sickchild	When your child was sick the last time, where did you go for medical advice?	1 The child was never sick 2 Health facility (health centre/clinic/hospital) 3 Community Health Worker/Health Surveillance Assistant (HSA) 4 Pharmacy/Shop 5 I have prepared an herbal remedy

Field	Question	Answer
		6 Parents/friends 7 Traditional/religious healer 8 I did not do anything 9 Other
sickchild_spec	If other, please specifiy	
nogohealth	If you did not go to the health facility, why did you not go to the health facility?	1 I cannot access the health facility 2 I do not like the health facility 3 I cannot afford the health facility 4 I prefer to go to the traditional healer 5 I prefer to prepare treatment for myself 6 It was not necessary to go to the health facility 7 Other (Specify)
other_nogohealth	If other, please specify	
malaria *(required)*	When was the last time anyone (adult or child) in your household had malaria?	1 This week 2 Last week 3 2-3 weeks ago 4 Last month 5 More than one month ago 6 Never had malaria
nets *(required)*	Does your household have any mosquito nets that can be used while sleeping?	yes Yes no No
whynonets *(required)*	Why don't you have or use any mosquito nets?	1 Not necessary 2 Not available 3 Don't like using them 4 Cannot afford them 5 Use something else (please specify) 6 Don't know
ifothernets *(required)*	If you use something else instead of mosquito nets, please specify:	
wherenets *(required)*	Where did you get these nets from?	healthfacility Health Facility gov Mass distribution by government ngo Mass distribution by NGO self Self-purchased other Other (specify)
wherenetsother *(required)*	If other, please specify:	
consentobtained > M. External shocks		
shock	What external shocks have you experienced in the past two years?	Drought Drought or late rains Floods Floods

Field	Question	Answer
		cyclone Cyclone Agriculturalpests Agricultural pests/diseases Insecurity Insecurity/violence chronicallyill Household member chronically ill Deathofa Death of a working household member Other Other shock No_Shock No shock experienced
shockother	If other, please specify	
shockh	What did you do when the shock occurred?	animals Sold more animals than usual redexpensen1 Reduced expenses on health and education redexpensen2 Reduced expenses on agricultural inputs loan Borrowed more money than usual noschool Withdrew children out of school femanimals Sold last female animals assets Sold productive assets migrated Entire household migrated allanimals Sold all animals soldland Sold land other Other
shockresponseother	If other, please specify	
consentobtained > N. Consultations		
consult1	Do you know about the planned Mpatamanga hydropower dam?	know Know Something dont No Knowledge
consult2	If you know something, where did you hear it form?	1 From a public meeting 2 From the village head 3 From a friend 4 During a survey 5 Other
consult2other	If other, please specify	
consult3	If you know something, when did you hear it?	1 Last month 2 This year 3 Last year 4 2 years ago

Field	Question	Answer
consult4	What day in the week is preferable for public consultation? (up to 2-3 hours each session)	mon Monday tue Tuesday wed Wednesday thu Thursday fri Friday sat Saturday sun Sunday any Any Day
consult5	What time of day is preferable for public consultation? (up to 2-3 hours each session)	anytime Anytime morning Morning afternoon Afternoon evening Evening
consult6	Where do you prefer the public consultation to be held?	lcoffice LC1 Office religiousfac Religious Facility govoffice Government Office village In the village other Other
consult6other	If other, please specify	
project_newsletter	Have you received any of the Project's Quarterly Newsletters?	1 yes 2 no 99 do not know 0 No answer
project_meetings	Have you attended any of the Project's monthly meetings?	1 yes 2 no 99 do not know 0 No answer
project_meetings_no	If no, can you tell us why not?	1 The meeting is too far from the village 2 I cannot go where the meetings take place 3 I was not informed of the project monthly meetings 4 I do not have time for these meetings 5 I am not interested 0 Other
project_meetings_no_other	If other, please specify	
project_grm	Do you know how to submit feedback or a complaint about the Project?	1 yes 2 no 99 do not know 0 No answer
project_grm_list	If yes, can you list one of the ways to do so?	1 Village Grievance Redress Committee members 2 MHPL Community Liaison Officers

Field	Question	Answer
		3 Grievances box in the village 4 Other 99 Do not know
project_grm_list_spec	If other, please specify	
project_info	What kind of information would you like to be informed of about the Mpatamanga Hydropower Project?	1 employment opportunities on the project 2 when the project will start 3 what will be the project's impacts 4 land acquisition and compensation 5 how the Shire river will change after the Project 0 other
project_info_other	Please specify what other type of information you are interested in about the Mpatamanga project.	
consentobtained > O. Perception of potential project impacts		
past_impacts	What aspects of your life have already been impacted by the Project?	1 no impact 2 influx of outsider in the area 3 Land speculation and land being bought by outsiders 4 Not able to expand my homestead 5 land price inflation 6 land price deflation 99 other
past_impacts_spec	If other, please specify	
consentobtained > O. Perception of potential project impacts > Potential impacts		
primpact2_label	What aspects of your life do you think the project will impact on?	1 positive impact 2 negative impact 3 no impact 99 do not know 0 no answer
primpact2_housing	Housing	1 positive impact 2 negative impact 3 no impact 99 do not know 0 no answer
primpact2_livcond	Living conditions	1 positive impact 2 negative impact 3 no impact 99 do not know 0 no answer
primpact2_job	Economic/employment	1 positive impact 2 negative impact

Field	Question	Answer
		3 no impact 99 do not know 0 no answer
primpact2_health	Health	1 positive impact 2 negative impact 3 no impact 99 do not know 0 no answer
primpact2_services	Access to services and facilities	1 positive impact 2 negative impact 3 no impact 99 do not know 0 no answer
primpact2_livestock	Livestock	1 positive impact 2 negative impact 3 no impact 99 do not know 0 no answer
primpact2_agricultural_farming	Agricultural / Farming	1 positive impact 2 negative impact 3 no impact 99 do not know 0 no answer
primpact2_cultural	Cultural activities or ceremonies	1 positive impact 2 negative impact 3 no impact 99 do not know 0 no answer
primpact2_other	Other	1 positive impact 2 negative impact 3 no impact 99 do not know 0 no answer
primpact2_other_spec	If other, please specify	
primpact3	Should you have to move, what form of resettlement option would you prefer for relocating your residence? *You can chose a combination of options.*	cash 1. = Cash compensation inkind 2. = Inkind provision (land for land, house for house) other 3. = Other (specify) notsure 4. = Not sure (would want more information)
primpact3other	If other, please specify	
resstlelocation	If you or your neighbours wanted new land to move to where would you look?	samegvh 1. Within the same GVH area

Field	Question	Answer
		sameta 2. Within the same TA area (different GVH) samedistrict 3. Within the same district elsewhere 4. Elsewhere (specify)
otherresstlelocation	if elsewhere, specify	
finalcomment	Add any comment you might have on this household/ on the survey	
thanking	Thank you for your time and your participation in this survey.	

MALAWI MPATAMANGA FISHERIES SURVEY, 2023

Date:	Location of survey (village name or site, coords):		
Name of Fisher:	Age:	Gender	Marital status
Are you the head of household (Y/N): If Noo, what is your relationship to head of household?			
Number of dependents (e.g. spouse, children):			
Name of current village where you live?	How long have you lived there?		
Name of your group village (if different)?	Name of Traditional Authority where you live?		
Main Occupation:	Secondary sources of income:		
How dependent are you on fishing for income and for food? Do you have other income sources?			
What are the main sources of protein in your family? (fish, goat, chicken, beef, groundnuts, beans, eggs, soya, other?)			
How much of the fish catch is used for home consumption compared with sale? (percentage)			
How much income is derived from fish sales (weekly/ monthly)?			
If sold, who sells the fish you catch? (yourself, wife, daughter, other?)			
Where do you sell the fish? How far is the closest market or place of sale for fish? (kilometres or time taken to drive or walk)			
Indicate which are the most important time/season of the year for fishing (December/February: March/May: June/August: September/November)?			

If you are unable to fish in the future, how will this impact on your livelihood? Do you have alternative livelihood activities that you can pursue instead? (List in order of importance)	
Frequency of fishing (days/week)?	Frequency of fishing (monthly pattern)?
How long have you fished in this area? (Number of years and Year of start)	Is there a dedicated fish landing area? Where?
Are you a member of a fishing association? If yes, why? (access to information, knowledge, access to market, credit, fishing rights)	
How do you access fishing rights (e.g. local village headman)?	
Where do you fish? Name of river/streams or nearest village?	
Do you fish in other areas currently? If so, where?	Have you fished elsewhere in the past? If so, where?
Do you fish in wetlands connected to the river in floods periods?	
Do you participate in aquaculture (fish farming)? Is there any and if so, where?	
What problems do you have when fishing? Do you consider it dangerous? If so, why? (fast water, hippo, crocs)	
Have you encountered crocodiles or hippopotamus when fishing here? Or where? How does this affect the way you fish? (avoid certain times/areas?) Do you know anyone who has been killed or injured by either hippo or crocodiles?	

What other your current challenges regarding fishing (e.g. weather, climate change, government policy, competition, crop failure forcing you to fish?)
Fishing Gear and Catch
Do you own a fishing boat? If so what type? How old isit? Or do you rent someone else's boat and if so for how much?
If you have a boat, do you use it for other purposes, e.g. as a ferry? If so, describe other uses.
Is there a jetty to safely access the river? If yes, describe?
What fishing gear are you currently using? (type and quantity/length)
What other gears do you use and when (e.g. time of year)?
What other resources do you rely on to catch fish? (e.g. type of bait, mud, reeds)
Observed catch: Species (local and scientific names), number, approximate weight. (e.g. Chambo; Utaka; Mcheni; Usipa; Matemba; Kampango; Mlamba)
How much do you expect to sell this catch for?
How does this catch compare with expected catches? (Expand on monthly expectations)

Do you keep all the fish you catch? Is there unwanted bycatch? Do you return any fish to the river (e.g. too small?)

How has fishing changed? (examples: quantity of fish caught daily (possible percentage decline), species changes in number and size)

(A) Over last ten years

(B) Over last five years

(C) Indicate current status of the fishery on a scale of 1 to 5 where 1 = excellent to 5 = very poor

What are your expectations for the future?

(A) Have you noticed or are aware of any changes to the river and fishing from upstream hydroelectric projects?

(B) How do you think the proposed Mpatamanga hydroelectric scheme may affect you?

(C) What are your expectations? (NOTE: Derive answers from general discussion, not simple questions, to draw out the overall picture of the fishery now and expectations for the future. This approach does not lend itself to simple yes or no questions)

Are there any other aquatic resources besides fishing that you catch (e.g. crabs, water birds, crocodiles / eggs or other animals)?

General notes:

Annex 5-4: Social Quantitative Survey Results

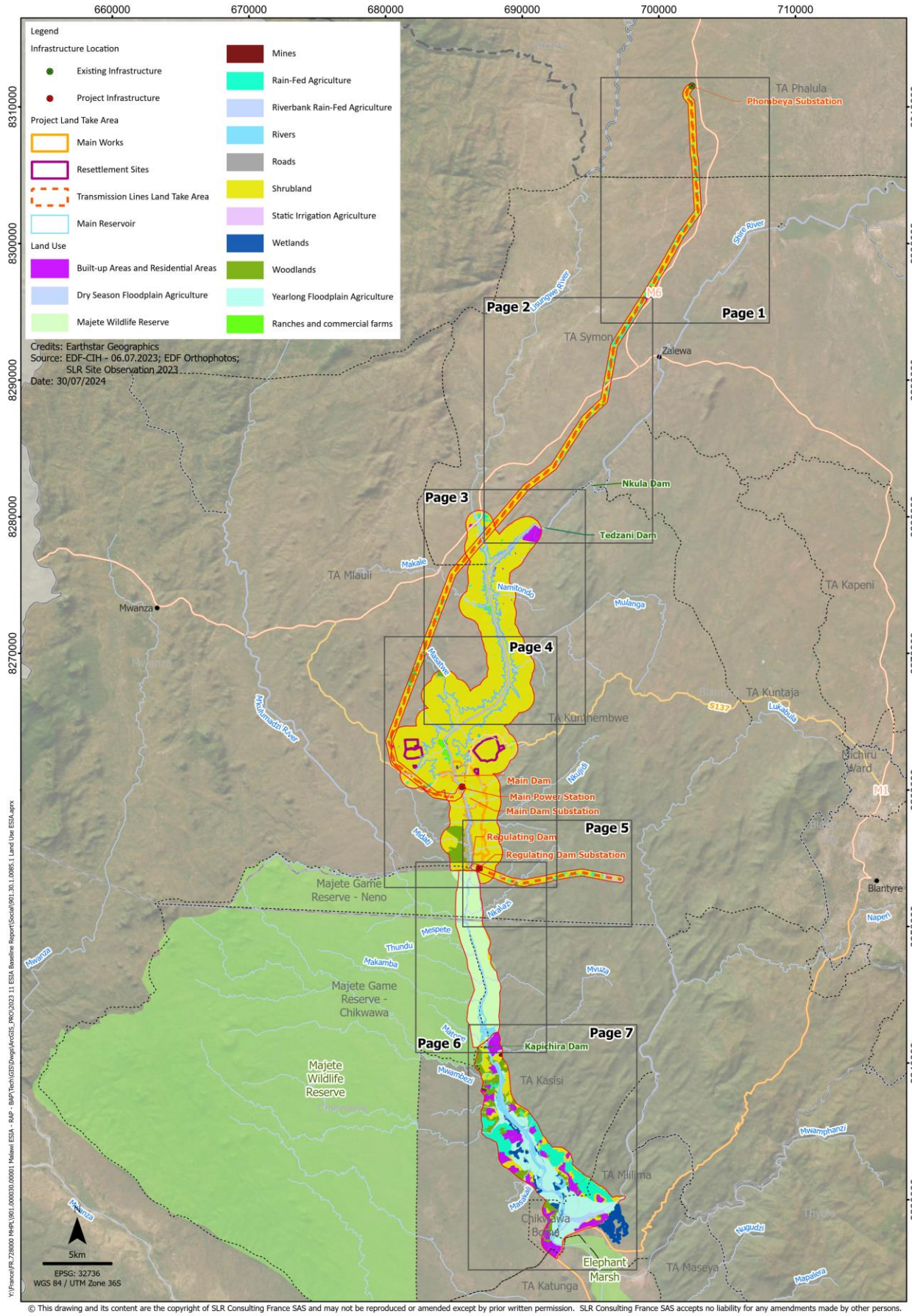
Sample Surveyed Through Quantitative Household Surveys

District (subtotal in parenthesis)	TA (subtotal in parenthesis)	Village	Total Number of Households Interviewed
Balaka (24)	Phalula (24)	Mpandasoni	5
		Ntchodola	2
		Phombeya	5
		Yonamu	12
Blantyre (555)	Kuntaja (15)	Botomani	6
		Jelani	5
		Nkata	2
		Ntatha	2
	Kunthembwe (540)	Adikachina	3
		Baluwa	5
		Chakhumbira	5
		Chaswanthaka	70
		Chikira	25
		Chikumbu	1
		Chilaulo	1
		Chimphanda	16
		Chinkhandwe	11
		Chinkwinya	51
		Chisembwere	16
		Dzifunika	2
		Dzikupi	5
		Galufu	3
		Gumeni	6
		Gwadani	3
		Imbwa	9
		Inosi	12
		Jelasi	4
		Juma	3
		Kabuluzi	7
		Kadikira	17
		Kaliyati	5
		Kubala	7
		Kunthembwe	12
		Kwapita	8
		Lisangwi	22
		Magombo	4
		Majola	1
		Makunje	8
		Malire	9
		Mbanda	3
		Mbwinja	8
		Mkwezalamba	15
		Mpindo	38
		Mvundula	7
		Mwazilinga	3
		Mzigala	10
		Namputu	72
		Ngoleka	4
		Nkhumba	8
		Simon	21
Neno (247)	Mlauli (120)	July	1
		Daelo	16
		Feremu	1
		Jonathan	8
		Kambalame	73

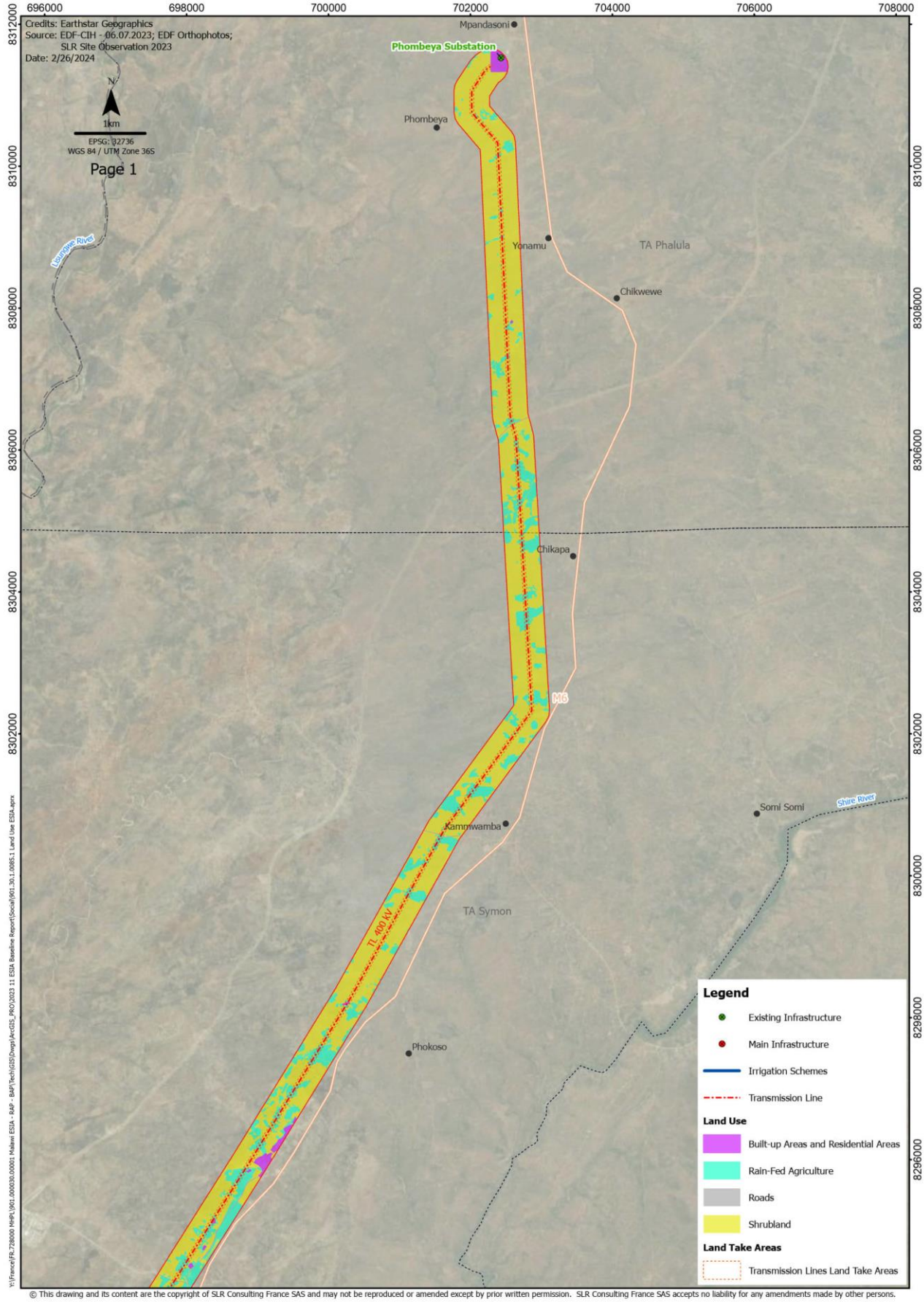
District (subtotal in parenthesis)	TA (subtotal in parenthesis)	Village	Total Number of Households Interviewed
		Liwonde	1
		Nkhwali	3
		Petulo	17
	Symon (127)	Chikapa	9
		Chivuta	3
		Kammwamba	12
		Kandoje	4
		Liyenda	21
		Mbemba	16
		Msonthe	5
		Ngwenyama	1
		Nkoka	2
		Ntingala	11
		Pajo	5
		Patasoni	3
		Salafosi	6
		Waiyatsa	15
		Zalewa	14
Grand Total			826

Annex 5-5: Land Use Maps

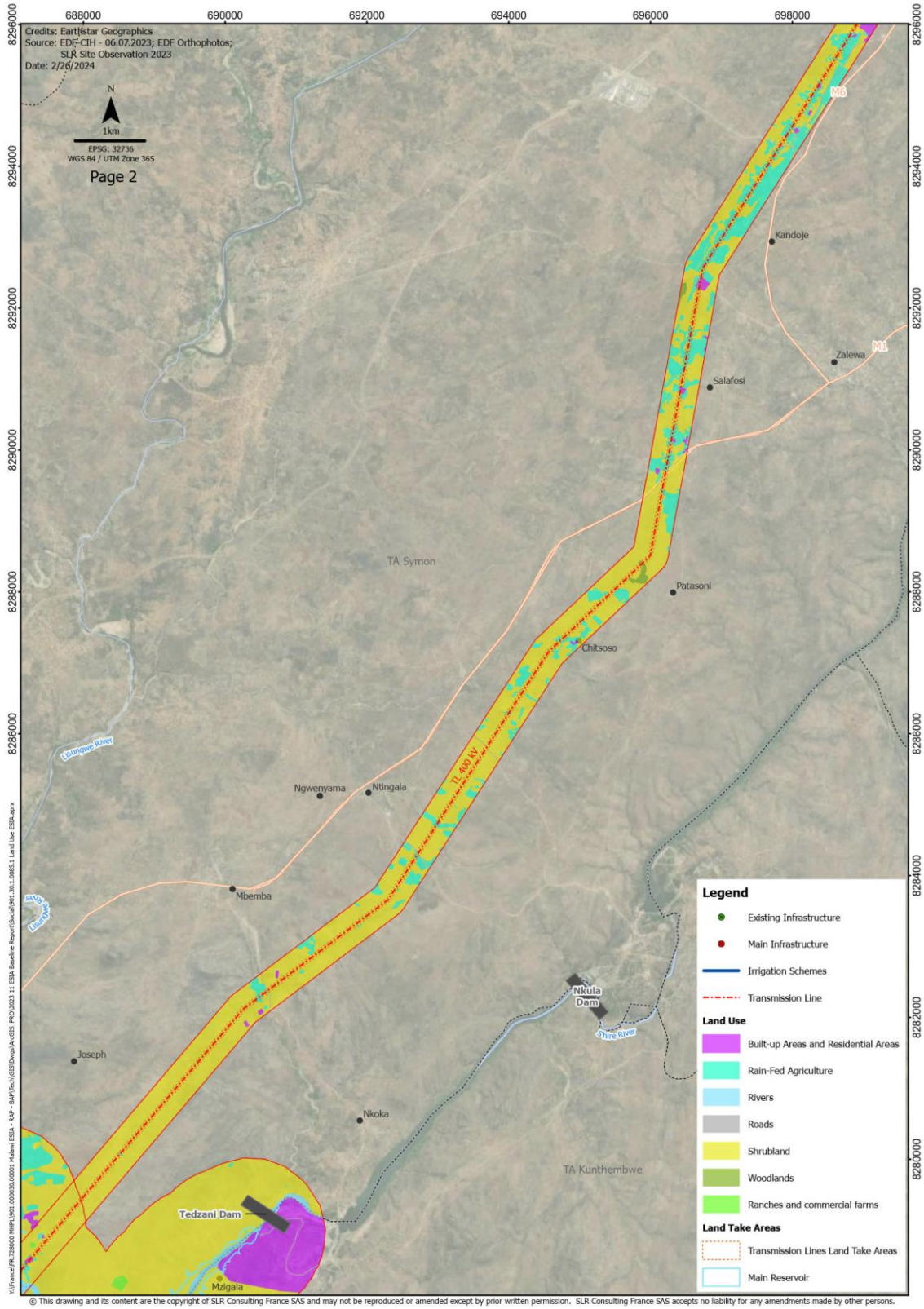
Land Use Map (Atlas)



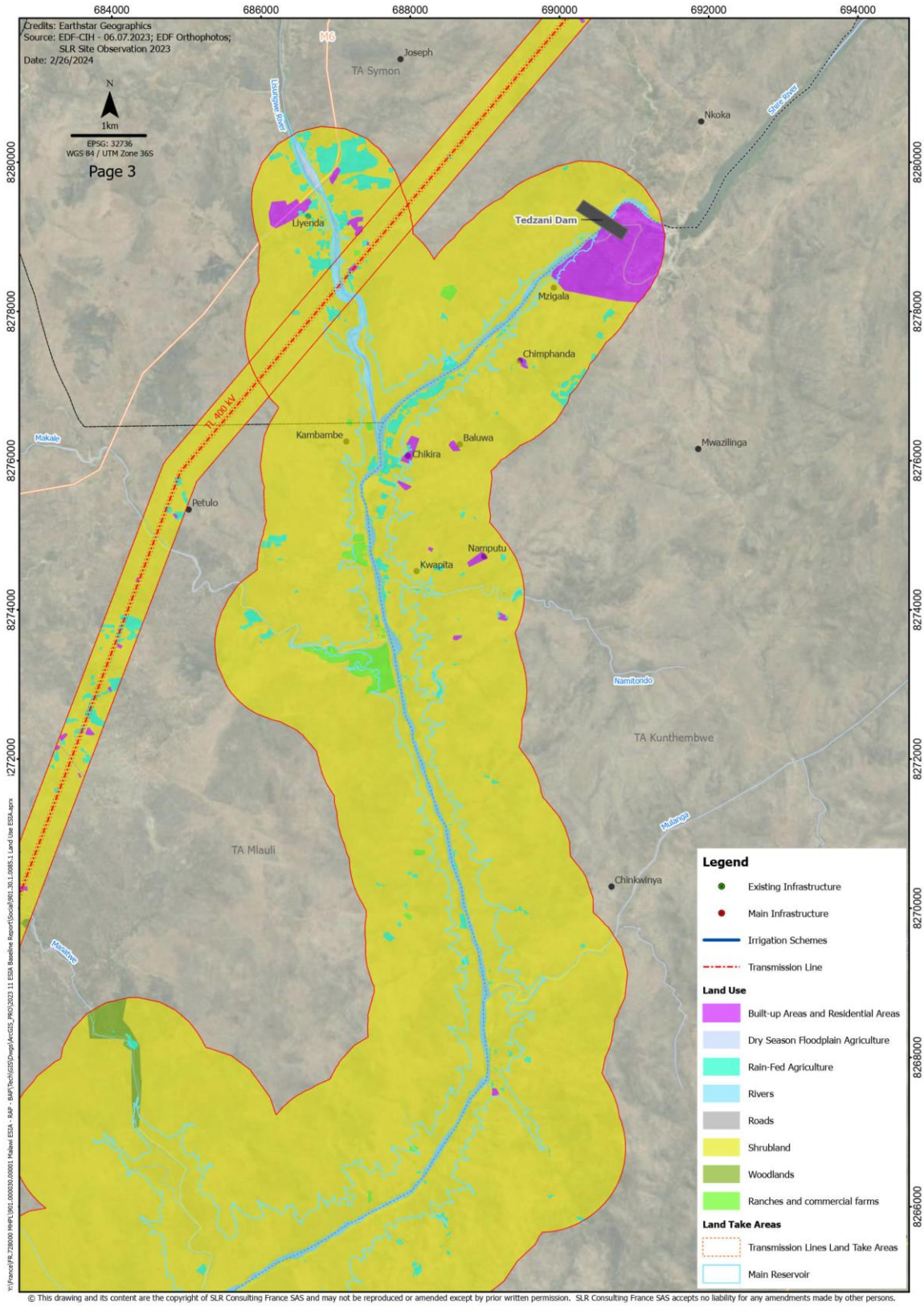
Land Use Map (Page 1)



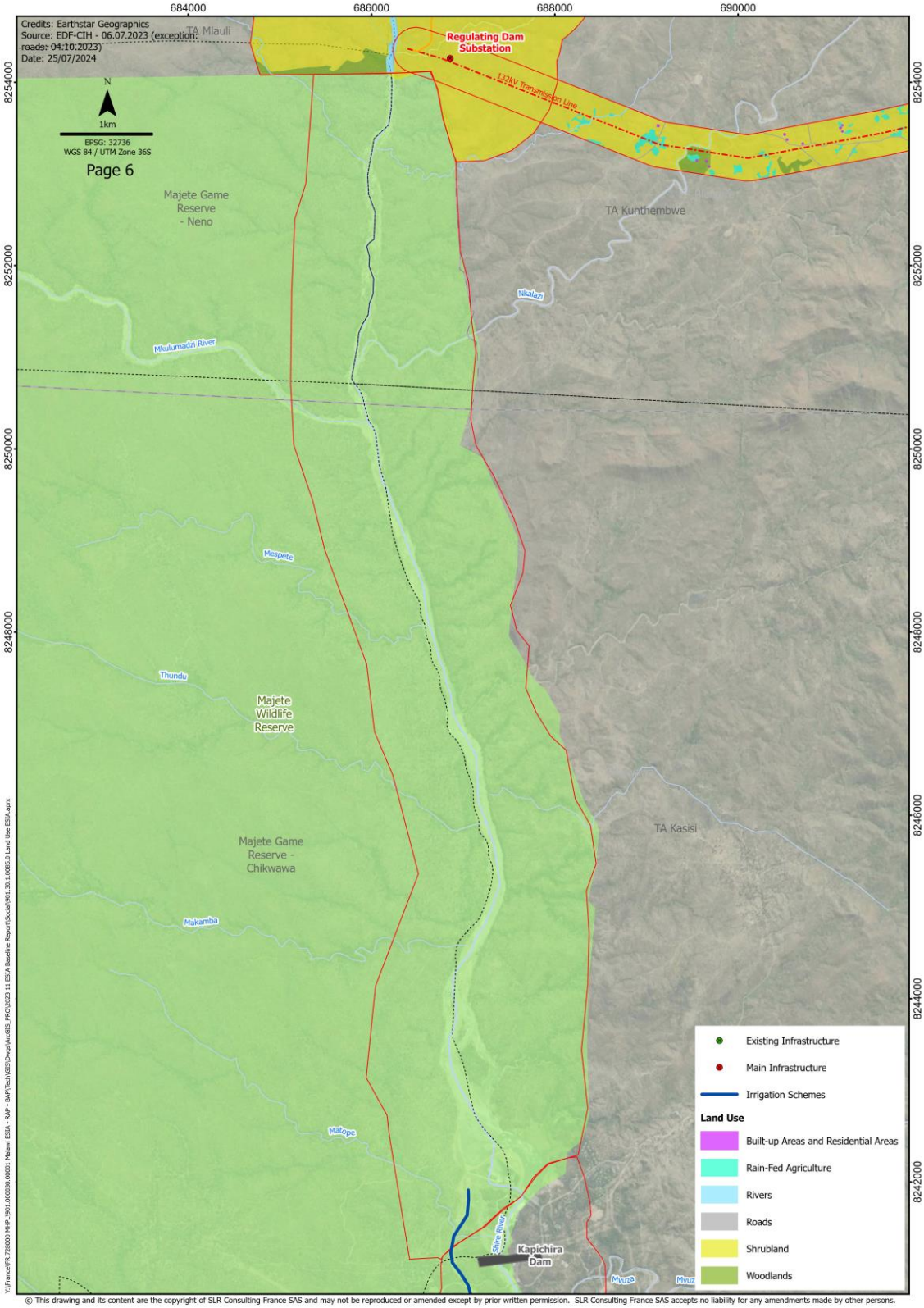
Land Use Map (Page 2)



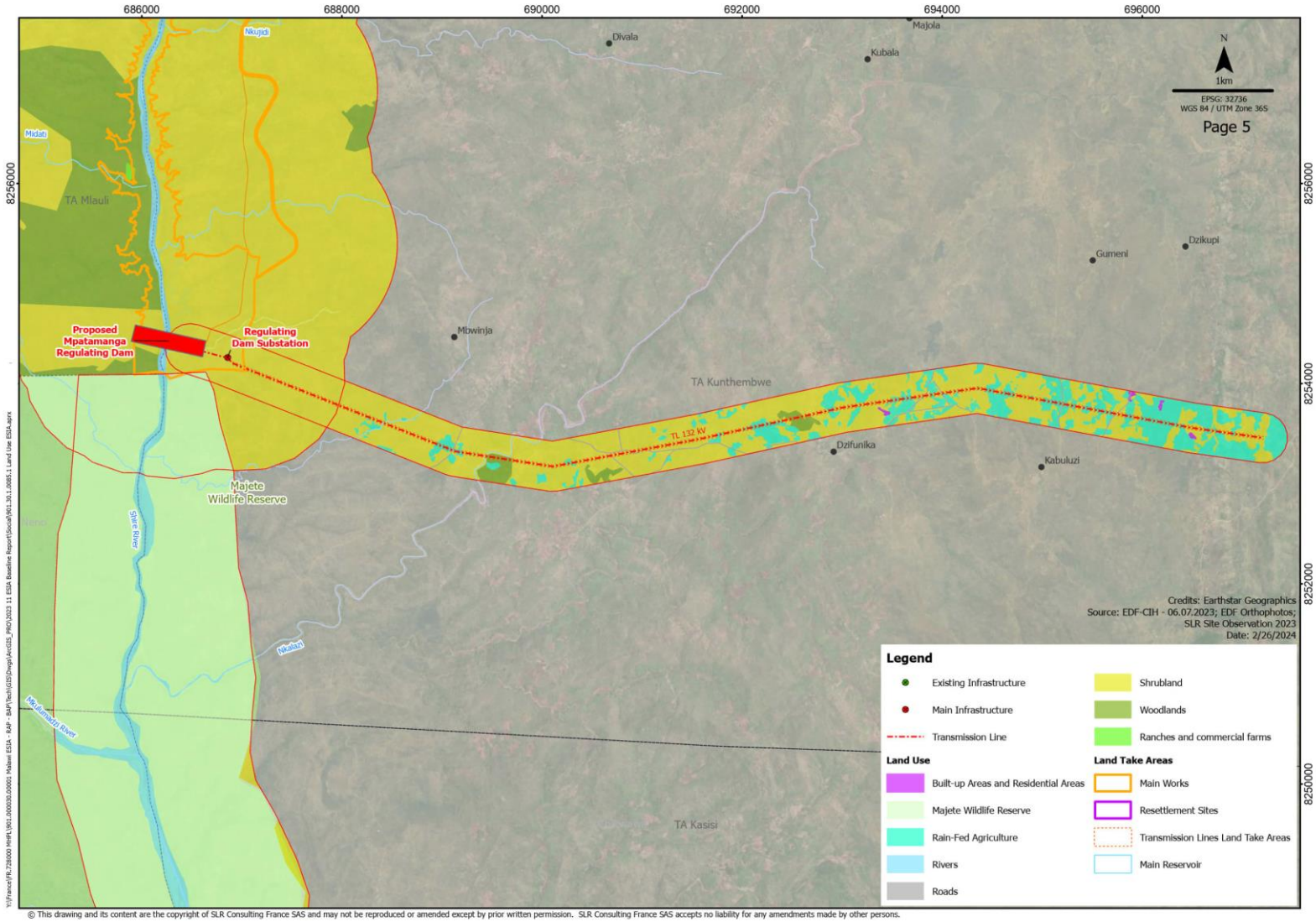
Land Use Map (Page 3)



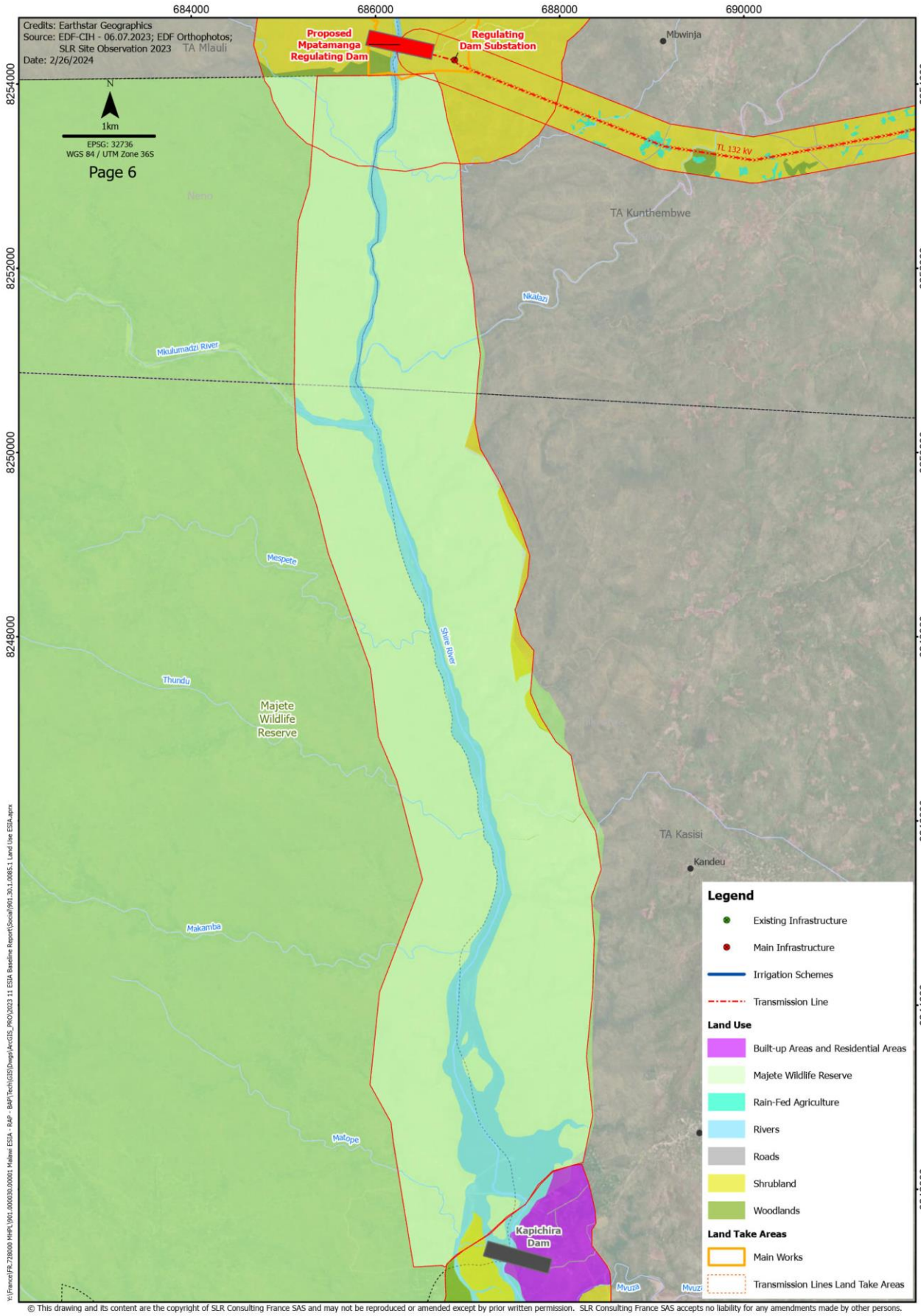
Land Use Map (Page 4)



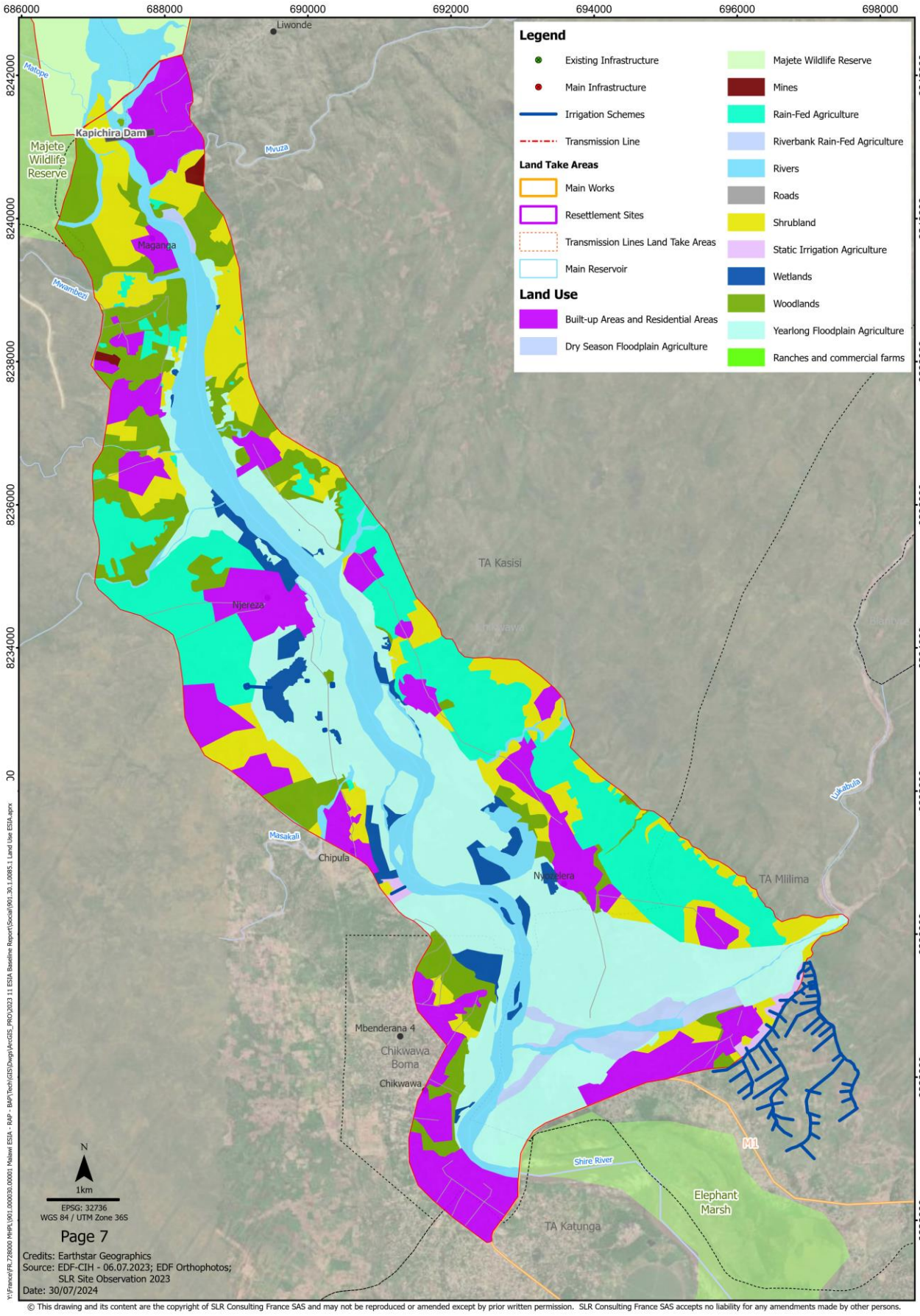
Land Use Map (page 5)



Land Use Map (Page 6)

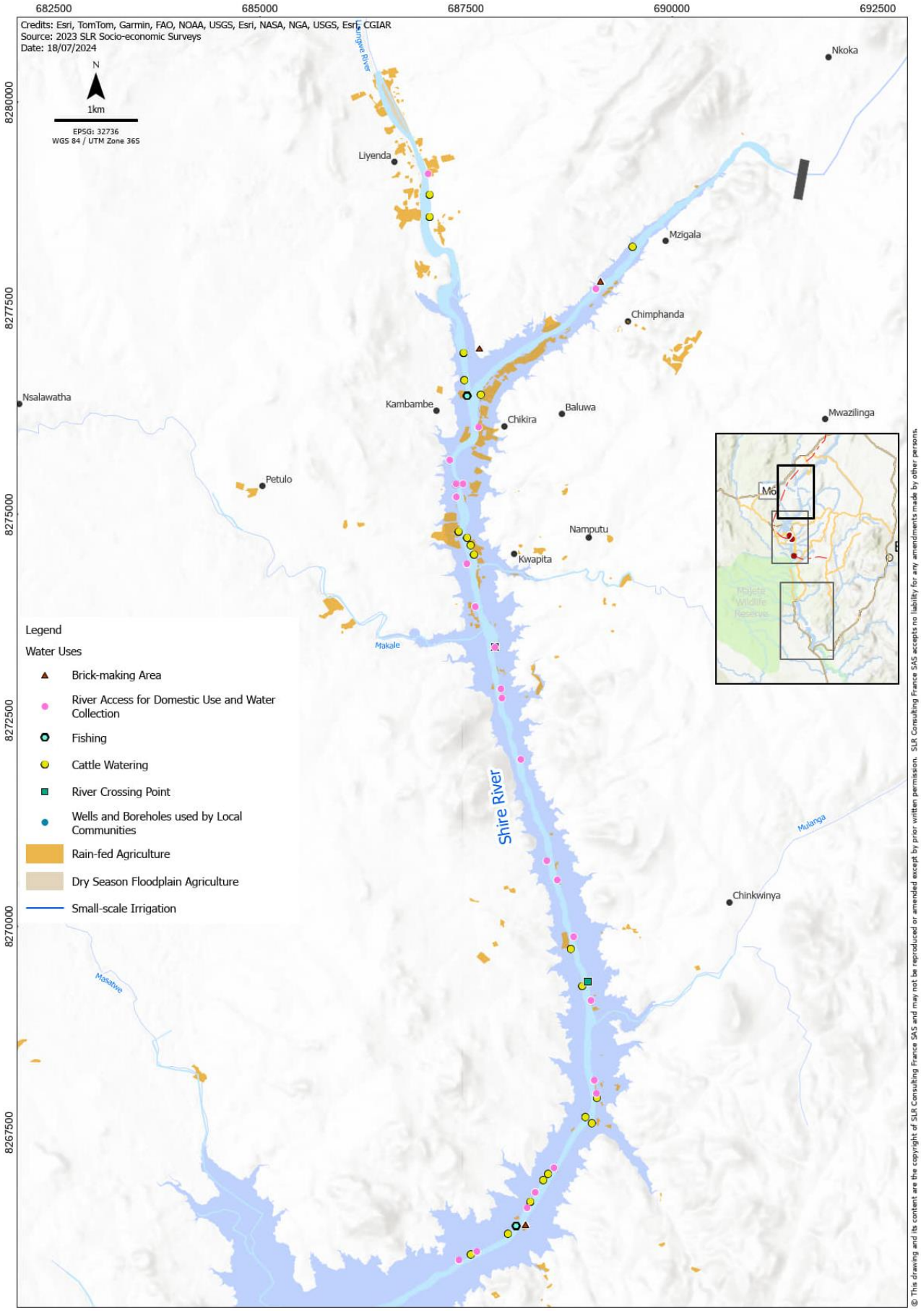


Land Use Map (Page 7)

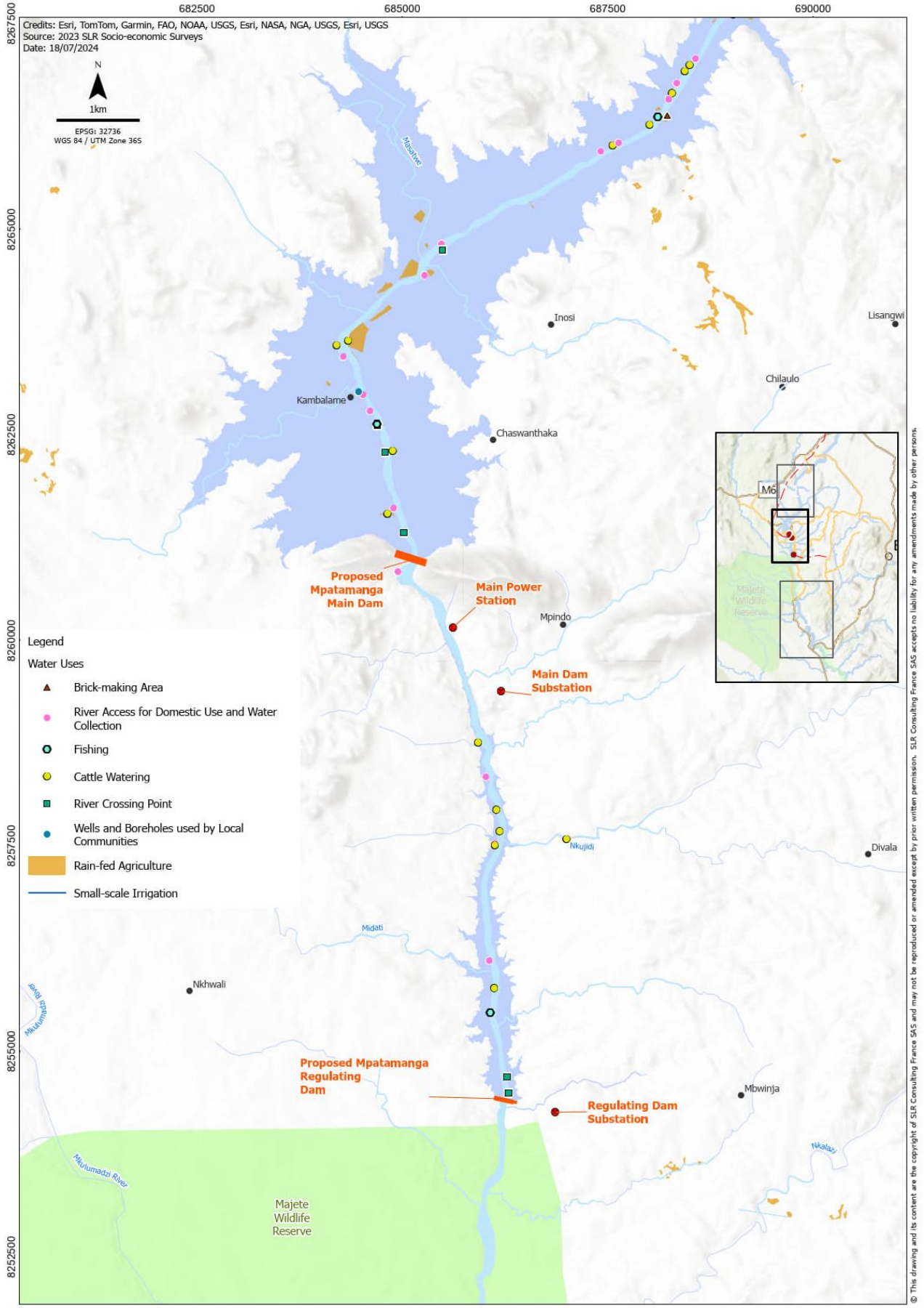


Annex 5-6: Water Use Maps

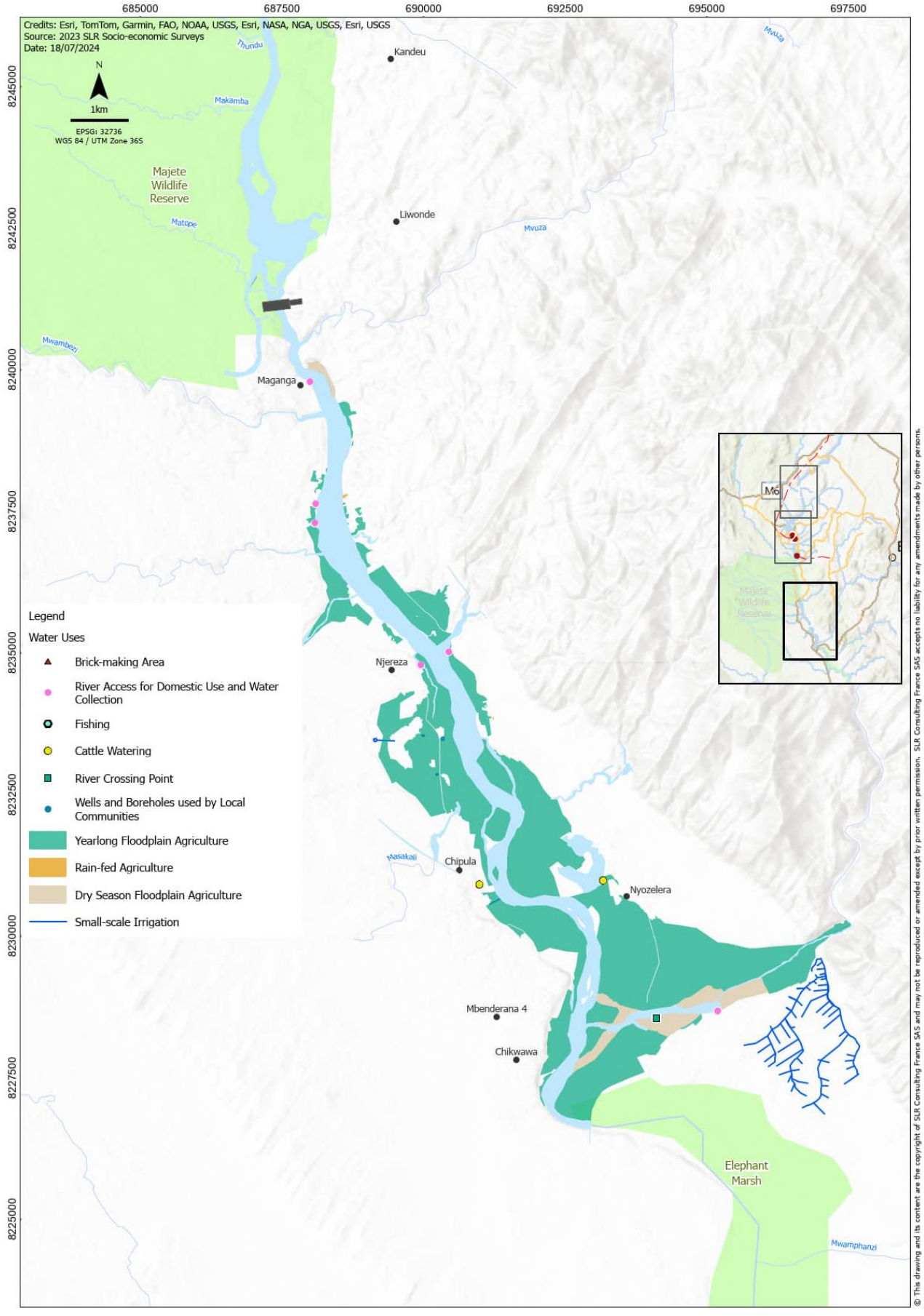
Map of Water Uses in Study Area (Upstream)



Map of Water Uses in Study Area (Reservoirs)



Map of Water Uses in Study Area (Downstream)



Annex 5-7: Health Facility Assessment

Detailed Health Assessment per Facility

Aspect	Finding
Queen Elizabeth Central Hospital	
Overview	The QECH is the largest and oldest tertiary hospital in Malawi since its inception in 1958. The hospital serves the whole of the Southern Region with an estimated population of 7,7 million people. As it is the largest hospital in the country, it also attracts patients from other regions. The hospital has multiple specialists in many departments listed below
Services	• Outpatient Department (all services) • Emergency Room for Adults and Paediatrics • General Surgery • Plastic Surgery • Ear Nose and Throat (Otorhinolaryngology) • Maxillo-facial Surgery • Head & neck Surgery • Neurosurgery • Orthopaedic Surgery • Ophthalmology • Obstetrics and Gynaecology • Internal medicine • Oncology • Neurology • Nephrology, including dialysis • Pulmonology • Paediatrics (oncology, surgery and orthopaedics) • Adult Intensive Care Unit • Paediatrics Intensive Care Unit • Radiology (Computed Tomography scan but not Magnetic Resonance Imaging) • Laboratory • Physiotherapy • Occupational Therapy • Dental • Blood transfusion services
Fees	All services are free of charge. Patients can fast track by paying MWK2,500 (equivalent to US$1.49). This allows them to see a general practitioner sooner but if their case warrants specialist involvement, they have to wait with all other patients.
Beds	The hospital has 1,400 beds available and typically run at an 80% bed occupancy rate
Staff	The hospital operates at a 40% staff complement. This is a historic issue and continues to persist as professional staff leave for better employment opportunities in the private sector
Water	Coupled to the main water supply of the city. Sometimes have outages but critical parts of the hospital have water storage tanks that allow them to operate, even during outages
Electricity	Connected to the main Escom power grid but has a backup generator that powers the whole hospital during outages
Waste	Domestic waste collected by the city of Blantyre. Biomedical waste incinerated on site and ashes collected by service provider who disposes on a landfill
Challenges	• Overburdened staff. The 40% staff complement fills the role of a primary-, secondary- and tertiary facility. This detracts from their focus as a tertiary facility and prohibits them from rendering an adequate service. • Medication and consumables. The hospital does not have a sufficient operational budget to cover all expenses and stock outs of consumables and medication occurs on a regular basis
Chikowa Health Centre	
Overview	The centre is located in Chikowa Village on the S137 Road that serves as the access road to the Project. At the time of the assessment, certain parts of the facility were undergoing refurbishment. The older portion of the facility is in a poor state with significant deterioration of the floors in certain parts of the facility. The target population in 38,840 from 55 communities in the surrounding area, the

Aspect	Finding
	furthest of which is located 25km away. The facility has two staff houses while the rest of the staff stay close by
Services	See between 300 and 500 patients per day. All services are free and include: • Primary healthcare • Antenatal care • HIV and STI management services, including ART clinic • Under five year clinic • Maternity services (uncomplicated and assisted deliveries) • Family planning services • Youth Friendly Services clinic • TB services • Small surgical procedures • Outreach activities The facility has a 24-hour standby service for emergencies
Commonest conditions	• Malaria • HIV • STI • TB • NCDs
Fees	All services are free of charge
Referral	The health centre refers to QECH. As ambulances are rarely available, most patients use private transport. This costs MWK5,000 (equivalent to US$2.97) one way and takes approximately 2 hours
Beds	Three short stay beds and nine maternity beds. Short stay beds are not used overnight, though
Staff	Staff complement consists of clinicians, nurses, groundsmen, security personnel and data clerks. The facility has 50% of the allocated staff at present. There are 18 HSAs attached to the clinic
Water	Have own borehole and solar pump. Water is unavailable when it is overcast but get water from manual water pump in community when that happens
Electricity	Connected to the main Escom grid. Adverse weather conditions will periodically interrupt the supply
Waste	Domestic waste is burned in a pit, while biohazardous waste is incinerated and then thrown in the same pit
Challenges	• Insufficient infrastructure in terms of size and lack of maintenance. The part of the facility that is not being refurbished shows significant deterioration • Stock outs of medication, inadequate equipment and consumables. At the time of the assessment, the facility did not have phenobarbital and certain antibiotics in stock. It also did not have test kits for blood glucose and Syphilis in stock, while the test equipment to determine haemoglobin levels in pregnant women was broken • Transport. The facility had a dedicated ambulance until 2019 when it was removed by the district. Patients now had to rely on three ambulances that cover the whole of the district or pay for private transport
Chimemebe Health Centre	
Overview	The facility has a target population of 19,800 people. The furthest villages are located 14km from the facility and it takes patients three to four hours to walk to the facility. The facility is in a poor state of repair in certain areas and some rooms cannot be used due to this. Some rooms are used to store motorcycles used for outreach activities to prevent theft. As a result, some sensitive services are run from corridors where confidentiality is difficult to maintain
Services	See between 180 and 220 patients a day. All services are free and include: • Primary healthcare • Antenatal care • HIV and STI management services, including ART clinic • Under five year clinic • Maternity services (uncomplicated and assisted deliveries) • Family planning services • Youth Friendly Services clinic • TB services • Small surgical procedures

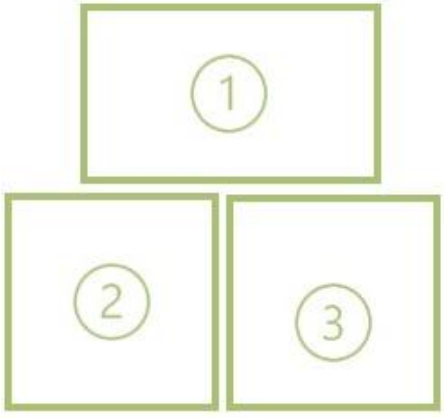
Aspect	Finding	
	• Outreach activities	
Commonest conditions	• Malaria • Pneumonia • Diarrhoea • URTIs • Skin diseases (scabies) • Bilharzia	
Fees	All services are free of charge	
Referral	Refers to QECH. Associated cost for private transport is MWK8,000 (equivalent to US$4.75) to Chileka, then still has to get to Blantyre. Takes approximately two hours	
Beds	One short stay bed and seven maternity beds	
Staff	Staff at between 50 and 60% compared to allocated positions. 15 HSA attached to the facility	
Water	Have own borehole and solar pump. Water is unavailable when it is overcast but has own standpipe as well	
Electricity	Connected to the main Escom grid	
Waste	Domestic waste is burned in a pit, while biohazardous waste is incinerated and then thrown in the same pit	
Challenges	• Inadequate infrastructure. The facility does not have enough room for an ART clinic and has to run it out of the maternity corridor • Stock outs of medication, notably for epilepsy (phenobarbital), hypertension, certain antibiotics and sometimes ART • Low number of staff	
Dziwe Health Centre		
Overview	The facility has a target population of 22,530 people from 40 surrounding villages. The whole facility is in a state of disrepair and requires significant intervention. The facility itself does not have power and has been informally rigged to receive electricity from the maternity ward. The water storage tanks have significant leaks that cause permanent water collections and acts as breeding site for mosquitoes. Improper management of biohazardous waste was observed with unsheathed, used needles and syringes lying openly in the facility grounds	
Services	See between 200 and 350 patients a day. All services are free and include: • Primary healthcare • Antenatal care • HIV and STI management services, including ART clinic • Under five year clinic • Maternity services (uncomplicated and assisted deliveries) • Family planning services • Youth Friendly Services clinic • TB services • Outreach activities • VIA screening for cervical cancer	
Commonest conditions	Adults: • Malaria • Pneumonia • Diarrhoeal disease • URTIs • Skin diseases (scabies) • Bilharzia	Children under five: • Malaria • Pneumonia • Diarrhoeal disease • URTI • Dysentery
Fees	All services are free of charge	
Referral	Refers to QECH. Cost for private transport is MWK16,000 to hospital on motorbike and up to MWK50,000 for a car (equivalent to US$9.51 and US$29.71). Takes approximately three hours	
Beds	Three short stay beds and twelve maternity beds	
Staff	Staff complement at below 50% compared to allocated positions. Five HSA attached to the facility. Have difficulty doing outreaches with low number of HAS	
Water	Have own borehole but holding tanks leak excessively, creating breeding site for mosquitoes	

Aspect	Finding
Electricity	Maternity connected to the main Escom grid and supply drawn from there. Supply erratic, though
Waste	Domestic waste is burned in a pit, while biohazardous waste is incinerated and then thrown in the same pit
Challenges	• Erratic electricity supply • Inadequate infrastructure • Better diagnostic equipment • Transport, specifically motorcycles to reach communities and facilitate outreach activities • Better roads
Neno District Hospital	
Overview	Significantly expanded and refurbished in 2012, the facility has a target population of 153,132 and covers the entire Neno district. In reality, however, the poor roads mean that most of the people in lower Neno go to Blantyre for medical care, if required. The hospital is experiencing significant funding challenges with regards to medication and consumables
Services	All services are free and include: • Orthopaedic services • General Surgery • Internal medicine • Paediatrics • Neonatal Intensive Care Unit (4 bed unit) No ventilators but Continuous Positive Airway Pressure. No adult ICU • Radiology – X-Rays and Ultrasound (no Computed Tomography scan and/or Magnetic Resonance Imaging) • Occupational Therapy • Physiotherapy • Dental services • Integrated Chronic Care Clinic (IC3) • Antenatal care • HIV and STI management services, including ART clinic • Maternity services (uncomplicated, assisted deliveries and Caesarean sections) • Family planning services • Youth Friendly Services clinic • TB services • Outreach activities • Laboratory services
Commonest conditions	• Malaria • Diarrhoea • Pneumonia • TB • Pregnancy and pregnancy complications • Malnutrition • HIV
Fees	All services are free of charge
Referral	Refers to QECH. Only two ambulances available. Takes approximately three hours
Beds	Have 160 inpatient beds available. Typically, at 80% occupancy
Staff	Operates on 50% nursing complement and 70% for rest of staff
Water	Connected to municipal water supply but erratic. Have storage tanks but not sufficient to supply hospital needs during power outages
Electricity	Connected to the main Escom grid. Supply very erratic. Have a backup generator but cannot support whole hospital
Waste	Domestic waste is burned in a pit, while biohazardous waste is incinerated and then thrown in the same pit
Challenges	• Insufficient funds for hospital. Cannot procure drugs, consumables and other crucial equipment. Made headlines in national newspaper

Aspect	Finding	
	• Transport is difficult to maintain due to terrain. Fuel and maintenance costs are exorbitant. Insufficient number of ambulances as well • Staffing issues. Operates on 70% staff complement on average. Less than 50% nurses' positions filled. Have to supply rural facilities with staff as well with nurses to ensure continuity of services there • Supply chain management, not only drugs, but also food Haven't been able to provide food for their patients for more than one year. Also, cannot provide linen to patients. Patients have to bring their own from home or lie on a bare mattress • Significant equipment shortages. The entire hospital uses one nebuliser and basic diagnostic equipment like sphygmomanometers and stethoscopes are in short supply. Only one of the two theatres are operational at the time of the assessment	
Luwani Health Centre		
Overview	The facility has a target population of 22,530 people from 40 surrounding villages	
Services	See between 200 and 350 patients a day. All services are free and include: • Primary healthcare • Antenatal care • HIV and STI management services, including ART clinic • Under five year clinic • Maternity services (uncomplicated and assisted deliveries) • Family planning services • Youth Friendly Services clinic • TB services • Outreach activities	
Commonest conditions	Adults: • Malaria • URTIs • STIs • Diarrhoeal disease	Children under five: • URTIs • Malaria • Diarrhoeal disease
Fees	All services are free of charge	
Referral	Refers to Lisungwi Hospital. Transport cost is MWK3,000 (equivalent to US$1.78) for a motorcycle and takes less than 30 minutes	
Beds	Two short stay beds and twelve maternity beds	
Staff	Staff complement low, but not sure by how much	
Water	Have own borehole but the pump is currently not working. Have to collect water in buckets from the community	
Electricity	Connected to the main Escom grid. Supply usually good	
Waste	Domestic waste is burned in a pit, while biohazardous waste is incinerated and then thrown in the same pit	
Challenges	• Maternity ward. The maternity ward is old and bats have made nests in the ceiling, making it an unpleasant place to work. Also low on vital equipment and maternity has no refrigerator • Transport, specifically vehicles to reach communities and facilitate outreach activities, as well as for referral to Lisungwi Hospital • Better diagnostic equipment • Beds and mattresses for maternity and other parts of the health facility • Computer to capture statistics on District Health Information System	
Chifunga Health Centre		
Overview	Chifunga Health Centre is located in proximity to Zalewa and communities on the Shire River. The facility has a target population of 11,500 people. It typically costs patients between MWK8,000 and MWK10,000 (equivalent to US$4.75 and US$5.94) to secure transport to the facility	
Services	See between 200 and 350 patients a day. All services are free and include: • Primary healthcare • Antenatal care • HIV and STI management services, including ART clinic • Under five year clinic	

Aspect	Finding	
	• Maternity services (uncomplicated and assisted deliveries) • Family planning services • Youth Friendly Services clinic • TB services • Outreach activities • VIA screening for cervical cancer	
Commonest conditions	Adults: • Malaria • URTIs • HIV and STIs • Diarrhoeal disease	Children under five: • Diarrhoeal disease • Malaria • URTIs
Fees	All services are free of charge	
Referral	Refers to Lisungwe Hospital. Cost for private transport is between MWK6,000 and MWK8,000 (equivalent to US$3.56 and US$4.75) to hospital on a motorcycle	
Beds	One short stay bed and fifteen maternity beds	
Staff	Staff complement between 50% and 60% compared to allocated positions	
Water	Have own borehole, supply stable	
Electricity	Connected to the main Escom grid	
Waste	Domestic waste is burned in a pit, while biohazardous waste is incinerated and then thrown in the same pit	
Challenges	• Inadequate infrastructure. Uses temporary structure to perform observations • Transport, both for access to health centre and for referral to Lisungwe • Require better and more diagnostic equipment	
Tedzani Health Centre		
Overview	The facility has a target population of 3,100 people, including 300 Egenco employees and their dependents. The clinic is owned by Egenco. It typically costs patients MWK5,000 (equivalent to US$2.97) in transport fees to get to the facility. The facility is in the process of expanding and a maternity wing and laboratory service will be added within the next few months	
Services	See between 20 and 30 patients a day. Services include: • Primary healthcare • Antenatal care • HIV and STI management services, including ART clinic • Under five year clinic • Family planning services	
Commonest conditions	• Diarrhoeal disease • URTIs • Malaria	
Fees	Certain services are free of charge, including Malaria diagnosis and treatment, antenatal care, HIV counselling and testing, ART and treatment of STIs. A typical consultation will cost MWK500 (equivalent to US$0.30) and may include basic medication. Any additional tests and medication will incur additional costs	
Referral	Refers to Lisungwe Hospital. The facility has its own ambulance and the service is free. Takes approximately one hour	
Beds	One short stay bed	
Staff	Staff complement at four persons at present. To be expanded when maternity and laboratory opens	
Water	Connected to Egenco supply and stable	
Electricity	Connected to the main Escom grid	
Waste	Managed by Egenco	
Challenges	Delay of expansion. Laboratory and maternity have been delayed. Equipment in place but not able to use	

Typical Examples of Health Infrastructure within the Study Area (1)



1: Entrance to the Queen Elizabeth Central Hospital (Blantyre District)

2: Weigh Station at Chikowa Health Centre

3: Current State of Disrepair at Chikowa Health Centre

Typical Examples of Health Infrastructure within the Study Area (2)

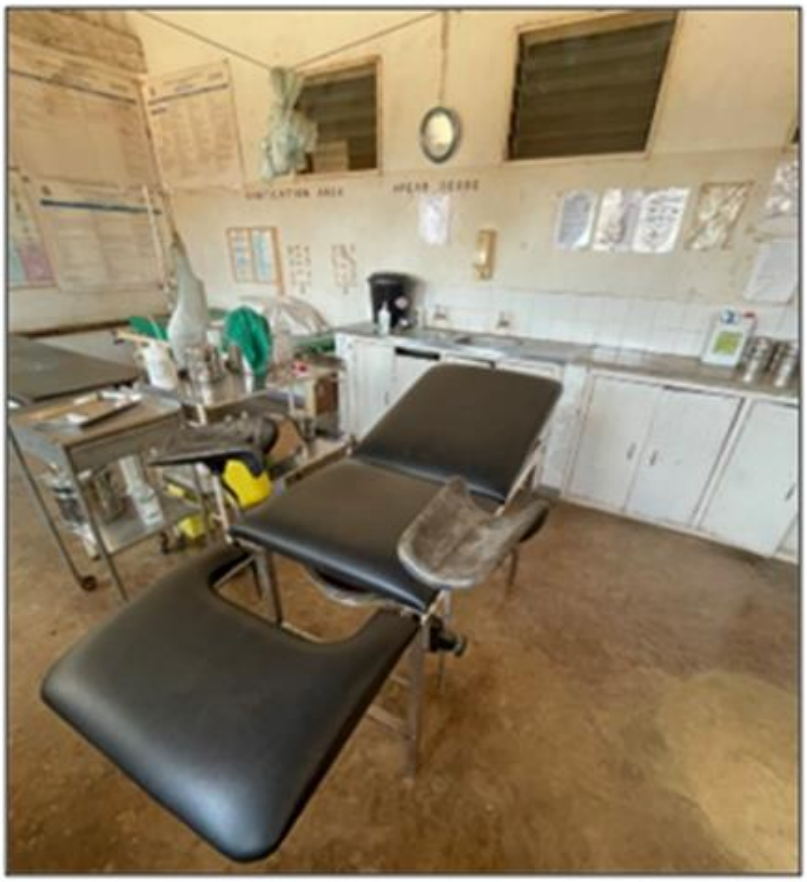
1: Solar Powered Water Supply

2: Outreach Motorcycles Stored in Health Centre

3: Short Stay Room at Dziwe Health Centre

4: Leaking Water Tank and Improperly Discarded Waste

Typical Examples of Health Infrastructure within the Study Area (3)



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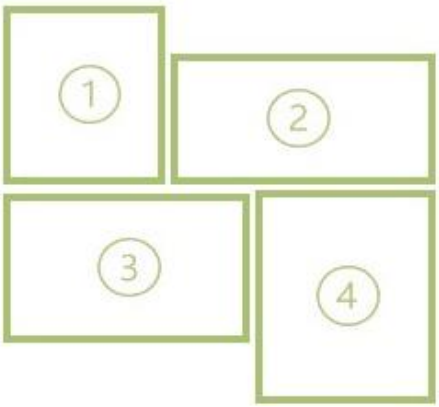
1: Entrance to Neno District Hospital

2: Maternity Ward at Luwani Health Centre

3: Delivery Room at Luwani Health Centre

Typical Examples of Health Infrastructure within the Study Area (4)



1: Consulting Room at Chifunga Health Centre

2: Chifunga Health Centre

3: Consulting Room at Tedzani Health Centre

4: Weigh Station at Tedzani Health Centre

Annex 5-8: Examples of Species Supporting Provisioning of Cultural Ecosystem Services

Typical Examples of Provisioning Ecosystem Services within the Study Area (1)

1: *Cordyla Africana* © Bernard DUPONT (CC BY-SA 2.0) (no changes made)

2: *Dichrostachys glomerata* © Lalithamba (CC BY 2.0) (no changes made)

3: *Eriosema affine* © BT Wursten

4: *Gmelina arborea Roxb.* © BT Wursten

Typical Examples of Provisioning Ecosystem Services within the Study Area (2)

1: *Newtonia buchananii* © S Dondeyne

2: *Mangifera indica* © B.navez

3: *Piliostigma thonningii* © Js St Guily

4: *Pleurostylia spp.* © B.navez

Typical Examples of Provisioning Ecosystem Services within the Study Area (3)

1: *Kigelia Africana* © Ettore Balocchi (upper left), Bjørn Christian Tørrissen (upper right), Marco Schmidt (bottom left), Genet (bottom right) (CC BY-SA 3.0) (no changes made)

2: *Kirkia acuminata* © John Becking

3: *Lepus saxatilis* © Bernard DUPONT (CC BY-SA 2.0) (no changes made)

4: *Lonchocarpus capassa* © Grow_wild

Typical Examples of Provisioning Ecosystem Services within the Study Area (4)

1: *Erythrina abyssinica* © sarahemcc (CC BY 2.0) (no changes made)

2: *Griselinia Littoralis* © Plantrescue.co.nz

3: *Hystrix africaeaustralis* © Shams Faraz Amir

4: *Flacourtia indica* © J.M.Garg (CC BY 3.0) (no changes made)

Typical Examples of Provisioning Ecosystem Services within the Study Area (5)

1: *Sylvicapra grimmia* © Bernard DUPONT (CC BY-SA 2.0) (no changes made)

2: *Tamarindus indica* © Photoongraphy

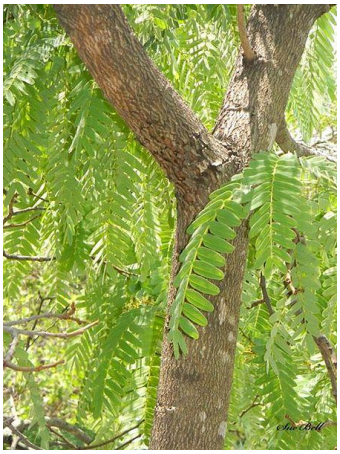
3: *Ximenia caffra* © Bernard DUPONT (CC BY-SA 2.0) (no changes made)

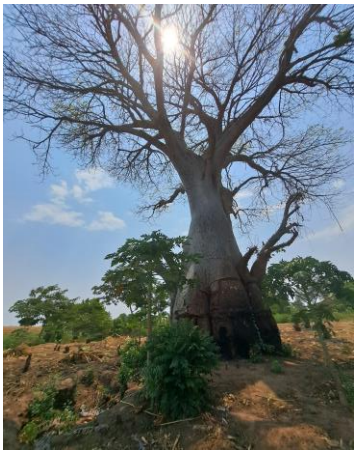
4: *Sterculia quinqueloba* © John Robert McPherson (CC BY-SA 4.0) (no changes made)

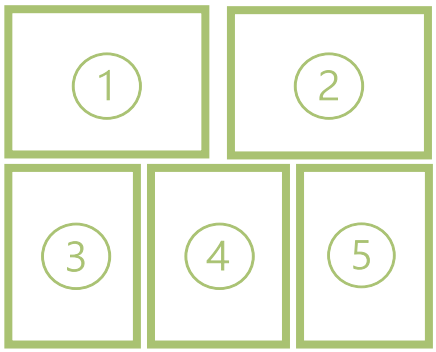
5: *Psidium guajava L.* © SLR Consulting

6: *Uapaca kirkiana* © Ton Rulkens

Typical Examples of Provisioning Ecosystem Services within the Study Area (6)







1: *Aloe Vera © Le Jardin du Pic Vert*

2: *Albizia chinensis (Osbeck) Merr.* © Dinesh Valke

3: *Brachystegia boehmii* © Sue Christian Bell (CC BY-SA 3.0) (no changes made)

4: *Adansonia digitata* © SLR Consulting

5: *Carica papaya* © SLR Consulting

Typical Examples of Provisioning Ecosystem Services within the Study Area (7)

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1: *Annona spp.* © Maksud

2: *Cajanus cajan* © SLR Consulting

3: *Capsicum annuum* © Jibrilenterprise

4: *Cucurbita maxima* © andreas160578

5: *Azadirachta Indica A. Juss.* © Manuel Anastácio (CC BY-SA 3.0) (no changes made)

Typical Examples of Provisioning Ecosystem Services within the Study Area (8)

1: *Mondia whitei* © Bart Wursten

2: *Moringa oleifera* © Jeff Kingma

3: *Luffa cylindrica (L.) N. Roem.* © SLR Consulting

4: *Panicum monticolum* © SLR Consulting

5: *Persea americana* © Sandid

Typical Examples of Provisioning Ecosystem Services within the Study Area (9)

1: *Pterocarpus angolensis* © Susan Adams (CC BY-SA 2.0) (no changes made)

2: *Sclerocarya birrea* © Rotational

3: *Ricinus communis L.* © SLR Consulting

4: *Psidium guajava L.* © SLR Consulting

5: *Pseudolachnostylis maprouneifolia* © Bernard DUPONT (CC BY-SA 2.0) (no changes made)

Screening of Ecosystem Services

Ecosystem Services			Terrestrial Woodland / Forest	Riparian Woodland	Secondary Shrubland	Water / River (Lotic Ecosystem)	Wetland	Cropland and Cultivated Areas	Residential Areas	Bare Rock/Soils	Beneficiaries
Habitats or vegetation association[90]			• Forest / Thicket (Non-riparian) • Miombo Woodland • Undifferentiated Woodlands	• Riparian Woodland / Forest / Thicket Mosaic	• Secondary Shrubland • Secondary Shrubland (Miombo) • Secondary Shrubland (Undifferentiated) • Secondary Shrubland (Wooded Grassland)	• Water - Man-Made Dams • Water - Natural	• Wetland • Wetland (Woody Grassland)	• Cropland - Commercial • Cropland - Small Scale • Plantations and Woodlots	• Settlements	• Bare Rock/Soils	
Provisional	Food	Game meat	*Hunting	*Hunting	*Hunting						*Reports of hunting in surveyed villages
		Wild plants, nuts, mushrooms fruits, honey	*Beekeeping	*Beekeeping	*Beekeeping		**Resources collected	*Beekeeping			**Beekeeping and the sale of honey is a secondary source of income for some households (Section 5.20.4) *Various resources collected by villagers (Section 5.17.1.2C)
		Cultivated crops		*Subsistence Farming **Commercial Ranches		***Floodplain Agriculture ****Irrigation		*Subsistence Farming **Commercial Ranches			*Subsistence agriculture is widespread across the study area. It is the main source of income for close to 30% of households (Section 5.20.1). **16 Commercial Ranches found along the riverbanks of the Shire within or close to the reservoir area (Sections 5.20.5) *** Flooding of agricultural land close the riverbanks during the rainy season renders them more fertile /arable during the dry season (Section 5.17.3). ****The Shire and its tributaries can be used for irrigation with the use irrigation pumps in both subsistence and commercial farms (Section 5.17.3).
		Livestock farming		*Commercial Livestock farming **Hay for livestock	*Commercial Livestock Farming **Hay for Livestock ***Subsistence Livestock Farming					***Used for Grazing	* 16 Commercial ranches along the riverbanks within or close to the reservoir area (0) **Hay for livestock is collected along the riverbanks during the rainy season ***Subsistence Livestock farming is widespread across the study area (Section 5.20.4). ***Rocky terrain along 400 KV Transmission Line and riverbanks used as grazing ground for cattle, sheep and goats (Section 5.17.1).

[90] As per figure 14 (p.33) of the Terrestrial Ecology Baseline (revA, dated 28 July 2023)

Ecosystem Services		Terrestrial Woodland / Forest	Riparian Woodland	Secondary Shrubland	Water / River (Lotic Ecosystem)	Wetland	Cropland and Cultivated Areas	Residential Areas	Bare Rock/Soils	Beneficiaries
Habitats or vegetation association[90]		• Forest / Thicket (Non-riparian) • Miombo Woodland • Undifferentiated Woodlands	• Riparian Woodland / Forest / Thicket Mosaic	• Secondary Shrubland • Secondary Shrubland (Miombo) • Secondary Shrubland (Undifferentiated) • Secondary Shrubland (Wooded Grassland)	• Water - Man-Made Dams • Water - Natural	• Wetland • Wetland (Woody Grassland)	• Cropland - Commercial • Cropland - Small Scale • Plantations and Woodlots	• Settlements	• Bare Rock/Soils	
	Wild-caught fish				*Fishing					*12.8% of respondents fish along the Riverbanks of the Shire River and its tributaries. Most fishing occurs during the dry season as water flows are slower. Most of the fish caught is used for subsistence and the rest is sold. (Section 5.17.3)
	Commercial fish farming				*Fish Farming					*3% of respondents indicated they engaged in commercial fish farming (Sections 5.17.3 and 5.20.7).
Freshwater				*Boreholes	**Fresh water for Household use ***water reservoirs. ***Watering Livestock		*Boreholes	*Boreholes		*Boreholes are spread across the study area. They are used as a source of freshwater for households, irrigation, and livestock. **A number of streams and rivers are used as sources of freshwater (drinking, laundry, bathing) for households in Blantyre, Neno and Chikwawa Districts. (Section 5.17.3). ***Shire river and tributaries serve to supply fresh water to artificial reservoirs used for households, irrigation, fisheries and environmental conservation (Section 5.17.3). ** The Shire river and its tributaries are used to water livestock (14% of households) (Section 5.17.3) ****The Shire and its tributaries can be used for irrigation with the use irrigation pumps in both subsistence and commercial farms. This is mostly done in the dry season (Section 5.17.3)

Ecosystem Services	Terrestrial Woodland / Forest	Riparian Woodland	Secondary Shrubland	Water / River (Lotic Ecosystem)	Wetland	Cropland and Cultivated Areas	Residential Areas	Bare Rock/Soils	Beneficiaries
Habitats or vegetation association[90]	• Forest / Thicket (Non-riparian) • Miombo Woodland • Undifferentiated Woodlands	• Riparian Woodland / Forest / Thicket Mosaic	• Secondary Shrubland • Secondary Shrubland (Miombo) • Secondary Shrubland (Undifferentiated) • Secondary Shrubland (Wooded Grassland)	• Water - Man-Made Dams • Water - Natural	• Wetland • Wetland (Woody Grassland)	• Cropland - Commercial • Cropland - Small Scale • Plantations and Woodlots	• Settlements	• Bare Rock/Soils	
Biomass fuel	*Charcoal **Firewood	*Charcoal **Firewood	*Charcoal **Firewood						*Charcoal Making / Burning is widespread across the surveyed area and used as an energy source and for sale. It is the main source of income for almost 15% of households (Sections 5.20.6, and 5.20.1) **Firewood for household use is collected wherever possible.
Construction : timber bamboo, grass, soil and clay.	*Timber	*Timber **Bamboo and Grass	***Soil and Clay for brickmaking and pottery						*Timber is used for construction. All villages collect this resource **Bamboo and grass are collected for construction purposes (e.g. thatch roofs, mats, mattresses) (Section 5.17.3). ***Brickmaking is widespread across the surveyed area and is primarily used for construction / housing. Clay is also used for pottery making.
Transportation				*Transportation					*Shire River used as means of transportation. Use of small boats to access cultivated land on the other bank, visit relatives, access markets, etc (Section 5.17.3).
Biochemicals, natural medicines, pharmaceuticals	*Medicinal Plants	*Medicinal Plants	*Medicinal Plants		*Medicinal Plants				*A range of medicinal plants and herbs are collected in forests, shrubs and along the riverbanks (Sections 5.17.1)
Artisanal Mining : Sand and stone			*Artisanal rock mining	*Artisanal gold panning				**Sand mining	*Artisanal rock mining extracted from mountainous areas in Phombeya Village (Section 5.20.9) **Community based artisanal gold panning along the Lisungwi River (Section 5.20.9). **Some artisanal sand mining reported. Used as construction material (Section 5.17.3).
Ornamental resources									

Ecosystem Services		Terrestrial Woodland / Forest	Riparian Woodland	Secondary Shrubland	Water / River (Lotic Ecosystem)	Wetland	Cropland and Cultivated Areas	Residential Areas	Bare Rock/Soils	Beneficiaries
Habitats or vegetation association[90]		• Forest / Thicket (Non-riparian) • Miombo Woodland • Undifferentiated Woodlands	• Riparian Woodland / Forest / Thicket Mosaic	• Secondary Shrubland • Secondary Shrubland (Miombo) • Secondary Shrubland (Undifferentiated) • Secondary Shrubland (Wooded Grassland)	• Water - Man-Made Dams • Water - Natural	• Wetland • Wetland (Woody Grassland)	• Cropland - Commercial • Cropland - Small Scale • Plantations and Woodlots	• Settlements	• Bare Rock/Soils	
Cultural	Spiritual or religious value	*Sacred trees	*Sacred trees	*Sacred trees	**Ceremonies	**Ceremonies				*Presence of sacred trees in the surveyed area, including the main reservoir (Section 5.21) **29% of respondents use the river and riverbanks for religious and cultural ceremonies (baptisms, initiation ceremonies) (Section 5.17.3)
	Cultural Heritage value	*Cultural Heritage elements	*Cultural Heritage elements	*Cultural Heritage elements	*Cultural Heritage elements	*Cultural Heritage elements				*Tangible and intangible cultural heritage elements (graveyards, archaeological ruins, sacred sites, streams) found in the main reservoir area, regulating dam ,400 KV transmission line and downstream area (Section 5.21.2)
	Recreation and tourism	*Majete Wildlife Reserve	*Majete Wildlife Reserve	*Majete Wildlife Reserve	**Recreation	***Elephant Marsh				*Sustainable tourism in Majete Wildlife Reserve **Children may use the Shire River and its tributaries for recreational purposes (Section 5.17.3). *** The Elephant Marsh located in the Lower Shire Valley and is tourist attraction (Section 5.20.8)
	Intrinsic value of biodiversity	*Majete Wildlife Reserve	*Majete Wildlife Reserve	*Majete Wildlife Reserve						*Majete Wildlife Reserve is a protected area where biodiversity is valued (Volume 3 'Ecology' of Chapter 5 'E&S Baseline')

Annex 5-9: Aquatic Baseline Survey Field Itineraries

Fish and IHI (July/Aug 2023)

Date	Task – Fish (D Tweddle with CIA team)	Overnight
08 July 2023 (Sat)	D Tweddle arrives in Malawi	Blantyre
09 July 2023 (Sun)	-	Blantyre
10 July 2023 (Mon)	Sample sites 2a and 4a	Blantyre
11 July 2023 (Tues)	Sample site 5a	Blantyre
12 July 2023 (Wed)	Sample Sites 4b, 3	Chikawa
13 July 2023 (Thurs)	Sample Sites 5 and 5b	Chikawa
14 July 2023 (Fri)	Sample Site 5c	Chikawa
15 July 2023 (Sat)	Sample Site 5c	Chikawa
16 July 2023 (Sun)	Sample Site 7	Chikawa
17 July 2023 (Mon)	Sample Site 6a-e	Chikawa
18 July 2023 (Tues)	Sample Site 6a-e	Chikawa
19 July 2023 (Wed)	Sample Site 6a-e	Chikawa
20 July 2023 (Thur)	Sample Site 1	Blantyre
	Task – Fish and IHI D Tweddle and R Palmer with TBC team	
23 July 2023	R Palmer arrives in Malawi	
24 July 2023	Mvuza 3, downstream	Chikawa
25 July 2023	Mvuza 2, central Mvuza 1, upstream	Chikawa
26 July 2023	Lukubula 3, upstream Lukubula 2, scarp base Lukubula 1, crossing	Chikawa
27 July	Nkalazi 3, 2 and 1	Chikawa
28 July	Nkujidi 1 and 2	Blantyre
29 July	Nkujidi 3 Unnamed tributary T1	Blantyre
30 July 2023	D Tweddle departs Malawi	Blantyre
	Task – IHI only R Palmer with Manasseh	
31 July 2023	Lisungwe 2 and 3	Balaka
1 Aug 2023	Lisungwe 4. 5 & 6	Balaka
2 Aug 2023	Lisungwe River 7, 8, 9, 10 and 11	Zalewa
3 Aug 2023	Mkulumadzi 1, 2, 3 & 4	Zalewa
4 Aug 2023	Mkulumadzi 5 & 6	Zalewa
5 Aug 2023	Travel and feedback to MHPL	Blantyre
6 Aug 2023	Depart Malawi	

Aquatic Ecology & Fish (Sept 2023):

DATE	TASK – AQUATICS (ROB PALMER)	TASK – FISH & FISHERIES (MEXFORD MULUMPWA)	OVERNIGHT
07 Sep 2023 (Thu)	-	Checked in at Chris Star Lodge in Blantyre	Blantyre
08 Sep 2023 (Fri)	-	Identified fishers from Blantyre side of Mpatamanga main reservoir site to be interviewed the following week.	Blantyre
09 Sep 2023 (Sat)	-	Identified fishers from Neno side of Mpatamanga main reservoir site to be interviewed the following week.	Blantyre
10 Sep 2023 (Sun)	-	Rest.	Blantyre
11 Sep 2023 (Mon)	Travel South Africa to Blantyre. Planning Meeting with Manasseh Matemba and Ibrahim Mitole.	Reviewing fisher questionnaire.	Blantyre
12 Sep 2023 (Tue)	Surveyed Shire River at Mpatamanga immediately upstream of proposed dam. Set baited funnel trap for crabs. Set UV light trap for nocturnal insects. Visited Mpatamanga gorge.	Assisted fish sampling, fish identification and arranged sampling of fisher catches.	Geotech Camp
13 Sep 2023 (Wed)	Checked crab trap and UV light trap. Surveyed Shire River ~900 m downstream of proposed dam at, and associated Seepage Wetland. Visited proposed reservoir site, but water level was too high to sample invertebrates and fish.	Sampled catch of fishers. Interviewed fishers on Blantyre side of Mpatamanga main reservoir site. Travelled to Zalewa and checked in at Nkunkhu Lodge.	Zalewa
14 Sep 2023 (Thu)	Arranged permission to access Nkula HPP. Surveyed Shire River downstream of Tedzani HPP. Collected bilharzia snails in Tedzani reservoir. Set baited funnel trap for crabs and UV light trap for nocturnal insects near Zalewa.	Assisted fish sampling of fishers' catch at Zalewa on Shire River. Interviewed 2 fishers found fishing on Shire River at Zalewa. Interviewed 16 fishers on the Neno side of Mpatamanga main reservoir site.	Zalewa
15 Sep 2023 (Fri)	Checked crab trap and UV light trap at Zalewa. Surveyed Shire River downstream of Nkula HPP. Surveyed bilharzia snails in Nkula reservoir. Surveyed Shire River in Tedzani reservoir. Sampled Fish near Zalewa.	Sampled fish on Shire River at Zalewa. Sampled fish at Nkula HPP. Sampled fish at Tedzani reservoir.	Zalewa
16 Sep 2023 (Sat)	Surveyed Shire River near proposed regulating dam. Surveyed macroinvertebrates at near Zalewa	Sampled fish at regulating dam site.	Blantyre
17 Sep 2023 (Sun)	Data capture, identifications and macro-photographs of aquatic macroinvertebrates.	Started entering fisher questionnaire data.	Blantyre
18 Sep 2023 (Mon)	Surveyed Shire River in Kapichira reservoir, and further upstream (IHI only). Set UV light trap at Ng'ona Lodge.		Ng'ona Lodge

DATE	TASK – AQUATICS (ROB PALMER)	TASK – FISH & FISHERIES (MEXFORD MULUMPWA)	OVERNIGHT
19 Sep 2023 (Tue)	Checked light trap. Surveyed Mkulumadzi River. Assessed habitats at five sites in the Mkulumadzi River. Surveyed Shire River upstream of confluence with Mkulumadzi River. Visited Shire River downstream of confluence with Mkulumadzi River (IHI only). Set UV light trap at Ng'ona Lodge.		Ng'ona Lodge
20 Sep 2023 (Wed)	Checked light trap. Surveyed Shire River at Ng'ona Lodge. Drove to Blantyre		Blantyre
21 Sep 2023 (Thu)	Debriefing Meeting Data capture	Debriefing Meeting. Drove to Salima.	Blantyre
22 Sep 2023 (Fri)	Travelled from Blantyre to South Africa.	-	-

Annex 5-10: Aquatic Ecosystem Types

Aquatic Ecosystem Classification

Site Code: **S-7.1 W**
River: Shire
Date: 2023/09/13

Figure A: Hillslope Seep

Level 1: System	
Inland	✓
Estuarine	-

Level 3: Landscape	
Valley Floor	-
Slope	✓
Plain	-
Bench - Hilltop	-
Bench - Saddle	-
Bench - Shelf	-

Level 4: HGM Unit	
Channel (River) - Zone	
Source	-
Mountain Headwater	-
Mountain Stream	-
Transitional	-
Upper Foothill	-
Lower Foothill	-
Lowland River	-
Rejuvenated Cascade	-
Rejuvinated Foothill	-
Upland Floodplain	-
Wetland	
Depression - Endorheic	-
Depression - Exorheic	-
Hillslope Seep	✓
Basin Seep	-
Valley Bottom - No Channel	-
Valley Bottom - Channel	-
Floodplain - Channel	-
Floodplain - Depression	-
Floodplain - Flat	-
Floodplain - Meander Cut-off	-
Lake	-
Estuary	-
Artificial	
Dam	-
Canal	-

Level 5: Hydrological Regime	
5a) Flow regime / Inundation	
Permanent	✓
Seasonal	-
Intermittent	-
Never	-
Unknown	-
5b) Saturation	
Permanent	✓
Seasonal	-
Intermittent	-
Never	-
Unknown	-
5c) Depth Class	
Limnetic (≥ 2m max depth)	-
Littoral (≤ 2m max depth)	✓
Unkown	-

Level 2: Regional Setting	
Freshwater Ecoregion of the World:	Lake Malawi

Level 6a: Biotopes	(0-6)
Natural	
Waterfall	-
Cascade	-
Rapid	-
Riffle	-
Run	-
Glide	-
Pool	3
Backwater	-
Inundation	-
Spring	5
Seep	4
Artificial	
Canal	-
Dam (in-channel)	-
Dam (off-channel)	-
Excavation	-
Salt Works	-
WWTW pond	-
Irrigated Land	-
Stormwater Pond	-
Other	-

Level 6e: Vegetation Cover	(0-6)
Aquatic	
Floating	-
Submerged	3
Emergent	5
Herbaceous	
Grasses	4
Herbs	5
Geophytes	-
Sedges/Rushes	4
Reeds	1
Restios	-
Palmiet	-
Palms	-
Crops	-
Shrubs	
Shrubs	1
Thicket	2
Trees	
Plantation	-
Riparian Forest - Natural	-
Swamp Forest	-
Other	-

Level 6b: Salinity	
Fresh (<500 mS/m)	✓
Brackish (500-3 000 mS/m)	-
Saline (3 000 - 8 000 mS/m)	-
Hypersaline (>8 000 mS/m)	-

Level 6c: pH	
Acidic (<6)	-
Circum-neutral (6-8)	✓
Alkaline (>8)	-

Level 6d: Substrate Types	(0-6)
Organic (>10% organic)	
Leaves/Detritus	-
Organic (<30% organic)	-
Peat (>30% organic)	-
Mineral Soils (<10% organic)	
Salt	-
Clay	3
Loam	5
Silt (<0.125)	3
Sand - Fine (0.125-0.5)	-
Sand - Coarse (0.5-2.0)	-
Other	-
Rocky	
Gravel - F (2-8)	-
Gravel - M (8-16)	-
Gravel - C (16-64)	-
Cobble - Small (64-128)	-
Cobble - Large (128-250)	3
Boulder - Small (250-500)	-
Boulder - Medium (500-1000)	-
Boulder - Large (1000-4000)	-
Bedrock	
Waterfall	-

Rating categories

0 = not present
1 = rare (>0–5%)
2 = sparse (>5–25%,)
3 = common (>25–50%)
4 = abundant (>50–75%)
5 = predominant (>75–95%)
6 = near-entire (>95–100%)

Reference: Ollis *et al.* (2013).

Aquatic Ecosystem Classification

Site Code: **S-7.1**
River: Shire
Date: 2023/09/13

Figure A: Perennial Upper Foothill.

Level 1: System	
Inland	✓
Estuarine	-

Level 3: Landscape	
Valley Floor	✓
Slope	-
Plain	-
Bench - Hilltop	-
Bench - Saddle	-
Bench - Shelf	-

Level 4: HGM Unit	
Channel (River) - Zone	
Source	-
Mountain Headwater	-
Mountain Stream	-
Transitional	-
Upper Foothill	✓
Lower Foothill	-
Lowland River	-
Rejuvenated Cascade	-
Rejuvinated Foothill	-
Upland Floodplain	-
Wetland	
Depression - Endorheic	-
Depression - Exorheic	-
Hillslope Seep	-
Basin Seep	-
Valley Bottom - No Channel	-
Valley Bottom - Channel	-
Floodplain - Channel	-
Floodplain - Depression	-
Floodplain - Flat	-
Floodplain - Meander Cut-off	-
Lake	-
Estuary	-
Artificial	
Dam	-
Canal	-

Level 5: Hydrological Regime	
5a) Flow regime / Inundation	
Permanent	✓
Seasonal	-
Intermittent	-
Never	-
Unknown	-
5b) Saturation	
Permanent	✓
Seasonal	-
Intermittent	-
Never	-
Unknown	-
5c) Depth Class	
Limnetic (≥ 2m max depth)	-
Littoral (≤ 2m max depth)	✓
Unkown	-

Level 2: Regional Setting	
Freshwater Ecoregion of the World:	Lake Malawi

Level 6a: Biotopes	(0-6)
Natural	
Waterfall	-
Cascade	3
Rapid	5
Riffle	2
Run	2
Glide	3
Pool	-
Backwater	2
Inundation	-
Spring	-
Seep	-
Artificial	
Canal	-
Dam (in-channel)	-
Dam (off-channel)	-
Excavation	-
Salt Works	-
WWTW pond	-
Irrigated Land	-
Stormwater Pond	-
Other	-

Level 6e: Vegetation Cover	(0-6)
Aquatic	
Floating	-
Submerged	-
Emergent	2
Herbaceous	
Grasses	4
Herbs	3
Geophytes	-
Sedges/Rushes	2
Reeds	3
Restios	-
Palmiet	-
Palms	-
Crops	-
Shrubs	
Shrubs	3
Thicket	2
Trees	
Plantation	-
Riparian Forest - Natural	1
Swamp Forest	-
Other	-

Level 6b: Salinity	
Fresh (<500 mS/m)	✓
Brackish (500-3 000 mS/m)	-
Saline (3 000 - 8 000 mS/m)	-
Hypersaline (>8 000 mS/m)	-

Level 6c: pH	
Acidic (<6)	-
Circum-neutral (6-8)	-
Alkaline (>8)	✓

Level 6d: Substrate Types	(0-6)
Organic (>10% organic)	
Leaves/Detritus	-
Organic (<30% organic)	-
Peat (>30% organic)	-
Mineral Soils (<10% organic)	
Salt	-
Clay	-
Loam	-
Silt (<0.125)	2
Sand - Fine (0.125-0.5)	4
Sand - Coarse (0.5-2.0)	-
Other	-
Rocky	
Gravel - F (2-8)	-
Gravel - M (8-16)	-
Gravel - C (16-64)	-
Cobble - Small (64-128)	-
Cobble - Large (128-250)	2
Boulder - Small (250-500)	3
Boulder - Medium (500-1000)	4
Boulder - Large (1000-4000)	5
Bedrock	3
Waterfall	-

Rating categories

0 = not present
1 = rare (>0–5%)
2 = sparse (>5–25%,)
3 = common (>25–50%)
4 = abundant (>50–75%)
5 = predominant (>75–95%)
6 = near-entire (>95–100%)

Reference: Ollis *et al.* (2013).

Aquatic Ecosystem Classification

Site Code: **S-7.6**
River: Shire
Date: 2023/09/18

Figure A: Perennial Lower Foothill.

Level 1: System	
Inland	✓
Estuarine	-

Level 3: Landscape	
Valley Floor	✓
Slope	-
Plain	-
Bench - Hilltop	-
Bench - Saddle	-
Bench - Shelf	-

Level 4: HGM Unit	
Channel (River) - Zone	
Source	-
Mountain Headwater	-
Mountain Stream	-
Transitional	-
Upper Foothill	-
Lower Foothill	✓
Lowland River	-
Rejuvenated Cascade	-
Rejuvinated Foothill	-
Upland Floodplain	-
Wetland	
Depression - Endorheic	-
Depression - Exorheic	-
Hillslope Seep	-
Basin Seep	-
Valley Bottom - No Channel	-
Valley Bottom - Channel	-
Floodplain - Channel	-
Floodplain - Depression	-
Floodplain - Flat	-
Floodplain - Meander Cut-off	-
Lake	-
Estuary	-
Artificial	
Dam	-
Canal	-

Level 5: Hydrological Regime	
5a) Flow regime / Inundation	
Permanent	✓
Seasonal	-
Intermittent	-
Never	-
Unknown	-
5b) Saturation	
Permanent	✓
Seasonal	-
Intermittent	-
Never	-
Unknown	-
5c) Depth Class	
Limnetic (≥ 2m max depth)	-
Littoral (≤ 2m max depth)	✓
Unkown	-

Level 2: Regional Setting	
Freshwater Ecoregion of the World:	Lake Malawi

Level 6a: Biotopes	(0-6)
Natural	
Waterfall	-
Cascade	-
Rapid	1
Riffle	2
Run	4
Glide	3
Pool	2
Backwater	2
Inundation	-
Spring	-
Seep	-
Artificial	
Canal	-
Dam (in-channel)	-
Dam (off-channel)	-
Excavation	-
Salt Works	-
WWTW pond	-
Irrigated Land	-
Stormwater Pond	-
Other	-

Level 6e: Vegetation Cover	(0-6)
Aquatic	
Floating	-
Submerged	-
Emergent	2
Herbaceous	
Grasses	4
Herbs	3
Geophytes	-
Sedges/Rushes	2
Reeds	3
Restios	-
Palmiet	-
Palms	-
Crops	-
Shrubs	
Shrubs	3
Thicket	2
Trees	
Plantation	-
Riparian Forest - Natural	2
Swamp Forest	-
Other	-

Level 6b: Salinity	
Fresh (<500 mS/m)	✓
Brackish (500-3 000 mS/m)	-
Saline (3 000 - 8 000 mS/m)	-
Hypersaline (>8 000 mS/m)	-

Level 6c: pH	
Acidic (<6)	-
Circum-neutral (6-8)	-
Alkaline (>8)	✓

Level 6d: Substrate Types	(0-6)
Organic (>10% organic)	
Leaves/Detritus	-
Organic (<30% organic)	-
Peat (>30% organic)	-
Mineral Soils (<10% organic)	
Salt	-
Clay	-
Loam	-
Silt (<0.125)	3
Sand - Fine (0.125-0.5)	4
Sand - Coarse (0.5-2.0)	-
Other	-
Rocky	
Gravel - F (2-8)	-
Gravel - M (8-16)	-
Gravel - C (16-64)	-
Cobble - Small (64-128)	1
Cobble - Large (128-250)	2
Boulder - Small (250-500)	3
Boulder - Medium (500-1000)	4
Boulder - Large (1000-4000)	2
Bedrock	
Waterfall	-

Rating categories

0 = not present
1 = rare (>0–5%)
2 = sparse (>5–25%,)
3 = common (>25–50%)
4 = abundant (>50–75%)
5 = predominant (>75–95%)
6 = near-entire (>95–100%)

Reference: Ollis *et al.* (2013).

Annex 5-11: List of Diatoms

The table below lists diatoms recorded in the Shire River in September 2023, expressed as the number recorded out of a total count of 400. Species are listed alphabetically. Numbers in brackets () indicate the number of unidentified species.

Table 5-224: Diatoms Recorded in the Shire River in September 2023

Species	S+48.0	S+35.7	S-29.3	S+7.1	S-0.2	S-12.2
ACHNANTHIDIUM F.T. Kützing		1	2		10	
AMPHORA C. G. Ehrenberg			2	1	2	1
AULACOSEIRA G.H.K. Thwaites		7	4 (2)	1	2(2)	2
Aulacoseira granulata (Ehrenberg) Simonsen		8				
Aulacoseira granulata var. angustissima O.M. Simonsen				1		
Bacillaria paradoxa Gmelin					3	
COCCONEIS C.G. Ehrenberg			2			67
Cocconeis placentula Ehrenberg				12		
CRATICULA A. Grunow		1				
CYCLOTELLA F.T. Kützing					1	
Cyclotella ocellata Pantocsek					1	
CYMBELLA C. Agardh					1	
Cymbella tumida (Brebisson) Van Heurck		2		1	3	6
DIPLONEIS C.G. Ehrenberg					1	
Encyonema mesianum (Cholnoky) D.G. Mann				1		
Encyonopsis leei var. *sinensis* Metzeltin & Krammer			2			
EOLIMNA Lange-Bertalot & Schiller			11		5	29
Eolimna subminuscula (Manguin) Moser Lange-Bertalot & Metzeltin						1
FRAGILARIA H.C. Lyngbye					17	
Fragilaria capucina Desmazieres var.capucina	12	2	7			10
Fragilaria ungeriana Grunow	35	1				4
Fragilaria vaucheriae (Kützing) Petersen				1		
FRUSTULIA L. Rabenhorst						1
GEISSLERIA Lange-Bertalot & Metzeltin	4	1	45	22	23	18
GOMPHONEMA C.G. Ehrenberg	107 (2)	12 (2)	12 (3)	90 (3)	74 (4)	64 (3)
Gomphonema minutum (Agardh) Agardh f. *minutum*	1					
Gomphonema parvulum (Kützing)		8				
GOMPHONITZSCHIA A. Grunow		20	15	19	3	11
GYROSIGMA A. Hassall		3				
Hantzschia amphioxys (Ehrenberg) Grunow				2		
LUTICOLA D.G. Mann			3	2	22	
MAYAMAEA Lange-Bertalot				1	1	1
NAVICULA J.B.M. Bory de St. Vincent		6 (3)	14 (3)	6 (3)	9 (3)	2
Navicula antonii Lange-Bertalot				1		
Navicula radiosa Kützing		1				
Navicula recens (Lange-Bertalot) Lange-Bertalot				1		
Navicula rostellata Kützing				1	1	
Navicula schroeteri var. *symmetrica* (Patrick) Lange-Bertalot			49	14	1	3

Species	S+48.0	S+35.7	S-29.3	S+7.1	S-0.2	S-12.2
Navicula small species					2	
Navicula veneta Kützing			1			1
NITZSCHIA A.H. Hassall	234 (3)	29 (7)	70 (5)	117 (7)	137 (8)	64 (8)
Nitzschia amphibia Grunow			5		5	
Nitzschia amplectens Hustedt		60	1	4	1	20
Nitzschia capitellata Hustedt			1			
Nitzschia clausii Hantzsch		4	9	10	28	4
Nitzschia dissipata (Kützing) Grunow		1	4		1	
Nitzschia draveillensis Coste & Ricard				1		
Nitzschia frustulum (Kützing) Grunow						14
Nitzschia linearis (Agardh) W.M. Smith			1			
Nitzschia nana Grunow			13			7
Nitzschia palea (Kützing) W. Smith				2		
Nitzschia paleacea (Grunow) Grunow				5		
PINNULARIA C.G. Ehrenberg		1				
Planothidium frequentissimum (Lange-Bertalot) Lange-Bertalot		2	1		4	4
Pleurosigma salinarum (Grunow) Cleve & Grunow		1				1
Pleurosira laevis (Ehrenberg) Compére			77	17		34
Pseudostaurosira brevistriata (Grunow) Williams & Round	4	6	30	24	19	26
Rhopalodia hirundiniformis O. Müller			1			
Seminavis strigosa (Hustedt) Danieledis & Economou-Amilli		13	14	14	13	5
STAUROSIRA (C.G. Ehrenberg) D.M. Williams & F.E. Round			1		1	
Staurosira construens Ehrenberg		5				
SYNEDRA C.G. Ehrenberg		2				
Tabularia fasciculata (Agardh) Williams et Round				12		
TRYBLIONELLA W. Smith			3		3	
ULNARIA Compére	3	3		17 (2)	6 (2)	
Total count	**59**	**153**	**300**	**170**	**172**	

Annex 5-12: Macroinvertebrate Data (ZISS1)

Zambian Invertebrate Scoring version 1 (ZISS1)

Date	14-Sep-2023
Site Code	S+48.0
Project	Mpatamanga HPP
Collector	Rob Palmer
River	Shire
Elev (m)	394
Grid	S15.453511 E34.868463
Zonation	D: Upper Foothills

Flow	High
Clarity (NTU)	18
Turbidity	Medium
Colour	Light Brown
Benthic Algae (%)	30
Temp (°C)	24.5
pH	8.7
Cond (mS/m)	27
DO (mg/ℓ)	-
Disturbance	Kamuzu Barrage

Biotopes	(0-5)	Weight
Stones In Current	4	20.0
Stones Out Current	3	10.0
Bedrock	4	5.0
Aquatic Veg	0	0.5
Marg Veg In Current	2	2.0
Marg Veg Out Of Current	4	2.0
Gravel	2	3.5
Sand	2	1.0
Mud	1	0.5
Visual observation	Yes	
BIOTOPE SUITABILITY	68%	B

Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5				
TURBELLARIA (Flatworm)	3				
ANNELIDA					
Oligochaeta (Earthworms)	1				
Hirudinea (Leeches)	3				
CRUSTACEA					
Potamonautidae* (Crabs)	3	1			1
Atyidae (Freshwater Shrimps)	8				
HYDRACARINA (Mites)	8				
PLECOPTERA (Stoneflies)					
Perlidae (True Stoneflies)	12	A			A
EPHEMEROPTERA (Mayflies)					
Baetidae 1sp	4				
Baetidae 2 sp	6				
Baetidae > 2 sp	12	A	B		B
Caenidae (Squaregills/Cainflies)	6	A			A
Dicercomyzidae	9				
Ephemeridae	15				
Ephemerythidae	10				
Heptageniidae (Flatheaded mayflies)	13		A		1
Leptophlebiidae (Prongills)	9		1		1
Machadorythidae	8				
Oligoneuridae (Brushlegged mayflies)	15				
Polymitarcyidae (Pale burrowers)	10				
Prosopistomatidae (Water specs)	15				
Tricorythidae (Stout crawlers)	9	A			A
ODONATA (Dragonflies & Damselflies)					
Calopterygidae (Demoiselles)	10				
Chlorocyphidae (Jewels)	10				
Coenagrionidae (Sprites and Blues)	4				
Lestidae (Emerald Damselflies/Spreadwings)	8				
Platycnemidae (Stream Damselflies)	10				
Protoneuridae (Threadwings)	8				
Aeshnidae (Hawkers & Emperors)	8				
Corduliidae (Cruisers)	8				
Gomphidae (Clubtails)	6				
Libellulidae (Darter/Skimmers)	4	A	1		A
LEPIDOPTERA (Aquatic Caterpillars/Moths)					
Crambidae (Pyralidae)	12				

Taxon	QV	S	Veg	GSM	TOT
HEMIPTERA (Bugs)					
Aphelocheiridae *	5				
Belostomatidae* (Giant water bugs)	3		B		B
Corixidae* (Water boatmen)	3				
Gerridae* (Pond skaters)	5				
Hydrometridae* (Water measurers)	6				
Naucoridae* (Creeping water bugs)	7		A		A
Nepidae* (Water scorpions)	3				
Notonectidae* (Backswimmers)	3				
Pleidae* (Pygmy backswimmers)	4		A		A
Veliidae/M...veliidae* (Ripple bugs)	5				
TRICHOPTERA (Caddisflies)					
Dipseudopsidae	10				
Ecnomidae (Tubecase Netspinning Caddisflie	8				
Hydropsychidae 1 sp	4				
Hydropsychidae 2 sp	6	A			A
Hydropsychidae > 2 sp	12				
Philopotamidae (Fingernet Caddisflies)	10				
Polycentropodidae (Tube Maker Caddisflies)	12				
Cased caddis:					
Calamoceratidae	11				
Hydroptilidae (Microcaddisflies)	6	A			A
Lepidostomatidae (Bizarre Caddisflies)	10				
Leptoceridae (Long-horned Caddisflies)	6		A		A
Pisuliidae (Triangle Caddisflies)	10				
COLEOPTERA (Beetles)					
Dytiscidae/Noteridae* (Diving beetles)	5		A		A
Elmidae/Dryopidae* (Riffle beetles)	8	A			A
Gyrinidae* (Whirligig beetles)	5				
Haliplidae* (Crawling water beetles)	5				
Scirtidae (Marsh beetles)	12				
Hydraenidae* (Minute moss beetles)	8				
Hydrophilidae* (Water scavenger beetles)	5		A		A
Limnichidae (Marsh-Loving beetles)	8				
Psephenidae (Water Pennies)	10				

Taxon	QV	S	Veg	GSM	TOT
DIPTERA (Flies)					
Athericidae (Snipe flies)	10				
Ceratopogonidae (Biting midges)	5				
Chironomidae (Midges)	2		A		A
Culicidae* (Mosquitoes)	1				
Dixidae* (Dixid midges)	10				
Empididae (Dance flies)	6				
Ephydridae (Shore flies)	3				
Muscidae (House flies, Stable flies)	1				
Psychodidae (Moth flies)	1				
Simuliidae (Blackflies)	5				
Syrphidae* (Rat tailed maggots)	1				
Tabanidae (Horse flies)	5				
Tipulidae (Crane flies)	5				
GASTROPODA (Snails)					
Ampullariidae (Apple Snails)	5				
Ancylidae (Limpets)	6				
Bithyniidae*	3				
Bulininae*	3				
Hydrobiidae* (Mud snails)	3				
Lymnaeidae* (Pond snails)	3				
Physidae* (Pouch snails) Alien	0				
Planorbinae* (Orb snails)	3				
Thiaridae* (=Melanidae)	3				
Viviparidae* (River snails)	5				
PELECYPODA (Bivalves)					
Corbiculidae (Clams)	5			B	B
Iridinidae (Toothless river mussels)	6				
Sphaeriidae (Pill clams)	3				
Unionidae (Perly mussels)	6				

ZISS1 Score					125
No. of Taxa					19
ASPT					6.6
Present Ecological State (A-F)					C

Other Taxa:

Pontederia crassipes present small patches
Arcopotamonautes orbitospinus
Helochares sp. and Amphiops sp.
Chironomus sp.
Hydrocanthus sp.
Stenelmis sp.
Compsoneuria njalensis
Zygonyx natalensis & Olpogastra lugubris
Pseudocloeon latum
Laccocoris spurcus

Zambian Invertebrate Scoring version 1 (ZISS1)

Date	15-Sep-2023
Site Code	S+32.6
Project	Mpatamanga HPP
Collector	Rob Palmer
River	Shire
Elev (m)	322
Grid	S15.546353 E34.796638
Zonation	D: Upper Foothills

Flow	V Low
Clarity (NTU)	-
Turbidity	Medium
Colour	Light Brown
Benthic Algae (%)	-
Temp (°C)	-
pH	-
Cond (mS/m)	-
DO (mg/ℓ)	-
Disturbance	Impoundment

Biotopes	(0-5)	Weight
Stones In Current	0	FALSE
Stones Out Current	0	FALSE
Bedrock	0	FALSE
Aquatic Veg	0	FALSE
Marg Veg In Current	0	FALSE
Marg Veg Out Of Current	3	FALSE
Gravel	0	FALSE
Sand	0	FALSE
Mud	0	FALSE
Visual observation	0	
BIOTOPE SUITABILITY	#####	#DIV/0!

Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5				
TURBELLARIA (Flatworm)	3				
ANNELIDA					
Oligochaeta (Earthworms)	1				
Hirudinea (Leeches)	3				
CRUSTACEA					
Potamonautidae* (Crabs)	3				
Atyidae (Freshwater Shrimps)	8				
HYDRACARINA (Mites)	8				
PLECOPTERA (Stoneflies)					
Perlidae (True Stoneflies)	12				
EPHEMEROPTERA (Mayflies)					
Baetidae 1sp	4				
Baetidae 2 sp	6				
Baetidae > 2 sp	12				
Caenidae (Squaregills/Cainflies)	6				
Dicercomyzidae	9				
Ephemeridae	15				
Ephemerythidae	10				
Heptageniidae (Flatheaded mayflies)	13				
Leptophlebiidae (Prongills)	9				
Machadorythidae	8				
Oligoneuridae (Brushlegged mayflies)	15				
Polymitarcyidae (Pale burrowers)	10				
Prosopistomatidae (Water specs)	15				
Tricorythidae (Stout crawlers)	9				
ODONATA (Dragonflies & Damselflies)					
Calopterygidae (Demoiselles)	10				
Chlorocyphidae (Jewels)	10				
Coenagrionidae (Sprites and Blues)	4				
Lestidae (Emerald Damselflies/Spreadwings)	8				
Platycnemidae (Stream Damselflies)	10				
Protoneuridae (Threadwings)	8				
Aeshnidae (Hawkers & Emperors)	8				
Corduliidae (Cruisers)	8				
Gomphidae (Clubtails)	6				
Libellulidae (Darter/Skimmers)	4				
LEPIDOPTERA (Aquatic Caterpillars/Moths)					
Crambidae (Pyralidae)	12				

Taxon	QV	S	Veg	GSM	TOT
HEMIPTERA (Bugs)					
Aphelocheiridae *	5				
Belostomatidae* (Giant water bugs)	3		A		A
Corixidae* (Water boatmen)	3				
Gerridae* (Pond skaters)	5		1		1
Hydrometridae* (Water measurers)	6		1		1
Naucoridae* (Creeping water bugs)	7				
Nepidae* (Water scorpions)	3				
Notonectidae* (Backswimmers)	3				
Pleidae* (Pygmy backswimmers)	4				
Veliidae/M…veliidae* (Ripple bugs)	5		A		A
TRICHOPTERA (Caddisflies)					
Dipseudopsidae	10				
Ecnomidae (Tubecase Netspinning Caddisflie	8				
Hydropsychidae 1 sp	4				
Hydropsychidae 2 sp	6				
Hydropsychidae > 2 sp	12				
Philopotamidae (Fingernet Caddisflies)	10				
Polycentropodidae (Tube Maker Caddisflies)	12				
Cased caddis:					
Calamoceratidae	11				
Hydroptilidae (Microcaddisflies)	6				
Lepidostomatidae (Bizarre Caddisflies)	10				
Leptoceridae (Long-horned Caddisflies)	6				
Pisuliidae (Triangle Caddisflies)	10				
COLEOPTERA (Beetles)					
Dytiscidae/Noteridae* (Diving beetles)	5		1		1
Elmidae/Dryopidae* (Riffle beetles)	8				
Gyrinidae* (Whirligig beetles)	5				
Haliplidae* (Crawling water beetles)	5				
Scirtidae (Marsh beetles)	12				
Hydraenidae* (Minute moss beetles)	8				
Hydrophilidae* (Water scavenger beetles)	5				
Limnichidae (Marsh-Loving beetles)	8				
Psephenidae (Water Pennies)	10				
Other Taxa:					

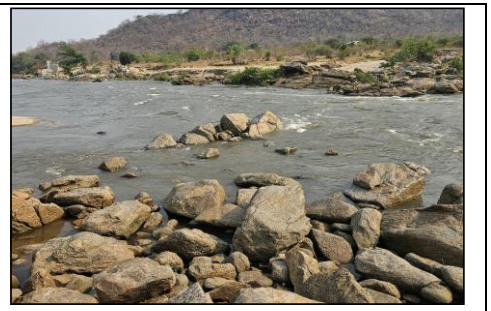
Taxon	QV	S	Veg	GSM	TOT
DIPTERA (Flies)					
Athericidae (Snipe flies)	10				
Ceratopogonidae (Biting midges)	5				
Chironomidae (Midges)	2				
Culicidae* (Mosquitoes)	1				
Dixidae* (Dixid midges)	10				
Empididae (Dance flies)	6				
Ephydridae (Shore flies)	3				
Muscidae (House flies, Stable flies)	1				
Psychodidae (Moth flies)	1				
Simuliidae (Blackflies)	5				
Syrphidae* (Rat tailed maggots)	1				
Tabanidae (Horse flies)	5				
Tipulidae (Crane flies)	5				
GASTROPODA (Snails)					
Ampulariidae (Apple Snails)	5				
Ancylidae (Limpets)	6				
Bithyniidae*	3				
Bulininae*	3				
Hydrobiidae* (Mud snails)	3				
Lymnaeidae* (Pond snails)	3				
Physidae* (Pouch snails) Alien	0				
Planorbinae* (Orb snails)	3				
Thiaridae* (=Melanidae)	3				
Viviparidae* (River snails)	5				
PELECYPODA (Bivalves)					
Corbiculidae (Clams)	5				
Iridinidae (Toothless river mussels)	6				
Sphaeriidae (Pill clams)	3				
Unionidae (Perly mussels)	6				
ZISS1 Score					-
No. of Taxa					5
ASPT					-
Present Ecological State (A-F)					

Zambian Invertebrate Scoring version 1 (ZISS1)

Date	12-Sep-2023
Site Code	S+7.5 km
Project	Mpatamanga HPP
Collector	Rob Palmer
River	Shire
Elev (m)	246
Grid	S15.718045 E34.726660
Zonation	D: Upper Foothills

Flow	High
Clarity (NTU)	21
Turbidity	Medium
Colour	Light Brown
Benthic Algae (%)	10
Temp (°C)	30.5
pH	8.7
Cond (mS/m)	26
DO (mg/ℓ)	8.1 (107%)
Disturbance	Intra-Day Flow Variation

Biotopes	(0-5)	Weight
Stones In Current	2	20.0
Stones Out Current	2	10.0
Bedrock	0	5.0
Aquatic Veg	0	0.5
Marg Veg In Current	0	2.0
Marg Veg Out Of Current	0	2.0
Gravel	0	3.5
Sand	2	1.0
Mud	0	0.5
Visual observation	Yes	
BIOTOPE SUITABILIT	28%	F



Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5				
TURBELLARIA (Flatworm)	3				
ANNELIDA					
Oligochaeta (Earthworms)	1				
Hirudinea (Leeches)	3				
CRUSTACEA					
Potamonautidae* (Crabs)	3				
Atyidae (Freshwater Shrimps)	8				
HYDRACARINA (Mites)	8				
PLECOPTERA (Stoneflies)					
Perlidae (True Stoneflies)	12				
EPHEMEROPTERA (Mayflies)					
Baetidae 1sp	4	1			1
Baetidae 2 sp	6				
Baetidae > 2 sp	12				
Caenidae (Squaregills/Cainflies)	6				
Dicercomyzidae	9				
Ephemeridae	15				
Ephemerythidae	10				
Heptageniidae (Flatheaded mayflies)	13				
Leptophlebiidae (Prongills)	9				
Machadorythidae	8				
Oligoneuridae (Brushlegged mayflies)	15				
Polymitarcyidae (Pale burrowers)	10				
Prosopistomatidae (Water specs)	15				
Tricorythidae (Stout crawlers)	9				
ODONATA (Dragonflies & Damselflies)					
Calopterygidae (Demoiselles)	10				
Chlorocyphidae (Jewels)	10				
Coenagrionidae (Sprites and Blues)	4		1		1
Lestidae (Emerald Damselflies/Spreadwings)	8				
Platycnemidae (Stream Damselflies)	10				
Protoneuridae (Threadwings)	8				
Aeshnidae (Hawkers & Emperors)	8				
Corduliidae (Cruisers)	8				
Gomphidae (Clubtails)	6				
Libellulidae (Darter/Skimmers)	4	1			1
LEPIDOPTERA (Aquatic Caterpillars/Moths)					
Crambidae (Pyralidae)	12				

Taxon	QV	S	Veg	GSM	TOT
HEMIPTERA (Bugs)					
Aphelocheiridae *	5				
Belostomatidae* (Giant water bugs)	3				
Corixidae* (Water boatmen)	3				
Gerridae* (Pond skaters)	5				
Hydrometridae* (Water measurers)	6				
Naucoridae* (Creeping water bugs)	7				
Nepidae* (Water scorpions)	3				
Notonectidae* (Backswimmers)	3				
Pleidae* (Pygmy backswimmers)	4				
Veliidae/M...veliidae* (Ripple bugs)	5				
TRICHOPTERA (Caddisflies)					
Dipseudopsidae	10				
Ecnomidae (Tubecase Netspinning Caddisflies)	8				
Hydropsychidae 1 sp	4				
Hydropsychidae 2 sp	6				
Hydropsychidae > 2 sp	12				
Philopotamidae (Fingernet Caddisflies)	10				
Polycentropodidae (Tube Maker Caddisflies)	12				
Cased caddis:					
Calamoceratidae	11				
Hydroptilidae (Microcaddisflies)	6				
Lepidostomatidae (Bizarre Caddisflies)	10				
Leptoceridae (Long-horned Caddisflies)	6	1			1
Pisuliidae (Triangle Caddisflies)	10				
COLEOPTERA (Beetles)					
Dytiscidae/Noteridae* (Diving beetles)	5				
Elmidae/Dryopidae* (Riffle beetles)	8		A		A
Gyrinidae* (Whirligig beetles)	5				
Haliplidae* (Crawling water beetles)	5				
Scirtidae (Marsh beetles)	12				
Hydraenidae* (Minute moss beetles)	8				
Hydrophilidae* (Water scavenger beetles)	5				
Limnichidae (Marsh-Loving beetles)	8				
Psephenidae (Water Pennies)	10				
Other Taxa:					
Hilarempis sp. (Empididae)					
Cheumatopsyche sp. (Hydropsychidae)					
Trichosetodes sp. (Leptoceridae)					

Taxon	QV	S	Veg	GSM	TOT
DIPTERA (Flies)					
Athericidae (Snipe flies)	10				
Ceratopogonidae (Biting midges)	5				
Chironomidae (Midges)	2				
Culicidae* (Mosquitoes)	1				
Dixidae* (Dixid midges)	10				
Empididae (Dance flies)	6				
Ephydridae (Shore flies)	3				
Muscidae (House&Stable flies)	1				
Psychodidae (Moth flies)	1				
Simuliidae (Blackflies)	5				
Syrphidae* (Rat tailed maggots)	1				
Tabanidae (Horse flies)	5				
Tipulidae (Crane flies)	5				
GASTROPODA (Snails)					
Ampulariidae (Apple Snails)	5				
Ancylidae (Limpets)	6				
Bithyniidae*	3				
Bulininae*	3				
Hydrobiidae* (Mud snails)	3				
Lymnaeidae* (Pond snails)	3				
Physidae* (Pouch snails) Alien	0				
Planorbinae* (Orb snails)	3				
Thiaridae* (=Melanidae)	3				
Viviparidae* (River snails)	5				
PELECYPODA (Bivalves)					
Corbiculidae (Clams)	5				
Iridinidae (Toothless river mussels)	6				
Sphaeriidae (Pill clams)	3				
Unionidae (Perly mussels)	6				
ZISS1 Score					26
No. of Taxa					5
ASPT					5.2
Present Ecological State (A-F)					E

		NB: No Crabs or crab shells
Pseudagrion sublacteum		*Corbicula* sp. (Corbiculidae) - Empty shells
Plumetella sp. (Bryozoa)		*Idiocella (Idiocella)* (Limoniidae)
Neoperla transvaalensis		*Potamodytes major*

Zambian Invertebrate Scoring version 1 (ZISS1)

Date	13-Sep-2023
Site Code	S+7.1 Seep
Project	Mpatamanga HPP
Collector	Rob Palmer
River	Shire
Elev (m)	229
Grid	S15.729199 E34.731638
Zonation	D: Upper Foothills

Flow	V Low
Clarity (NTU)	-
Turbidity	V Low
Colour	Clear
Benthic Algae (%)	-
Temp (°C)	-
pH	-
Cond (mS/m)	-
DO (mg/ℓ)	-
Disturbance	-

Biotopes	(0-5)	Weight
Stones In Current	0	20.0
Stones Out Current	0	10.0
Bedrock	0	5.0
Aquatic Veg	4	0.5
Marg Veg In Current	0	2.0
Marg Veg Out Of Current	0	2.0
Gravel	0	3.5
Sand	0	1.0
Mud	0	0.5
Visual observation	y	
BIOTOPE SUITABILITY	1%	FALSE

Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5				
TURBELLARIA (Flatworm)	3				
ANNELIDA					
Oligochaeta (Earthworms)	1				
Hirudinea (Leeches)	3				
CRUSTACEA					
Potamonautidae* (Crabs)	3				
Atyidae (Freshwater Shrimps)	8				
HYDRACARINA (Mites)	8				
PLECOPTERA (Stoneflies)					
Perlidae (True Stoneflies)	12				
EPHEMEROPTERA (Mayflies)					
Baetidae 1sp	4				
Baetidae 2 sp	6				
Baetidae > 2 sp	12	A	A		B
Caenidae (Squaregills/Cainflies)	6				
Dicercomyzidae	9				
Ephemeridae	15				
Ephemerythidae	10				
Heptageniidae (Flatheaded mayflies)	13				
Leptophlebiidae (Prongills)	9				
Machadorythidae	8				
Oligoneuridae (Brushlegged mayflies)	15				
Polymitarcyidae (Pale burrowers)	10				
Prosopistomatidae (Water specs)	15				
Tricorythidae (Stout crawlers)	9				
ODONATA (Dragonflies & Damselflies)					
Calopterygidae (Demoiselles)	10				
Chlorocyphidae (Jewels)	10				
Coenagrionidae (Sprites and Blues)	4		A		A
Lestidae (Emerald Damselflies/Spreadwings)	8				
Platycnemidae (Stream Damselflies)	10				
Protoneuridae (Threadwings)	8				
Aeshnidae (Hawkers & Emperors)	8		1		1
Corduliidae (Cruisers)	8				
Gomphidae (Clubtails)	6				
Libellulidae (Darter/Skimmers)	4		B		B
LEPIDOPTERA (Aquatic Caterpillars/Moths)					
Crambidae (Pyralidae)	12				

Taxon	QV	S	Veg	GSM	TOT
HEMIPTERA (Bugs)					
Aphelocheiridae *	5				
Belostomatidae* (Giant water bugs)	3		A		A
Corixidae* (Water boatmen)	3				
Gerridae* (Pond skaters)	5		B		B
Hydrometridae* (Water measurers)	6				
Naucoridae* (Creeping water bugs)	7				
Nepidae* (Water scorpions)	3		B		B
Notonectidae* (Backswimmers)	3				
Pleidae* (Pygmy backswimmers)	4		1		1
Veliidae/M...veliidae* (Ripple bugs)	5				
TRICHOPTERA (Caddisflies)					
Dipseudopsidae	10				
Ecnomidae (Tubecase Netspinning Caddisflie	8				
Hydropsychidae 1 sp	4				
Hydropsychidae 2 sp	6				
Hydropsychidae > 2 sp	12				
Philopotamidae (Fingernet Caddisflies)	10				
Polycentropodidae (Tube Maker Caddisflies)	12				
Cased caddis:					
Calamoceratidae	11				
Hydroptilidae (Microcaddisflies)	6				
Lepidostomatidae (Bizarre Caddisflies)	10				
Leptoceridae (Long-horned Caddisflies)	6		A		A
Pisuliidae (Triangle Caddisflies)	10				
COLEOPTERA (Beetles)					
Dytiscidae/Noteridae* (Diving beetles)	5				
Elmidae/Dryopidae* (Riffle beetles)	8		1		1
Gyrinidae* (Whirligig beetles)	5				
Haliplidae* (Crawling water beetles)	5				
Scirtidae (Marsh beetles)	12				
Hydraenidae* (Minute moss beetles)	8				
Hydrophilidae* (Water scavenger beetles)	5				
Limnichidae (Marsh-Loving beetles)	8				
Psephenidae (Water Pennies)	10				
Other Taxa:					
Ostracoda; *Bulinus forskalii*					

Taxon	QV	S	Veg	GSM	TOT
DIPTERA (Flies)					
Athericidae (Snipe flies)	10				
Ceratopogonidae (Biting midges)	5				
Chironomidae (Midges)	2		A		A
Culicidae* (Mosquitoes)	1		A		A
Dixidae* (Dixid midges)	10				
Empididae (Dance flies)	6				
Ephydridae (Shore flies)	3				
Muscidae (House flies, Stable flies)	1				
Psychodidae (Moth flies)	1				
Simuliidae (Blackflies)	5				
Syrphidae* (Rat tailed maggots)	1				
Tabanidae (Horse flies)	5				
Tipulidae (Crane flies)	5				
GASTROPODA (Snails)					
Ampulariidae (Apple Snails)	5				
Ancylidae (Limpets)	6				
Bithyniidae*	3				
Bulininae*	3		A		A
Hydrobiidae* (Mud snails)	3				
Lymnaeidae* (Pond snails)	3				
Physidae* (Pouch snails) Alien	0				
Planorbinae* (Orb snails)	3				
Thiaridae* (=Melanidae)	3				
Viviparidae* (River snails)	5				
PELECYPODA (Bivalves)					
Corbiculidae (Clams)	5				
Iridinidae (Toothless river mussels)	6				
Sphaeriidae (Pill clams)	3				
Unionidae (Perly mussels)	6				
ZISS1 Score					-
No. of Taxa					13
ASPT					-
Present Ecological State (A-F)					-

Zambian Invertebrate Scoring version 1 (ZISS1)

Date	13-Sep-2023
Site Code	S+7.1
Project	Mpatamanga HPP
Collector	Rob Palmer
River	Shire
Elev (m)	229
Grid	S15.729199 E34.731638
Zonation	D: Upper Foothills

Flow	High
Clarity (NTU)	23
Turbidity	Medium
Colour	Light Brown
Benthic Algae (%)	40
Temp (°C)	33.4
pH	8.8
Cond (mS/m)	27
DO (mg/ℓ)	5.9 (82%)
Disturbance	HPP; sand

Biotopes	(0-5)	Weight
Stones In Current	3	20.0
Stones Out Current	2	10.0
Bedrock	2	5.0
Aquatic Veg	0	0.5
Marg Veg In Current	3	2.0
Marg Veg Out Of Current	0	2.0
Gravel	0	3.5
Sand	2	1.0
Mud	1	0.5
Visual observation	y	
BIOTOPE SUITABILITY	44%	D

Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5				
TURBELLARIA (Flatworm)	3				
ANNELIDA					
Oligochaeta (Earthworms)	1				
Hirudinea (Leeches)	3				
CRUSTACEA					
Potamonautidae* (Crabs)	3				
Atyidae (Freshwater Shrimps)	8				
HYDRACARINA (Mites)	8				
PLECOPTERA (Stoneflies)					
Perlidae (True Stoneflies)	12				
EPHEMEROPTERA (Mayflies)					
Baetidae 1sp	4				
Baetidae 2 sp	6				
Baetidae > 2 sp	12	A	A		B
Caenidae (Squaregills/Cainflies)	6				
Dicercomyzidae	9				
Ephemeridae	15				
Ephemerythidae	10				
Heptageniidae (Flatheaded mayflies)	13				
Leptophlebiidae (Prongills)	9				
Machadorythidae	8				
Oligoneuridae (Brushlegged mayflies)	15				
Polymitarcyidae (Pale burrowers)	10				
Prosopistomatidae (Water specs)	15				
Tricorythidae (Stout crawlers)	9				
ODONATA (Dragonflies & Damselflies)					
Calopterygidae (Demoiselles)	10				
Chlorocyphidae (Jewels)	10				
Coenagrionidae (Sprites and Blues)	4		1		1
Lestidae (Emerald Damselflies/Spreadwings)	8				
Platycnemidae (Stream Damselflies)	10				
Protoneuridae (Threadwings)	8				
Aeshnidae (Hawkers & Emperors)	8				
Corduliidae (Cruisers)	8				
Gomphidae (Clubtails)	6				
Libellulidae (Darter/Skimmers)	4				
LEPIDOPTERA (Aquatic Caterpillars/Moths)					
Crambidae (Pyralidae)	12				

Taxon	QV	S	Veg	GSM	TOT
HEMIPTERA (Bugs)					
Aphelocheiridae *	5				
Belostomatidae* (Giant water bugs)	3		A		A
Corixidae* (Water boatmen)	3				
Gerridae* (Pond skaters)	5				
Hydrometridae* (Water measurers)	6				
Naucoridae* (Creeping water bugs)	7				
Nepidae* (Water scorpions)	3				
Notonectidae* (Backswimmers)	3				
Pleidae* (Pygmy backswimmers)	4				
Veliidae/M...veliidae* (Ripple bugs)	5				
TRICHOPTERA (Caddisflies)					
Dipseudopsidae	10				
Ecnomidae (Tubecase Netspinning Caddisflie	8				
Hydropsychidae 1 sp	4				
Hydropsychidae 2 sp	6				
Hydropsychidae > 2 sp	12				
Philopotamidae (Fingernet Caddisflies)	10				
Polycentropodidae (Tube Maker Caddisflies)	12				
Cased caddis:					
Calamoceratidae	11				
Hydroptilidae (Microcaddisflies)	6				
Lepidostomatidae (Bizarre Caddisflies)	10				
Leptoceridae (Long-horned Caddisflies)	6		A		A
Pisuliidae (Triangle Caddisflies)	10				
COLEOPTERA (Beetles)					
Dytiscidae/Noteridae* (Diving beetles)	5				
Elmidae/Dryopidae* (Riffle beetles)	8		1		1
Gyrinidae* (Whirligig beetles)	5				
Haliplidae* (Crawling water beetles)	5				
Scirtidae (Marsh beetles)	12				
Hydraenidae* (Minute moss beetles)	8				
Hydrophilidae* (Water scavenger beetles)	5				
Limnichidae (Marsh-Loving beetles)	8				
Psephenidae (Water Pennies)	10				

Taxon	QV	S	Veg	GSM	TOT
DIPTERA (Flies)					
Athericidae (Snipe flies)	10				
Ceratopogonidae (Biting midges)	5				
Chironomidae (Midges)	2		A		A
Culicidae* (Mosquitoes)	1				
Dixidae* (Dixid midges)	10				
Empididae (Dance flies)	6				
Ephydridae (Shore flies)	3				
Muscidae (House flies, Stable flies)	1				
Psychodidae (Moth flies)	1				
Simuliidae (Blackflies)	5				
Syrphidae* (Rat tailed maggots)	1				
Tabanidae (Horse flies)	5				
Tipulidae (Crane flies)	5				
GASTROPODA (Snails)					
Ampullariidae (Apple Snails)	5				
Ancylidae (Limpets)	6				
Bithyniidae*	3				
Bulininae*	3				
Hydrobiidae* (Mud snails)	3				
Lymnaeidae* (Pond snails)	3				
Physidae* (Pouch snails) Alien	0				
Planorbinae* (Orb snails)	3				
Thiaridae* (=Melanidae)	3				
Viviparidae* (River snails)	5				
PELECYPODA (Bivalves)					
Corbiculidae (Clams)	5				
Iridinidae (Toothless river mussels)	6				
Sphaeriidae (Pill clams)	3				
Unionidae (Perly mussels)	6				
ZISS1 Score					35
No. of Taxa					6
ASPT					5.8
Present Ecological State (A-F)					E

Zambian Invertebrate Scoring version 1 (ZISS1)

Date	19-Sep-2023
Site Code	S-4.2
Project	Mpatamanga HPP
Collector	Rob Palmer
River	Shire
Elev (m)	167
Grid	S15.817189 E34.735141
Zonation	D: Upper Foothills

Flow	High
Clarity (NTU)	22
Turbidity	Medium
Colour	Light Brown
Benthic Algae (%)	10
Temp (°C)	31.0
pH	8.9
Cond (mS/m)	27
DO (mg/ℓ)	-
Disturbance	

Biotopes	(0-5)	Weight
Stones In Current	2	20.0
Stones Out Current	4	10.0
Bedrock	2	5.0
Aquatic Veg	0	0.5
Marg Veg In Current	0	2.0
Marg Veg Out Of Current	0	2.0
Gravel	0	3.5
Sand	2	1.0
Mud	0	0.5
Visual observation	Yes	
BIOTOPE SUITABILITY	41%	D

Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5				
TURBELLARIA (Flatworm)	3				
ANNELIDA					
Oligochaeta (Earthworms)	1	1			1
Hirudinea (Leeches)	3				
CRUSTACEA					
Potamonautidae* (Crabs)	3				
Atyidae (Freshwater Shrimps)	8				
HYDRACARINA (Mites)	8				
PLECOPTERA (Stoneflies)					
Perlidae (True Stoneflies)	12				
EPHEMEROPTERA (Mayflies)					
Baetidae 1sp	4				
Baetidae 2 sp	6	A			A
Baetidae > 2 sp	12				
Caenidae (Squaregills/Cainflies)	6				
Dicercomyzidae	9				
Ephemeridae	15				
Ephemerythidae	10				
Heptageniidae (Flatheaded mayflies)	13				
Leptophlebiidae (Prongills)	9				
Machadorythidae	8				
Oligoneuridae (Brushlegged mayflies)	15				
Polymitarcyidae (Pale burrowers)	10				
Prosopistomatidae (Water specs)	15				
Tricorythidae (Stout crawlers)	9	1			1
ODONATA (Dragonflies & Damselflies)					
Calopterygidae (Demoiselles)	10				
Chlorocyphidae (Jewels)	10				
Coenagrionidae (Sprites and Blues)	4				
Lestidae (Emerald Damselflies/Spreadwings)	8				
Platycnemidae (Stream Damselflies)	10				
Protoneuridae (Threadwings)	8				
Aeshnidae (Hawkers & Emperors)	8				
Corduliidae (Cruisers)	8				
Gomphidae (Clubtails)	6				
Libellulidae (Darter/Skimmers)	4	A			A
LEPIDOPTERA (Aquatic Caterpillars/Moths)					
Crambidae (Pyralidae)	12				

Taxon	QV	S	Veg	GSM	TOT
HEMIPTERA (Bugs)					
Aphelocheiridae *	5				
Belostomatidae* (Giant water bugs)	3				
Corixidae* (Water boatmen)	3				
Gerridae* (Pond skaters)	5				
Hydrometridae* (Water measurers)	6				
Naucoridae* (Creeping water bugs)	7				
Nepidae* (Water scorpions)	3				
Notonectidae* (Backswimmers)	3				
Pleidae* (Pygmy backswimmers)	4				
Veliidae/M…veliidae* (Ripple bugs)	5				
TRICHOPTERA (Caddisflies)					
Dipseudopsidae	10				
Ecnomidae (Tubecase Netspinning Caddisflie	8				
Hydropsychidae 1 sp	4	C			C
Hydropsychidae 2 sp	6				
Hydropsychidae > 2 sp	12				
Philopotamidae (Fingernet Caddisflies)	10				
Polycentropodidae (Tube Maker Caddisflies)	12				
Cased caddis:					
Calamoceratidae	11				
Hydroptilidae (Microcaddisflies)	6				
Lepidostomatidae (Bizarre Caddisflies)	10				
Leptoceridae (Long-horned Caddisflies)	6				
Pisuliidae (Triangle Caddisflies)	10				
COLEOPTERA (Beetles)					
Dytiscidae/Noteridae* (Diving beetles)	5				
Elmidae/Dryopidae* (Riffle beetles)	8	A			A
Gyrinidae* (Whirligig beetles)	5				
Haliplidae* (Crawling water beetles)	5				
Scirtidae (Marsh beetles)	12				
Hydraenidae* (Minute moss beetles)	8				
Hydrophilidae* (Water scavenger beetles)	5				
Limnichidae (Marsh-Loving beetles)	8				
Psephenidae (Water Pennies)	10				
Other Taxa:					

Taxon	QV	S	Veg	GSM	TOT
DIPTERA (Flies)					
Athericidae (Snipe flies)	10				
Ceratopogonidae (Biting midges)	5				
Chironomidae (Midges)	2				
Culicidae* (Mosquitoes)	1				
Dixidae* (Dixid midges)	10				
Empididae (Dance flies)	6				
Ephydridae (Shore flies)	3				
Muscidae (House flies, Stable flies)	1				
Psychodidae (Moth flies)	1				
Simuliidae (Blackflies)	5				
Syrphidae* (Rat tailed maggots)	1				
Tabanidae (Horse flies)	5				
Tipulidae (Crane flies)	5				
GASTROPODA (Snails)					
Ampulariidae (Apple Snails)	5				
Ancylidae (Limpets)	6				
Bithyniidae*	3				
Bulininae*	3				
Hydrobiidae* (Mud snails)	3				
Lymnaeidae* (Pond snails)	3				
Physidae* (Pouch snails) Alien	0				
Planorbinae* (Orb snails)	3				
Thiaridae* (=Melanidae)	3				
Viviparidae* (River snails)	5				
PELECYPODA (Bivalves)					
Corbiculidae (Clams)	5				
Iridinidae (Toothless river mussels)	6				
Sphaeriidae (Pill clams)	3				
Unionidae (Perly mussels)	6				
ZISS1 Score					32
No. of Taxa					6
ASPT					5.3
Present Ecological State (A-F)					E

Zambian Invertebrate Scoring version 1 (ZISS1)

Date	18-Sep-2023
Site Code	S-4.6
Project	Mpatamanga HPP
Collector	Rob Palmer
River	Shire
Elev (m)	161
Grid	S15.861277 E34.749524
Zonation	E: Lower Foothills

Flow	Low
Clarity (NTU)	16
Turbidity	Medium
Colour	Light Brown
Benthic Algae (%)	10
Temp (°C)	30.0
pH	8.8
Cond (mS/m)	26
DO (mg/ℓ)	-
Disturbance	26

Biotopes	(0-5)	Weight
Stones In Current	1	18.0
Stones Out Current	4	12.0
Bedrock	2	3.0
Aquatic Veg	0	1.0
Marg Veg In Current	0	2.0
Marg Veg Out Of Current	0	2.0
Gravel	2	4.0
Sand	2	2.0
Mud	2	1.0
Visual observation	Yes	
BIOTOPE SUITABILITY	38%	E

Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5				
TURBELLARIA (Flatworm)	3				
ANNELIDA					
Oligochaeta (Earthworms)	1				
Hirudinea (Leeches)	3	A			A
CRUSTACEA					
Potamonautidae* (Crabs)	3				
Atyidae (Freshwater Shrimps)	8				
HYDRACARINA (Mites)	8				
PLECOPTERA (Stoneflies)					
Perlidae (True Stoneflies)	12				
EPHEMEROPTERA (Mayflies)					
Baetidae 1sp	4				
Baetidae 2 sp	6	A			A
Baetidae > 2 sp	12				
Caenidae (Squaregills/Cainflies)	6	A			A
Dicercomyzidae	9				
Ephemeridae	15				
Ephemerythidae	10				
Heptageniidae (Flatheaded mayflies)	13	A			A
Leptophlebiidae (Prongills)	9	A			A
Machadorythidae	8				
Oligoneuridae (Brushlegged mayflies)	15				
Polymitarcyidae (Pale burrowers)	10				
Prosopistomatidae (Water specs)	15				
Tricorythidae (Stout crawlers)	9				
ODONATA (Dragonflies & Damselflies)					
Calopterygidae (Demoiselles)	10				
Chlorocyphidae (Jewels)	10				
Coenagrionidae (Sprites and Blues)	4				
Lestidae (Emerald Damselflies/Spreadwings)	8				
Platycnemidae (Stream Damselflies)	10				
Protoneuridae (Threadwings)	8				
Aeshnidae (Hawkers & Emperors)	8				
Corduliidae (Cruisers)	8				
Gomphidae (Clubtails)	6				
Libellulidae (Darter/Skimmers)	4				
LEPIDOPTERA (Aquatic Caterpillars/Moths)					
Crambidae (Pyralidae)	12				

Taxon	QV	S	Veg	GSM	TOT
HEMIPTERA (Bugs)					
Aphelocheiridae *	5				
Belostomatidae* (Giant water bugs)	3				
Corixidae* (Water boatmen)	3				
Gerridae* (Pond skaters)	5				
Hydrometridae* (Water measurers)	6				
Naucoridae* (Creeping water bugs)	7				
Nepidae* (Water scorpions)	3				
Notonectidae* (Backswimmers)	3				
Pleidae* (Pygmy backswimmers)	4				
Veliidae/M…veliidae* (Ripple bugs)	5				
TRICHOPTERA (Caddisflies)					
Dipseudopsidae	10				
Ecnomidae (Tubecase Netspinning Caddisflie	8				
Hydropsychidae 1 sp	4				
Hydropsychidae 2 sp	6				
Hydropsychidae > 2 sp	12				
Philopotamidae (Fingernet Caddisflies)	10				
Polycentropodidae (Tube Maker Caddisflies)	12				
Cased caddis:					
Calamoceratidae	11				
Hydroptilidae (Microcaddisflies)	6				
Lepidostomatidae (Bizarre Caddisflies)	10				
Leptoceridae (Long-horned Caddisflies)	6				
Pisuliidae (Triangle Caddisflies)	10				
COLEOPTERA (Beetles)					
Dytiscidae/Noteridae* (Diving beetles)	5	A			A
Elmidae/Dryopidae* (Riffle beetles)	8	A	A		A
Gyrinidae* (Whirligig beetles)	5	A			A
Haliplidae* (Crawling water beetles)	5				
Scirtidae (Marsh beetles)	12				
Hydraenidae* (Minute moss beetles)	8				
Hydrophilidae* (Water scavenger beetles)	5				
Limnichidae (Marsh-Loving beetles)	8				
Psephenidae (Water Pennies)	10				
Other Taxa:					

Taxon	QV	S	Veg	GSM	TOT
DIPTERA (Flies)					
Athericidae (Snipe flies)	10				
Ceratopogonidae (Biting midges)	5				
Chironomidae (Midges)	2				
Culicidae* (Mosquitoes)	1				
Dixidae* (Dixid midges)	10				
Empididae (Dance flies)	6				
Ephydridae (Shore flies)	3				
Muscidae (House flies, Stable flies)	1				
Psychodidae (Moth flies)	1				
Simuliidae (Blackflies)	5				
Syrphidae* (Rat tailed maggots)	1				
Tabanidae (Horse flies)	5				
Tipulidae (Crane flies)	5				
GASTROPODA (Snails)					
Ampulariidae (Apple Snails)	5				
Ancylidae (Limpets)	6				
Bithyniidae*	3				
Bulininae*	3				
Hydrobiidae* (Mud snails)	3				
Lymnaeidae* (Pond snails)	3				
Physidae* (Pouch snails) Alien	0				
Planorbinae* (Orb snails)	3				
Thiaridae* (=Melanidae)	3				
Viviparidae* (River snails)	5				
PELECYPODA (Bivalves)					
Corbiculidae (Clams)	5			A	A
Iridinidae (Toothless river mussels)	6				
Sphaeriidae (Pill clams)	3				
Unionidae (Perly mussels)	6				
ZISS1 Score					60
No. of Taxa					9
ASPT					6.7
Present Ecological State (A-F)					E

Zambian Invertebrate Scoring version 1 (ZISS1)

Date	18-Sep-2023
Site Code	S-12.2
Project	Mpatamanga HPP
Collector	Rob Palmer
River	Shire
Elev (m)	149
Grid	S15.885999 E34.745890
Zonation	

Flow	Low
Clarity (NTU)	21
Turbidity	Medium
Colour	Light Brown
Benthic Algae (%)	
Temp (°C)	27.6
pH	9.1
Cond (mS/m)	27
DO (mg/ℓ)	-
Disturbance	Impoundment

Biotopes	(0-5)	Weight
Stones In Current	1	FALSE
Stones Out Current	3	FALSE
Bedrock	2	FALSE
Aquatic Veg	0	FALSE
Marg Veg In Current	0	FALSE
Marg Veg Out Of Current	0	FALSE
Gravel	0	FALSE
Sand	2	FALSE
Mud	1	FALSE
Visual observation	Yes	
BIOTOPE SUITABILITY	#####	#DIV/0!

Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5				
TURBELLARIA (Flatworm)	3				
ANNELIDA					
Oligochaeta (Earthworms)	1				
Hirudinea (Leeches)	3				
CRUSTACEA					
Potamonautidae* (Crabs)	3				
Atyidae (Freshwater Shrimps)	8				
HYDRACARINA (Mites)	8				
PLECOPTERA (Stoneflies)					
Perlidae (True Stoneflies)	12				
EPHEMEROPTERA (Mayflies)					
Baetidae 1sp	4	1			1
Baetidae 2 sp	6				
Baetidae > 2 sp	12				
Caenidae (Squaregills/Cainflies)	6				
Dicercomyzidae	9				
Ephemeridae	15				
Ephemerythidae	10				
Heptageniidae (Flatheaded mayflies)	13				
Leptophlebiidae (Prongills)	9				
Machadorythidae	8				
Oligoneuridae (Brushlegged mayflies)	15				
Polymitarcyidae (Pale burrowers)	10				
Prosopistomatidae (Water specs)	15				
Tricorythidae (Stout crawlers)	9				
ODONATA (Dragonflies & Damselflies)					
Calopterygidae (Demoiselles)	10				
Chlorocyphidae (Jewels)	10				
Coenagrionidae (Sprites and Blues)	4	A			A
Lestidae (Emerald Damselflies/Spreadwings)	8				
Platycnemidae (Stream Damselflies)	10				
Protoneuridae (Threadwings)	8				
Aeshnidae (Hawkers & Emperors)	8				
Corduliidae (Cruisers)	8				
Gomphidae (Clubtails)	6				
Libellulidae (Darter/Skimmers)	4				
LEPIDOPTERA (Aquatic Caterpillars/Moths)					
Crambidae (Pyralidae)	12				

Taxon	QV	S	Veg	GSM	TOT
HEMIPTERA (Bugs)					
Aphelocheiridae *	5				
Belostomatidae* (Giant water bugs)	3				
Corixidae* (Water boatmen)	3			1	1
Gerridae* (Pond skaters)	5				
Hydrometridae* (Water measurers)	6				
Naucoridae* (Creeping water bugs)	7				
Nepidae* (Water scorpions)	3	A			A
Notonectidae* (Backswimmers)	3				
Pleidae* (Pygmy backswimmers)	4				
Veliidae/M...veliidae* (Ripple bugs)	5				
TRICHOPTERA (Caddisflies)					
Dipseudopsidae	10				
Ecnomidae (Tubecase Netspinning Caddisflie	8				
Hydropsychidae 1 sp	4				
Hydropsychidae 2 sp	6				
Hydropsychidae > 2 sp	12				
Philopotamidae (Fingernet Caddisflies)	10				
Polycentropodidae (Tube Maker Caddisflies)	12				
Cased caddis:					
Calamoceratidae	11				
Hydroptilidae (Microcaddisflies)	6				
Lepidostomatidae (Bizarre Caddisflies)	10				
Leptoceridae (Long-horned Caddisflies)	6	B			B
Pisuliidae (Triangle Caddisflies)	10				
COLEOPTERA (Beetles)					
Dytiscidae/Noteridae* (Diving beetles)	5				
Elmidae/Dryopidae* (Riffle beetles)	8	1			1
Gyrinidae* (Whirligig beetles)	5				
Haliplidae* (Crawling water beetles)	5				
Scirtidae (Marsh beetles)	12				
Hydraenidae* (Minute moss beetles)	8				
Hydrophilidae* (Water scavenger beetles)	5				
Limnichidae (Marsh-Loving beetles)	8				
Psephenidae (Water Pennies)	10				
Other Taxa:					

Taxon	QV	S	Veg	GSM	TOT
DIPTERA (Flies)					
Athericidae (Snipe flies)	10				
Ceratopogonidae (Biting midges)	5				
Chironomidae (Midges)	2				
Culicidae* (Mosquitoes)	1				
Dixidae* (Dixid midges)	10				
Empididae (Dance flies)	6				
Ephydridae (Shore flies)	3				
Muscidae (House flies, Stable flies)	1				
Psychodidae (Moth flies)	1				
Simuliidae (Blackflies)	5				
Syrphidae* (Rat tailed maggots)	1				
Tabanidae (Horse flies)	5				
Tipulidae (Crane flies)	5				
GASTROPODA (Snails)					
Ampulariidae (Apple Snails)	5				
Ancylidae (Limpets)	6				
Bithyniidae*	3				
Bulininae*	3				
Hydrobiidae* (Mud snails)	3				
Lymnaeidae* (Pond snails)	3				
Physidae* (Pouch snails) Alien	0				
Planorbinae* (Orb snails)	3				
Thiaridae* (=Melanidae)	3				
Viviparidae* (River snails)	5				
PELECYPODA (Bivalves)					
Corbiculidae (Clams)	5			A	A
Iridinidae (Toothless river mussels)	6				
Sphaeriidae (Pill clams)	3				
Unionidae (Perly mussels)	6				
ZISS1 Score					-
No. of Taxa					7
ASPT					-
Present Ecological State (A-F)					

Zambian Invertebrate Scoring version 1 (ZISS1)

Date	19-Sep-2023
Site Code	M11
Project	Mpatamanga HPP
Collector	Rob Palmer
River	Mkulumadzi
Elev (m)	183
Grid	S15.819273 E34.731570
Zonation	D: Upper Foothills

Flow	Low
Clarity (NTU)	16
Turbidity	Medium
Colour	Light Brown
Benthic Algae (%)	30
Temp (°C)	28.8
pH	8.8
Cond (mS/m)	16
DO (mg/ℓ)	-
Disturbance	sand

Biotopes	(0-5)	Weight
Stones In Current	3	20.0
Stones Out Current	3	10.0
Bedrock	4	5.0
Aquatic Veg	0	0.5
Marg Veg In Current	0	2.0
Marg Veg Out Of Current	0	2.0
Gravel	1	3.5
Sand	3	1.0
Mud	1	0.5
Visual observation	Y	
BIOTOPE SUITABILITY	53%	C

Taxon	QV	S	Veg	GSM	TOT
PORIFERA (Sponge)	5				
TURBELLARIA (Flatworm)	3				
ANNELIDA					
Oligochaeta (Earthworms)	1				
Hirudinea (Leeches)	3				
CRUSTACEA					
Potamonautidae* (Crabs)	3				
Atyidae (Freshwater Shrimps)	8				
HYDRACARINA (Mites)	8				
PLECOPTERA (Stoneflies)					
Perlidae (True Stoneflies)	12				
EPHEMEROPTERA (Mayflies)					
Baetidae 1sp	4				
Baetidae 2 sp	6				
Baetidae > 2 sp	12	A			A
Caenidae (Squaregills/Cainflies)	6				
Dicercomyzidae	9				
Ephemeridae	15				
Ephemerythidae	10				
Heptageniidae (Flatheaded mayflies)	13				
Leptophlebiidae (Prongills)	9				
Machadorythidae	8				
Oligoneuridae (Brushlegged mayflies)	15				
Polymitarcyidae (Pale burrowers)	10				
Prosopistomatidae (Water specs)	15				
Tricorythidae (Stout crawlers)	9	1			1
ODONATA (Dragonflies & Damselflies)					
Calopterygidae (Demoiselles)	10				
Chlorocyphidae (Jewels)	10				
Coenagrionidae (Sprites and Blues)	4				
Lestidae (Emerald Damselflies/Spreadwings)	8				
Platycnemidae (Stream Damselflies)	10				
Protoneuridae (Threadwings)	8				
Aeshnidae (Hawkers & Emperors)	8				
Corduliidae (Cruisers)	8				
Gomphidae (Clubtails)	6			A	A
Libellulidae (Darter/Skimmers)	4	A			A
LEPIDOPTERA (Aquatic Caterpillars/Moths)					
Crambidae (Pyralidae)	12				

Taxon	QV	S	Veg	GSM	TOT
HEMIPTERA (Bugs)					
Aphelocheiridae *	5				
Belostomatidae* (Giant water bugs)	3				
Corixidae* (Water boatmen)	3			1	1
Gerridae* (Pond skaters)	5				
Hydrometridae* (Water measurers)	6				
Naucoridae* (Creeping water bugs)	7		1		1
Nepidae* (Water scorpions)	3				
Notonectidae* (Backswimmers)	3		A		A
Pleidae* (Pygmy backswimmers)	4				
Veliidae/M…veliidae* (Ripple bugs)	5				
TRICHOPTERA (Caddisflies)					
Dipseudopsidae	10				
Ecnomidae (Tubecase Netspinning Caddisflie	8				
Hydropsychidae 1 sp	4				
Hydropsychidae 2 sp	6				
Hydropsychidae > 2 sp	12				
Philopotamidae (Fingernet Caddisflies)	10				
Polycentropodidae (Tube Maker Caddisflies)	12				
Cased caddis:					
Calamoceratidae	11				
Hydroptilidae (Microcaddisflies)	6				
Lepidostomatidae (Bizarre Caddisflies)	10				
Leptoceridae (Long-horned Caddisflies)	6				
Pisuliidae (Triangle Caddisflies)	10				
COLEOPTERA (Beetles)					
Dytiscidae/Noteridae* (Diving beetles)	5	A			A
Elmidae/Dryopidae* (Riffle beetles)	8		A		A
Gyrinidae* (Whirligig beetles)	5		A		A
Haliplidae* (Crawling water beetles)	5				
Scirtidae (Marsh beetles)	12				
Hydraenidae* (Minute moss beetles)	8				
Hydrophilidae* (Water scavenger beetles)	5				
Limnichidae (Marsh-Loving beetles)	8				
Psephenidae (Water Pennies)	10				

Taxon	QV	S	Veg	GSM	TOT
DIPTERA (Flies)					
Athericidae (Snipe flies)	10				
Ceratopogonidae (Biting midges)	5	1			1
Chironomidae (Midges)	2	A			A
Culicidae* (Mosquitoes)	1				
Dixidae* (Dixid midges)	10				
Empididae (Dance flies)	6				
Ephydridae (Shore flies)	3				
Muscidae (House flies, Stable flies)	1				
Psychodidae (Moth flies)	1				
Simuliidae (Blackflies)	5				
Syrphidae* (Rat tailed maggots)	1				
Tabanidae (Horse flies)	5	A			A
Tipulidae (Crane flies)	5				
GASTROPODA (Snails)					
Ampullariidae (Apple Snails)	5				
Ancylidae (Limpets)	6				
Bithyniidae*	3				
Bulininae*	3				
Hydrobiidae* (Mud snails)	3				
Lymnaeidae* (Pond snails)	3				
Physidae* (Pouch snails) Alien	0				
Planorbinae* (Orb snails)	3				
Thiaridae* (=Melanidae)	3				
Viviparidae* (River snails)	5				
PELECYPODA (Bivalves)					
Corbiculidae (Clams)	5				
Iridinidae (Toothless river mussels)	6				
Sphaeriidae (Pill clams)	3				
Unionidae (Perly mussels)	6				
ZISS1 Score					74
No. of Taxa					13
ASPT					5.7
Present Ecological State (A-F)					D

Annex 5-13: Index of Habitat Integrity – Summary Results

	S+48.0	S+39.3	S+35.7	S+32.6	S+31.1	S+29.3	S+28.5	S+9.9	S+7.5	S+7.1	S-0.2	S-4.2	S-4.6	S-7.6	S-9.3	S-12.2	S-15.8	EF5	EF6a	EF6c
1) Instream																				
a) Water Abstraction	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	7	5	8
b) Flow Modification	11	21	16	21	21	21	21	21	21	21	21	18	21	18	21	21	11	20	18	12
c) Bed Modification	15	23	18	23	23	14	14	16	23	23	23	15	23	15	23	23	23	22	18	20
d) Channel Modification	8	17	0	17	17	8	8	16	14	14	14	6	17	6	18	18	20	12	10	11
e) Water Quality	5	4	4	6	6	4	6	5	6	6	4	6	6	6	6	6	5	7	8	8
f) Inundation	0	22	0	22	22	0	0	0	0	0	0	0	0	0	0	22	0	0	0	0
g) Exotic Macrophytes	15	0	0	6	8	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0
h) Exotic Fauna	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	0	0	0	0
i) Solid Waste	3	4	4	4	4	4	4	0	3	0	5	6	6	6	6	6	3	6	6	6
2) Riparian																				
a) Vegetation Removal	12	11	4	16	10	4	8	18	18	6	4	2	8	0	8	15	16	2	23	18
b) Alien Vegetation	12	5	5	11	5	5	5	11	11	3	3	4	5	4	5	5	5	6	4	2
c) Bank Erosion	4	0	0	0	0	0	4	12	18	0	0	10	16	10	13	15	16	18	16	12
d) Channel Modification	12	21	0	21	21	0	6	12	13	10	10	7	10	7	12	16	18	12	12	15
e) Water Abstraction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	6
f) Inundation	0	15	0	15	15	0	0	0	0	0	0	0	0	0	0	15	0	0	0	0
g) Flow Modification	11	21	14	18	18	18	18	18	18	18	18	12	18	12	18	18	14	20	16	12
h) Water Quality	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6
Score (%)	59%	36%	59%	34%	35%	51%	49%	43%	40%	45%	46%	59%	42%	59%	42%	37%	42%	40%	42%	45%
IHI Category (A-F)	C/D	E	C/D	E	E	D	D	D	D/E	D	D	C/D	D/E	C/D	D	E	D/E	D/E	D/E	D

Annex 5-14: Index of Habitat Integrity – Detailed Results

S+48.0: S15.453511 E34.868463
2023.09.15





1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*11*	Seasonal variation flattened by Kamuzu
c) Bed Modification	13	*15*	large increase of mobile sand, pools infilled
d) Channel Modification	13	*8*	channel activily contracting
e) Water Quality	14	*5*	conductivity moderate (26 mS/m); *Lyngbya* present. E. Coli present
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*15*	*Pontederia crassipes* and Pistia present (cover high channel
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*3*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100: 71
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2): 55

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*12*	moderate removal of woody riparian veg, agricultural enroachment
b) Alien Vegetation	12	*12*	*20 exotics and 36 indigenous*
c) Bank Erosion	14	*4*	bedrock controlled, so banks were mostly stable, but upper banks
d) Channel Modification	12	*12*	Wetbank sedimented, resticed riparian zone access to main
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*11*	Seasonal variation flattened by Kamuzu
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100: 75
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2: 63

IHI Score (%) = (Score (1+2)/2) 59%

IHI Category (A to F): C/D: Moderately Modified

S+39.3: S15.516126 E34.830165
2023.09.15





1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	critical intra-day fluctuations caused by operation Nkula HPP
c) Bed Modification	13	*23*	critical deposition of silt
d) Channel Modification	13	*17*	serious increase in channel width from inundation
e) Water Quality	14	*4*	conductivity moderate (26 mS/m)
f) Inundation	10	*22*	inundated by Nkula HPP
g) Exotic Macrophytes	9	*0*	*none*
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*4*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	54
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**31**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*11*	large removal of woody riparian veg
b) Alien Vegetation	12	*5*	*Solanum chrysotrichum*
c) Bank Erosion	14	*0*	none
d) Channel Modification	12	*21*	impounded
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*15*	inundated by Nkula HPP
g) Flow Modification	12	*21*	critical intra-day fluctuations caused by operation Nkula HPP
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	65
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**41**

IHI Score (%) = (Score (1+2)/2)	**36%**
IHI Category (A to F):	**E: Seriously Modified**

S+35.7: S15.527552 E34.817624
2023.09.15

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*16*	serious intra-day fluctuations caused by operation Nkula HPP
c) Bed Modification	13	*18*	serious increase of mobile sand
d) Channel Modification	13	*0*	none
e) Water Quality	14	*4*	conductivity moderate (26 mS/m); Cladophora absent
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*0*	none
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*4*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	76
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**52**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*4*	small removal of woody riparian veg
b) Alien Vegetation	12	*5*	low levels of infestation
c) Bank Erosion	14	*0*	bedrock controlled, so banks stable.
d) Channel Modification	12	*0*	channel stable
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*14*	large intra-day fluctuations caused by operation Nkula HPP
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	89
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**66**

IHI Score (%) = (Score (1+2)/2)	**59%**
IHI Category (A to F):	**C/D: Moderately Modified**

S+32.6: S15.546353 E34.796638
2023.09.15

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	critical intra-day fluctuations caused by operation Tedzani HPP
c) Bed Modification	13	*23*	critical deposition of silt
d) Channel Modification	13	*17*	serious increase in channel width
e) Water Quality	14	*6*	conductivity moderate (26 mS/m); *Pistia* present
f) Inundation	10	*22*	inundated by Tedzani HPP
g) Exotic Macrophytes	9	*6*	*Pistia present* ; *Pontederia crassipes* present
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*4*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	50
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**29**

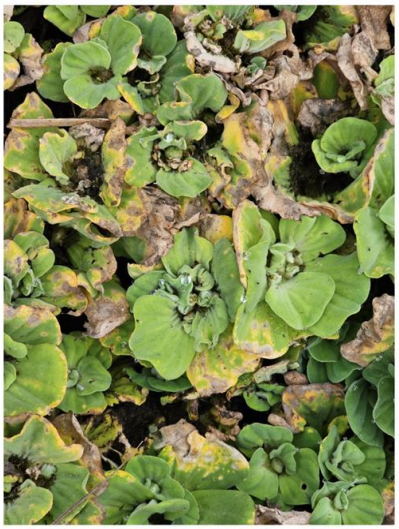
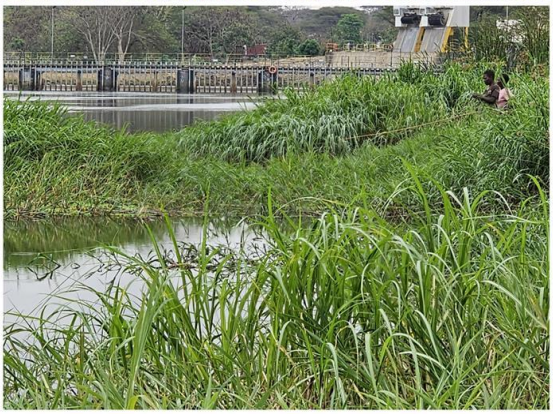
2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*16*	serious removal of woody riparian veg
b) Alien Vegetation	12	*11*	cultivation
c) Bank Erosion	14	*0*	none
d) Channel Modification	12	*21*	impounded
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*15*	inundated by Tedzani HPP
g) Flow Modification	12	*18*	serious intra-day fluctuations caused by operation Tedzani HPP
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	61
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**39**

IHI Score (%) = (Score (1+2)/2)	**34%**
IHI Category (A to F):	**E: Seriously Modified**

S+31.1: S15.556663 E34.787910
2023.09.14


1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	critical intra-day fluctuations caused by operation Tedzani HPP
c) Bed Modification	13	*23*	critical deposition of silt
d) Channel Modification	13	*17*	serious increase in channel width
e) Water Quality	14	*6*	conductivity moderate (26 mS/m); *Pistia* common
f) Inundation	10	*22*	inundated by Tedzani HPP
g) Exotic Macrophytes	9	*8*	*Pistia* common; *Pontederia crassipes* present
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*4*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	50
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**29**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*10*	moderate removal of woody riparian veg
b) Alien Vegetation	12	*5*	*Moringa oleifera*
c) Bank Erosion	14	*0*	none
d) Channel Modification	12	*21*	impounded
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*15*	inundated by Tedzani HPP
g) Flow Modification	12	*18*	serious intra-day fluctuations caused by operation Tedzani HPP
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	67
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**42**

IHI Score (%) = (Score (1+2)/2)	**35%**
IHI Category (A to F):	**E: Seriously Modified**

S+29.3: S15.564169 E34.770625
2023.09.14

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	critical intra-day fluctuations caused by operation Tedzani HPP
c) Bed Modification	13	*14*	large increase of mobile sand
d) Channel Modification	13	*8*	moderate increase in channel width
e) Water Quality	14	*4*	conductivity moderate (26 mS/m); Cladophora absent
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*0*	none
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*4*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	72
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**44**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*4*	small removal of woody riparian veg
b) Alien Vegetation	12	*5*	*Senna*
c) Bank Erosion	14	*0*	bedrock controlled, so banks were stable.
d) Channel Modification	12	*0*	channel stable
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*18*	serious intra-day fluctuations caused by operation Tedzani HPP
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	87
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**57**

IHI Score (%) = (Score (1+2)/2)	**51%**
IHI Category (A to F):	**D: Largely Modified**

S-28.5: S15.564169 E34.770625
2023.09.14

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	critical intra-day fluctuations caused by operation Tedzani HPP
c) Bed Modification	13	*14*	large increase of mobile sand
d) Channel Modification	13	*8*	moderate increase in channel width
e) Water Quality	14	*6*	conductivity moderate (26 mS/m); *Cladophora* common
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*0*	none
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*4*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	71
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2:	**43**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*8*	moderate removal of woody riparian veg
b) Alien Vegetation	12	*5*	*Senna*
c) Bank Erosion	14	*4*	limited bank erosion
d) Channel Modification	12	*6*	moderate increase in channel width
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*18*	serious intra-day fluctuations caused by operation Tedzani HPP
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	80
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**54**

IHI Score (%) = (Score (1+2)/2)	**49%**
IHI Category (A to F):	**D: Largely Modified**

S+9.9: S15.699582 E34.720257
2023.09.13

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	Hydropeaking at Tedzani and seasonal flattening at Kamuzu
c) Bed Modification	13	*16*	critical increase of mobile sand; failed bridge; in main stream
d) Channel Modification	13	*16*	serious increase in channel width
e) Water Quality	14	*5*	conductivity moderate (26 mS/m); *Cladophora* common
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*4*	Minor
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*0*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	66
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**41**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*18*	serious removal of woody riparian veg, and agriculture to the rivers
b) Alien Vegetation	12	*11*	*Ricinis communis* , cultivation
c) Bank Erosion	14	*12*	Bank erosion, and scour toe, and seepage slumping
d) Channel Modification	12	*12*	serious increase in channel width
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*18*	Hydropeaking at Tedzani and seasonal flattening at Kamuzu
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	64
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**46**

IHI Score (%) = (Score (1+2)/2)	**43%**
IHI Category (A to F):	**D: Largely Modified**

S+9.9: S15.699582 E34.720257
2023.09.13

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	Hydropeaking at Tedzani and seasonal flattening at Kamuzu
c) Bed Modification	13	*16*	critical increase of mobile sand; failed bridge; in main stream
d) Channel Modification	13	*16*	serious increase in channel width
e) Water Quality	14	*5*	conductivity moderate (26 mS/m); *Cladophora* common
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*4*	Minor
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*0*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	66
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**41**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*18*	serious removal of woody riparian veg, and agriculture to the rivers
b) Alien Vegetation	12	*11*	*Ricinis communis* , cultivation
c) Bank Erosion	14	*12*	Bank erosion, and scour toe, and seepage slumping
d) Channel Modification	12	*12*	serious increase in channel width
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*18*	Hydropeaking at Tedzani and seasonal flattening at Kamuzu
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	64
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**46**

IHI Score (%) = (Score (1+2)/2)	**43%**
IHI Category (A to F):	**D: Largely Modified**

S+7.5: S15.718045 E34.726660
2023.09.12

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	critical intra-day fluctuations caused by operation Tedzani HPP
c) Bed Modification	13	*23*	critical increase of mobile sand
d) Channel Modification	13	*14*	large increase in channel width (60 to 140 m)
e) Water Quality	14	*6*	conductivity moderate (26 mS/m); *Cladophora* common
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*0*	none
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*3*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	63
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**36**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*18*	serious removal of woody riparian veg
b) Alien Vegetation	12	*11*	*Ricinis communis, Lanatana camara, Argemone mexicana;*
c) Bank Erosion	14	*18*	serious bank erosion
d) Channel Modification	12	*13*	large increase in channel width
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*18*	serious intra-day fluctuations caused by operation Tedzani HPP
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	60
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**44**

IHI Score (%) = (Score (1+2)/2)	**40%**
IHI Category (A to F):	**D/E: Seriously Modified**

S+7.1: S15.721316 E34.727953
2023.09.13

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	3	unknown but likely to be ecologically insignificant
b) Flow Modification	13	21	critical intra-day fluctuations caused by operation Tedzani HPP
c) Bed Modification	13	23	critical increase of mobile sand
d) Channel Modification	13	14	large increase in channel width
e) Water Quality	14	6	*Cladophora glomerata* common
f) Inundation	10	0	none
g) Exotic Macrophytes	9	0	none
h) Exotic Fauna	8	3	*Oreochromis mossambicus* *
i) Solid Waste	6	0	none

Original Score (%) = 100 - sum weighted ave (a to i)/100:	64
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**36**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	6	moderate removal of woody riparian veg
b) Alien Vegetation	12	3	very low levels
c) Bank Erosion	14	0	bedrock controlled, so banks were stable.
d) Channel Modification	12	10	moderate increase in channel width
e) Water Abstraction	13	0	unknown but unlikely to impact riparian functions
f) Inundation	11	0	none
g) Flow Modification	12	18	serious intra-day fluctuations caused by operation Tedzani HPP
h) Water Quality	13	0	none

Score (%) = 100 - sum weighted ave (a to h)/100:	82
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**55**

IHI Score (%) = (Score (1+2)/2)	**45%**
IHI Category (A to F):	**D: Largely Modified**

S-0.2: S15.783879 E34.737942
2023.09.16

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	critical intra-day fluctuations caused by operation Tedzani HPP
c) Bed Modification	13	*23*	critical increase of mobile sand
d) Channel Modification	13	*14*	large increase in channel width
e) Water Quality	14	*4*	*Oedogonium and Stigeoclonium present*
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*0*	none
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus **
i) Solid Waste	6	*5*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	64
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**36**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*4*	limited removal of woody riparian veg
b) Alien Vegetation	12	*3*	very low levels
c) Bank Erosion	14	*0*	bedrock controlled, so banks were stable.
d) Channel Modification	12	*10*	moderate increase in channel width
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*18*	serious intra-day fluctuations caused by operation Tedzani HPP
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	83
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**56**

IHI Score (%) = (Score (1+2)/2)	**46%**
IHI Category (A to F):	**D: Largely Modified**

S-4.2: S15.817189 E34.735141
2023.09.19

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*18*	Hydropeaking at Tedzani (but some attenuation relative to ES2)and
c) Bed Modification	13	*15*	serious increase of mobile sand
d) Channel Modification	13	*6*	width bedrock controlled, but obvious erosion on banks associated
e) Water Quality	14	*6*	*Cladophora glomerata* and *Stigeoclonium common*
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*0*	none
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*6*	moderate

Original Score (%) = 100 - sum weighted ave (a to i)/100:	72
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**50**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*2*	limited removal of woody riparian veg
b) Alien Vegetation	12	*4*	*8 exoctics but mainly herbs*
c) Bank Erosion	14	*10*	large erosion left bank, obvious scouring of toes at power station
d) Channel Modification	12	*7*	Limited, due to excess sediments and hydropeaking
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*12*	Hydropeaking at Tedzani (but some attenuation relative to ES2)
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	82
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**67**

IHI Score (%) = (Score (1+2)/2)	**59%**
IHI Category (A to F):	**C/D: Moderately Modified**

S-4.6: S15.821868 E34.736494
2023.09.19





1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	critical intra-day fluctuations caused by operation Tedzani HPP
c) Bed Modification	13	*23*	critical increase of mobile sand
d) Channel Modification	13	*17*	serious increase in channel width
e) Water Quality	14	*6*	*Cladophora glomerata* and *Stigeoclonium common*
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*0*	none
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*6*	moderate

Original Score (%) = 100 - sum weighted ave (a to i)/100:	61
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**34**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*8*	moderate removal of woody riparian veg
b) Alien Vegetation	12	*5*	*Eucalyptus; Ricinis; Datura inoxia*
c) Bank Erosion	14	*16*	serious erosion
d) Channel Modification	12	*10*	moderate increase in channel width
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*18*	serious intra-day fluctuations caused by operation Tedzani HPP
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	71
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**50**

IHI Score (%) = (Score (1+2)/2)	**42%**
IHI Category (A to F):	**D/E: Seriously Modified**

S-7.6: S15.847498 E34.744509
2023.09.14

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*18*	Hydropeaking at Tedzani (but some attenuation relative to ES2)and
c) Bed Modification	13	*15*	serious increase of mobile sand
d) Channel Modification	13	*6*	width bedrock controlled, but obvious erosion on banks associated
e) Water Quality	14	*6*	*Cladophora glomerata* and *Stigeoclonium common*
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*0*	none
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*6*	moderate

Original Score (%) = 100 - sum weighted ave (a to i)/100: 72
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2): 50

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*0*	no removal of woody riparian veg
b) Alien Vegetation	12	*4*	*8 exoctics but mainly herbs*
c) Bank Erosion	14	*10*	large erosion left bank, obvious scouring of toes at power station
d) Channel Modification	12	*7*	Limited, due to excess sediments and hydropeaking
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*12*	Hydropeaking at Tedzani (but some attenuation relative to ES2)
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100: 83
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2: 68

IHI Score (%) = (Score (1+2)/2) 59%

IHI Category (A to F): C/D: Moderately Modified

S-9.3: S15.861277 E34.749524
2023.09.18





1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	3	unknown but likely to be ecologically insignificant
b) Flow Modification	13	21	critical intra-day fluctuations caused by operation Tedzani HPP
c) Bed Modification	13	23	critical increase of mobile sand
d) Channel Modification	13	18	serious increase in channel width
e) Water Quality	14	6	*Lyngbya common*
f) Inundation	10	0	none
g) Exotic Macrophytes	9	0	none
h) Exotic Fauna	8	3	*Oreochromis mossambicus* *
i) Solid Waste	6	6	moderate

Original Score (%) = 100 - sum weighted ave (a to i)/100:	60
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**34**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	8	moderate removal of woody riparian veg
b) Alien Vegetation	12	5	*Datura inoxia*
c) Bank Erosion	14	13	large erosion
d) Channel Modification	12	12	large increase in channel width
e) Water Abstraction	13	0	unknown but unlikely to impact riparian functions
f) Inundation	11	0	none
g) Flow Modification	12	18	serious intra-day fluctuations caused by operation Tedzani HPP
h) Water Quality	13	0	none

Score (%) = 100 - sum weighted ave (a to h)/100:	72
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**50**

IHI Score (%) = (Score (1+2)/2)	**42%**
IHI Category (A to F):	**D: Largely Modified**

S-12.2: S15.885999 E34.745890
2023.09.18

1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown but likely to be ecologically insignificant
b) Flow Modification	13	*21*	critical intra-day fluctuations caused by Kapichira HPP
c) Bed Modification	13	*23*	critical increase of mobile sand
d) Channel Modification	13	*18*	serious increase in channel width
e) Water Quality	14	*6*	*Lyngbya common*
f) Inundation	10	*22*	inundated by Kapichira HPP
g) Exotic Macrophytes	9	*0*	none
h) Exotic Fauna	8	*3*	*Oreochromis mossambicus* *
i) Solid Waste	6	*6*	moderate

Original Score (%) = 100 - sum weighted ave (a to i)/100:	52
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**30**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*15*	large removal of woody riparian veg
b) Alien Vegetation	12	*5*	*Datura inoxia*
c) Bank Erosion	14	*15*	large erosion
d) Channel Modification	12	*16*	serious increase in channel width
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*15*	inundated by Kapichira HPP
g) Flow Modification	12	*18*	serious intra-day fluctuations caused by Kapichira HPP
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	58
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**43**

IHI Score (%) = (Score (1+2)/2)	**37%**
IHI Category (A to F):	**E: Seriously Modified**

S-15.8: S15.913109 E34.754475
2023.09.20





1) Instream

Criterion	Weight	Rate	Comment
a) Water Abstraction	14	*3*	unknown. Irrigation diversion not yet operational
b) Flow Modification	13	*11*	operation of Kapichira HPP
c) Bed Modification	13	*23*	critical deposition of mobile sand
d) Channel Modification	13	*20*	serious increase in channel width
e) Water Quality	14	*5*	benthic alga absent
f) Inundation	10	*0*	none
g) Exotic Macrophytes	9	*0*	none
h) Exotic Fauna	8	*0*	*none*
i) Solid Waste	6	*3*	sparse

Original Score (%) = 100 - sum weighted ave (a to i)/100:	67
Modified Score (%) = 100 - (min (a to i) + weighted ave (a to i))/2):	**37**

2) Riparian

Criterion	Weight	Rate	Comment
a) Vegetation Removal	13	*16*	serious removal of woody riparian veg
b) Alien Vegetation	12	*5*	*Solanum; Jatropha gossypiifolia*
c) Bank Erosion	14	*16*	serious erosion
d) Channel Modification	12	*18*	serious increase in channel width
e) Water Abstraction	13	*0*	unknown but unlikely to impact riparian functions
f) Inundation	11	*0*	none
g) Flow Modification	12	*14*	large increase in high flows associated with deforestation
h) Water Quality	13	*0*	none

Score (%) = 100 - sum weighted ave (a to h)/100:	65
Score (%) = 100 - min (a to h) + weighted ave (a to h))/2:	**46**

IHI Score (%) = (Score (1+2)/2)	**42%**
IHI Category (A to F):	**D/E: Seriously Modified**

Annex 5-15: Fish Data (Lists)

The fish fauna in the project area can be divided into three ecological zones.

1. Upper Shire: Upstream of the rapid sections, between the outlet from Lake Malombe and Matope. The stretch of river is generally slow flowing with an extensive floodplain in Liwonde National Park, but gathering speed below the barrage at Liwonde (Table 5-225).

2. Middle Shire: The fast-flowing stretch from the first major rapids down to Kapichira falls, including tributaries. The river is torrential with numerous rapids and falls (Table 5-226).

3. Lower Shire: The stretch below Kapichira falls, including the extensive floodplains of the Elephant Marsh. The fauna in this river is Lower Zambezian as the Shire flows into the Zambezi in Mozambique, but with occasional stragglers from upstream found above Chikwawa (Figure 5-27).

Table 5-225: Middle Shire fish fauna in flat slower flowing stretches between outlet from Lake Malombe to Liwonde, particularly within Liwonde National Park, summarised from Tweddle (2018)
As in the rest of this report, lacustrine Lake Malawi endemic cichlid species have been excluded. No extra species were recorded by Mulumpwa et al. (2022 draft unpublished report) at Liwonde apart from a possible record of *Petrocephalus catostoma* at Kamuzu barrage. The species highlighted in grey have not been recorded in the project area from Matope downstream.

	IUCN Red Data Status	Kamuzu Barrage Six electric fishing samples between 1976 and 2011	Liwonde National Park	Likwenu River
Year		**1976-2011**	**2018**	1992
SPECIES				
Mormyrus longirostris	LC	X	X	
Cyphomyrus discorhynchus	LC		X	
Marcusenius nyasensis	LC	X	X	
Opsaridium microlepis	VU	X		X
Opsaridium microcephalum	LC	X	X	X
Enteromius arcislongae	LC	X	X	
Enteromius atkinsoni	LC	X		X
Enteromius kerstenii	LC	X		X
Enteromius sp. nov. "cf. *lineomaculatus* (A)"	NA	X		X
Enteromius sp. nov. "cf. *lineomaculatus* (B)"	NA	X		X
Enteromius litamba	DD		X	
Enteromius macrotaenia	LC	X	X	X
Enteromius paludinosus	LC	X	X	X
Enteromius radiatus	LC	X		X
Enteromius trimaculatus	LC	X	X	X
Labeobarbus johnstonii	LC	X		X
Labeobarbus latirostris	DD	X	X	
Engraulicypris sardella	LC	X	X	
Labeo cylindricus	LC	X	X	X
Labeo mesops	CR		X	
Brycinus imberi	LC	X	X	
Hemigrammopetersius barnardi	LC	X		X
Amphilius hargeri	LC			X
Clarias gariepinus	LC	X	X	X
Clarias theodorae	LC	X		
Chiloglanis sp.nov "Shire"	NA	X	X	X

	IUCN Red Data Status	Kamuzu Barrage Six electric fishing samples between 1976 and 2011	Liwonde National Park	Likwenu River
Synodontis njassae	LC	X	X	
Bagrus meridionalis	CR	X	X	
Lacustricola johnstoni	LC	X		X
Mastacembelus shiranus	LC	X		X
Astatotilapia calliptera	LC	X	X	X
Serranochromis robustus	CR	X		X
Oreochromis shiranus	LC	X	X	X
Coptodon rendalli	LC	X	X	

NA = Not assessed

Table 5-226: Fish fauna of Middle Shire between Matope and Kapichira

(*** = tributaries only, not in river mainstem), based on Tweddle *et al.* (1979). (* = *Chiloglanis* now believed to be two species, one common throughout the Shire River and one that replaces it in the Mkulumadzi River and found in very small numbers elsewhere. Taxonomic study is needed.)

Species	IUCN Red Data Status
Marcusenius macrolepidotus	LC
Marcusenius nyasensis	LC
Cyphomyrus discorhynchus	LC
Mormyrus anguilloides	LC
Mormyrus longirostris	LC
Anguilla labiata	LC
Hemigrammotopetersius barnardi	LC
Enteromius arcislongae	LC
Enteromius atkinsoni	LC
Enteromius kerstenii	LC
E. macrotaenia	LC
E. paludinosus	LC
E. radiatus	LC
E. trimaculatus	LC
E. sp. nov. "cf. *lineomaculatus* (A)"	NA
Enteromius sp. nov. "cf. *lineomaculatus* (B)"	NA
Labeobarbus johnstonii	LC
Opsaridium microcephalum	LC
O. tweddleorum ***	DD
Labeo cylindricus	LC
Lacustricola johnstonii	LC
Mastacembelus shiranus	LC
Brycinus imberi	LC
Amphilius hargeri ***	LC
Zaireichthys cf. *maravensis* ***	LC
Clarias gariepinus	LC
C. ngamensis	LC
C. theodorae	LC
Synodontis njassae	LC
Chiloglanis sp. nov. "Shire"	NA
Astatotilapia calliptera	LC
Coptodon rendalli	LC
Oreochromis shiranus	LC

Table 5-227: Fish fauna of Lower Shire between Kapichira and Chiromo (Ruo confluence) including the Elephant Marsh, based on Tweddle & Willoughby (1979) and Tweddle (2008, 2015). This table, with minor updates, is from Tweddle (2015).

Species	Comment	IUCN Red Data Status
Protopterus annectens brieni		LC
Megalops cyprinoides	Rare visitor from delta	DD
Anguilla bicolor bicolor	One specimen, Lisuli Lagoon, 1974	LC
Anguilla labiata		LC
Cyphomyrus discorhynchus		LC
Marcusenius macrolepidotus		LC
Mormyrops anguilloides		LC
Mormyrus longirostris		LC
Brycinus imberi		LC
Brycinus cf. *lateralis*	Very rare	NA
Hemigrammopetersius barnardi		LC
Hydrocynus vittatus		LC
Micralestes acutidens		LC
Distichodus mossambicus		LC
Distichodus schenga		LC
Enteromius afrohamiltoni		LC
E. atkinsoni	Limited distribution in East Bank streams	LC
E. choloensis	Believed extinct in valley, found (mid-1970s) in a pool in Mwabvi Wildlife Reserve	DD
E. haasianus		LC
E. kerstenii		LC
E. macrotaenia		LC
E. paludinosus		LC
E. radiatus		LC
E. trimaculatus		LC
E. sp. nov. "cf. *lineomaculatus* (A)"		NA
E. cf. *toppini*		NA
E. cf. *viviparus*		NA
Labeobarbus johnstonii	East Bank tributaries down to but not including the Ruo River	LC
Labeobarbus marequensis	Lower Ruo River only	LC
Opsaridium microcephalum	Lukubula River and Lisuli lagoon	LC
Opsaridium tweddleorum	East Bank tributaries	DD
Opsaridium zambezense	Mainstem river & Lower Ruo River only, not in East Bank tributaries	LC
Labeo altivelis		LC
Labeo congoro		LC
Labeo cylindricus		LC
Zaireichthys monomotapa		LC
Amphilius hargeri	East Bank streams, water possibly now too hot. Not in mainstem Shire	LC
Schilbe depressirostris		LC
Bagrus meridionalis	Rare strays from Lake Malawi	CR
Clarias gariepinus		LC
Clarias ngamensis		LC
Clarias theodorae		LC
Heterobranchus longifilis		LC
Malapterurus shirensis		LC
Chiloglanis sp. nov. "Shire"		NA
Synodontis nebulosus		LC
Synodontis zambezensis		LC
Lacustricola chobensis		LC

Species	Comment	IUCN Red Data Status
Lacustricola katangae		LC
Poecilia reticulata	East bank tributary, single specimen	LC
Nothobranchius orthonotus	Probably locally extinct in Malawi	LC
Astatotilapia calliptera		LC
Pseudocrenilabrus philander		LC
Oreochromis mossambicus		LC
Oreochromis placidus		LC
Oreochromis squamipinnis / O. karongae	Rare strays from Lake Malawi at the head of the valley.	CR
Oreochromis shiranus shiranus		LC
Serranochromis robustus	Rare strays from Lake Malawi	CR
Coptodon rendalli		LC
Glossogobius callidus		LC
Glossogobius giuris		LC
Microctenopoma intermedium		LC
Ctenopoma multispinis		LC
Mastacembelus shiranus	Rare strays from Lake Malawi, single specimen from Nchalo	LC
Carcharhinus leucas	Rare visitors from Zambezi delta	VU
Pristis microdon	Rare visitors from delta, last known record mid-1980s	CR

Annex 5-16: Fish Catch Data from Sept 2023 Surveys (R Palmer)

The data in this annex has been summarised in Table 5-110 in Section 5.13.18.2B.

Site	**S+48.0 (Zalewa)**
River	**Shire**
Date	**2023/09/15**
dd.dddd	S15.4535108583 E34.8684632658
Collector	Rob Palmer & Mexford Mulumphwa

Depth-Flow Classes (0-4)	
Shallow-Slow	2
Deep-Slow	3
Shallow-Fast	4
Deep-Fast	2
Overall	**69%**

Cover (0-4)	
Marginal	2
Macrophytes	1
Undercut Banks &	0
Woody Debris	2
Bed Substrate	4
Overall	**45%**

		Size - mm (weight)								
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**20 - 25** (113 g)	**Total** (No)	**Weight** (g)
Order Cichliformes										
Cichlidae	***Astatotilapia calliptera***		9	5	1				15	18
Cichlidae	***Oreochromis mossambicus ****				11	9	1		21	240
Order Cypriniformes										
Cyprinidae	***Enteromius arcislongae***		5		1				6	7
Cyprinidae	***Enteromius macrotaenia #***	(1)							(1)	-
Cyprinidae	***Enteromius trimaculatus***		1	1	2				4	10
Cyprinidae	***Labeo cylindricus***						2	1	3	217
Cyprinidae	***Labeobarbus johnstonii***			1	1			1	3	119
Danionidae	***Opsaridium microcephalum***		2	14					16	28
Order Cyprinodontiformes										
Poeciliidae	***Lacustricola johnstoni #***		(1)						(1)	-
Order Siluriformes										
Mochokidae	***Chiloglanis sp. "Shire"***			1					1	2
Mochokidae	***Chiloglanis sp. "Mkulumadzi"***		22						22	11
Mochokidae	***Synodontis njassae***		1						1	1
Order Synbranchiformes										
Mastacembelidae	***Mastacembelus shiranus***				3	1	2		6	132
	Effort (min)								**25**	
	Total Number of Species								**11+2**	
	Total								**98**	**785**
	Catch per Unit Effort (Hour)								**235**	**1 883**

 # = Scoop Net
* = Alien

Site	**S-41.0 (Zalewa)**
River	**Shire**
Date	**2023/09/15**
dd.dddd	S15.4535108583 E34.8684632658
Collector	Rob Palmer & Mexford Mulumphwa

Depth-Flow Classes (0-4)	
Shallow-Slow	2
Deep-Slow	3
Shallow-Fast	4
Deep-Fast	2
Overall	**69%**

Cover (0-4)	
Marginal	2
Macrophytes	1
Undercut Banks &	0
Woody Debris	2
Bed Substrate	4
Overall	**45%**

		Size - mm (weight)								
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**20 - 25** (113 g)	**Total** (No)	**Weight** (g)
Order Cichliformes										
Cichlidae	***Astatotilapia calliptera***		9	5	1				15	18
Cichlidae	***Oreochromis mossambicus ****				11	9	1		21	240
Order Cypriniformes										
Cyprinidae	***Enteromius arcislongae***		5		1				6	7
Cyprinidae	***Enteromius macrotaenia #***	(1)							(1)	-
Cyprinidae	***Enteromius trimaculatus***		1	1	2				4	10
Cyprinidae	***Labeo cylindricus***						2	1	3	217
Cyprinidae	***Labeobarbus johnstonii***			1	1			1	3	119
Danionidae	***Opsaridium microcephalum***		2	14					16	28
Order Cyprinodontiformes										
Poeciliidae	***Lacustricola johnstoni #***		(1)						(1)	-
Order Siluriformes										
Mochokidae	***Chiloglanis sp. "Shire"***			1					1	2
Mochokidae	***Chiloglanis sp. "Mkulumadzi"***		22						22	11
Mochokidae	***Synodontis njassae***		1						1	1
Order Synbranchiformes										
Mastacembelidae	***Mastacembelus shiranus***				3	1	2		6	132
	Effort (min)								**25**	
	Total Number of Species								**11+2**	
	Total								**98**	**785**
	Catch per Unit Effort (Hour)								**235**	**1 883**

 # = Scoop Net
* = Alien

Site	**S+48.0 (Zalewa)**
River	**Shire**
Date	**2023/09/14**
dd.dddd	S15.4535108583 E34.8684632658
Collector	Geoffrey Sanduka & Eric Fakson

Field Data Sheet: Shire

(Gill Net)

Depth-Flow Classes (0-4)	
Shallow-Slow	
Deep-Slow	
Shallow-Fast	
Deep-Fast	
Overall	**0%**

Cover (0-4)	
Marginal	
Macrophytes	
Undercut Banks &	
Woody Debris	
Bed Substrate	
Overall	**0%**

		Size - mm (weight)											
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**20 - 25** (113 g)	**25 - 30** (210 g)	**30 - 35** (352 g)	**35 - 40** (547 g)	**Total** (No)	**Weight** (g)
Order Cichliformes													
Cichlidae	***Oreochromis mossambicus***						1					1	52
Order Cypriniformes													
Cyprinidae	***Labeo cylindricus***							4	1		1	6	1 209
Cyprinidae	***Labeobarbus johnstonii***							1	1			2	323
Order Synbranchiformes													
Mastacembelidae	***Mastacembelus shiranus #***			1								1	2
	Effort (min)											**n/a**	**-**
	Total Number of Species											**4**	**-**
	Total											**4**	**1 586**
	Catch per Unit Effort (Hour)											**-**	**-**

 # = Scoop Net

Site	**S+35.7 (AQS3 Nkula)**
River	**Shire**
Date	**2023/09/15**
dd.dddd	S15.5275515202 E34.8176240878
Collector	Rob Palmer & Mexford Mulumphwa

Depth-Flow Classes (0-4)	
Shallow-Slow	3
Deep-Slow	2
Shallow-Fast	0
Deep-Fast	0
Overall	**31%**

Cover (0-4)	
Marginal	2
Macrophytes	0
Undercut Banks &	0
Woody Debris	0
Bed Substrate	3
Overall	**25%**

		Size - mm (weight)							
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**Total** (No)	**Weight** (g)
Order Anguilliformes									
Anguillidae	***Anguilla labiata*** (TL=71 cm) *							(1)	-
Order Cichliformes									
Cichlidae	***Astatotilapia calliptera***		47	11	1			59	49
Cichlidae	***Oreochromis mossambicus***		1	1	3	1		6	30
Cichlidae	***Oreochromis shiranus***			1	1			2	6
Order Cypriniformes									
Cyprinidae	***Enteromius arcislongae***		3	1				4	3
Cyprinidae	***Enteromius macrotaenia***		2					2	1
Cyprinidae	***Labeo cylindricus***				1			1	4
Cyprinidae	***Labeobarbus johnstonii***		12	2				14	10
Danionidae	***Opsaridium microcephalum***		1	1				2	2
Order Synbranchiformes									
Mastacembelidae	***Mastacembelus shiranus***				1			1	4
	Effort (min)							**20**	
	Total Number of Species							**9+1**	
	Total							**91**	**111**
	Catch per Unit Effort (Hour)							**273**	**332**

** Caught by fisher using hand line*

Site	**S+32.6 (AQS2 Tedzani)**
River	**Shire**
Date	**2023/09/15**
dd.dddd	S15.5463534587 E34.7966376657
Collector	Rob Palmer & Mexford Mulumphwa

Depth-Flow Classes (0-4)

Shallow-Slow	2
Deep-Slow	0
Shallow-Fast	0
Deep-Fast	0
Overall	**13%**

Cover (0-4)

Marginal	3
Macrophytes	0
Undercut Banks &	0
Woody Debris	0
Bed Substrate	0
Overall	**15%**

		Size - mm (weight)							
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**Total** (No)	**Weight** (g)
Order Cypriniformes									
Danionidae	***Opsaridium microcephalum***				2			2	8
Order Cyprinodontiformes									
Poeciliidae	***Poecilia reticulata ****			3				3	6
	Effort (min)							**5**	
	Total Number of Species							**2**	
	Total							**5**	**14**
	Catch per Unit Effort (Hour)							**60**	**164**

** = Alien*

Site	**S+29.3 (Tedzani HPP Below)**
River	**Shire**
Date	**2023/09/14**
dd.dddd	S15.5598792859 E34.7756078092
Collector	Rob Palmer

Depth-Flow Classes (0-4)

Shallow-Slow	2
Deep-Slow	1
Shallow-Fast	2
Deep-Fast	0
Overall	**31%**

Cover (0-4)

Marginal	1
Macrophytes	0
Undercut Banks &	0
Woody Debris	0
Bed Substrate	3
Overall	**20%**

		Size - mm (weight)							
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**Total** (No)	**Weight** (g)
Order Cichliformes									
Cichlidae	***Astatotilapia calliptera***			1				1	2
Order Cypriniformes									
Cyprinidae	***Labeobarbus johnstonii***						**5**	5	20
Danionidae	***Opsaridium microcephalum***			3				3	6
Order Siluriformes									
Mochokidae	***Chiloglanis sp. "Mkulumadzi"***		7					7	4
	Effort (min)							**7**	
	Total Number of Species							**4**	
	Total							**4**	**31**
	Catch per Unit Effort (Hour)							**34**	**268**

Site	**S+21.7 (AQS 1 Tedzani)**
River	**Shire**
Date	**2023/09/14**
dd.dddd	S15.5566633112 E34.7879095359
Collector	Rob Palmer

Depth-Flow Classes (0-4)

Shallow-Slow	4
Deep-Slow	0
Shallow-Fast	0
Deep-Fast	0
Overall	**25%**

Cover (0-4)

Marginal	4
Macrophytes	2
Undercut Banks &	0
Woody Debris	0
Bed Substrate	0
Overall	**30%**

		Size - mm (weight)							
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**Total** (No)	**Weight** (g)
Order Cichliformes									
Cichlidae	***Astatotilapia calliptera***			3	4	5		12	102
Order Cypriniformes									
Cyprinidae	***Enteromius macrotaenia***			4				4	8
Cyprinidae	***Enteromius trimaculatus***				1			1	4
Danionidae	***Opsaridium microcephalum***				1			1	4
Order Cyprinodontiformes									
Poeciliidae	***Poecilia reticulata ****			1				1	2
	Effort (min)							**n/a**	
	Total Number of Species							**5**	
	Total							**19**	**-**
	Catch per Unit Effort (Hour)							**-**	**-**

** = Alien*

Site	**S+7.5 (AQ8a)**
River	**Shire**
Date	**2023/09/12**
dd.dddd	-15.7180454928, 34.7266603478
Collector	Rob Palmer & Mexford Mulumphwa

Depth-Flow Classes (0-4)	
Shallow-Slow	4
Deep-Slow	1
Shallow-Fast	1
Deep-Fast	0
Overall	**38%**

Cover (0-4)	
Marginal	0
Macrophytes	0
Undercut Banks &	0
Woody Debris	0
Bed Substrate	4
Overall	**20%**

		Size - mm (weight)								
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**20 - 25** (113 g)	**Total** (No)	**Weight** (g)
Order Cichliformes										
Cichlidae	***Astatotilapia calliptera***		6	9	5				20	40
Order Cypriniformes										
Cyprinidae	***Enteromius arcislongae***			2					2	4
Cyprinidae	***Labeobarbus johnstonii***			4	2	1		1	8	145
Order Siluriformes										
Mochokidae	***Chiloglanis sp. "Shire"***		1						1	1
Mochokidae	***Chiloglanis sp. "Mkulumadzi"***		3						3	2
	Effort (min)								**22**	
	Total Number of Species								**5**	
	Total								**34**	**191**
	Catch per Unit Effort (Hour)								**93**	**520**

Field Data Sheet: Shire

Site	**S+7.1 (AQS9)**
River	**Shire**
Date	**2023/09/13**
dd.dddd	S15.7213160465 E34.7279531216
Collector	Michael Leonard (Gill Net)

Depth-Flow Classes (0-4)	
Shallow-Slow	
Deep-Slow	
Shallow-Fast	
Deep-Fast	
Overall	**0%**

Cover (0-4)	
Marginal	0
Macrophytes	
Undercut Banks &	
Woody Debris	
Bed Substrate	
Overall	**0%**

		Size - mm (weight)											
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**20 - 25** (113 g)	**25 - 30** (210 g)	**30 - 35** (352 g)	**35 - 40** (547 g)	**Total** (No)	**Weight** (g)
Order Cypriniformes													
Cyprinidae	***Labeo cylindricus***							3		3	1	7	1 942
Cyprinidae	***Labeobarbus johnstonii***									1		1	352
Danionidae	***Opsaridium microcephalum***					3						3	48
Order Osteoglossiformes													
Mormyridae	***Mormyrus longirostris***									1		1	352
	Effort (min)											**n/a**	
	Total Number of Species											**4**	
	Total											**12**	**2 694**
	Catch per Unit Effort (Hour)											**4**	**-**

Site	**S-0.2 (FQS 11)**
River	**Shire**
Date	**2023/09/18**
dd.dddd	S15.783879 E34.737942
Collector	Mexford Mulumphwa & Ibrahim Mitole

Depth-Flow Classes (0-4)	
Shallow-Slow	2
Deep-Slow	0
Shallow-Fast	4
Deep-Fast	1
Overall	**44%**

Cover (0-4)	
Marginal	1
Macrophytes	0
Undercut Banks &	0
Woody Debris	0
Bed Substrate	4
Overall	**25%**

		Size - mm (weight)								
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**20 - 25** (113 g)	**Total** (No)	**Weight** (g)
Order Cichliformes										
Cichlidae	***Astatotilapia calliptera***		1						1	1
Order Cypriniformes										
Cyprinidae	***Labeo cylindricus***					1			1	16
Order Siluriformes										
Mochokidae	***Chiloglanis sp. "Mkulumadzi"***		6						6	3
	Effort (min)								**17**	
	Total Number of Species								**3**	
	Total								**8**	**20**
	Catch per Unit Effort (Hour)								**28**	**69**

Field Data Sheet: Shire

Site	**S-4.2 (AQS 12)**
River	**Shire**
Date	**2023/09/18**
dd.dddd	S15.817189 E34.735141
Collector	Mexford Mulumphwa & Ibrahim Mitole

Depth-Flow Classes (0-4)	
Shallow-Slow	4
Deep-Slow	0
Shallow-Fast	1
Deep-Fast	0
Overall	**31%**

Cove	
Marginal	0
Macrophytes	0
Undercut Banks &	0
Woody Debris	0
Bed Substrate	3
Overall	**15%**

		Size - mm (weight)										
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**20 - 25** (113 g)	**25 - 30** (210 g)	**30 - 35** (352 g)	**Total** (No)	**Weight** (g)
Order Cichliformes												
Cichlidae	***Astatotilapia calliptera***			6	5						11	31
Order Cypriniformes												
Cyprinidae	***Labeobarbus johnstonii***		1		1						2	5
Order Synbranchiformes												
Mastacembelidae	***Mastacembelus shiranus***						1				1	52
	Effort (min)										**14**	
	Total Number of Species										**3**	
	Total										**14**	**88**
	Catch per Unit Effort (Hour)										**60**	**377**

Site	**S-9.3 (WQ S 15)**
River	**Shire**
Date	**2023/09/18**
dd.dddd	S15.861277 E34.749524
Collector	Mexford Mulumphwa & Ibrahim Mitole

Depth-Flow Classes (0-4)

Shallow-Slow	3
Deep-Slow	0
Shallow-Fast	3
Deep-Fast	1
Overall	**44%**

Cove

Marginal	0
Macrophytes	0
Undercut Banks &	0
Woody Debris	0
Bed Substrate	4
Over	**20%**

		Size - mm (weight)							
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**Total** (No)	**Weight** (g)
Order Cichliformes									
Cichlidae	***Astatotilapia calliptera***		7	10	3			20	35
Cichlidae	***Oreochromis mossambicus***					4		4	64
Cichlidae	***Oreochromis shiranus***				1			1	4
Order Cypriniformes									
Cyprinidae	***Labeobarbus johnstonii***			1	1			2	6
	Effort (min)							**13**	
	Total Number of Species							**4**	
	Total							**27**	**109**
	Catch per Unit Effort (Hour)							**125**	**501**

Site	**S-15.8 (AQS 18)**
River	**Shire**
Date	**2023/09/20**
dd.dddd	S15.913109 E34.754475
Collector	Mexford Mulumphwa & Ibrahim Mitole

Field Data Sheet: Shire

Depth-Flow Classes (0-4)	
Shallow-Slow	3
Deep-Slow	2
Shallow-Fast	1
Deep-Fast	0
Overall	**38%**

Cove	
Marginal	0
Macrophytes	0
Undercut Banks &	0
Woody Debris	0
Bed Substrate	3
Overall	**15%**

		Size - mm (weight)										
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**20 - 25** (113 g)	**25 - 30** (210 g)	**30 - 35** (352 g)	**Total** (No)	**Weight** (g)
Order Characiformes												
Cichlidae	***Micralestes acutidens***			1							1	2
Order Cichliformes												
Cichlidae	***Astatotilapia calliptera***		1	1	1						3	6
Cichlidae	***Oreochromis mossambicus***					3	1				4	100
Order Cypriniformes												
Cyprinidae	***Enteromius cf lineomaculatus sp A***		1								1	1
Cyprinidae	***Enteromius macrotaenia***		2								2	1
Cyprinidae	***Enteromius radiatus***		2								2	1
Cyprinidae	***Enteromius cf viviparus***		24								24	12
Cyprinidae	***Labeo cylindricus***		1	2	3				1		7	226
Cyprinidae	***Labeobarbus johnstonii***		1								1	1
Danionidae	***Opsaridium microcephalum #***			(1)							(1)	-
Order Siluriformes												
Mochokidae	***Chiloglanis sp. "Mkulumadzi"***	1	30	3							34	21
Mochokidae	***Synodontis zambezensis #***					(1)					(1)	-
	Effort (min)										**25**	
	Total Number of Species										**10+2**	
	Total										**79**	**372**
	Catch per Unit Effort (Hour)										**190**	**892**

** Caught by fisher using hand line*

Field Data Sheet: Shire

Site	**M11 (AQ Mk 1)**
River	**Mkulumadzi**
Date	**2023/09/18**
dd.dddd	S15.819273 E34.731570
Collector	Mexford Mulumphwa & Ibrahim Mitole

Depth-Flow Classes (0-4)	
Shallow-Slow	3
Deep-Slow	0
Shallow-Fast	3
Deep-Fast	1
Overall	**44%**

Cove	
Marginal	0
Macrophytes	0
Undercut Banks &	0
Woody Debris	0
Bed Substrate	4
Overall	**20%**

		Size - mm (weight)										
Family	**Species**	**0 - 3** (0.05 g)	**3 - 5** (0.52 g)	**5 - 7** (1.9 g)	**7 - 10** (4.0 g)	**10 - 15** (16 g)	**15 - 20** (52 g)	**20 - 25** (113 g)	**25 - 30** (210 g)	**30 - 35** (352 g)	**Total** (No)	**Weight** (g)
Order Cichliformes												
Cichlidae	***Astatotilapia calliptera***			1	2						3	10
Cichlidae	***Oreochromis mossambicus ****			1	4	2					7	50
Cichlidae	***Oreochromis shiranus***				2	2					4	40
Order Cypriniformes												
Cyprinidae	***Enteromius arcislongae***			2							2	4
Cyprinidae	***Enteromius trimaculatus***		2	1	1						4	7
Cyprinidae	***Labeo cylindricus***					1	1	1			3	181
Cyprinidae	***Labeobarbus johnstonii***			7	8						15	45
Danionidae	***Opsaridium microcephalum***		2								2	1
Order Siluriformes												
Clariidae	***Clarias gariepinus***									1	1	352
Mochokidae	***Chiloglanis sp. "Mkulumadzi"***		1	9							10	18
	Effort (min)										**37**	
	Total Number of Species										**10**	
	Total										**51**	**708**
	Catch per Unit Effort (Hour)										**83**	**1 147**

** = Alien*