GOVERNMENT OF MALAWI

MINISTRY OF AGRICULTURE

SHIRE VALLEY TRANSFORMATION PROGRAM

P-MW-AA0-039 SHIRE VALLEY TRANSFORMATION PROGRAM –PHASE 2 (SVTP-2), MALAWI

UPDATED ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA)

June, 2023

Executive Summary

Overview of the project

The Government of Malawi has priotised development of agriculture as indicated in the Malawi 2063 Vison, Pillar 1 – Agriculture Productivity and Commercialisation. This pillar is being addressed through a number of projects including the Shire Valley Transformation Program (SVTP). With support from the World Bank, African Development Bank, Global Environmental Facility (GEF), Opec Fund for International Development (OFID), Nigerian Trust Fund (NTF) and the Government of Malawi, SVTP has now moved into Phase 2.

Implementation of SVTP is expected to generate various impacts on the bio-physical and socio-economic environment in the project areas and Malawi in general. The scope and nature of the works that will be undertaken before, during, after construction and operation, led to the Category 1 classification that implies the need to carry out an Environmental and Social Impact Assessment (ESIA) study and develop a Resettlement Action Plan (RAP) in line with Section 24 of the Environmental Management Act (2017) and the world Bank's Environmental and Social Framework and AFDB's Operational safegurds.

The specific objectives of the ESIA included identifying and assessing potential environmental and social impacts and recommending appropriate mitigation strategies (avoid, minimize, restore and compensate); analysing project alternatives with a view of avoiding and minimizing adverse impacts and risks, and to optimize the benefits to socioeconomic development and other development activities in the region; To undertake meaningful consultations with relevant stakeholders including potentially affected persons, government agencies, interest groups, private sector and the public in order to design and implement an all-inclusive project; prepare an Environmental and Social Management Plan that details required mitigation and monitoring actions.

There are two major options that were considered by the Government of Malawi, namely, "no project" option' and "implement SVTP with due diligence to safeguard the environmental and social requirements". The environmental and social implications of each were considered in development of SVTP 1 and revisited formulation of Phase 2 of SVTP in selecting the project option. The "no project" option would imply continuing with the high poverty levels manifested in food and income insecurity and poor markets.

Description of the project site and the major environmental and social stakes

Ministry of Agriculture, through the Department of Irrigation, is implementing the Shire Valley Transformation Programme (SVTP) in Chikwawa and Nsanje distrcts in the southern region of the country. . The programme development objective is to increase agricultural productivity and commercialization for targeted households in the Shire Valley; and to improve the sustainable management and utilization of natural resources. The Project Development Objective (PDO) is

to develop irrigated commercial agriculture and strengthen the management of natural resources in the program area.

SVTP is a 14-year Program (2018-2031) supported by a series of projects (SoP) with three sequential but partially overlapping phases namely: SVTP-I, SVTP-II and SVTP-III (Figure 1).

- Phase I (SVTP-1) initiated the process on all four pillars with a focus on irrigation scheme development to eventually serve about 22,000 ha (including about 10,000 ha new irrigation area), securing land tenure, farmer and agriculture block organization, and natural resources management.
- Phase II (SVTP-2) shifts investment focus to agricultural investment, private sector and value chain support, as well as investments in bulk infrastructure;
- Phase III (SVTP-3) is the scale-up phase of investments to the SVIP-2 area.

SVTP-1 became effective on March 21, 2018, and the expected completion date is December 31, 2023. SVTP-1 has initiated the process on all four pillars with a focus on irrigation scheme development to eventually serve about 22,000 ha (including about 10,000 ha new irrigation area), securing land tenure, farmer and agriculture block organization, and natural resources management. The program activities are well sequenced. Infrastructure development and land tenure activities (SVTP-1 Components 1 and 2) are prerequisite for the development of commercial agriculture (Component 3). The main canal infrastructure (intake and 52 km of main canal) is under construction, with a planned completion date of December 2023. Secondary canal/pipeline systems in the Phase 1 area have been designed and will be contracted during quarter 3 of 2022.

The first 10.5 km of the main canal to be constructed under SVTP-2 will pass through the Lengwe National Park which is a protected area harbouring unique fauna such as (Nyala *Tragelaphus angasii)* and vegetation such as Mopane (*Colophospermum mopane*) which is endangered in Malawi (Chikuni, 1996). The uniqueness of the Nyala is that Lengwe contains the northern most naturally occurring population of the Nyala antelope extending from South Africa and extending to Zimbabwe and Mozambique before finally reaching southern Malawi (Clarke, 1983). It is believed that nyala prefers thicket vegetation, a development that necessitated the change of alignment to avoid the thicket.

SVTP-2 will have the following components, some of which are similar to SVTP-1: Component 1 - Irrigation Infrastructure Development and Service Provision; Component 2 - Land Tenure and Consolidation; Component 3 - Agriculture Development and Commercialization; Component 4 – Strengthening Landscape and Natural Resources Management; Component 5 – Project Management and Coordination; and Component 6 - Contingent Emergency Response. SVTP-2 will continue to work in the Phase 1 area, in particular with remaining secondary canal/pipeline construction and agriculture block development. SVTP-2 will also expand the geographical coverage further south into the Shire Valley where about 21,000 ha will benefit from new or improved irrigation and commercial agricultural practices, including 17,500 ha of newly developed irrigation area.

It is important to note that apart from the construction of irrigation facilities, the project will also advance a series of initiatives under component 4 in protected areas, forest reserves and the

Elephant Marsh to strengthen biodiversity resources in the valley as a whole and provide improvements to the watershed. The targeted protected areas are Lengwe National Park, Mwabvi Wildlife Reserve. Among forest reserves, the following will be targeted: Thambani, Michiru and Kalulu.

Institutional and legal framework for implementation of the project

National Policy Framework

The key national policy documents consulted for this ESIA report were: The Constitution of the Republic of Malawi (1995), the Malawi Vision 2063, .1.3 Malawi Growth and Development Strategy II, National Environmental Action Plan (1994), National Environmental Policy, 2004, National Land Policy, 2002, the National Irrigation Policy (2016), the National Forest Policy of Malawi (2016) And Forest Landscape Restoration Strategy (2017), National Disaster Risk Management (NDRM) Policy 2015, National Water Resources Policy 2005, National Wildlife Policy 2000, National Gender Policy 2012 – 2017, National HIV/AIDS Policy, 2012, National Land Resources Management Policy and Strategy, 2000, National Fisheries and Aquaculture Policy (2016), National Climate Change Policy, Charcoal Strategy, National Biodiversity Strategy and Action Plan (NABSAP) 2015-2025, National Waste Management Strategy (2019-2023),

Legal Framework

The national laws consulted were as follows: Environment Management Act, 2017; National Parks and Wildlife (Amendment) Act, 2017; Land Act (2016); Customary Land Act (2016); Land Survey Act (2016); Physical Planning Act (2016); Cultural Heritage Regulations; Water Resources Act (2013); Pesticides Act (2000); Forestry Act (2016); Irrigation Act, 2001; Occupational Safety, Health and Welfare Act (1997); Environment Waste Management and Sanitation Regulations 2008; Environmental (Management of Chemicals and toxic substances) Regulations, 2008; Workers Compensation Act 2000; the Employment Act, 2000; the Labour Relations Act, 1996; and Fisheries Conservation and Management Act (1997).

Funding Agency Policies

SVTP receives funding from the WB, AFDB, GEF, OFID, and NTF and as such safeguard policies of these development partners have to be complied with.

For Phase 1, the relevant WB Operational Policies (OP) were: Environmental Assessment (OP 4.01), Pest Management (OP 4.09), Involuntary Resettlement (OP 4.12), Cultural Heritage (OP 4.11), Natural Habitats (OP 4.04), Projects on International Waterways (OP7.50), Safety of Dams (OP4.37, ESS4) and the World Bank's Information Disclosure Policy, BP 17.50.

World Bank Environmental and Social Framework

The World Bank Environmental and Social Framework (ESF) and the relevant Environmental and Social Standards (ESS) have replaced the Ops that were applied in Phase . The applicable

ESS to Phase 2 are as follows: ESS1 (Assessment and Management of Environmental and Social Risks and Impacts), ESS2: (Labor and Working Conditions), ESS (Resource Efficiency and Pollution Prevention and Management), ESS4 (Community Health and Safety), ESS5 (Land Acquisition, Restrictions on Land Use and Involuntary Resettlement), ESS6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources), ESS8 (Cultural Heritage), and ESS10 (Stakeholder Engagement and Information Disclosure).

African Development Bank Integrated Safeguards System

In developing SVTP 2, the Government of Malawi has taken into consideration full recognition of the requirements of the AFDB Integrated Safeguards System through application of Operational Safeguards (OS).

The Operational Standards that have been applied are as follows: OS 1(Environmental and Social Assessment), OS 2 (Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation), OS3 (Biodiversity, renewable resources and ecosystem services), OS4 (Pollution prevention and control, hazardous materials and resource efficiency), OS5 (Labour conditions, health and safety),

Summary of positive and negative environmental and social impacts

The implementation of SVTP is expected to have both positive and negative impacts at the designing, construction and decommissioning stage of the project. These impacts are going to be more during the construction and operation of the irrigation program than during the designing phase.

Positive Impacts

a) Increased trading activities – construction staff will provide markets for local produce and merchandise within the project area

Enhancement Measures

- Carry out community sensitization on business opportunities that will come about due to the project implementation.
- Conduct safety awareness regarding construction activities and how the people can conduct their businesses in a safe manner.
- Ensureb that the contractor pays construction material suppliers within the agreed time;
- Source materials from approved licenced suppliers;
- Pay all associated taxes to the Malawi Revenue Authority; and
- Promote, where possible, use of materials manufactured in Malawi.

b) Creation of Employment opportunities – the irrigation construction works in SVTP, growth on industries in SEZs and SOCFEs will recruit people mostly from the local area.

Enhancement Measures

- The developer shall maximise employment of local Malawian, both professionals registered with relevant Malawian institutions and authorities and unskilled Malawian;.
- Give equal employment opportunities for both men and women including the youth
- Enforce the Malawi labour laws to ensure wages are not below the minimum wage and overtime is paid on time.
- The Contractor shall engage the District Labour office in collaboration with Ministry of Labour throughout the project.
- The contractor should seek guidance from the District Labour office on hiring procedures and employment contracts to ensure compliance; and Ensure job security by having all workers with valid employment contract.

c) Knowledge and Skills Transfer - Employment of local people from within the projects area of impact will facilitate capacity enhancement and the acquisition of specific skill sets through on the job and formal training.
   Enhancement Measures
   - Establish a window for counetrparts from the Department of Irrigation Services,
   - Promote government apprenticeship / internship opportunities program the youth and students from the public and private universities to build capacities in engineering, human resource development and environmental fields

d) Increase in government revenue
   Enhancement Measures
   - The contractor will have to ensure fairly, honestly and timely remittance of the taxes to Government;
   - Encourage procurement of services and goods from tax compliant businesses.

e) Increased disposable income/ Improved Standards of Living
   Enhancement Measures
   - Ensure compliance to minimum wage requirement based on Malawi labour laws;
   - Identify sustainable and profitable markets for farm produce

f) Enhanced food security/ Improved Standards of Living – SVTP will enhance food security in the area and Malawi in general.
   Enhancement Measures
   - Ensure the infrasture is well maintained;
   - Develop equitable and sustained markets for the produce

g) Increased trade and marketing - The project will also be buying construction materials from the local market and will provide business for the local businesses
   Enhancement measures
   - Carry out community sensitization on business opportunities that will come about due to the project implementation.

- Conduct safety awareness regarding construction activities and how the people can conduct their businesses in a safe manner.
- Ensureb that the contractor pays construction material suppliers within the agreed time;
- Source materials from approved licenced suppliers;
- Pay all associated taxes to the Malawi Revenue Authority; and
- Promote, where possible, use of materials manufactured in Malawi.

h) Improved knowledge base of species and the existence of potential areas of high conservation value in the project area

Enhancement Measures

- Develop monitoring protocol for threatened species and identified areas/habitats of conservation value;
- Collaborate with conservation NGOs and MDAs (responsible Ministries, Departments and Agencies) in conservation and management of these areas;
- Undertake fresh biodiversity studies annually to determine species and species abundance of fauna in project area.

i) Improved safety of threatened and protected fauna species due to fauna rescue program

Enhancement Measures

- Develop Rescue protocol for all protected species;
- Intensify law enforcement to check illegal activities;
- Employ well qualified and well-trained wildlife cares; and
- Strengthen and expanding the implementation of CCA

j) Improved attraction infrastructure features for the park

Enhancement Measures

- Establish eco-bridges that will be additional attractive feature to the park for tourism and education
- Establish rescue center that will be important for tourism and education

k) Enhanced access to water by wildlife in New Lengwe

Enhancement Measures

- Drill 6 water holes on the western side of the canal; and
- Provide water troughts in the eastern side (Solar panel operated /fed by water from the cana)

l) Improved facilities such as rangers' houses, camps sites, roads in LNP

Enhancement Measures

- Support establishment of 2 New ranger camps, with semi detached houses;
- Establish a Makeshift Camp at the centre of the canal inside the park;
- Provide 3 Toyota Land Cruisers for patrols;
- Acquire communication equipment for DNPW;

m) Health delivery system for the management of schistosomiasis

Enhancement Measures

- Raise awareness on bilharzia;
- Acquire microscopes for health facilities in Chikwawa and Nsanje
- Support Chikwawa and Nsanje district councils in acquiring and administering medication for schistosomiasis

Negative Impacts

The negative impacts have been classified as follows:

A. Impacts for Majete Wildlife Reserve

(i) Loss of revenue from tourism as most visitors may not be comfortable with construction works

Mitigation Measures

- Include loss of revenue in the compensation for Majete;
- Construct alternate access routes for tourists coming to Majete; and
- Support improvements and construction of new tourism facilities in majete
- Develop bridge to provide access to Kapichira falls

(ii) Loss of vegetation emanating from clearance of vegetation - The construction works under SVTP will, in certain areas including protected areas, necessitate clearing of vegetation.

Mitigation Measures

- Support African Parks Majete in the development and implementation of the Biodiversity Management Plan;
- Develop and implement a restoration plan covering the Intake and the First 6 km including the borrow pit;

(iii) General disturbance to wildlife – Civil works have potential to disturb wildlife especially within Majete Wildlife Reserve, Lengwe National Park, Shire River and the Elephant Marsh.

Mitigation Measures

- Prohibit establishment of workers' camps within the wildlife reserve and National Park
- Prohibit contractor and workers so as not to hunt, kill, capture or trap any wildlife or bird at the project sites and vicinity. .
- Ensure regular and proper servicing of machinery and vehicles to reduce the impact of noise.
- Ensure that no construction takes place at night in the protected areas; and
- Ensure that blasting does not take place outside the times agreed with DNPW or APM

(iv) Noise and vibration - Noise will be generated by the movement of construction vehicles to and from work sites and the operation of construction machinery.

Mitigation Measures

- Service machinery and vehicles regularly and properly to reduce the impact of noise.
- Restrict work to daytime only, thus from 06:00 to 17:00 hours inside protected areas, unless agreed with DNPW or AP.
- Restrict blasting to daytime only and the residents of nearby settlements should be informed prior to the blasting.
- Restrict blasting to times agreed with park authorities;
- Record baseline conditions by way of photographs of all properties adjacent to the work sites prior to blasting and drilling for future reference in the event of compensation.

(v) Improper Waste Disposal - Different types of wastes are expected to be produced at various stages of SVTP implementation.

Mitigation Measures

- Designate places where unwanted waste should be carefully disposed of;
- Conduct, where necessary, rehabilitation and planting of avenue trees and grass on all slopes and unstable areas;
- Provide toilets at the work and camp sites. No pit latrines are allowed to be constructed at these sites as pit latrines are known to contaminate ground water quality. The contractor could use mobile chemical toilets or construct flush toilets connected to a septic tank (depending on the expected life of the camp site).
- Ensure septic tank do not overfill and spill, and that they are emptied on a regular basis for disposal at an appropriate and designated off-site facility capable of handling such waste.

- The contractor should install sufficient and appropriate waste bins with lids at work and camp sites to store the waste produced on a daily basis.
- Discourage burying and burning of waste.
- Ensure that fuel and oils storage areas are adequately bundled and that any spills and leakages are not released to the environment but retained in sealed containers for disposal at an appropriate and designated off site facility.

(vi)Reduced security for wildlife and construction workers in Majete Wildlife Reserve

Mitigation Measures

- AP should provide two rangers to provide security to construction workers;
- Prohibit night works unless with prior arrangement with park authorities

B. Impacts on Lengwe National Park

(i) Limitations on wildlife movement between the eastern and western parts of the park due to canal construction

Mitigation Measures

- Construct eco-bridges to enable game movement between the Old and New Lengwe;
- Provide for under passess

(ii) Increased cases of illegality in the park

Mitigation Measures

- Enhance enforcement capacity of the park authority
- Support establishment of 2 New ranger camps, with semi detached houses and Makeshift Camp at the centre of the park and
- Provide transport support for cruisers;
- Acquire communication and radio equipment for use by rangers;

(iii)Loss of vegetations including the critical habitat for Nyala

Mitigation Measures

- Re-align the canal to the west of the thicket and critical habitat in respect of the mitigation hierarchy
- Ensure adequate environmental and social design measures (EDM) are integrated into the design of the canal in the park
- Conduct environmental restoration based on the BMP plan

(iv)Introduction of alien invasive species in the park

Mitigation Measures

- Ensure vehicles, plant and equipment are washed clean before they enter the protected areas;

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(v) Deprivation of wildlife access to water.

Mitigation Measures

- Provide water holes in the western side of the park;
- Provide water troughs fed by water from the canal and driven by gravity in the eastern side of the park
- Provide enough security for water holes.

C. Impacts on the Elephant Marsh

i. Increased cases of human wildlife conflicts

Mitigation Measures

- Support the development and implementation of a human wildlife conflict management plan (HWCP);
- Promote the community conservation concept
- Restrict cultivation of crops to 100 m radius from the marsh boundary

ii. Deterioration of water quality due to agrochemical loading and eutrophication

Mitigation Measures

- Conduct baseline water quality monitoring in the Shire river including Elephant marsh
- Institute water quality monitoring survey at regular times in the O&M Operator and SOCFE operations

iii. Increase in water use conflicts

Mitigation Measures

- Ensure that optimal environmental flows are allowed from Kapichira Reservoir at all times;
- Encourage stakeholder engagement on water usage in the Shire to minimize conlicts

D. Impacts on Health

(i) Increase in cases of schistosomiasis

Mitigation Measures

- Raise awareness on bilharzia;
- Acquire microscopes for health facilities in Chikwawa and Nsanje
- Support Chikwawa and Nsanje district councils in acquiring and administering medication for schistosomiasis

(ii) Increased incidence of sexually transmitted illnesses (STIs) including HIV and AIDS

Mitigation Measures

- Encouraged the contractor to source unskilled labour from the project area and minimize the need to import labour from outside the project area.
- Ensure compliance with national and district health and safety initiatives, guidelines, programmes, policies and legislation
- A fully fledged HIV/AIDS programme should be implemented both for the contractor staff and the residents of the project area.
- Sensitise communities around the project area on HIV/AIDS prevention ;
- Distribute IEC materials (e.g. T-shirts, caps, flyers, newsletters etc) on HIV and AIDS.

(iii)Increased Covid-19 infections Cases

Mitigation Measures

- Implement Covid-19 prevention guidelines.
- Make sure workplaces / Campsites are clean and hygienic. Surfaces (e.g. desks and tables) and objects (e.g. telephones, keyboards and equipment) need to be wiped with disinfectant regularly.
- Provide garbage disposal facilities including facilities for non-reusable PPE (used face masks).
- Promote regular and thorough hand-washing by all workers. Place hand-washing facilities at strategic locations at the workplace/campsite/construction site.
- Allow all vulnerable workers including those with underlying health conditions to work from home (where possible) or stay at home. These include people with weakened immune systems and people with conditions such as diabetes, heart and lung disease and older workers.
- Display posters promoting hand-washing and all other measures in these guidelines.

(iv)Surge in GBV Cases

Mitigation Measures

- Ensure all workers are inducted regarding the code of conduct;
- Ensure that the code of conduct is understood and signed by each worker;
- Engage the services of a GBV Service Provider to manage GBV issues on a daily basis.
- Enforce punitive and disciplinary measures, including dismissal from employment, on any worker involved in any social malpractices; and
- Put in place proper and effective channels for reporting SEA and/or GBV related issues.
- Collaborate with the community heads and the District Social Welfare Office to sensitize communities on the ills of SEA and GBV.

E. Social Impacts

(i) Impact on air quality – Civil works have a bearing on air quality. Some of the pollution sources include emissions from construction machinery and vehicles

Mitigation Measures

- Provide dust mask and respirators to those people who operate or work near machines, or work in dust prone areas and asphalt preparation or application areas so that no human health problem will be of concern.
- Ensure compliance to air pollution regulations as provided by the EMA 2017 and other Acts including World Bank and AFDB safeguards policies;
- Minimise dust impact by occasional water sprinkling of access routes and work areas.
- Ensure that excavated materials being transported are well secured within vehicles and covered to minimise the risk of being blown by wind or spilling out due to overfilling and causing damage to other vehicles and air quality.
- The SE should regularly inspect dust emitting areas and operations is necessary.
- Cover stockpiled material, which could be blown by the wind.

(ii) Increased incidence of unplanned pregnancies

Mitigation Measures

- Promote reproductive health education among workers, adolescents and communities;
- Raise awareness among pupils/students on the risks of unplanned pregnancies;
- Promote family planning
- Encourage collaboration with safe motherhood groups

(iii)Disruption of traffic - Slow moving contractor delivery vehicles and machinery to and from the work sites will result in traffic disruption and possibly accidents.

Mitigation Measures

- Erect adequate signage to warn motorists of the presence of contractor vehicles and machinery on the road and of the road diversions.
- Designate access routes for contractor vehicles and machinery to and from work sites to minimize disruption.
- Institute maximum speed limit of 50km/h on all contractor vehicles within the project area.
- Collaborate with traffic police on traffic management on project sites.

(iv)Exposure Occupational health and safety risks

Mitigation Measures

- Provide all the workers with protective equipment and impose their use.

- Supervise all dangerous operations based on method statements
- Erect or post danger warning or direction signs for residents and the general public to prevent confusions
- Drill staff on instructions and procedures for specific hazardous operations
- Post clear instructions and procedure on machines and operating areas to prevent accidents
- Install firefighting equipment in fire prone areas
- Ensure that comprehensive work place safety regulations are developed and used to minimize exposure of personnel and surrounding people from these dangers.
- Develop and implement Emergency Preparedness Plan

(v) Destruction and alteration of the aesthetic value of the landscape

Mitigation Measures

- Implement restoration plan to preserve the aesthetic beauty of the landscape at the opened borrow pits and quarry sites
- In all earth works operations, ensure topsoil is stripped and stockpiled separately from subsoil and is reused for finishing works.
- Conduct landscaping of cleared areas along the SVTP canal and access road stretch at the end of the construction works.

Stakeholder Consultations

In line with the Environmental Impact Assessment Guidelines (1997); Environmental and Social Management Framework and the Resettlement Management Framework, the team ensured that all those that have stakes in the project more especially the communities in the project area are consulted to give their views on the project. Specially designed stakeholder consultation data collection tools (checklist) were developed and used during the stakeholder consultation process. Apart from consultations at national level (Lilongwe), the consulting team conducted stakeholder meetings and interviews at district level and community levels targeting the Chikwawa and Nsanje District Councils, traditional leaders, villagers in the project area, business owners at the trading centres and many other stakeholders. At community level, the consulting team conducted Focus Group Discussions (FGDs) and individual interview with the identified stakeholders.

At national level Malawi Environment Protection Authority (MEPA), Environmental Affairs Department, Department of National parks and Wildlife (DNPW), Ministry of Gender, Community Development & Social Welfare, Ministry of Water & Sanitation, Water Resources Authority (WRA), and Ministry of Lands Housing and Urban Development were consulted.

At a district level the following stakeholders were consulted: District Gender Office, District Commissioner, Directorate of Planning & Development, Directorate of Administration, Directorate of Public Works, Environmental District Office, District Labour Office, District Forest Office, District Social Welfare Office, Directorate of Agriculture and Natural Resources, District Irrigation Office, District Environmental Health Office, Fisheries Department, African

Parks – Majete Wildlife Reserve, DNPW in Lengwe National Park, Southern Region Water Board and Catholic Commission for Justice and Peace (CCJP) of Chikwawa Diocese.

At a community level following groups consulted during the proces: Area Development Committees, local communities, Agricane, and agriculture cooperatives.

ESMP Implementation Indicators

The following indicators will be tracked to ensure successful implementation of the ESIA and ESMP:

- Inclusion of E&S requirements into three (3) sets of bidding documents for the design engineer, supervision engineer and contractor, namely, works for 10.3 km of canal in Lengwe, 49.7 Km oc MC2 (Bangula Canal: and secondary pipelines;
- Area of thicket (Ha) avoided as a result of revision of the alignment of the canal to avoid the thicket that is a critical habitat for Nyala;
- Implementation of E&S Requirements set out in the Construction Contract including the Biodiversity Management Plan (BMP) for Lengwe and Elephant Marsh
- Implementation of the RAP and GBV Strategy
- Action Plan for Gender and Youth

The overall estimated budget for the implementation of all environmental and social measures is eleven million five hundred and forty six thousandseven hundred and fifty-eight United States Dollars (US$11,546,758.00).

Institutional Responsibilities for Implementation of ESMP

In order to effectively implement the ESMP, the coordination of efforts of the various stakeholders is necessary. By nature, this Project will be multi-sectoral and will involve a number of key government agencies, and consultation and coordination mechanisms. However, the main implementing agency is the Ministry of Agriculture, Water Development and Irrigation, and will coordinates overall implementation of the ESMP.

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List of Acronyms

ADD	Agricultural Development Division
BMP	Biodiversity Management Plan
Ca	Calcium
CC	Construction contractor
CBOs	Community Based Organizations
CMIP	Common Management Information Protocol
COB	Coyne et Bellier Study
DNPW	Department of National Parks and Wildlife
EC	Electrical Conductivity
EFR	Environmental Flow Requirement
EIA	Environmental Impact Assessment
EGENCO	Electricity Supply Commission of Malawi
ESIA	Environmental and Social Impact Assessment
ESMP	Environmental and Social Management Plan
ESP	Exchangeable Sodium Percentage
FAO	Food and Agriculture Organization of the United Nations
FGD	Focus Discussion Group
FS	Feasibility Study
GCM	Global Climate Model
GIEMS	Global Inundation Extent from Multi-Satellites
GoM	Government of Malawi
Ha	Hectares
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
ITCZ	Inter-Tropical Convergence Zone
JICA	Japan International Cooperation Agency
KRC	Korea Rural Corporation

LNP	Lengwe National Park
Masl	Meters above sea level
Mg	Magnesium
MWK	Malawian Kwacha (1$ US equals +/-715 MWK)
MoAIWD	Ministry of Agriculture, Irrigation and Water Development
MWR	Majete Wildlife Reserve
N	Nitrogen
NWDP	National Water Development Project
OHSM	Occupational Health and Safety Manual
P	Phosphorus
PAPs	project-affected people
PCCPLTRPF	Preparation and implementation of a Communications, Community Participation, Land Tenure and Resettlement Policy Framework
pH	Soil Reaction
PMP	Pest Management Plan
PPE	Protective Personal Equipment
PPP	Public Private Partnership
RoW	Right-of-Way
SOCFE	Smallholder Owned Commercial Farm Enterprise
SRBMP	Shire River Basin Management Program
SVTP	Shire Valley Irrigation Project
SVTP	Shire Valley Transformation Program
TORs	Terms of Reference
UNESCO	United Nations Education Scientific and Cultural Organization
WASVTP	Water Availability for Shire Valley Irrigation Project
WESM	Wildlife and Environmental Society of Malawi
WRB	World Reference Base for Soil Resources

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1. INTRODUCTION

In August, 2019, the Government of Malawi (GoM) formulated the ESIA for the SVTP covering Phases 1 and 2 command areas. An important undertaking to update the document based on the realisation that new information would keep emerging was made. Since 2020 the Republic of Malawi has been implementing the first phase of the Shire Valley Transformation Program (SVTP-I). The Republic of Malawi is now seeking to commence the second phase of the program, and has prepared this update to the program ESIA to incorporate the most recent information on the potential environmental and social impacts.

The Shire Valley Transformation Program is a 14-year program (2017-2031) structured around three coordinated pillars:

(i) Providing reliable, professionally managed and sustainably financed irrigation service to a large number of irrigators in a phased construction of the Shire Valley Irrigation Project scheme and providing multiple services including water supply;

(ii) Support farmer organization within a comprehensive land use plan; supporting land tenure strengthening and consolidation; as well as natural resources management; and

(iii) Establishment of smallholder owned commercial farm enterprises transitioning into commercial agriculture from subsistence farming and integrating them into commercial value chains.

These pillars all contribute to the overarching goals of the program, and build on each other in a phased approach.

This project comprises three sequential but partially overlapping phases (with different financiers entering at different times and in parallel financing arrangements). In general terms, SVTP-I initiates the process on all pillars with a major focus on irrigation service provision to the SVTP-I area, land tenure, farmer organization and natural resource management as these precede any downstream development. While not investing heavily yet in areas of agricultural commercialization and investment promotion, it incorporates the vision and principles of agricultural modernization and commercialization and prepares for downstream investments under SVTP-II, which shifts investment focus to agricultural investment, private sector and value chain support, as well as the investments in bulk infrastructure for the SVTP-II area. Finally, SVTP-III is the scale up phase of investments to the SVTP-II area.

All three phases of the program were subject to impact assessment in 2017, prior to the start of works. Phase 1 commenced commenced construction in 2020, and contractors are mobilized and actively working on the first 52km of the main canal, including the intake for the program and the fish barrier.

The project aims to commence Phase 2 in 2022 and therefore the impact assessment for the program has been reviewed and updated to reflect the most current information about the scheme and the baseline conditions.

This report is the updated Environmental Impact Aassessment (ESIA) report. A new Environmental and Social Management Plan has been prepared and the Pesticide

Management Plan has also been reviewed and updated in preparation for Phase 2 of the project.

The project is being taken forward by the Ministry of Agriculture, Irrigation and Water Development (the "Client"). Korea Rural Corporation (KRC) is the consultant undertook the Feasibility Study (FS) and detailed design for a significant component of the project, including the main canal being constructed as part of Phase 1 and the agricultural irrigation component. BRLi undertook the initial ESIA of the program and prepared two stand-alone reports, the Inception report (June 2015) and the Pest Management Plan (PMP, September 2016). The ESIA, PMP and Phase 1 ESMP were disclosed in 2017 on the project website (www.svtp.gov.mw/reports-2/svtp-1-safeguards-documents/).

OBJECTIVE OF THE PROJECT

The Project objective is to provide access to reliable gravity-fed irrigation and drainage services, secure land tenure for smallholder farmers, and strengthen management of wetlands and protected areas in the Shire Valley. It will improve the management and utilization of natural resources in a sustainable way to increase agricultural productivity and commercialization for targeted households in the Shire Valley.

The Program is directly aligned with Malawi's policy commitments to address climate change and build resilience, as set-out in Malawi's Nationally Determined Contribution (NDC) document submitted to the United Nations Framework Convention on Climate Change in 2015. NDC's top adaptation priorities are to address land and watershed degradation and specifically the loss and degradation of forests, improve the resilience of the agriculture sector to climate change through development of irrigation and climate smart agriculture and improved management of fisheries and natural ecosystems.

UPDATE OF THE ESIA

This update has been undertaken by the Government of Malawi to reflect new technical project information (especially the detailed design of the irrigation works undertaken to date and any lessons learned from the works in Phase 1) and to ensure that baseline information about environmental and social receptors remains uptodate. The update has included a review of the environmental (including biodiversity) conditions, feedback received from stakeholders and the public, an examination of canal alignment options in Lengwe National Park, and consideration of the cumulative impacts of this project in combination with others on the Shire Valley.

The update ensures continuing compliance with national policies regarding impact assessment as well as demonstrating how the second phase of the project will accord with the World Bank Environmental and Social Framework (ESF) and African Development Bank's Integrated Safeguards System. Phase 1 of the project is being implemented in accordance with the World Bank Safeguard Policies and the AfDB environmental and social standards. Measures developed under this assignment have informed the Client and technical studies about ways to mitigate impacts and enhance positive effects of the Project.

The ESIA is based on the FS description of the Project amended to reflect the most recent available detailed design for the irrigation canal and associated features and a review of the preiminary designs of main canal for Phase 1.. The detailed design is complete for Phase 1

but is yet to be completed for Phase 2. Although the detailed design of Phase 2 is not expected to result in a major changes to the alignment of the canals (except perhaps at Lengwe National Park) or command areas, the design will allow for refinement of the canal alignment, precise locations for crossings, and fix the points at which the irrigation canal will feed the command areas.

In October, 2022, an AFDB Project Formulation Mission engaged the Government of Malawi being co-financiers of SVTP. The mission examined the adequacy of the ESIA and ESMP and concluded that the two documents needed improvements by incorporating provisions of the AFDB Integrated safeguards System in both the ESIA and ESMP. It was further agreed that in line with Operational Safeguard (OS) 3 on Biodiversity Conservation and Ecosystem Services of the AFDB and Environmental and Social Standard (ESS) 6 of the World Bank on Biodiversity Conservation and Sustainable Management of Living Natural Resources, the canal alignment needed to be changed as the thicket section of Lengwe National Parks is critical habitat for Nyala (*Tragelapus angasii*).

The change in canal alignment to avert the impact on the thicket has, thus, necessitated the updating of the ESIA to incorporate the changes that may not have been included in the previous version of the ESIA.

The Mission further undertook to engage the Government of Malawi to develop a Resettlement Action Plan (RAP) in line with the Land Acquisition Act (2016), World Bank's ESS5 (Land Acquisition, Restrictions on Land Use and Involuntary Resettlement) and AFDB's OS 2 (Involuntary resettlement: land acquisition, population displacement and compensation). It is a requirement that the RAP be prepared, approved and disclosed before the project is approved by the Boards of the financing institutions.

The mitigation measures have been informed not only by BRLi's experience (not only in designing canals but also in monitoring impacts during construction of canals in Africa as presented in the 2017 ESIA), but also from the detailed design process and lessons learned during the supervision of the Phase 1 works. Fieldwork and discussions with stakeholders have helped identify risks and impacts and inform the mitigation design.

This updated ESIA is not only intended for funding agencies who financed the ESIA but also to inform the measures that need to be delivered during the detailed design, construction and operation of Phase 2 of SVTP. The ESMP for Phase 2 sets out how the measures will be delivered during the design, construction and operation phases. The updated PMP describes how persticides, herbicides, fertilizers and other chemicals will be safely used by the agricultural enterprises.

SHIRE VALLEY TRANSFORMATION PROGRAM

The first phase under the program has initiated the process of transformation of the Shire Valley and paved the way for agricultural commercialization and improved natural resource management at the landscape level. The objectives for the second and third phases are to increase agricultural productivity in targeted smallholder-owned commercial farm enterprises; support value chain and value addition; extend area supported with irrigation and

farm development; and continue and expand efforts to address land degradation and sustainable management of forests, wetlands and protected areas.

SVTP-I

Under SVTP-I there are five components:

Component 1: Irrigation Service Provision

This component is implementing the works, goods and services necessary to develop irrigation and drainage infrastructure in the SVTP-I area. This includes preparation of detailed designs and construction supervision and quality assurance, construction of the physical bulk water conveyance and main distribution system, major drainage and service and access roads. Provisions have been made for SVTP-II and SVTP-III in terms of canal dimensions, right of way, and preparatory studies. In parallel, the component will support spatial planning in the wider project area to ensure the irrigation scheme is well integrated with other land uses and natural resources. Subcomponent 1.2 will support the establishment of a professional management, operation and maintenance system for the scheme.

Component 2: Preparing land-based investments and natural resources management support

Sub-component 2.1 provdes the works, goods and services in support of addressing security of land tenure and organizing farmers for commercial production – as a first step in developing commercially oriented agriculture. This subcomponent supports coordinated pilot implementation of the new legal framework for land administration. Subcomponent 2.2 is GEF funded in which the Government of Malawi has allocated GEF-6 resources to support investments from the Biodiversity, Climate Change, and Sustainable Forest Management focal areas and supports natural resources management (figure 1) broaden the multi-sectoral benefits of the program and enhance environmental sustainability within the modernization program. Key activities focus upon national level strengthening of frameworks for biodiversity conservation, sustainable landscape management and building capacity for field level monitoring and management of information for enforcement. The program will invest in protected areas, the Elephant Marshes and associated activities that will support improved natural resource management and the development of a broader land use plan for the Shire Valley.

Component 3: Agriculture Development and Commercialization

This component provides the works, goods and service in support of a program of activities to support inclusive commercialization in agriculture through smallholder owned commercial farm enterprises. Financial sustainability of the SVTP irrigation investment can only be achieved through profitable agricultural production. Farms will need to be linked to Commercial Value Chains for production and sale of their produce. Development of commercial value chains will be needed to enable farmers to gain access to markets and commercial services; this is essential to enable viable commercial agriculture. The process of identifying and capacitating farmers for commercial production has begun so that farmers

are prepared for commercial operation when the irrigation infrastructure is completed. This component will pave the way for major scale up in SVTP-II & SVTP-III.

Components 4 and 5: Project Management and Project Preparation

Components 4 and 5 for SVTP -I provide for the management of the project, and provided assistance during the preparation of the project.

SVTP-II

The proposed focus of SVTP-2 will continue to be on infrastructure development, land tenure, and natural resources management but development of agricultural modernization and commercialization will play an increasingly important role, including private sector and value chain support. The components will be similar to SVTP-1, and will include:

(i) Component 1 - Irrigation Infrastructure Development and Service Provision: This 70km section of the main canal will eventually supply water to about 21,000 ha (including some 17,500 ha of new irrigation) in the Phase II project area, which comprises the agricultural blocks south of Lengwe National Park. The development will be led by DoI, but consultants have been hired under SVTP-1 to prepare the detailed designs and tender documents for the 70 km main canal section. The full design will be completed before the end of 2022 but designs of part of the canal system will be completed well before that. The first 14 km of this section of the main canal will pass through Lengwe National Park, bisecting 'Old Lengwe' from 'New Lengwe' and the design and approach to construction will need careful consideration to ensure that the canal will not hamper the restoration of the park to favorable conservation status and will minimize impacts to critical habitat. It is proposed that because of the construction of the canal in a sensitive nature area a separate contract will be awarded for the construction of the canal in Lengwe. The proposed project will also finance the construction of a number of secondary canals in the Phase II project area, the number depending on the available funds for development of agriculture blocks and secondary canals, as well as drainage and flood protection works and service and access roads. SVTP-2 will finance required consulting services for remaining detailed design services, e.g. secondary canals in the Phase 2 project area, and construction supervision and quality assurance. Development of the electricity grid with a dedicated line along the main canal will be considered in close cooperation with ESCOM.

(ii) Component 2 - Land Tenure and Consolidation: All farmed agricultural land under customary tenure within the project area will be demarcated and formally registered using a gender sensitive approach**.** Most agricultural land in Malawi farmed by smallholders is held under customary systems, either patrilineal, matrilineal or mixed, governed by traditional authorities (male or female). The chieftaincy hierarchy starts from the village chief, to the Group Village Headman (GVH) and traditional chief. The Traditional Land Management Authority (TLMA). Land administration institutions will only be established in GVHs and TLMAs gazetted by the Ministry of Local government. As already indicated, the obligation that women constitute at least 50% of the members of the Customary Land Committee (CLC) was met in SVTP I. Recruitment of staff, communication, and training programs is also gender sensitive and is . monitored.

SVTP II will complete any outstanding demarcation and registration work started under SVTP I, and also complete on demand issuance of consolidation customary estate. SVTP II will also continue to support the functioning and renewal of CLC and land tribunals and will consolidate the land dispute monitoring system set up under SVTP I.

District land registries will keep the record of all registered land parcels and shares in consolidated customary estate, and register follow up transactions or updates. All land records (or "customary estate") and cadastral maps produced under SVTP I and completed under SVTP II will be kept and maintained in an electronic format at the district land registry. The land registry will also keep the cadastral map and record of all individual[1] "shares" (equivalent to the size of the land parcel(s) contributed by a member to the consolidated customary estate). Land records and shares can be printed upon request. An individual customary estate as well as a share in a consolidate customary estate are transferable (e.g., inheritance, lease, mortgage) and after five years also sold. The two district land registry for the SVTP project area (Chikwawa and Nsanje) will be established under SVTP I and use the Land Information Management System developed by MoL with support from AGCOM (P158434). The sustainability of the District land registry and the land clerks is related to progress with the devolution process and transfer of this responsibility to the Ministry of local government, which will become responsible for budget and staffing. SVTP II will consolidate the two District Land Registries in collaboration with MoL and MoLGov; train and mentor land registrars, land clerks and other staff engaged in land record maintenance and transactions, and support to land institutions (land tribunals, CLC); support information and communication campaigns on formalizing land transactions and keeping information on land records and land shares updated. SVTP II will consolidate and institutionalize monitoring and accountability systems to track emerging land markets – including for shares in consolidated customary estates and based on gender disaggregated administrative and management data, which were started under SVTP I. SVTP II will also continue and consolidate (quick) surveys to assess land holders awareness of rights and procedures; assess knowledge and accessibility and affordability of land administration services, options for using e-governance; assess sustainability (including financial). The project will also institutionalize gender sensitive capacity building of district staff (land clerks, district and registrars and land institutions. SVTP II will assist MoL and MoLGov to draw lessons for national level rolling out of customary land registration.

SVTP-2 will complete any outstanding land use planning, support monitoring and updating land use management in response to the changes resulting from the operationalization of the irrigation scheme. SVTP I will complete the Nsanje District Physical Development Plan, urbanization plans for both districts and all group village land use plans in the phase 2 area. The new irrigation scheme will become operational in 2023 (Phase 1), which will change the environmental conditions, bring about land use changes with new opportunities and also risks. SVTP 2 will assist the districts and the villages to assess changes, update their land use plans if needed and monitor compliance.

(iii) Component 3 - Agriculture Development and Commercialization: This component will support implementation of activities that leads to improved productivity, diversified production, cropping intensity, competitiveness, market access and agro-processing for smallholder farmers. SVTP 2 will finance farmer mobilization and training, technical assistance to build farmer capacity to run and manage the irrigated blocks and associated

activities, form productive alliances to improve market access, setting up of SOCFE management, acquisition of equipment, and matching grants. The component will also draw lessons from the Agriculture Commercialization Project (AGCOM) on how to establish coherent Productive Alliances (PAs) while linking farmers to off-takers. Specifically, the following subcomponents will be financed by the project.

SVTP-2 will, through MoA and PMT, continue adopting the current farmer driven approach around the Smallholder Owned Commercial Farm Enterprises (SOCFE) and models. The farmer mobilization process will represent the commencement of activities in the identified project areas. A multi-disciplinary team from various implementing agencies at the Chikwawa District Council and the Project team will carry out intensive sensitization campaigns to inform the communities of the project activities, their roles and prepare a consolidated action plan for the initial activities to be implemented and their timelines. These activities are key to successful project implementation. The component will promote and enable effective collaboration among smallholders to consolidate their land into customary estates, coordinate production, and sell their produce collectively as cooperatives. Under the proposed Component 3, the project will finance the commercialization of agriculture in the developed areas through establishment of 25 new SOCFEs located on the new 17,000 ha of irrigation command area. In addition, the project will also continue to support 14 SOCFEs identified under SVTP-1 to make them fully operational.

Component 3 will also promote productive diversification through promotion of cultivation of various crops other than sugarcane, which is prominent in the area. SOCFEs will also be encouraged to develop fishponds, pasture, vegetable gardens, and sustainable woodlots for charcoal production on land in the blocks not suitable for irrigation and also as long as these have been assessed to be both technically and financially viable. It is unlikely that sugarcane production will be part of the cropping pattern under SVTP II as the only possible off-taker, ILLOVO has signaled that it has no capacity for additional sugarcane processing.

Technical Assistance and Farmer Capacity Building: Component 3 will finance the recruitment of a firm to provide technical assistance (TA) to SOCFEs on the development of desired possible development pathways[1] , farm investments and farm operations. The TA will facilitate the establishment of SOCFEs; provide intensive training, mentoring and guidance to the SOCFEs; and subsequently assist them to recruit farm managers and key staff; and facilitate the formation of productive alliances between SOCFEs and partners, value chain players and investors. The TA will also be responsible for the identification of commercial partners to provide technical advice, training and mentoring on the essentials of farm business management such as agronomy and crop husbandry and value chain development services to enable SOCFEs to function as viable and profitable commercial farms. Further, the TA will help the SOCFEs in farm investment planning which will include, i) selection of enterprises to venture and its associated husbandry; ii) irrigation methods to be employed; iii) farm equipment; iv) farm management and staffing; v) financing for equipment and production costs; and vi) identification and contact with possible markets.

The STVP-2 will further finance the recruitment of Services Providers (SPs) that will appoint professional management and associated farm specialist staff that will be working with the SOCFEs on daily basis to kick start implementation of commercial agricultural operations.

The country has over the years gained considerable lessons from implementation of similar projects like the Agriculture Commercialization Project (AGCOM) and Irrigation, Rural Livelihoods Development Project (IRLADP). It has been learnt that considerable time and effort is needed in the social formation process of developing clusters of farmers into enterprises. In addition, the process of having clusters develop well thought-through business plans takes time and considerable support. Further, continued viable operation of newly formed enterprises needs considerable support, including training and ongoing mentoring, especially in management and facilitating market linkages. The SPs will thus be crucial to support the SOCFEs with the identification of a pathway of their choice, determination of the choice of value chains, to a large extent based on the identification of off-takers, and sensitization of the SOCFEs on matching grant requirements. In addition, SPs will have to advise the SOCFEs on the investment cost implications of different water application methods; the O&M cost implications of different water application methods; and the crops that be grown under different water application methods, and the degree of flexibility or otherwise for crop choice with different methods. The STVP-2 will recruit SPs at the start of the second phase to have ample time to support the farmers though mentorship.

Establishment of viable Productive Alliance (PA). Introduction of the viable productive alliances under STVP-2 will help to address several constraints related to market failures and inefficiencies experienced by many farmers along the value chain. The market failures are mainly caused by inadequate integration of actors, information asymmetries and coordination failures amongst stakeholders. The introduction of PAs has to some extent proven to increase productivity, incomes, and commercial viability apart from prospects of creating employment in rural economies. Under the STVP-2, support will be provided for the establishment of the PAs as soon as planning for production from SOCFEs is initiated. They would consist of entities operating within identified value chains and each PA could include one or more SOCFEs, financial institutions, suppliers of farm inputs and services (services to include Government research and extension), and crucially, off-takers of farm produce. These voluntary organizations will operate on the principle of mutually beneficial partnerships. They will initially be formed and mentored by the SDSPs and the ACTA. All SOCFEs will receive training and capacity building to enhance their skills. The training will include basic accounting and financial management, governance, business plan management, procurement, leadership training for those elected to the management committees, and health and safety management and resource efficiency on farm. It is envisaged that the training will assist SOCFEs to manage their businesses and improve marketing skills that enables them to enter effective PA to sustain their operations.

The project will also provide capital investment support to enable capital investments in the SOCFEs based on their on-farm irrigation and development designs and business plans. An estimated 80 percent of the available funds under the component will finance block development investments in irrigation and drainage, land leveling, and commercial farm development. This will include irrigation systems (including surface, sprinkler, center pivot, drip, or microjet as per informed decision by the SOCFEs), farm equipment (fixed and moveable), initial production and management support at SOCFE level, and basic infrastructure. Matching grants will be made available to lower the investment costs to be paid by SOCFEs, while private finance leveraged in value chain development is expected to be available as well. As the number of agricultural blocks to be developed is expected to increase considerably under SVTP-2, the component will put a lot of emphasis on ensuring

that any matching grant is made available in a timely manner. All farms would receive investment as a grant to provide access to irrigation water. They would receive a 90 percent grant for land development, with the balance to be provided by the SOCFEs though "in-kind contribution (labor and/or materials)". On the other hand, investments in farm assets (including warehouses and agro-processing equipment), overhead and production costs will follow a formal matching grant procedure.

Investment Assessment Panel (IAP). The project will, through Component 3, also finance the recruitment an expert team of independent evaluators to assess business plans prepared by SOCFEs. The IAP would consist of a commercial financier, at least two private agribusiness representatives, an irrigation agronomist, and a project representative (Project's Agribusiness Specialist or an alternate). The IAP will be responsible for evaluating the business proposals which will be the basis on which the project grants will be awarded. The IAP will evaluate and select PA business plans for funding based on technical and feasibility in line with terms and conditions that will be detailed in the Project Implementation Manual (PIM). SVTP-2 will continue to explore ways of linking SOCFEs with commercial banks and other potential financiers, including Development Partners. Loans or grants to SOCFEs will have to be matched with engagement of SOCFEs with viable value chain businesses for their products. Thus, a three-party arrangement of commercial banks, off-takers, and SOCFEs should be the model from the outset, supported through productive alliances. Detailed and transparent communication between these three parties and providers of the required capital investment would be an important feature of such arrangements.

During SVTP program development, an Agricultural Development Planning Strategy was prepared in 2015 that identified possible value chains. SVTP-2, mostly through departments in MoA and the Ministry of Trade (MoT), will support additional studies, including regular market studies and road shows to identify additional prospective off-takers and where possible enter pre-contractual arrangements on specific value chains. Possible crops that have been researched and tested in the valley that have an import-substitution or export potential include cotton, sorghum (for beer production), beans, soya beans, bananas, vegetables, sugar cane for ethanol (if a viable off-taker becomes available), and fruit trees such as mangoes or citrus. The SOCFEs owners and managers will also need to be equipped with the necessary skills and knowledge to make production and management adjustments in the light of evolving market conditions. The crops chosen will have to be technically and financially viable, fit into the developed irrigation application method, and have an appropriate position in a crop rotation to avoid depletion of soils and unsustainable farm practices.

The component will promote waste management by supporting studies and private sector engagement in waste management. Activities that will be implemented as part of this component are separate from, and additional to, the mitigation measures specified in this ESIA. Although these activities will have benefit for the Natural Resources in the Lower Shire Valley and will therefore result in positive environmental impacts, a screening procedure is included in the ESMP to identify and manage any possible negative impacts that may arise from these community level activities during their implementation.

According to ILO, the agricultural sector presents key challenges for safety and health of farmers and communities. Measures to safeguard community health, for example through providing the necessary infrastructure to identify and prepare for an increase in number of

waterborne diseases will be included within SVTP-II. Resource efficiency and safety considerations will be issues to be addressed as part of the advice provided to the SOCFEs, and measures to ensure the training, PPE and processes for the safe transport, storage, use and disposal of farm chemicals will be incorporated into farm management plans, in accordance with the principles established in the Pest Management Plan.

(iv) Component 4 – Strengthening Landscape and Natural Resources Management in the Lower Shire Valley. The Lower Shire Valley includes ecological regions, protected areas, and biodiversity hotspots which are essential to the maintenance and functioning of the Lower Shire watershed. However, critical aspects of the watersheds are becoming degraded, leading to reduced water availability, deteriorating water quality, increasing vulnerability to droughts and floods, and reducing agricultural productivity. The planned project activities will strengthen the management and sustainability of key protected areas (Lengwe, Mwabvi), the Elephant Marsh (EM), and forest reserves (Matandwe, Thambani, and Thyolo. Development of park trails/roads, ranger camps, eco-tourism facilities and cultural sites, fences, water holes, and utilities are among the proposed works to be financed under SVTP-2. Accompanying these proposed investments will be critical community livelihoods interventions in the areas around the protected areas to strengthen co-management and reduce direct threats to aquatic and terrestrial biodiversity, such as overfishing and habitat destruction. Importantly, SVTP-2 will support strengthening the management of the Elephant Marsh, which provides a unique habitat sanctuary to birds and flora, through the implementation of its Community Conservation Area Management Plan (developed under SVTP-I) including through further promoting ecosystem-based fisheries management.

Deforestation has had a tremendous impact on the landscape of the Lower Shire. The proposed activities will provide support to the Government's 2016 commitment to place 4.5 million hectares of degraded and deforested land under restoration by 2030 in support of the Bonn Challenge. Proposed activities will promote private sector engagement and investment in the sustainable management of the remaining forest reserves through awareness raising and capacity building, as well as performance-based grants and payments (carbon credits), in order to shift toward ensuring sustainable financing of the management of the remaining forests.

Key natural resources are under threat from overexploitation, habitat encroachment, as well as poor pollution and solid waste management practices in the project area, with a lot of unregulated waste dumping and burning, including hazardous waste disposal. As the Lower Shire transforms and the generation of waste increases, there is a necessity to prepare the services for the communities and private enterprises to manage pollution and comply with environmental regulations. Studies will be conducted to determine mechanisms and strategies for management of the threats to biodiversity and ecological values posed by invasive species, increased generation of waste, and increased demand for natural resources that is expected to occur throughout the transformation of the valley.

This component will promote an inter-sectoral approach to the management of the Lower Shire landscape by addressing biodiversity conservation, protecting and enhancing the role that natural assets and wetlands play in supporting livelihoods mitigating climate change; and promoting sustainable approaches to forest management that protect forest resources and deliver benefits to local communities.

At landscape and park level, this sub-component would:

(i) Invest in community-level natural resource management in areas adjacent to the irrigation and conservation areas (Lengwe National Park, Mwabvi and Majete Wildlife Reserves, Matandwe Forest Reserve and the Elephant Marsh proposed Community Conservation Area) and in wildlife corridors,

(ii) Provide targeted support to these conservation areas to strengthen conservation and community management and encourage private sector investments (e.g. by tourism concession investors) that could boost revenues for re-investment in local community development and conservation management,

Activities that will be implemented as part of this component are separate from, and additional to, the mitigation measures specified in this ESIA. Although these activities will have benefit for the Natural Resources in the Lower Shire Valley and will therefore result in positive environmental impacts, a screening procedure is included in the ESMP to identify and manage any possible negative impacts that may arise from these community level activities during their implementation.

Activities implemented under this component arise from sectoral needs, i.e Parks and Wildlife, Forestry and Environment and are largely meant to enhance positive benefits that emanate from the project. In line with Malawi Environmental Impact Assessment (EIA) Guidelines of 1997, actions that take place in protected areas require environmental and social screening.

Building on the experiences of SVTP-I, all proposed actions in protected areas and surrounding communities will, therefore, undergo environmental and social screening.

(v) Component 5 - Project Management, Coordination, and Communication. SVTP-2 will continue to provide funding for the Project Management Team. This will allow the PMT to provide day-to-day management and coordination, monitoring and evaluation, communication, and management of safeguard related issues, including the grievance redress mechanism. The PMT is fully staffed with qualified and competent specialists. It also has an external Gender Based Violence (GBV) service provider.

This component will finance the multiple coordination and management needs of a project of this scale and focus on the roll out of the communications strategy and manage grievance redress mechanisms, as well as day-to-day management, monitoring and evaluation of the project. The GRMs will provide a responsive ongoing mechanism to address PAP and other stakeholder concerns raised throughout the life of the project, including those arising from resettlement and compensation initiatives, and construction and operations phases. The sub-component will finance project management structures that have been established and in place throughout project preparation. The project will provide funding for professional and support staff to strengthen the PMT and facilitate its operations, coordination and communication, including procurement, financial management, environmental and social safeguards specialists.

(VI) Component 6 – Contingent Emergency Response: This component would draw from the uncommitted credit resources under the project from other project components to cover emergency response. For the Contingent Emergency Response Component (CERC) to be activated, and financing to be provided, the Government will need to: (i) submit a

request letter for CERC activation and the evidence required to determine eligibility of the emergency, as defined in the CERC Annex to the Project Operations Manual (POM); (ii) prepare an Emergency Action Plan, including the emergency expenditures to be financed; and (iii) meet the environmental and social requirements as agreed in the Environmental and Social Commitment Plan and CERC Annex.

SVTP-III

The third phase of the project will be focused on the agricultural commercialization and continuing natural resource management activities, scaling up what has been achieved under SVTP-I and what will be achieved under SVTP-II.

Lessons Learned from SVTP-I for Application in SVTP-II

During the update of the ESIA, consideration has been given to the lessons learned from the environmental and social safeguards work undertaken as part of the implementation of SVTP-I. Key points that have been integrated into this ESIA review include:

a. Ensuring adequate allocation of temporary working area and defined and contractor's responsibility vis a vis spoil/rock falling into neighbouring land, and clauses for not deposing spoil in Majete National Park
b. Focus on speeding vehicles and dust generated on local roads
c. Controlling litter and waste
d. Ensuring senior contractor management participate actively in community meetings
e. Controls for fuel theft and interations with local law enforcement
f. Dedicated locations for the provision of wood to local communities
g. Adequate numbers of ESHS specialists in Supervision and contractor's team, each with dedicated transport.
h. Established program and process for submission and approval of key documents (including OHSM/CESMP/approval of camp locations) prior to start of works
i. Establishing a clear reporting process (to include for regular and incident reporting)
j. Ensuring progressive restoration of sensitive areas, including National Parks, to ensure planting timescales and proposals for care of planted areas rather than leaving restoration to the end
k. Clear requirement for worker welfare facilities (including food preparation and eating areas, washing facilities and toilet facilities) to be established and maintained by the contractor at suitable distances along the linear works site
l. Provision and use of safe worker transport
m. Provision of on-site COVID-19 testing facilities at the contractor's campsite for staff and relevant awareness messages and PPEs

2. RELATION BETWEEN THE IMPACT ASSESSMENT REPORT AND OTHER STUDIES IN THE LOWER SHIRE VALLEY

The ESIA/ESMP has many links with other studies. These links can be distinguished in three different categories:

- Relations with the Project technical studies (feasibility and design study);
- Relations with Shire River Basin Management Programme (SRBMP) funded by the World Bank;
- Relations with other studies under the SVTP.

The following table presents these relations.

Table 1: Relations between studies

SVTP Project technical studies	**Relation**
Shire Integrated Flood Risk Management Strategy Project (Atkins, 2012)	Objective of the Plan was to assist the GoM in development of an Action Plan to address the flood risk situation in the Lower Shire in an integrated way, based on sound diagnostics and systems to assess and implement future interventions. The Action Plan aimed to address both the hazard (Water regime) and the vulnerability to these hazards (adaptation of human behavior). This life and livelihoods are better protected from flood risks and enhance the capability of socio economic development in the basin. This was done in harmony with Malawi growth and development strategies which emphasis sustainable growth and MDGs. The study helped inform the design of SVTP.
Shire Valley Irrigation Project Phase I Project Preparation Activities. Appraisal Report (AfDB, October 2012)	The GoM has for many years intended to develop irrigated agriculture in the Lower Shire Valley and a number of successive studies and reports has been prepared, to help prepare for the SVTP project. The report identified the need for additional activity: Study on water availability at Kapichira – pre-feasibility level study. This was undertaken under the SRBMP-1 (Norplan report 2013)
Hydraulic model study at the headpond of Kapichira dam	Although the title of the study is hydraulic modeling, the main objective of this study is to assess the impact of the Project on the reservoir sedimentation pattern. The study's objectives are also to avoid negative impact on sediment flushing operations at the power station and to minimize the entry of sediment into the proposed feeder canal system of SVTP.

SVTP Project technical studies	Relation
Feasibility Study report (December 2016)	The 2017 ESIA is based on the scheme described in the FS. The 2021 update of the ESIA is based on the latest detailed design for Phase 1 works (under construction) provides to the FS study the series of mitigations that need to be technically tested. These mitigations only relate to infrastructures or changes in the Project design that will be required to mitigate of avoid impacts.
Preparation and implementation of a Communications, Community Participation, Land Tenure and Resettlement Policy Framework (PCCPLTRPF) (on going)	Many elements on socioeconomics are dealt with in the PCCPLTRPF. The ESIA make references to it. This assignment is divided in several studies: • Communication strategy: This study describes the main stakeholders and presents a SWOT analysis. It also presents the communication strategy toward stakeholders. • Gender and Youth Strategy Study: This study describes the current challenges that women and young people face. This report also recommends a series of measures and guidelines aiming at these two groups. In addition, roles of various stakeholders and monitoring actions are defined. • Grievance redress mechanism: This study describes the current method for grievance redress (revolving around traditional leaders). This study also implements the Grievance Redress Mechanism (GRM) and Grievance Redress Committee (GRC) to ensure that people's opinions and grievances regarding the project are documented and addressed. In addition, monitoring of complaints will be carried out under this mechanism. • Resettlement Policy Framework This document provides the basis for the Resettlement Action Plan (regulatory review, gap analysis, etc.). It deals with impact of resettlement but also the issue of access to sources of livelihood and to impact on cultural heritage. The ESIA refers to this study, especially when it comes to the number of affected villages and the number of bridges that shall be built to cross canals (and footpaths for people). • Stakeholders' views report This report presents the main conclusions from various stakeholder's consultation. It discusses stakeholders' views on several topics: land tenure, access to irrigated land, resettlement, agricultural development, access to water for livestock and gender vulnerability.

SVTP Project technical studies	Relation
	• Socio-economic baseline report This report presents the main socio-economic figures of the SVTP area and discusses about health, land tenure, livestock, agriculture, etc. It also includes a chapter on communities' views of the Project.
Agricultural Development Planning Strategy (2016)	This study describes the crops of SVTP. Many elements related to agriculture and fisheries are dealt with in this report. It discusses about mitigation for smallholder livestock farmers and assesses the potential for fish farming. In addition, this study describes efficient organization of producers that shall be implemented
Pest Management Plan (2021)	The PMP identifies the main pest based on the type of crops and proposes measures to fight pests.
A Cultural Heritage Impact Assessment Report (2016)	This report provides information on cultural heritage baseline conditions by identifying key sites of interest within the SVTP study area. The report has informed the ESIAs.
Public-Private Partnership (PPP Feasibility study) (on going)	The PPP study informed the ESIA about public-private partnership arrangements for irrigation services for SVTP. The ESIA also makes recommendations about arrangements and responsibilities of the Bulk Water Operator for maintenance and its relationship with park management (Lengwe). The ESIA also helps to identify environmental and social risks regarding the BWO
Lengwe National Park, 5 years business plan 2016-2020	This document, written by DNPW, describes the reserve's objectives and presents its zoning. It also describes the various infrastructures of the reserves.
Lengwe National Park, General Management Plan 2016-2020 work document	The 2017 ESIA refers to this document has it defines objectives for the LNP as well as identifies issues with wildlife and infrastructures of the park.
Detailed Design Studies (after the FS) for Phase 1. The Detailed Design works have not started yet for Phase 2 but is complete for Phase 1 works.	The 2017 ESIA proposed measures for study in the Design Study for Phase 1. The updated 2021 ESIA describes the outcome of these design studies for Phase 1 and by providing detail of what was constructed. It has also reviewed the current baseline conditions against the FS design for Phase 2, to update the assessment.
2017 Environmental and Social Impact Assessment	The 2017 ESIA studied the predicted impacts and effects of all three phases of the proposed SVTP in preparation for Phase 1 works. It was disclosed in August 2017.
2017 Environmental and Social Management Plan	The 2017 Environmental and Social Management Plan set out the management arrangements for delivering the mitigation measures to be delivered as part of Phase 1 works

SVTP Project technical studies	Relation
2021 Update to ESIA	An update of the ESIA in 2021 was undertaken to ensure that the current design was reflected for Phase 1 works, and to reflect any changes in baseline conditions that have occurred since 2017. The 2021 ESIA was prepared in advance of Phase 2 works.
Lengwe National Park, General Management Plan 2021-2026	The 2021 update of the ESIA refers to this document has it defines updated management objectives for the LNP.
Matandwe-Mwabvi Protected Area Complex Integrated Management Plan 2021	Details of Natural Resource Management measured to be provided as part of SVTP will be information by the management objectives set out in this plan.

SRBMP studies	Relation
Component A – Shire Basin Planning Sub-components: A1-Basin planning framework A2-Institutional capacity A3-Water resources information systems A4-Program management monitoring & evaluation Component B – Catchment Management Sub-components: B1-Catchment planning, monitoring and learning B2-Rehabilitation targeted catchments B3-Alternative rural livelihoods B4-Ecological management Component C – Water related infrastructure Sub-components: C1- Kamuzu Barrage C2-Flood management C3-New water investment	The recommendations of the ESIAs and ESMPs have taken into account the studies undertaken as part of SRBMP, and those that were particularly relevant, for example by providing baseline information, information on cumulative impacts or details of management interventions that will improve the natural resources in the catchment. Most activities of the SRBMP relate to catchment management and rehabilitation, as well as the upgrading and future operation of the Kamuzu Barrage that influences the Shire River's flow, well upstream of the SVTP.
Implementation Service Provider (ISP) for Flood Risk Management (SRBMP-1)	This report deals with risk from floods, and has been considered as part of the hydrological information included

SRBMP studies	Relation
	in SVTP. In some sections, it presents measures to minimize flood impacts on human safety from: • Ruo River • Thangadzi East River • Mwanza River • Lalanje River • Tombokamwa River
Study on water availability for Irrigation and hydropower production on Shire River at Kapichira Falls (Norplan, 2013)	Prepared under SRBMP, the objective of the study was: a) To assess utilization levels of Shire River, suggest areas for improvement so that reliable water is available for a number of purposes. b) To independently assess the water availability for hydropower and irrigation purposes at Kapichira falls. c) To recommend the best possible strategies for accommodating demands for irrigation and hydropower and explore possible trade-offs in use. The study gave priority to satisfy the demand for irrigation (SVTP) project to the demand of water for maximum energy production. The consequences of shortage of water has been calculated as loss of and value of energy production.
The Elephant Marsh General Adaptive Management Plan 2018-2022 (2017). Prepared under SRBMP-1	The aim of this management plan is to ensure that the integrity of the Elephant Marsh is maintained and enhanced, together with the natural functions that these wetlands perform and the benefits that they supply, including the sustainable utilization of wetland resources, without undermining future adaptive capacity. The management plan has informed the measures undertaken as part of the Natural Resource Management components of SVTP.
Shire River Basin Management Program (Phase I) Project Final Environmental and Social Assessment Report (July, 2013)	The overall assessment of impact of SRBMP planned activities is dealt with in this report (except for the impact of Kamuzu barrage).
Independent Environmental Impact Assessment for the Upgraded Kamuzu Barrage (December 2011)	An ESIA was carried out under the Component C.1: upgrading of the Kamuzu Barrage. The barrage is a key element that has many interactions with SVTP as the current objective of the upgraded barrage is to raise the water level up to 40 cm in Lake Malawi.

SRBMP studies	Relation
Climate resilient livelihoods and sustainable natural resources management in the Elephant Marsh, Malawi. Ministry of Water Development and Irrigation. Description of the livelihoods in the area of the Elephant Marsh Report November 2016	This study addresses the following objectives (MRAG, 2016): • Describe local livelihoods, including spatial and temporal use of resources; • Assess the past, present and potential future influence of human livelihoods on the Elephant Marsh, and what effect these will have on the functional resilience of the Marsh in the future, and the implication for climate change; • Identify the socio-economic impacts of livelihoods and how climate change might affect these livelihoods; • Describe the risks to livelihoods (e.g. flooding or overfishing), and current strategies to increase resilience to these risks that will be exacerbated by climate change; and • Provide an assessment of the support mechanisms for community welfare in line with possible flood mitigation measures and disaster management strategies.
Climate Resilient Livelihoods and Sustainable Natural Resource Management in the Elephant Marsh, Malawi Hydromorphology study	The hydromorphology study objectives are to: • To establish the current status and recent trends of the hydromorphology of the Elephant Marsh. To establish a hydraulic model predicting flooding patterns in the Elephant Marshes since flow records began. • To evaluate historic land-use change (especially deforestation and agriculture) and its effect on sedimentation and siltation. • To map historic changes in the channel patterns in the marshes.

SRBMP studies	Relation
Climate Resilient Livelihoods and Sustainable Natural Resource Management in the Elephant Marsh, Malawi. SubStudy 3. Ecosystem Services of the Elephant Marsh. (December 2016).	This study is a desktop study which: • Describes the ecosystem services provided by the Elephant Marsh in physical terms and provide desktop estimates of their economic and social value; • Draws comparisons with other wetlands in Africa of a similar nature; • Discusses how capacity of the system to deliver these services responds to hydromorphology how this has changed over time; • Discusses the wetland's sensitivity and adaptive capacity to multiple pressures, with a description of those pressures.
Climate Resilient Livelihoods and Sustainable Natural Resource Management in the Elephant Marsh, Malawi SubStudy 4: Biodiversity of the Elephant Marsh (2016)	"This sub study forms part of a larger study on the Elephant Marsh which also includes studies of the hydrodynamics, local communities and ecosystem services, in order to inform a management plan for the marshes and in order to prepare an application for Ramsar status as a wetland of international importance" (Anchor, 2016). This sub-study aimed at describing (through surveys), biodiversity of Elephant marsh. Specialized surveys and studies of several taxonomic groups were carried: plants, aquatic invertebrates, dragonflies, butterflies, reptiles, amphibians, fish, birds and mammals.
Climate Resilient Livelihoods and Sustainable Natural Resource Management in the Elephant Marsh, Malawi Analysis of the potential effects of alternative future scenarios of flow and/or management on the ecological condition of the Elephant Marsh (Ecosystem Functional Model (DRIFT) 2016)	This sub study explores the potential effects of alternative future scenarios of flow and/or management on the ecological condition of the Elephant Marsh.

3. PROJECT LOCATION AND DESCRIPTION

The update of the impact assessment is based on the the Program set out in the FS, updated by the current information from the detailed designs work undertaken to date for Phase 1. The Study area remains as for the 2017 ESIA, and is the geographical area that includes all the Project components as well as the boundaries of potentially affected geographical areas.

The Study area includes all phases and zones of the Project as well as the right-of-way of all canals. It starts, at its northernmost limit, at Majete Wildlife Reserve and ends at its southernmost limit after Elephant Marsh at Bangula. It includes most of Chikwawa district and a part of Nsanje district. From a hydrological perceptive, the Study area is included in the Lower Shire River valley. It includes the Ruo River confluence with Shire River and all rivers feeding the Elephant marsh (both on the right and left banks of the marsh). The following map shows the Study area.

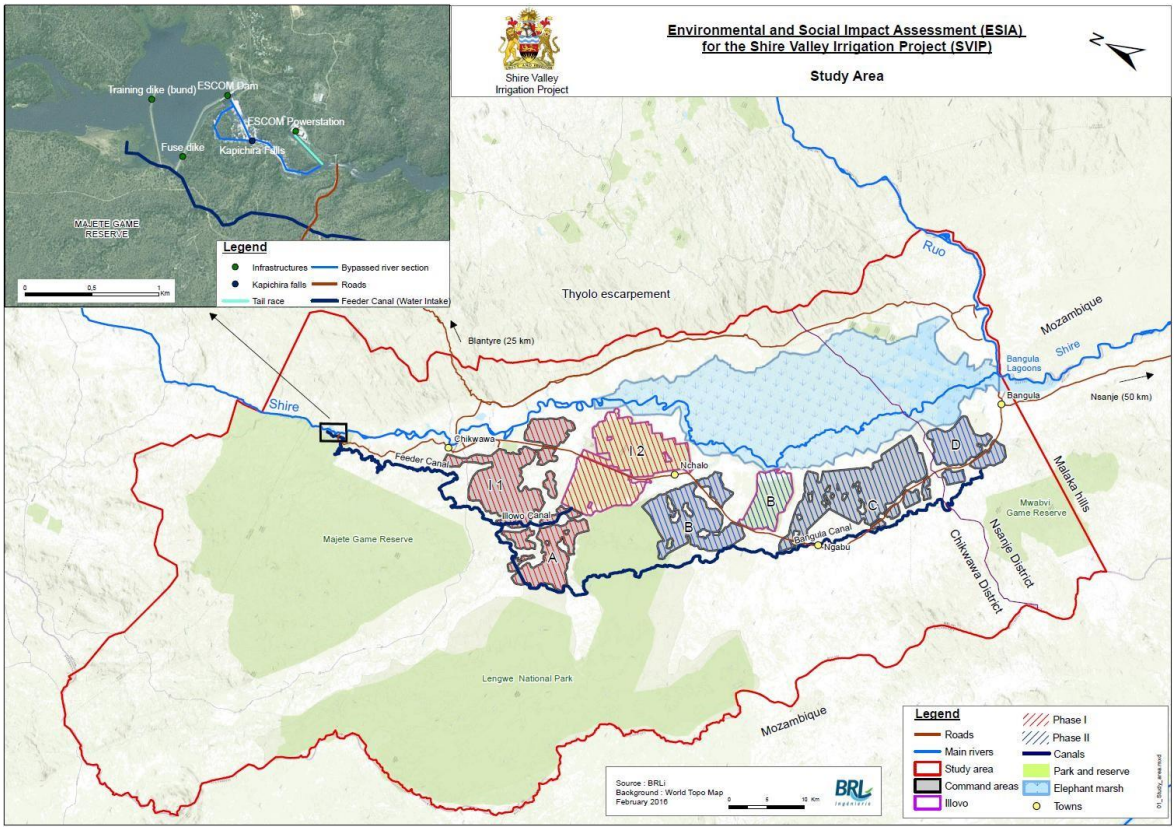


Figure 1: Impact Area of SVTP

In addition, an Extended Study area was identified in the 2017 ESIA and has been maintained for this update to include all infrastructures and major waterbodies that influence the hydrology downstream of Lake Malawi: namely Lake Malombe, Kamuzu barrage (Liwonde barrage), and the Nkula, Tedzani and Kapichira EGENCO hydropower plants. The Map on the next page shows the Extended Study area.

Construction work of the SVTP began in 2020 after a tendering process for a designer, and a construction contractor. The water will start to flow inside the water intake at Kapichira

Dam towards the end of year 2023. The total cost of SVTP taking into account direct and indirect construction costs is estimated at 519,250,000 USD (KRC FS report, 2016).

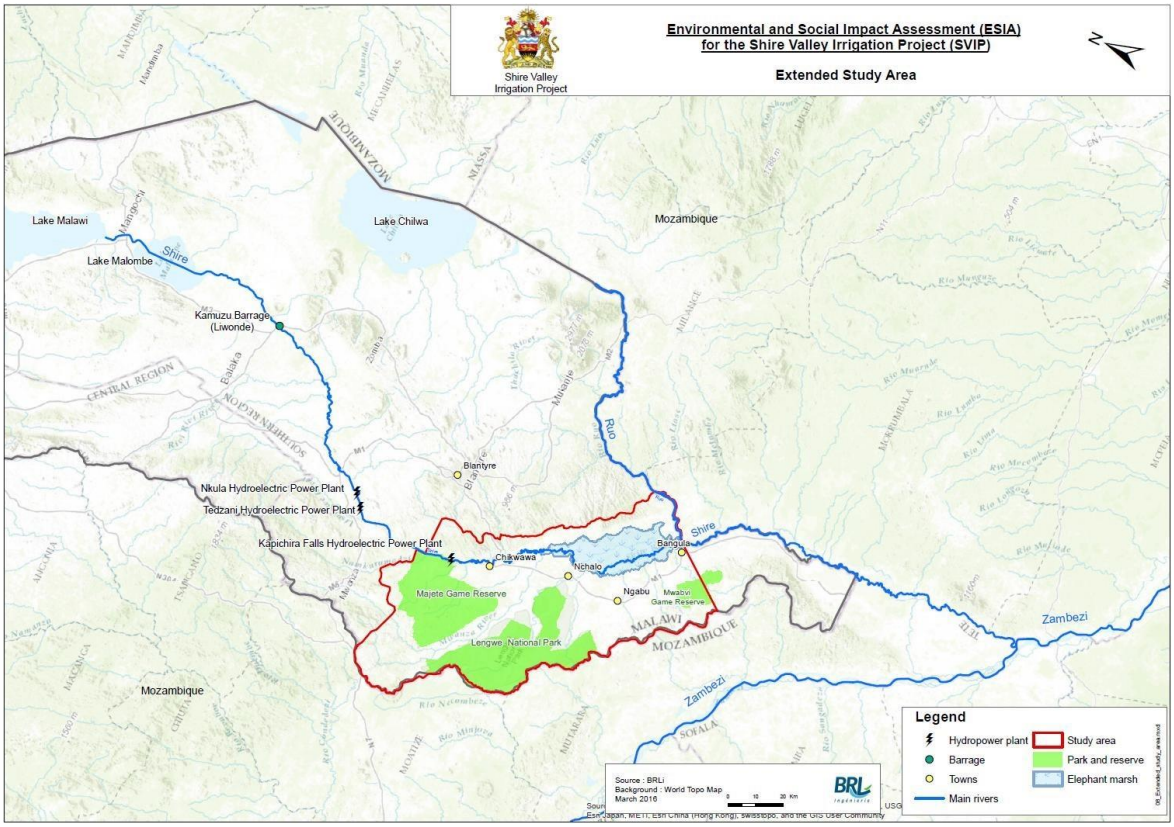


Figure 2: Extended Study Area

As mentioned in the latest version of the FS (Korea Rural Corporation, in Joint Venture with Dasan Consultants co., LTD., GK Works Civil and Structural Engineers, December 2016), the Project consists of several key infrastructures that are described in this section of the report.

3.1 WATER INTAKE

A water intake will be built at Kapichira reservoir, the highest topographic point of the scheme (145.5~146.5masl), on the right bank of the Shire River, upstream from EGENCO training dike and the fuse dike, on the opposite side of the water intake of EGENCO hydropower station.

The SVTP water intake will extract a certain amount of water from the Shire River (the reservoir) to distribute water by gravity to the scheme. The value will be between 20.5 and 51.3 m^3/s depending on the season. Based on the Hydraulic Modeling study, a bathymetric survey was carried out to select the adequate location which is shown in the following figure.

Figure 3: (Water Intake Area Inside MWR (source : KRC)

The SVTP intake structure will comprise a 46.5 m long intake sill, with 12 sluice gates each 3 m wide.

The EGENCO power plant as a capacity of 132 MW. The by-passed section between the reservoir dam and the power plant is very short (900 meters). An informal environmental flow of 30-50m^3/s is currently released from the dam spillway, which helps to maintain a strong flow over the Kapichira Falls during the rainy season. Although not a primary reason for visitors to come to the Majete Wildlife Reserve, the Kapichira Falls serve as a seasonally valuable tourist attraction. During much of the dry season, this environmental flow is not guaranteed and the Kapichira Falls sometimes dwindle to a trickle.

3.1.1 Construction and characteristics

Before the impact of Cyclone Anna, construction of the intake was at 16% and siphone 1 had been completed. With the damage incurred, designs for the intake will be reviewed and information regarding the construction of the intake will be available (quantity of material needed, location of quarries, RoW, duration of work, etc.) after the review process. One element can be highlighted: in order to prepare the passage for the water intake, part of the reservoir may be dredged to deepen the channel (using a dredger), if not already fully implemented by the planned reservoir dredging by EGENCO. The ESIA and ESMP will be updated with specific information as it becomes available after detailed design, and will also need to be included in the contractor's ESMP, in line with the ESF and based on principles of this ESIA avoiding impacts within the Reserve..

3.1.2 Operation

The gates will be operated by an automatic control system. When the operator inputs the required amount of water into the system, the system will automatically operate the gates based on the relation between the flow rate, gate opening and water level variation. The 12 sluice gates will be installed into two partitions, the first one comprising 8 gates and the second one 4 gates. The second partition will allow abstraction of 18 m^3/s, and will be operated when the water requirements at the scheme is less than 18 m^3/s. The first partition will allow abstraction of up to 32 m^3/s and will be operated when the water requirements at the scheme are between 18 m^3/s and 32 m^3/s. Both partitions will be operated for scheme water requirements above 32 m^3/s to the maximum requirement of 50 m^3/s (KRC, 2016).

The SVTP water demand per month is presented in section 6.5 (hydrology impact assessment).

The water intake is not a pumping station as water enters the intake passively (by gravity).

3.2 CANALS

There will be three main canals:

- A Main canal 1 (MC1), with a total length of 33.8 km (conveying water from the water intake), will extend from the intake at Kapichira Reservoir to the northern end of Lengwe National Park.
- The Supuni canal, also called Main canal 3 (MC3), which will be piped for a total length of 10.7 km (previously called Illovo canal) mainly irrigating Phase 1,
- The Bangula canal, also called Main canal 2, with a total length of 88.0 km mainly irrigating Phase II but also some Zone in Phase I (before Lengwe National Park).

Main canals 1 & 2 will be lined with concrete, although the stretch of the Bangula canal may either be lined with pre-fabricated concrete mats, Amorflex, or be earth lined where it passes through Lengwe National Park, to allow easier escape by animals and minimise fragmentation effects.

The following are the main characteristics of the canals based on the feasibility study (lined canal). RoWs are estimated as below.

Table 2: Main canals characteristics

	Side Slope of Canal	Canal Length (km)	Water Depth (m)	Average Velocity (m/sec) at max. capacity	Peak flow (m^3/s)	Bed width (m)	Upper width (m)	Total Right of Way (RoW) (m)
Feeder Canal (also called Main Canal 1)	1H/1.5V	33.8	2.2	1.44	50	12.6	22.0	40-45
Bangula Canal (also called Main canal 2)	1H/1.5V	88	1.8	1.50	29	8.1	13.5	30-45
Supuni Pipeline (also called Main canal 3 and Illovo Canal)	2.5m x 2.5m	10.7	2.5	1.91	11.6	2.5	2.5	12-14

Each of these canals separate into Branch canals.

Siphons are provided to cross large valleys and rivers with important floods. In total, 11 siphons are expected (6 are in the detailed designed for Phase 1), for a total length of about 4 km. Culverts will be used at river crossings where topographic changes are high but floods are small. Culverts will also be used to cross small-scale rivers and roads.

With current layout, the Feeder canal will cross about 2.45 km of Majete Wildlife Reserve and about 14km of Lengwe National Park.

INSIDE MAJETE WILDLIFE RESERVE

The Feeder canal inside MWR is underground for 1.25 km inside MWR boundaries, and is open (open lined canal) for 1.20 km. A wall with fenceis being constructed to prevent annimals from falling into the open areas of canal, but animals will be able to freely pass over the parts of the canal that are underground, and the canal has been designed to withstand the passage of animals and allow for some remediation of vegetation over the canal. Animal escape ladders have also been provided in the flume to allow a means of escape should any smaller animals fall into the canal.

The following are the characteristics of the underground canal (siphon) in MWR.

Table 3: Siphons of MWR

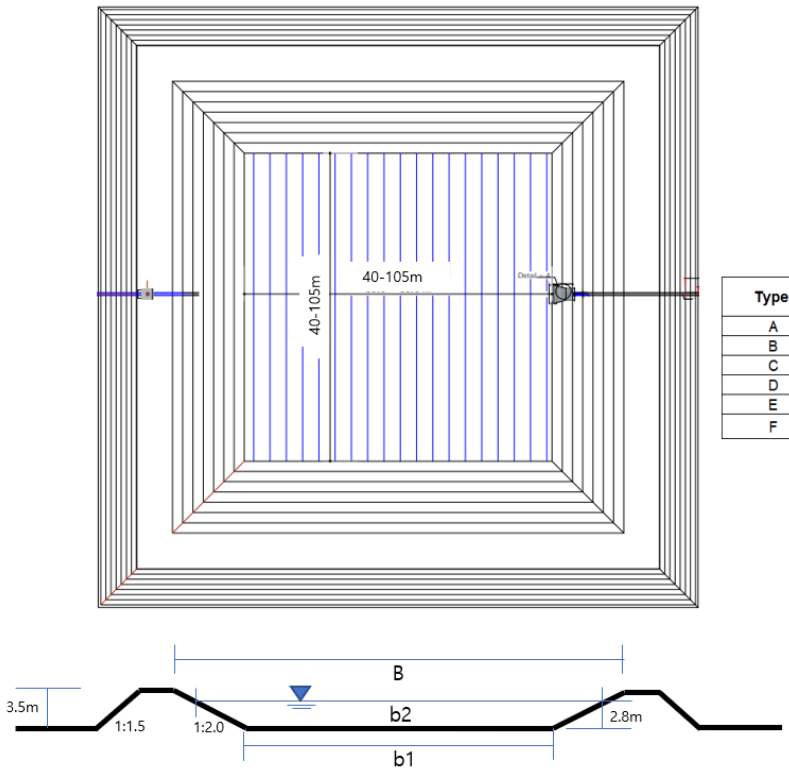
Chainage location of siphons	Length (m)	Length in MWR (m)	Size (m)	Name
0+64 to 0+817 (entirely in MWR)	755.40	755.40	8.0 x 3.0	Intake and #1 Siphon
1+237 to 1+430 (entirely in MWR)	195.40	195.40		#2 Siphon
2+710 to 2+890 (partially in MWR)	181.70	100		#3 Siphon
3+400 to 3+800 (partially in MWR)	406.80	200		#4 Siphon
Total length of buried canal inside MWR		**1250.8**		

INSIDE LENGWE NATIONAL PARK

The FS design for the canal through Lengwe National Park will be further developed in consultation with DNPW. Considerations will be given to the alignment (to minimise impacts on thicket areas) to minimise fragmentation and maintain linkages, and to minimise disturbance during the construction works. The design includes for 5 wildlife overpasses of between 100m and 250m wide (three of them to also carry roads over the canal) and one underpass specifically for wildlife. Where necessary and to assist with the spoil balance, considerations will be given to burying sections of the canal. In addition, up to 10 foot bridges may be incorporated into the design, and perimeter fencing will be provided in the design as agreed, with particular attention where the canal enters and leaves the park to ensure that the canal does not become an easy access point into the park.

NIGHT WATER STORAGE

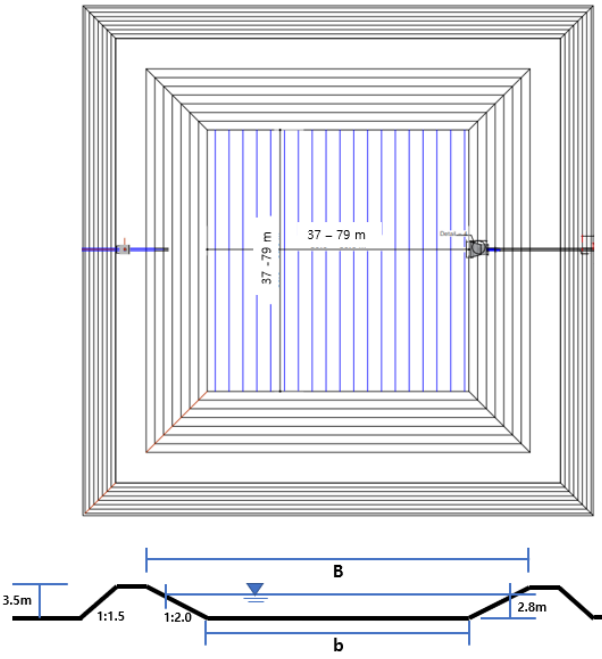
In addition, night water storages will be built. Although their locations are not yet known, they will not be constructed within protected areas.. In Phase 1, there will be 29 night storage reservoirs of varying sizes as depicted in figure 4 below covering three zones, namely, Zone 1-1, Zone A and Zone 1-2 shown in Figure 4.



Type	b1	b2	B	Number of NSR
A	40	51.2	54	4
B	55	66.2	69	4
C	70	81.2	84	6
D	85	96.2	99	3
E	95	106.2	109	8
F	105	116.2	119	4

Figure 4: Number of NSR by Type for Phase 1 of SVTP

Phase 2 , on the other hand, will have 60 night storage reservoirs 59 of which are new while one is an existing one operated by Illovo. These are located in Zones B, C and D shown in Figure 5 and their specifications will be as indicated in Figure 10 below depending on size:



Type	b (m)	B (m)
A	37	51
B	55	69
C	68	82
D	79	93

Figure 5: SVTP 2 NSR by Type

Their construction will generate significant quantities of spoil (that will need to be disposed of at approved locations) and they will need to have appropriate safety measures integrated into the design to prevent animal or people from drowning. The night storages will be subject to their own ESIA and ESMP, which will be prepared in parallel with the design development.

3.2.1 Designs of Secondary Canals

A total of six secondary canals branch off the Main Canal 1, eleven secondary canals branch off the Main Canal 2, five secondary canals branch off the MC3 (concrete pipeline).The secondary canals have varying lengths and specifications as detailed below:

Table 4: Description of Secondary Canals off Main canal 1

Secondary Canals	Location (Detailed Design)	Length(m)	Hydraulic Gradient		Ground Level	Area(ha)	Water Flow, Q(m³/s)
			B.P. El.(m)	E.P. El.(m)	E.P. El.(m)		
SC1A	MC1, STA 9+576	1,200	133.14	130.12	112.0	310	0.357
SC1	MC1, STA 16+500	8,220	131.76	114.32	90.0	1,125	1.297
SC2	MC1, STA 19+980	14,508	131.07	104.94	81.00	2,998.0	3.457
SC2-1	SC2, STA 110+00	1,000	118.03	116.40	90.00	1,202	1.386
SC2-2	SC2, STA 261+00	454	107.84	106.54	90.00	332	0.383
SC3	MC1, STA 22+925	1,300	130.49	127.72	124.09	208	0.240
SC4	MC1, STA 28+460	808	129.38	127.95	114.00	480	0.553
SC5	MC1, STA 29+400	750	129.19	127.25	116.00	314	0.362
SC6	MC1, STA 30+600	1,100	128.95	127.15	122.00	628	0.724

Table 5: Secondary Canals (Pipelines) Branch off the Main Canal 2:

Secondary Canals	Location (Detailed Design)	Length(m)	Hydraulic Gradient		Ground Level	Area(ha)	Water Flow,Q (m³/s)
			B.P. El.(m)	E.P. El.(m)	E.P. El.(m)		
SC12	MC2, STA 3+480	396	127.22	126.54	121.70	347	0.400
SC13	MC2, STA 4+540	650	126.85	124.85	119.00	188	0.217
SC14	MC2, STA 6+620	50	124.44	124.27	120.00	109	0.126
SC15	MC2, STA 6+620	50	124.44	124.29	118.00	106	0.122
SC16	MC2, STA 7+900	100	124.12	123.75	118.00	116	0.134
SC17	MC2, STA 11+980	1,000	123.59	122.51	118.03	367	0.423
SC18	MC2, STA 13+720	4,709	123.10	117.06	108.00	1,022	1.178
SC19	MC2, STA 29+400	7,756	122.67	107.87	104.00	1,464	1.688
SC19-1	SC19, STA 75+00	1,450	118.10	116.16	111.00	562	0.648

Table 6: Secondary Canals (pipelines) Branch off the Main Canal 3 (Pipeline)

Secondary Canals	Location (Detailed Design)	Length(m)	Hydraulic Gradient		Ground Level	Area(ha)	Water Flow, Q(m³/s)
			B.P. El.(m)	E.P. El.(m)	E.P. El.(m)		
SC7	MC3, STA 0+582	50	127.74	127.61	122.00	435	0.502
SC8	MC3, STA 2+242	50	125.68	125.56	109.00	585	0.675
SC9	MC3, STA 3+144	6,000	124.69	114.43	92.00	869	1.002
SC10	MC3, STA 6+400	500	121.05	119.25	104.00	155	0.179
SC11	MC3, STA 9+211	500	118.01	116.32	96.00	198	0.228

Detailed characteristics of secondary canals for SVTP II area are not known at present and will be known after detailed designs of the Bangula Line from northen border of Lengwe National Park to Bangula and its auxiliary secondary canals.

3.2.2 Construction and characteristics

Earthworks for leveling the bed and constructing the sides of the canal will require the use of excavators and movement of material by truck to either temporary storage or permanent disposal. The excavation will then be lined with a water-proof membrane ontop of which smoothed reinforced concrete will be placed to form a solid and scour-proof base and walls for the canal. Through Lengwe Nation Park, the canal lining will not be smoothed poured concrete, but earth lined or a rough concrete mesh, laid at a slack angle, to allow for animals to cross the canal. The Contractors will be required to work to approved ESMP and OHSM, which will be approved by the Supervising Engineer prior to the start of works.

Quarries, borrow pits and disposals sites have not yet been identified for Phase 2 works, although suggestions in the FS are to use existing borrow pit locations at Tomali, Nyaika, Sibale old pit, Nyamithuthu old pit, Chikhama, Moroko, Chikalumpha and Namiche. Quarry sites identified in the FS that may be suitable are at Kajawo, Thabwa existing quarry, Nzongwe and Ngabu. The contractor of the main canal for the intake and first 6km of SVTP-I has elected not to open a quarry or borrow pit, and is instead purchasing materials from existing operations in the area. The detailed design of the scheme for Phase 1 has taken into

account the spoil balance, to minimise the need for offsite disposal of excavated materials, and it is expected that this principle will be applied for Phase 2.

If the Contractor for the remaining sections of Phase 1 or Phase 2 main canal construction works wishes to open a quarry and/or borrow pit (which may or may not be from the options listed in the FS), the contractor will be required to prepare first an ESIA and ESMP to identify potential impacts, associated mitigation measures and agree restoration proposal in accordance with national law and to meet the requirements of the World Bank ESF. Site specific ESMPs will be developed for quarry, borrow pit, disposal site and campsites by the contractor for the approval of the supervising engineer.

3.2.3 Operation

All canals are gravity canals. In some area, canals may be in siphons (such as when crossing large rivers such as Mwanza River) and MC3 may be in pipeline to increase pressure.

The daily time for irrigation depends on the irrigation methods. For pivot irrigation system, irrigation time is 24 hours, a whole day. For furrow irrigation, water application is normally 12 hours, during the daytime. Therefore, Branch canals shall be used only for 12 hours based on furrow irrigation methods. The main canals are designed for 24-hour continuous supply, for the whole year. Therefore, there is an operating time gap between the main canals and the Branch canals. Night storages will allow to store water (KRC, 2016).

Regarding field drainage, existing rivers and streams that flow eventually into the River Shire will be used as drainage channels. Where necessary, new drainage channels will be cut within command areas to link to the existing streams and rivers.

The following figure 6 summarizes the system.

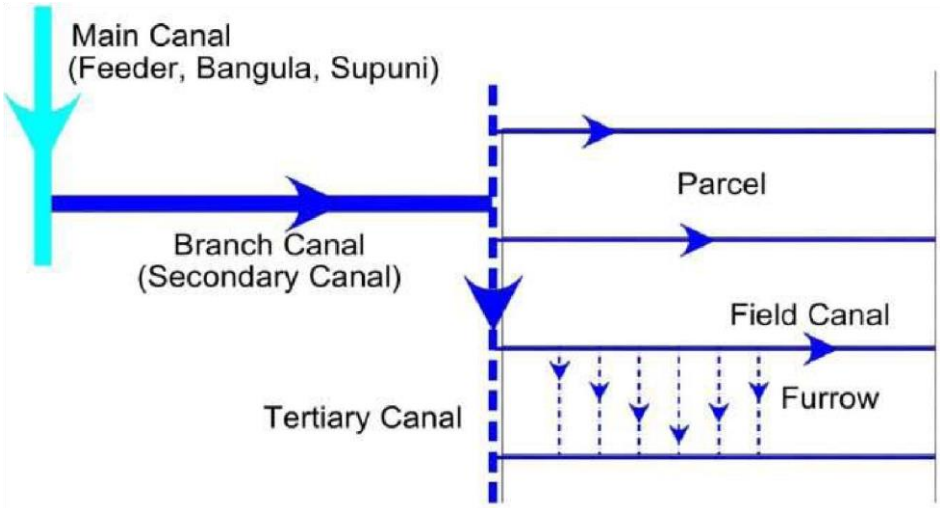


Figure 6: Diagram of Irrigation Canals

3.3 COMMAND AREAS

The project is made of several irrigated areas as shown in figure 7.

- Phase 1 of the Government Program consist of three zones:
  - Zone I-1: 9,631ha (total area, including access roads and right of ways)
  - Zone I-2: 11,250ha (total area, which is made of Illovo estate)
  - Zone A: 5,199ha (total area)
- Phase 2 consists of three zones:
  - Zone B: 9,925ha (total area, which is partly made of Illovo estate)
  - Zone C: 10,749ha (total area)
  - Zone D: 4,076ha (total area)
- Phase 3 will be a consolidation phase that will expand the agricultural commercialization works, building capacities of the SOCFEs and farm operators, and considering whether agricultural spatial zones are needed to support the transformation of the valley. During this phase, Natural Resource Enhancement measures studied and planned during earlier phases will be implemented.

The total area is 50,830ha of land. The irrigation land covers 43,370ha (without farm roads, canals and infrastructures etc.).

3.3.1 Construction and characteristics

The command areas or farm blocks will be made of parcels, with irrigation systems (such as pivots or drainage channels) and farm roads (between 4 and 6m wide) designed and built to reflect the characteristics and relationships between the parcels. Work to prepare the parcels for irrication will involve land leveling and major earthwork.

3.3.2 Operation

The operation of each farm block will be determined by the responsible farmer co-operative to reflect the desired crops, long term plans for the farm (including investment levels) and desired working arrangements. Each co-operative will be advised as part of the agricultural commercialization process, which will present the options for irrigation and help each co-operative decide on the preferred management plan for the farm.

The irrigation and drainage system and roads in a unit parcel of land shall be based on its size. Typically, roads inside the farmland have been planned to be spaced at every 1.5 km distance. In this regard, several parcels comprise a single block around which roads have been planned. A field block shall comprise 6 parcels, and a farm lot shall comprise 2 field blocks (KRC, 2016).

A farm lot=2 field blocks, 1 field block=6 parcels.

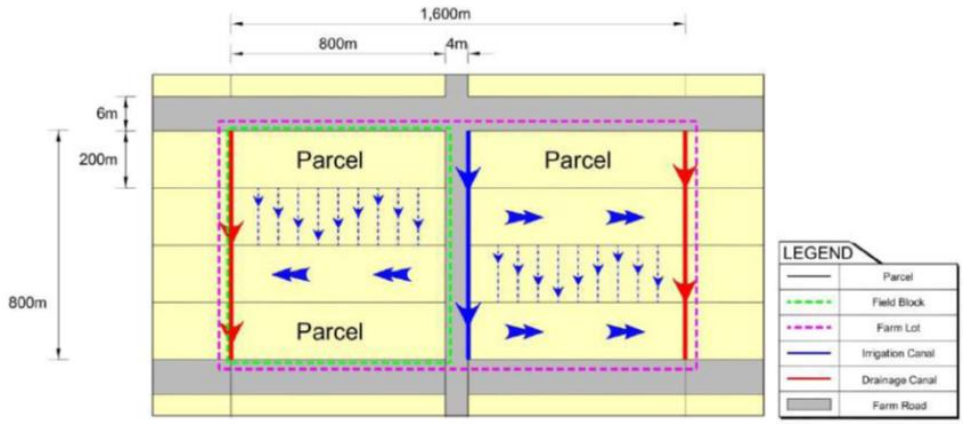


Figure 7:Arrangement of Field Blocks

The field canal will supply irrigation water directly to the parcel through furrows.

APPLICATION EFFICIENCY

The various efficiency coefficients are:

- Application Efficiency Ea (furrow irrigation): 64%
- Distribution Efficiency Ed: 90%
- Conveyance Efficiency Ec: 90%

Multiplying the three coefficient shows how much irrigation water will return to the system either to the water table, to drain canals or evaporates. The overall Application efficiency is 52%, which means that about half of the water is returned to the natural environment (or evaporates).

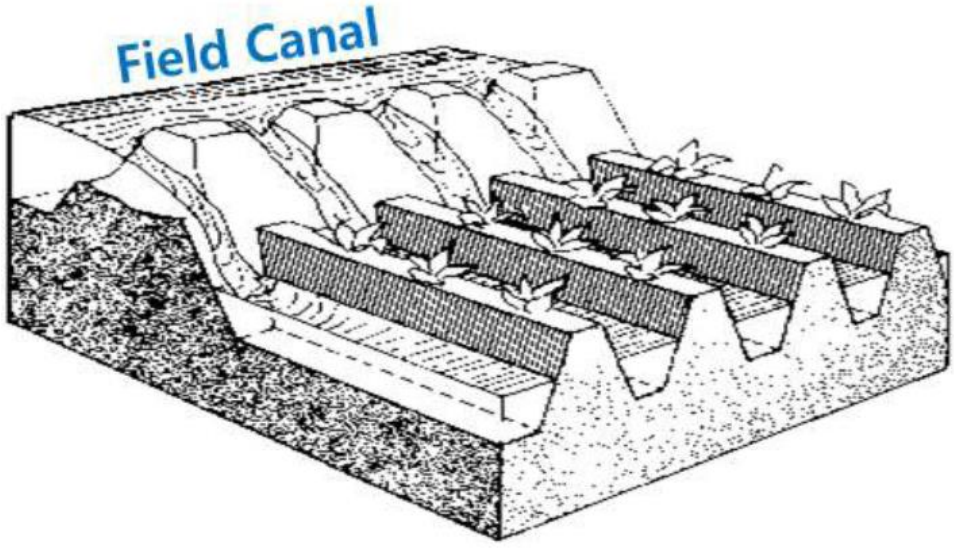


Figure 8: Design of Furrow Irrigation

3.4 NATURAL RESOURCES MANAGEMENT (NRM) COMPONENT

The Sub-component 2.2 Natural Resources Management has, in Phase 1, included site level support for Conservation Areas of the Lower Shire Landscape So far:

- **Mwabvi Wildlife Reserve and Matandwe Forest Reserve**: Interagency planning has been strengthened, and between DNPW and DoF a combined management plan has been prepared, along with a training plan fo Nature Based Tourism. Beekeeping has been introduced as an income generating activity for 112 beneficiaries. 605 goats have been distributed to 121 households, and 15 tree nurseries have raised seedlings for planting new woodlots. 96 Village Forest Areas have been identified and the process of ensuring the communities participat in forest management has begun. Village Savings and Loan Schemes have been established and continue to be managed. These activities will continue throughout Phase 1.

  In Phase II, tools for managing human wildlife conflicts will be developed and disseminated with backstopping training of extension staff and farmers.

- **Elephant Marsh**: In Phase I, Malawi's first 'Community Conservation Wetland Area' was established and guidelines prepared, and briefings on this have been held with District Assemblies and Traditional Authorities. The community has been consulted on potential areas for CCA establishment, in discussion with the communities. A re-assessment of the biodiversity hotspots has been undertaken, to identify non-use areas, and patrols have been conducted to curb illegal fishing methods. 70 community members have constructed 18 fish ponds. A community based ecotourism training plan has been prepared.

  In Phase II efforts will be directed at water quality monitoring with respect to pesticide and other chemicals, fisheries quantity and quality with respect to pollution from pesticides and sediment load monitoring. Tools for managing human wildlife conflicts will be developed and disseminated with backstopping training of extension staff and farmers.

- **New Lengwe** (the Lengwe "Extension" in the Western par of LNP): During Phase 1 a management plan for the whole of the park (ie including New Lengwe was prepared, including the development of co-management arrangements with local communities to build on an existing platform of Community-based Organizations around the Park. A road network of 130km has been opened, following community based works to assist with the clearance of the roads. These will ensure that New Lengwe is now accessible, and more than 156 patrols have been carried out for illegal activities; in addition DNPW has attended to resolve Human Wildlife Conflicts. 1100 goats have been distributed to 220 households surrounding the park, and the communities have been encouraged to develop bee keeping enterprises within the protected area. A study into identifying a feasible route to link Majete Wildlife Reserve and Lengwe National Park was undertaken, and baseline surveys undertaken of the plants, animals and birds within the park.

  In Phase II, many of these initiatives will continue, particularly with respect to law enforcement, and on measures to help increase the biodiversity value and interest for tourism.

- **Majete Wildlife Reserve**: The Project has supported existing community livelihood initiatives from African Parks, as well as deliver the compensation and mitigation measures commensurate with the progress of the construction activities.
- **Increased use of Pesticides, herbicides and fertilizers**: commensurate with the commercialization of the farms it is expected that there will be an increase in the use of chemicals inputs not only into the commercial enterprises, but also by 'spill-over' into family and local farm settings. Training of farmers will be carried out in integrated pest management, handling and application of pesticides and disposal.

It is antincipated that sub-component 2.2 of Phase 1 will become Component 4 in Phase 2 owing to the magnitude of the scope.

3.5 DOMESTIC WATER SUPPLY

From the Feeder canal at Chikwawa, a pipeline will be constructed to provided potable water to Chikwawa town. The pipeline will be designed to carry up to 1,240 m^3 per day and consideration during the detailed design will be given to the form and location of treatment works. Small water supplies, for example to provide non-potable water to staff housing in Majete and to village cattle troughs will also be included in the detailed design.

3.6 ASSESSMENT OF ALTERNATIVES CONSIDERED

A number of alternatives have been considered during program design, including the withoutproject
scenarios. This section presents the assessment of alternatives to achieve the program objectives.

The parameters of the scheme are convincing in addressing the critical water-agriculture-nexus in
Malawi and the scheme features highly in investment prioritization matrices. This is due to:

(i) Its unique location for agriculture. Agro-ecological potential is very high if water is brought to this area as demonstrated by existing pumped irrigation in the valley. Any intensification for commercial agriculture in Malawi requires investment in irrigation; this area suffers most from lack of precipitation making even subsistence rain fed agriculture very precarious. Finally, the area is close to Blantyre, the country's largest market and transportation hub and the Nacala railway for exports;

(ii) Its impact on the water balance. When fully developed the scheme will abstract in the critical month of September about 12 percent of the long term Q_{80} Shire River flow for that month at Kapichira. This corresponds to an 8 percent net abstraction (taking into account substitution for existing pumping by gravity-fed irrigation) and is determined to have limited appreciable harm on downstream marshes or other uses, as has been confirmed by a hydromorphological study on the marshes and modelling under the SRBMP. The potential trade-off with power production at Kapichira hydro-electric plant is obvious given the scheme's intake location, yet is determined to be limited and restricted to dry months in dry years (full supply is guaranteed in 4 out of 5 years for both hydropower and irrigation in the critical month of September – this

is common practice). Virtually all other irrigation in the country would be upstream and affect the entire hydropower cascade and other uses and possibly future upstream hydropower development as well, so this is a least harm alternative, and economically justified. The scheme is designed and technically limited within sustainable resource use parameters and this was confirmed in the national water resources investment strategy as well as the Shire River Basin Management Program planning where alternative sites/developments have been analyzed; and

(iii) Its impact on the energy balance. With Malawi's severely constrained energy situation, pump-based irrigation is unfeasible and undesirable. This scheme enables the expansion of irrigated area in the country by 40 percent, only relying on gravity, while enabling the release of power to the currently underserved national grid through converting current large scale pump based irrigation to gravity.

The technical design studies have been optimized from earlier versions that have been developed over the years, and alternatives have been considered, including options that would bypass Majete Wildlife Reserve altogether, and smaller pump-based versions. These designs would have prohibitive cost in construction and long term operation, rendering them non-viable. The current design is robust, has reduced environmental impacts by rejecting the alternative original design with an intake at Hamilton Rapids (9km upstream) and is better addressing current technology and farming models, optimizing resource utilization rather than low equilibrium agriculture. It has prioritized commercial agriculture instead of low value crops and better integrated multiple uses including livestock, drinking water and the environment. The design parameters are conservative and robust to reduce operation and maintenance costs, while allowing for gradual water efficiency improvements. The phasing has been optimized within available funding. It is technically, financially and socially undesirable to "pilot" with a smaller command area as costs per hectare would dramatically increase, future expansions would be significantly compromised, and short term benefits would be skewed towards existing commercial enterprises.

Several options have been considered as part of the development of the design:

- **Canal options**: Apart from the choice of route inside vs. outside Majete Wildlife Reserve (MWR) as mentioned above, several technical options within Majete have been considered to minimize impacts during construction and operation. An option was considered to bury most of the length of canal, which will not function as a barrier or trap for animal movement as an open canal would. Much of this stretch will be within a siphon which reduces the length of canal and physical footprint in the canal as compared with the alternative where the canal follows the contours. Various lining options have been considered for the open sections.
- **Wildlife protection within MWR**: Various work schedules have been discussed and the selected option limits disturbance to wildflife and tourism. For the open canal section alternative barriers have been considered and a masonry wall with local rocks and fence has been selected as the most robust and most visually attractive scenario.
- **Wildlife protection in Lengwe**: During design development, the alignment will be optimized to avoid/minimise loss of thicket habitat. Final selection for the stretch in

Lengwe National Park is to be made, but there is a strong preference for a technical design option that avoids slippery slopes and allows safe access and passing of wildlife.

- **Tiger fish invasion at Lake Malawi and Shire River**: Various alternatives have been considered and discussed with technical experts. While an independent panel is to verify final design, the choice was made for the design of a fish barrier that uses a high vertical drop with proven effectiveness and very low maintenance requirements, as compared with the two alternatives: use of fish screens (which would have had less head loss but which would be very difficult to maintain in good working condition and a construction with a lower drop and screen, which was considered less desirable.
- **Environmental flows**: Various scheme sizes, cropping patterns, scenarios with/without Illovo estate have been considered; and alternatives were considered for expanding hydropower rather than irrigation, and other developments and climate change scenarios were incorporated in this multi-criteria analysis under the Shire River Basin Management Program. Consideration has been given for various flow scenarios for downstream impacts from Kapichira Falls to Elephant Marshes. The technical design considered limiting overall abstraction to within sustainable resources use and SVTP will consult with EGENCO to include environmental considerations into the operating rules at Kapichira Dam and at the basin level for releases at Kamuzu Barrage, keeping in mind overall water security, lake levels and human safety. EGENCO in collaboration with Water Resources Department regulate water flows from the barrage and Kapichira reservoir. In the event of increasing water levels and imminent floods, alerts and warnings against floods are issued to stakeholders and communities along the Shire to move to safer higher areas.

  While this will be an ongoing process of optimization and scenario development, the alternative would have been not coordinating water resource utilization with obvious detrimental effects.
- **Flood risk management:** It has been considered that the scheme should generally only be constructed in areas outside the 10 year floodplain. The alternative would have opened up more areas for irrigation, but would have necessitated construction of significant stretches of embankments which has been discarded for environmental reasons, for hydrological reasons (it transfers flooding elsewhere) and economic reasons. The project area now provides a livelihood outside the immediate floodplain and reduces risk to production significantly.

A without project scenario would perpetuate the unsustainable livelihood scenario and poverty levels in the lower Shire, with long term negative impacts on household food security, natural resource utilization, and would not provide much needed economic impetus in the Shire Valley and beyond. From an safeguards perspective certain potential impacts associated with canal infrastructure and intensive agriculture would be avoided, but also opportunities for addressing these and other challenges in an integrated landscape approach would not be seized. On balance, with robust mitigation measures in place, it is anticipated that the program can deliver net social and environmental benefits over the baseline scenario. The no project scenario would also entail no leveraging of resources for the NRM component on natural resources management, which includes critical protection for protected areas and wetlands (Elephant Marsh protection and support for RAMSAR status). It is a safe

assumption that without the project, continuous unregulated use and exploitation of the marsh will continue that will contribute to its degradation in the long run. Majete WR might not be negatively impacted most likely as it is managed well, but the other reserves and natural habitats might continue to be degraded and lose biodiversity.

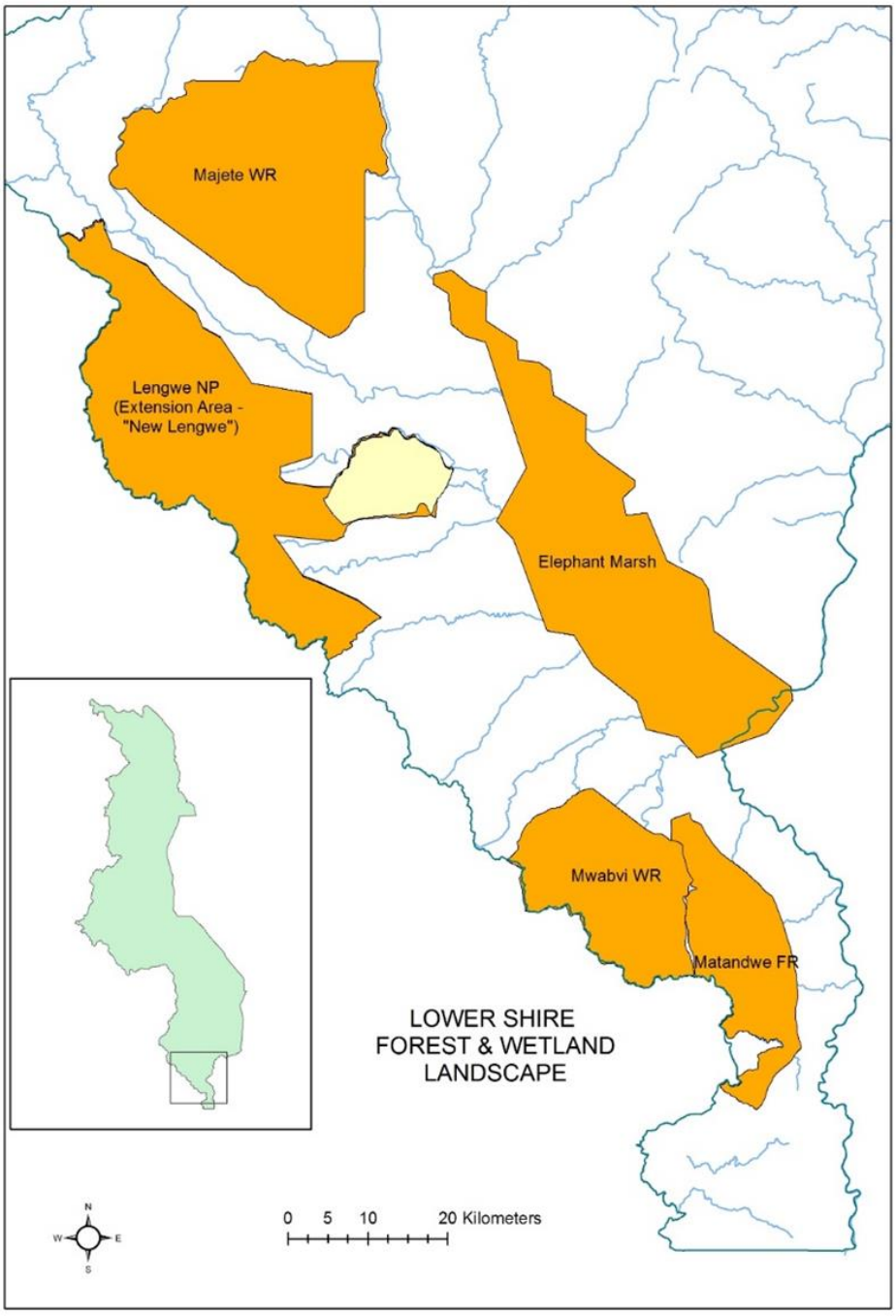
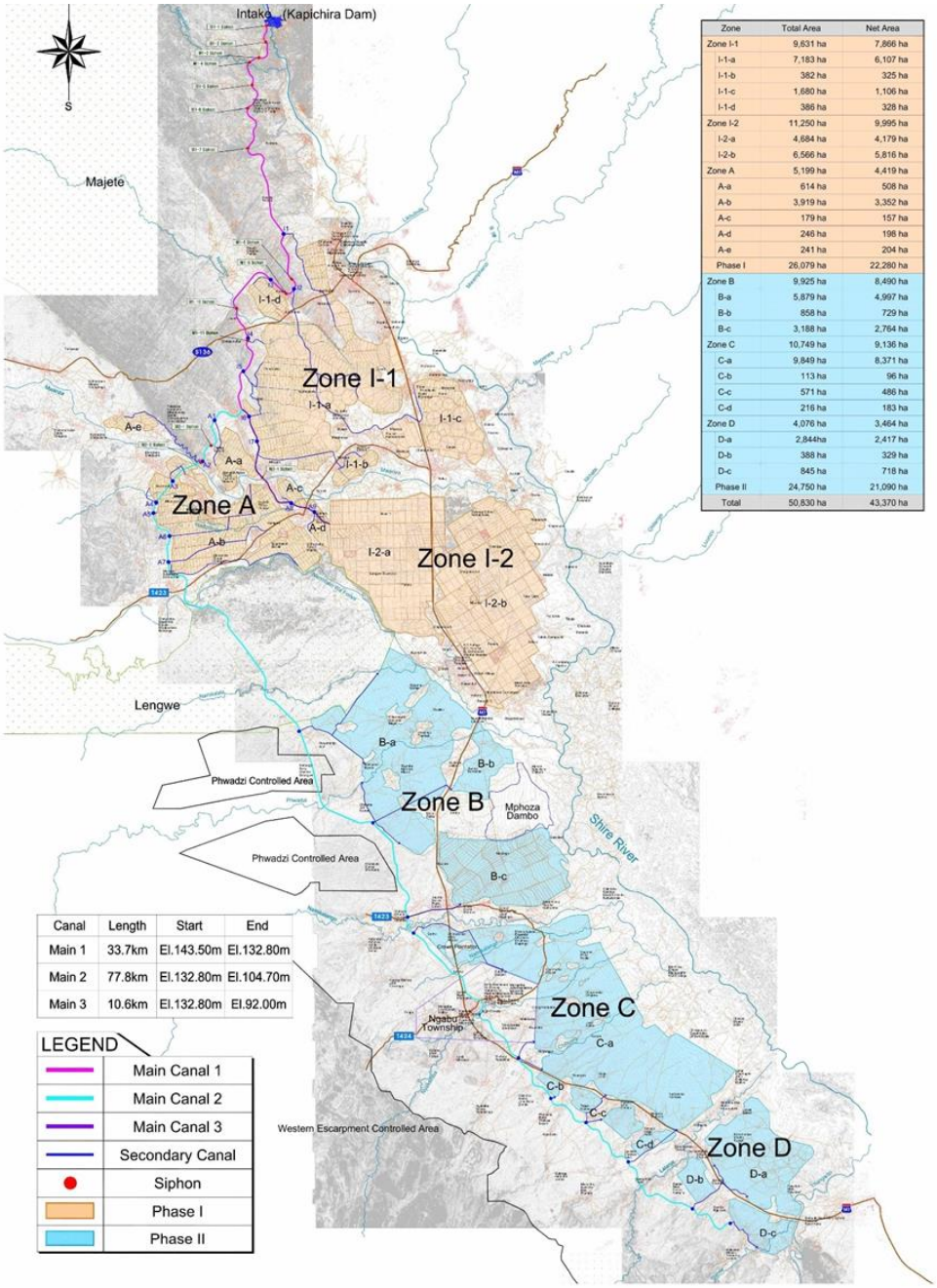


Figure 9: Protected Areas of the Shire Valley



Zone	Total Area	Net Area
Zone I-1	9,631 ha	7,866 ha
I-1-a	7,183 ha	6,107 ha
I-1-b	382 ha	325 ha
I-1-c	1,680 ha	1,106 ha
I-1-d	386 ha	328 ha
Zone I-2	11,250 ha	9,995 ha
I-2-a	4,684 ha	4,179 ha
I-2-b	6,566 ha	5,816 ha
Zone A	5,199 ha	4,419 ha
A-a	614 ha	508 ha
A-b	3,919 ha	3,352 ha
A-c	179 ha	157 ha
A-d	246 ha	198 ha
A-e	241 ha	204 ha
Phase I	26,079 ha	22,280 ha
Zone B	9,925 ha	8,490 ha
B-a	5,879 ha	4,997 ha
B-b	858 ha	729 ha
B-c	3,188 ha	2,764 ha
Zone C	10,749 ha	9,136 ha
C-a	9,849 ha	8,371 ha
C-b	113 ha	96 ha
C-c	571 ha	486 ha
C-d	216 ha	183 ha
Zone D	4,076 ha	3,464 ha
D-a	2,844ha	2,417 ha
D-b	388 ha	329 ha
D-c	845 ha	718 ha
Phase II	24,750 ha	21,090 ha
Total	50,830 ha	43,370 ha

Canal	Length	Start	End
Main 1	33.7km	El.143.50m	El.132.80m
Main 2	77.8km	El.132.80m	El.104.70m
Main 3	10.6km	El.132.80m	El.92.00m

Figure 10: SVTP Layout

4. POLICY AND LEGAL FRAMEWORK

4.1 MALAWI POLICIES RELEVANT TO THE SHIRE VALLEY IRRIGATION PROJECT

The policy framework in support of agriculture, irrigation and sustainable natural resources management comprise the National Constitution of the Republic, the national road map Malawi Vision 2020, the umbrella national development planning instrument; the National Growth and Development Strategy (MGDS), various sectorial policies in agriculture, land, forestry, irrigation, environment; the various strategies to implement international conventions on biodiversity, sustainable development, climate change, desertification etc. Most of the policies have recently been reviewed, revised or/ and harmonized. The following sections highlight some selected policies and laws which are applicable in the planning and implementation of public sector projects, more especially those in the agricultural and irrigation sector and therefore relevant to the preparation of Environmental & Social Impact Assessment and Pest Management Plan for Shire Valley Irrigation Project.

4.1.1 The Constitution of the Republic of Malawi (1995)

A new Constitution of the Republic of Malawi was adopted in 1995. Section 13 (d) of the Constitution provides a broad framework for sustainable environmental management at various levels in Malawi. Among other issues, it calls for prudent management of the environment and accords future generations their full rights to the environment. The Constitution provides the fundamental principles that require the State to promote the welfare and development of the people by progressively adopting and implementing policies and legislation aimed at achieving gender equality, adequate nutrition, adequate health care and responsible management of the environment. Specifically for the environment, the constitution makes the following provisions:

- To manage the environment responsibly in order to:
    - Prevent degradation of the environment;
    - Provide healthy living and working environment for the people of Malawi;
    - Accord full recognition to the rights of future generations by means of environmental protection and sustainable development of natural resources; - Conserve and enhance the biodiversity of Malawi.

Section 13 (e) of the Constitution:

- To enhance the quality of life in rural communities and to recognize rural standards of living as a key indicator in the success of Government policies.

With respect to gender equality, the Constitution under Section 13 (e) gives the State the responsibility to achieve gender equality for women through:

- Full participation of women in all spheres of Malawian society on the basis of equality with men;
- The implementation of principles of non-discrimination and such other measures as may be required;

- The implementation of policies to address social issues such as domestic violence, security of the person, lack of maternity benefits, economic exploitation and rights to property.

In view of the environmental principles stipulated in the constitution, SVTP ensures that activities implemented under the project promotes environmental protection and sustainable socio-economic development of natural resources by effectively implementing environmental and social management as well as pest management plan in compliance with the government legislative requirements stipulated in acts, policies and approved guidelines applicable to environmental management.

The ESIA and PMP assignment also addresses gender inequality issues between men and women and measures to ensure that women are included in implementation of project both during construction and operation phases.

4.1.2 The Malawi Vision 2063

The Government of Malawi adopted the Malawi Vision 2063 as successor development agenda for the country replacing the Malawi Vision 2020. The agenda was arrived at in a consultative manner that involved participation of full representation of key actors in the country.

In it's Enabler 7 (Environmental Sustainability), the government and people of Malawi aspire that "Malawi shall have a safe, clean, secure and sustainable environment."

The agenda recognizes that challenges confronting environmental sustainability in Malawi are both externally and internally induced. These include: natural disasters and climate adversities; environmental degradation; weak institutional capacity and coordination exacerbated by political interference in regulation and enforcement; limited awareness of environmental best practices; data gaps and limited funding for environment sustainability initiatives. Poor Industrial waste management coupled with loss of forest cover have increased the destruction risks on flora and fauna and endangered species. Industrial activity associated with unregulated disposal of waste, discharge of untreated industry effluents, lack of proper waste treatment systems and leaking of toxic waste leads to modification of the ecosystem and related services.

Consequently, Malawi undertakes to harmonize policies and coordinate implementation efforts towards environmental sustainability, embrace ecosystem based approaches in managing the environment, embrass Green Economy measures and account for the full economic value of environmental resources.

The ESIA and PMP assignment describes potential and actual impacts to be generated by SVTP activities on issues in the Vision 2063 such as land degradation, deforestation, degradation and depletion of water resources, diversity loss, air pollution, and poverty and land tenure. The ESIA through ESMP will recommend site specific measures to mitigate the negative impacts and enhance the positive impacts.

4.1.3 Malawi Growth and Development Strategy II

The Malawi Growth and Development Strategy (MGDS II) of 2011 – 2016 is Malawi's road map for the attainment of the MDGs that among many goals set out to halve the level of poverty by year 2015 and the need for ensuring environmental sustainability. The MGDS needs to be reviewed and aligned to the new Sustainable Development Goals (SDGs) but in its present form, it is still relevant to the SVTP. Agricultural production and smallholder integration into commercial activities is seen as of the Malawian economy, while strategies to target high growth sectors are being developed. Commercialization of agriculture entails improving management and making land and water use decisions that lead to improvement quality, seasonality of production and attract good prices on the market. Commercialization fuels proper land and water management as it provides incentives for irrigated agriculture.

The MGDS II has six thematic areas: Sustainable Economic Growth; Social Development; Social
Support and Disaster Risk Management; Infrastructure Development; Improved Governance and Cross Cutting Issues. Out of these six thematic areas, nine priority areas pivotal to the achievement of sustainable economic growth and wealth creation have been identified among which Agriculture and Food Security, Green Belt and Water Development and Natural Resources and Environmental Management are relevant to SVTP. Inclusion of these priority areas is a clear manifestation of government commitment to irrigation development that is sensitive to social and environmental impacts.

The ESIA and PMP assignment assesses how issues of fish resources, wildlife, sanitation, malaria and HIV management are impacted by the project and designs mitigation measures to address them. The ESIA and PMP also look at how smallholder farmers are integrated into commercial farming and how this affects poverty reduction and proposes measures on how these can be enhanced.

4.1.4 National Environmental Action Plan (1994)

The National Environmental Action Plan (NEAP) developed in 1994 and updated in 2004 provides a framework for integrating the environment into all socio-economic development activities of the country. The objectives of the NEAP are to: document and analyze all major environmental issues and measures to alleviate them; promote sustainable use of natural resources in Malawi; and develop an environmental protection and management plan. The NEAP identifies the following as key environmental issues to be addressed: soil erosion, deforestation, water resources degradation and depletion, threat to fish resources, threat to biodiversity, human habitat degradation, high population growth, air pollution and climatic change. Most of the issues identified are linked to agriculture and therefore any efforts to address the issues will involve and benefit the agriculture sector.

In order to protect the environment from further degradation; the NEAP outlines actions that need to be undertaken and to ensure adequate environmental protection. The actions relevant to the SVTP include:

- Discourage cultivation on marginal lands (steep slopes and river banks);

- Construct permanent physical conservation structures such as storm water drains, terraces and bunds;
- Promote crop rotation;
- Promote mixed and intercropping by smallholder farmers;
- Improve land productivity through sustainable land saving technologies;
- Intensify training of farmers in improved farming practices;
- Improve management of forest resources on customary land; and
- Promote proper handling and use of agrochemicals.

4.1.5 National Environmental Policy, 2004

The 2004 National Environment Policy prescribes the policy and institutional arrangements necessary for effective delivery of sustainability agenda and provides the basis for Environmental Impact Assessment and environmental management plans. The implementation of the policy is, however hampered by lack of the required legal framework and institutional arrangements to support the aspirations.

The National Environmental Policy as an umbrella framework guides different lead agencies and stakeholders when their activities affect the environment and natural resources management, including how to minimize impacts of environmental degradation. Its aspirations under different sectors considered relevant to enhance the ideals of sustainable land and water management are summarized in the overall goal of the policy that states that "the overall policy goal is the promotion of sustainable social and economic development through the sound management of the environment and natural resources". Specifically, the policy sets out many objectives that are inclined towards supporting sustainable land and water management and irrigation development in the country as advocated under SVTP. Some of the relevant objectives are as follows:

To promote environmentally sustainable agricultural development by ensuring crop and livestock production through ecologically appropriate production and management of systems and appropriate legal and institutional framework for sustainable environmental management;

- To sustainably manage forestry resources so as to maximize benefits to the nation;
- To manage fish resources for sustainable utilization and conservation of aquatic biodiversity;
- To manage and conserve wildlife resources inside and outside protected areas so as to ensure their protection, sustainable utilization and reduction of people/ wildlife conflicts; and
- To manage and use water resource efficiently and effectively so as to promote its conservation and availability in sufficient quality and acceptable quantity.

In relation to the SVTP relevant objectives under this policy, this ESIA and PMP assignment seeks to provide mitigation measures that ensure sustainable utilization and conservation of

aquatic biodiversity, water resources use efficiency, human/wildlife conflicts and wildlife habitat loss.

4.1.6 National Land Policy, 2002

The 2002 Malawi National Land Policy recognizes the centrality of land as a basic resource common to all people of Malawi for their social and economic development. The policy provides opportunities for the people of Malawi to embark on a path of socially and environmentally sustainable development. In addition, the policy highlights a number of approaches for redressing problems facing land resources. Some of relevant provisions to the proposed SVTP activities are as follows:

- Recognition that agriculture development is and will continue to be the major benefactor land use sector is of the policy's strength. The policy guarantees full legal protection to customary land tenure to the people of Malawi in order to enable the ordinary Malawians adequately participate in agricultural activities and other rural livelihoods by converting them to "customary estates".
- The policy recognizes several sectoral policies and strategies in physical planning fisheries, environment, forestry, irrigation and wildlife and for this reason; it encourages multi-sectoral approach in land use and management at local and districts level.
- The policy recognizes environmental impact assessment of all big land development projects, and those planned in fragile ecosystems in order to protect biodiversity and water resources.

Thirteen years after the adoption of what is considered to be one of the most progressive land policies, the reviews and enactment of relevant land laws have not been completed making the implementation of the provisions of policy difficult if not impossible.

Key statutes which regulate land use are the Land Act and the Town and Country Planning Act, Number 26, 1988. These statutes deal with land tenure and land use quite comprehensively. The issues of land tenure and land use are recognized as critical in sustainable environmental management in Malawi. The Land Act and The Town and Country Planning Act highlight the sustainable use of land resources by strengthening and clearly defining security of tenure. This is essential, as people are more inclined to manage well, land that belongs to them.

In terms of the SVTP this implies that land protection and management principles should be adhered to in order to preserve land resources for the benefit of current and future generations. It also implies that the SVTP will adopt a multi-sectoral approach in protection and conservation of the land resources in question.

Chapter 10 of the Land Policy, 2002 deals with inter-sectoral coordination and relations. The chapter highlights the need for collective responsibility for monitoring of the land resources, forging strong inter-ministerial commitments to land stewardship in Malawi, feedback from land sector agencies and their regulatory processes to inform land use decision-making, recognition of the importance of maize production and food self-sufficiency in a dualistic agricultural sector, and consideration for land use proposed in other sectors.

The SVTP will rely on several experts that will describe actions aiming at protecting customary land tenure, addressing gender inequality in terms of access and control over irrigated land and measures to enhance governance of land and water through local institutions such as Water Users Associations.

4.1.7 The National Irrigation Policy (2016)

The overall National Irrigation Policy goal is to contribute to sustainable national economic growth and development through enhanced irrigated agriculture production and productivity. The policy is supplemented by the Environmental Impact Assessment (EIA) Guidelines for Irrigation and Drainage Projects (2002) that guides development of ESIA in the irrigation sector.

The policy aspires to attain the following outcomes:

- Increased irrigated agriculture production and productivity for local and export use using irrigation technologies that take into account climate change;
- Improved national and household incomes, food and nutritional security;
- Improved irrigation service delivery;
- Increased employment opportunities; and
- Enhanced land and water productivity through sustainable land tenure arrangements, catchment management and water harvesting.

The ESIA and PMP assignment will include measures that will ensure integration of irrigation, environmental and social considerations and that issues such as salinity, soil erosion and human health are monitored and mitigated.

4.1.8 The National Forest Policy of Malawi (2016) And Forest Landscape Restoration Strategy (2017)

Forestry resources play a major part in supporting livelihoods, infrastructure development and energy besides providing habitat for animals and providing protection for soil and water resources for agriculture and domestic use. The ecological services provided by forests in providing protection of watersheds that supply water to irrigation schemes are very important for sustainable irrigation development in Malawi making the sector policy relevant to SVTP.

The 2016 National Forestry Policy calls for conservation, establishment, protection and management of trees and forests for the sustainable development of Malawi. The 2017 Forest Strategy seeks to reinforce landscape governance by strengthening local bylaws for the use and management of trees and other natural resources; expand communication and outreach to share information broadly about restoration techniques and benefits, and to mobilize a restoration movement; ensure increased socioeconomic benefits accrue to communities and individual households investing in implementing restoration; and mainstream integrated landscape management approaches and increased support for implementing restoration in development programs at all levels.

Although SVTP will have minimal impact on forests, as it takes place within a predominantly agricultural area, the canals may lead to opening up of new areas and canal passage in the

protected areas may lead to reduction in forest cover and reduction in carbon sinks. The ESMP recommends establishing Set-aside Lands within the proposed irrigation areas for a variety of reasons, including to avoid clearing remnant forest patches and other environmentally sensitive areas such as wetlands and riverbanks and restoration of pieces of land that may get degraded as a result of the project. The ESMP further advocates restricting clearing of areas within the canal alignment and RoW.

4.1.9 National Disaster Risk Management (NDRM) Policy 2015

The overall goal of the NDRM Policy is to sustainably reduce disaster losses in lives and in the social, economic and environmental assets of communities and of the nation. The policy aims at creating and providing enabling framework for the establishment of a comprehensive disaster risk management system in Malawi. The priority areas of the policy focus on including mainstreaming of disaster risk management into sustainable development, establishment of comprehensive system for disaster risk identification, assessment and monitoring, development and strengthening of a people centred early warning system, promotion of a culture of safety, adoption of resilience enhancing interventions and the reduction of underlying risks. The strategies to implement the policy cut across several sectors including infrastructure development, agricultural diversification, microfinance initiatives, disaster risk insurance, social support schemes, reforestation and river training.

This policy is very relevant to the SVTP as the project will be implemented in areas that are prone to floods.

4.1.10 National Water Resources Policy 2005

The 2005 National Water Resources Policy whose aim is to ensure sustainable management and utilization of water resources is very much relevant to SVTP. It is meant to address all aspects of water including resource management, development and service delivery.

The policy relating to riverbank cultivation states: “there shall be no agricultural and infrastructure construction activities below the 477-metre above mean sea level contour line along Lake Malawi and below the 100-year flood water level along rivers, except where written authority from the responsible Minister is granted”. The 477 meter above sea level and the 100- year water flood level limits are very relevant and care must be taken that the proposed SVTP irrigation areas do not violate this limit without consent from the responsible minister.

The ESIA and PMP assignment will provide measures for monitoring compliance to this provision to ensure there is no cultivation or infrastructure construction in the specified low laying areas and flood prone areas.

4.1.11 National Wildlife Policy 2000

The National Wildlife Policy 2000 aims at ensuring proper conservation and management of the wildlife resources in order to provide for sustainable utilisation and equitable access to the resources and fair sharing of the benefits from the resources for both present and future generations. It recognizes that wildlife forms the basis for the tourism industry in Malawi

which is overwhelmingly nature-based and has potential for increased contribution to GDP. The National Wildlife Policy seeks to meet a number of objectives including ensuring adequate protection of representative ecosystems and their biological diversity through promotion and adoption of appropriate land and water management practices that adhere to the principles of sustainable use and enhancing public awareness and understanding of the importance of wildlife conservation and management and its close relationships with other forms of land use.

The ESIA and PMP assignment will consider the potential and actual threats posed by the SVTP on the terrestrial and aquatic habitants of wildlife in the Study area and institute mitigation measures that would protect wildlife from negative impacts caused by the activities of the project. Actual impacts to be generated by construction of main canal through Lengwe National Park and Majete Wildlife Reserve will be assessed and mitigation measures to reduce the adverse impacts will be instituted.

4.1.12 National Gender Policy 2012 – 2017

The 2012 – 2017 National Gender Policy recognizes that women play important roles in agriculture; they constitute 70% of full time farmers, carry out most of the agricultural work, and produce most of food for home consumption and therefore they ensure household nutrition security. This contribution is however not matched with their access to and control over resources such as land and capital and their enjoyment of benefits from management and use of natural resources.

Strengthening of gender mainstreaming and women empowerment at all levels in order to facilitate attainment of gender equality and equity in Malawi is the main purpose and the goal is to reduce gender inequalities and enhance participation of women, men, girls and boys in socio economic development processes. The policy has seven objectives and those directly relevant to SVTP are:

- To ensure women and girls sexual and reproductive health rights, and HIV AIDS status are improved;
- To strengthen gender mainstreaming in all sectors of the economy;
- To reduce poverty among women and other vulnerable groups (orphans, widows, people living with HIV and AIDS, persons with disabilities, the elderly) through economic empowerment; and,
- To promote women's participation in decision making positions in both politics and public life.

The policy identifies a number of priority areas including gender in health, gender in agriculture, food security and nutrition, gender in natural resources, environment and climate change management, gender in governance and human rights and gender and economic development. All these priority areas are relevant to SVTP. For instance, the policy ensures that women and other vulnerable groups have access to and control over agricultural productive resources, technologies and markets for cash crops, food and nutrition security. In natural resources management the policy ensures that all gender groups value and own natural resources and their environment and that gender is mainstreamed in natural resource

and the environment. On economic development, the policy advocates that gender issues are mainstreamed in all poverty reduction and economic empowerment initiatives and that women participation in economic empowerment initiatives is increased and strengthened.

Various experts to be used by the SVTP will prepare interventions to help ensure that women and other vulnerable groups will have access to land and water under SVTP and that women as well as men will participate actively in natural resources management activities. Employment by the contractors particularly during the construction phase should not be biased towards men and that the benefits accruing from project activities benefit both men and women equally. This will ensure compliance to AfDB Operational Safeguard (OS) 5 on International labor standards, World Bank ESS2 on Labor and Working Conditions and the Employment Act, 2000.

4.1.13 National HIV/AIDS Policy, 2012

The national HIV/AIDS policy highlights that HIV/AIDS impact on the country is quite significant and affects a range of socio-economic activities be it in agriculture, fisheries, public sector, private sector, tourism, urban areas, rural areas among others. HIV/AIDS prevalence in the country varies from one region to the other and from rural to urban areas. The highest rate is in the Southern Region and the lowest in the Northern Region. Prevalence rate is high in urban areas as compared to the rural areas.

National HIV/AIDS Policy identifies migrant workers and women among highly vulnerable people to transmission of HIV/AIDS and other sexually transmitted diseases. An application of migrant workers is that some single male migrant workers would be at an increased likelihood of contracting HIV/AIDS. The reason is that some migrant workers may approach and indulge in casual sexual intercourse with infected local female partners in the surrounding local communities or some sex workers in the targeted irrigation schemes. In addition, increased disposal of income from migrant workers may enhance some workers to indulge in extra-marital affairs with either local girls or married women within the surrounding villages. These sexual activities would enhance the spread of HIV/AIDS among workers and local people. In order to minimize the risks, this ESIA and PMP study recommends various mitigation measures.

4.1.14 National Land Resources Management Policy and Strategy, 2000

The overall goal of this policy is to promote the efficient, diversified and sustainable use of land based resources both for agriculture and other uses in order to avoid sectoral land use conflicts and ensure sustainable socio-economic development. Some of the selected policy objectives are to promote integrated land conservation measures in all forms of agricultural practices, and to protect and preserve environmentally fragile areas such as steep slopes, stream banks, water sheds and dambos. The policy is not explicit on the issue of riverbank cultivation as it provides no guidance on the size of buffer zones along rivers and the recommended management practices of such zones.

This policy is quite relevant in the implementation of the proposed SVTP because a number of the activities fall within the framework of this policy such as integration with land conservation and the protection and preservation of environmentally fragile areas.

4.1.15 National Fisheries and Aquaculture Policy (2016)

The goal of the Policy is to promote sustainable fisheries resource utilisation and aquaculture development in order to contribute to food and nutrition security and economic growth of the country.

The policy objectives hinge on increasing annual fish production from capture fisheries; increasing aquaculture production; strengthening participatory fisheries management regimes; reducing fish post harvest losses; increase annual fish exports; increasing per capita fish consumption; improving decent employment in fishing communities for youth, women and men and to reduce the number of child labourers; promotion of applied research in fisheries and aquaculture and monitor the impact of pollution and environmental changes including climate change; and developing capacity of the Government and local management institutions to serve the industry.

SVTP I, through its sub-component 2.2 has been promoting fish farming to ensure both income and food security and Phase II intends to promote monitoring against invasive alien tiger fish in line with ESS 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources). In SVTP II, efforts will be applied to ensure that ESS 2 (Labour and Working Conditions) is complied with as regards employment in project supported aquaculture activities.

4.1.16 National Climate Change Policy

Malawi's policy commitments to address climate change and build resilience, as set-out in Malawi's Nationally Determined Contribution (NDC) document submitted to the United Nations Framework Convention on Climate Change in 2015 sets the country's top adaptation priorities that include addressing land and watershed degradation and specifically the loss and degradation of forests, improving the resilience of the agriculture sector to climate change through development of irrigation and climate smart agriculture and improved management of fisheries and natural ecosystems.

4.1.17 Charcoal Strategy

The goal of the National Charcoal Strategy (NCS) is to provide a framework to address the linked problems of increased deforestation and increased demand for household cooking fuel, with defined and prioritized short-term, mediumterm and long-term actions. Aligned with the Forestry Policy (2016), Forestry Act (1997), Energy Policy (2003), draft National Energy Policy (2016), Energy Act (2004), and the Climate Change Policy (2016), the NCS supports Government's objectives to arrest and reverse deforestation and forest degradation and to reduce energy overdependence on solid biomass fuels.

The strategy defines seven strategic pillars in order to realise its objective aspirations, namely: promote alternative household cooking fuels; promote adoption of fuel-efficient cookstove technologies; promote sustainable wood production; strengthen law enforcement; regulate sustainable charcoal production; enhance livelihoods; and information, awareness and behavior change communications

4.1.18 National Biodiversity Strategy and Action Plan (NABSAP) 2015-2025

The goal of the NABSAP is to enhance the management of biodiversity for economic growth and well-being of the present and future generations.

To realise the goal, the NABSAP will pursue the following strategic objectives: Improved capacity and knowledge on biodiversity issues; Increased mainstreaming of biodiversity management into sectoral and local development planning; Reduced direct pressures on biodiversity; Improved status of biodiversity by safeguarding ecosystems, species and genetic diversity; and Enhanced access and benefit sharing from biodiversity and ecosystem services

4.1.19 National Waste Management Strategy (2019-2023)

The National Waste Management Strategy (2019-2023) stipulates measures for the management of hazardous wastes and pesticides as elaborated in the Seventh Schedule of the Environment Management (Waste Management and Sanitation) Regulations development under the Environment Management Act of 2017.

The strategy defines pesticides are chemicals used to control pests. Pesticide waste consists of expired and contaminated pesticides as well as the used containers. Due to their toxicity, potential to pollute and threat to human health, pesticide wastes are extremely hazardous and the strtaegies proposes measures for transporting, treating and disposal of pesticides and pesticide wastes in an environmentally sound manner in accordance with the stipulations of the relevant laws. Invariably, some of these pesticides contain persistent organic pollutants (POPs) which can accumulate in the food chain if not well managed.

Owing to the anticipated rise in pesticide use, SVTP will institute measures that reduce the risk associated with pesticide use, transportation, handling and disposal of associated wastes.

4.2 LEGAL FRAMEWORK

4.2.1 Environment Management Act, 2017

This Act has replaced the Environment Management Act of 1996. The new act provides for the creation of regulations on all aspects of environmental management, and creation of the Malawi Environmental Protection Agency (MEPA) in Part III of the Act.

The Act empowers the minister responsible for environment under Section 31 to categorise type and size of projects for which an ESIA is required as follows:

31.—(1) The Minister may, on the recommendation of the Authority, specify, by notice published in the Gazette, the type and size of a project which shall not be implemented unless an Environmental and Social Impact Assessment is carried out.

(2) A person shall not undertake any project for which an Environmental and Social Impact Assessment is required without the written approval of the Authority, and except in accordance with any conditions imposed in that approval.

(3) Any other licensing authority shall not grant a permit or licence for the execution of a project referred to in subsection (1) unless an approval for the project is granted by the Authority, or the grant of the permit or licence is made conditional upon the approval of the Authority being granted.

(4) The Minister may, on the advice of the Authority, make regulations for the effective administration of Strategic Environmental Assessment, Environmental and Social Impact Assessment and Environmental Audit.

The Act further provides for imposition of environmental protection orders in Section 72 in respect of actions that the MEPA may deem detrimental. The act defines penalties in sections 105 and 106 in respect of non compliance to the act.

Fines are provided for in outlines the EIA process to be followed in Malawi; and requires that all project developers in both the public and private sectors comply with the process. The Act under section 26 (3) further requires that no licensing authority issue any license for a project for which an EIA is required unless the Director of Environmental Affairs (DEA) has given consent to proceed; on the basis of a satisfactory EIA or non-requirement of an EIA. Non-compliance with the EIA requirements is an offence and attracts penalties.

Review of the ESIA for the SVTP has been conducted to ensure it is aligned to the new act so that it remains relevant at all times.

4.2.2 National Parks and Wildlife (Amendment) Act, 2017

The act was amended in 2017 to replace the National parks and Wildlife Act of 1992 with an aim to curb the rising number of illegalities in the protected areas. All protected species are now referred to as endangered or listed in line with IUCN classification.

Part IV of the Act, provides for the conduct of environmental and social impact assessment (ESIA) for activities that may occur in protected areas. This may be initiated by any person with sufficient grounds that such actions may have an adverse effect on any wildlife species or community. SVTP II will conduct an ESIA and ESMP for Phase II that will include the impact the project may have on Lengwe National Park in line with this act and ESS 6 (Biodiversity Conservation and Sustainable Mangement of Living Natural Resources.

Part XIII of the act, stipulates penalties and offences that include depositing any waste material in a protected are; introducing any plant into a protected area; lighting fires in a protected area; and poaching, among others.

Contractors and designers for SVTP will need to ensure their actions take into account the requirements of the Act.

4.2.3 Land Act (2016)

The Land Act (2010) is the principal legal framework on land administration and management and it replaces that he Land Act (1965). A number of enabling acts were also enacted in 2016, namely, the Customary Land Act, the Land survey Act and the Physical Planning Act.

Section 17(1) of the act, defines procedure and purpose for which the Minister responsible for lands may acquire customary land. Section 17 (2) defines occupation of land for public utility for less that seven years as temporary and creates a requirement that such piece of land should revert to customary land status.

Section 17 (5) defines public utility as:

> *"For the purposes of this section "public utility" means a utility which is for the direct or indirect benefit of the community as a whole, or a part of the community within a traditional land management area".*

Section 18 of the act provides for compensation to individuals for loss, damage or disturbance that may arise as a result of land acquisition under Section 17 above.

SVTP II will build upon the successes of SVTP I in line with the Land Act 2016, World Bank ESF especially ESS 5 (Land Acquisition, Restrictions on Land Use and Involuntary Resettlement), and Operational Safeguard 2 of the African Development Bank: Involuntary Resettlement: Land Acquisition, Population Displacement and Compensation. The RAP for Phase II of SVTP will be aligned to the Act, ESS 5 and OS2.

4.2.4 Customary Land Act (2016)

The new Customary Land Act (CLA) proposes the creation and registration of customary estates based on current, legitimate, customary land occupation within Traditional Land Management Areas (TLMAs) and transforms these holdings into private land, capable of being transacted (with certain limitations) and encumbered. It envisages identification and formalization processes that incorporate international best-practice principles and lays the legal foundation for transparent and decentralized administration of these estates.

Arrangements for local governance of land rights envisage formal approval and dispute resolution roles for the Traditional Authorities (TAs), and for new institutions to be established at Group Village Level. These comprise of Customary Land Committees (CLCs), established in terms of section 5 of the CLA, which will have powers to make grants of customary estates. In addition, the current regional land registry will be decentralised to district level.

Each TLMA will also have a Customary Land Tribunal (CLT) with responsibilities for hearing appeals and resolving disputes as a forum of first instance, and to be chaired by the Traditional Authority. The establishment of these Group Village CLCs and TLMA CLTs is a conscious attempt to institute greater legitimacy in decisions regarding the application of

customary norms to land management. Whilst formalizing the roles of the TAs in this regard, the CLA introduces a level of democratization; the CLCs will be chaired by the Group Village Headperson, ex oficio, but an additional six members shall be elected by people in the TLMA, three of whom must be women.

Section 3 (3) of the act provides a solid legal platform for securing the current tenure rights of customary occupants within the SVTP area through transparent and locally-legitimate processes and institutions. The opportunity to undertake the systematic adjudication and formalisation of customary land rights, in areas defined by the development plans of the irrigation infrastructure, along with the introduction of customary estates as a form of legal land-holding, available to individuals, groups and corporate entities, allows the SVTP to provide safeguards for current occupants and affected persons, as well as mechanisms for making land available to the intended beneficiaries.

4.2.5 Land Survey Act (2016)

In line with the 2002 Land Policy, the Land Survey Act (2016) was promulgated to enhance security of tenure of land by making provisions for adjudication and registration of land including customary land that hitherto was not the case.

The act recognizes efforts carried out under the Customary land Act (2016) by providing under section 46 (1) the marking of boundaries for Traditional Land management Areas (TLMA), a district or local government area, as follows:

46. —(1) The boundaries of any area declared as a Traditional Land Management Area, a district or a local government area shall be surveyed and registered in the Land Registry under the traditional authority or local government authority of the area.

Customary land registration and adjudication are further enhanced by Section 46 (2):

46. (2) Where a Traditional Land Management Area is registered, all the villages and the public land within the area shall be surveyed and registered.

The SVTP II will build on successes of Phase I, sub-component 2.1 (Land Consolidation) and in line with this act to consolidate customary land estates and adjudication and registration of the customary land currently held by villagers.

4.2.6 Physical Planning Act (2016)

The Act makes provision for physical planning and the orderly and progressive development of land in both urban and rural areas; to preserve and improve amenities thereof; for the grant of permission to develop land and for other powers of control over the use of land; for the establishment of the Physical Planning Council; for the establishment of the Physical Planners Board; for the registration and regulation of physical planners and for matters connected therewith and incidental thereto.

Sections 29 to 32 of the Act deal with the powers of the district councils to develop District Physical Development Plans, whereas Sections 33 to 35 deal with the powers of district councils to develop local physical development plans and local land use plans.

Part VIII of the Act, on the other hand, makes provision for acquisitions of land and equitable compensation in respect of people that lose land to pave way for national development.

In line with these legal provisions and with ESS 5 (Land Acquisition, Restrictions on Land Use and Involuntary Resettlement), the SVTP will in Phase II continue with the development of the Nsanje District Physical Development Plan, Urban Structural Developmentfor both Chikwawa and Nsanje and formulation of local land use plans. The RAP for Phase II will address provisions of Part VIII of the act and ESS 5.

4.2.7 Cultural Heritage Regulations

Cultural resources are nowadays protected in almost every country by national legislations and international conventions. This also applies to Malawi, which has provisions for the protection of cultural resources in its National Cultural Policy and its Monuments and Relics Act. The Project is also committed to undertake its activities in compliance with the World Bank Group's safeguard policies on cultural resources.

The Malawi Department of Antiquities (MDoA) was founded in 1967 by an Act of Parliament with the mandate to study, preserve, conserve and protect the country's cultural and national heritage. Its offices are located in Lilongwe, which also houses other divisions of the Department of Culture.

The two most important legal frameworks are the Monuments and Relics Act of 1990 and the Malawi Cultural Policy (2014). The latter, which has been approved by President Peter Mutharika in 2015, provides guidelines for proper implementation processes on issues such as heritage protection.

Section 5.7.8, Objective 8 of the Policy is that cultural factors need to be taken into account in development projects, policies and programmes for the nation. Its first strategy asserts that, "development projects include a cultural heritage impact assessment".

The need for cultural heritage impact assessments are not mentioned in the Monuments and Relics Act of 1990 but it provides statutory protection against the threat of development on declared monuments, historical buildings, archaeological, paleontological, geological, anthropological, ethnological, and other heritage sites to enable their preservation.

Section 29. (1) of the Monuments and Relics Act reads, "A person in charge of any survey, excavation, exploration, construction or new development shall, at the earliest stages of planning for such activities, give notice to the Minister to enable, where necessary, rescue archaeology to be carried out in accordance with subsection (2)". Section 29 (2) mentions that Rescue archaeology of a monument or relic under subsection (1) shall be carried out by the Chief Antiquities Officer or any qualified person with an excavation permit issued by the Minister, and the cost of such work shall, unless the Minister otherwise directs, be borne by the person in charge of any survey, excavation, exploration, construction or other development.

The Monuments and Relics Act provides clear definitions of cultural resources in its tangible forms, comprising both movable and immovable physical cultural heritage of the following types:

- Places, buildings and structures of cultural significance;

- Places and objects to which oral traditions are attached or which are associated with living heritage such as ethnographic art and objects;
- Historical settlements, townscapes and sites of significance relating to the history of slavery;
- Landscapes and natural features of cultural significance;
- Geological sites of scientific or cultural importance;
- Archaeological and paleontological sites and objects;
- Graves and burial grounds.

The protection of intangible expressions of cultural heritage in contrast does not appear in the Monuments and Relics Act. Hence, no provisions are made for its protection in the context of development projects.

4.2.8 Water Resources Act (2013)

The Act provides for the management, conservation, use and control of water resources; for the acquisition and regulation of rights to use water. It creates the National Water Resources Authority (NWRA) to replace the National Water Resources Board and also creates Catchment Committees for different river basins such as the Shire River basin where SVTP irrigation activities will be implemented. It also sets appropriate standards and techniques for the investigation, use, control, protection, management and administration of water resources and regulates public and private activities which may influence quality, quantity, distribution, use or management of water resources. It also sets out the coordination, allocation and delegation of responsibilities. It enforces use of water resources for domestic uses, livestock watering, irrigation and agriculture, industrial, commercial and mining, recreation, hydro-electric power generation, and other uses, in ways that minimize harmful effects to the environment, control pollution, and promote the safe storage, treatment, discharge and disposal of waste and effluents.

One of the key provisions of the Act relevant to SVTP is that it prohibits persons from cultivating or carrying out activities within the bed and banks of water courses and lakes and the adjacent land strips except as determined by the Authority created by the Act. It also enforces water rights (permits), water abstraction, water pollution control and building of dams. For SVTP a water abstraction right will have to be acquired from NWRA for the intake at Kapichira Dam.

This is a very important Act and the ESIA and PMP provide measures to ensure proper quality (pollution), quantity, distribution, use or management of water resources within the project sites. The ESIA and PMP assignment recommend measures for controlling cultivating or carrying out of activities within the beds and banks of watercourses and lakes as provided by the Act.

4.2.9 Pesticides Act (2000)

This Act provides for the control and management of the import, export, manufacture, distribution, storage, disposal and use of pesticides. The Act also establishes the Pesticides Control Board that enforces the provisions of the Act relating to pesticides and other incidental matters. It therefore protects the importation and use of expired products that can be hazardous to the environment and human health. This is relevant to the proposed SVTP as in pursuit of increased production use will be made of production enhancing technologies including use of pesticides and herbicides which if not properly regulated can harm the environment and human health thereby contravening with World Bank and African Development Bank's operational policies on safeguards. The PMP will include measures for ensuring proper and safe use and storage of agrochemicals and safe disposal of empty containers to avoid contamination of water resources and poisoning. This may include training of farmers on handling and safe use of agrochemicals, use of protective clothing, disposal, dangers of using expired products and public health. This must also target agro-dealers emphasizing on the need for approval from the Pesticide Control Board for clearing, importation and certification of chemicals.

4.2.8 Forestry Act (2016)

The Forestry Act provides for participatory forestry, forest management, forestry research, forestry education, forest industries, protection and rehabilitation of environmentally fragile areas. The act among other things seeks to: augment, protect and manage trees and forests on customary land in order to meet basic fuelwood and forest produce needs of local communities and for the conservation of soil and water; promote community involvement in the conservation of trees and forests in forest reserves and protected forest areas; prevent resources degradation and to increase socio-economic benefits; promote community involvement in conservation of trees and forests; promote optimal land use practices through agroforestry in small holders farming systems; protect fragile areas such as steep slopes, river banks, water catchment and to conserve and enhance biodiversity.

The Act is very relevant to the SVTP as trees and forests are important for sustenance of ecological integrity of watersheds. This ESIA and PMP assignment therefore advocates integration of irrigation activities with natural resources management activities such as land restoration, ree planting and riverbank protection.

4.2.9 Irrigation Act, 2001

The Act is central to SVTP since it provides for the sustainable development and management of irrigation, protection of the environment from irrigation related degradation, establishment of the National Irrigation Board, the Irrigation Fund and other matters related to irrigation development in Malawi.

It even mandates farmers to maintain irrigation canals, drains and other associated infrastructure in their holdings and prohibits people from engaging in practices which are destructive or potentially destructive to the catchment area of a river that provides water for irrigation. It goes further and prohibits livestock grazing, setting or causing to set fire on irrigation schemes or farms. Recognizing the destructive effects of fires, puts the responsibility for averting, fighting or extinguishing fire on irrigation schemes or farms in

the hands of everybody. Although the Act is silent on the maintenance of buffer zones along riverbanks, it prohibits any actions that are destructive to the catchment. Issues of livestock, fire management, and catchment protection are very pertinent to SVTP and therefore this Act is very relevant.

Various experts engaged by the SVTP have proposed measures to control livestock grazing and bush fires, enhance riverbank protection, stabilize water dams, and properly construct water delivery and storage systems. This includes the stabilization of embankments and protection of water intake points..

4.2.10 Occupational Safety, Health and Welfare Act (1997)

The Act makes provisions for the regulation of conditions of employment in workplaces with regard to safety, health and welfare of employees. It also provides for the inspection of certain plant and machinery, the prevention and regulation of accidents occurring to persons employed or authorised to go into the workplace, and for some related matters. The Act requires registration of workplaces and defines duties and responsibilities of employers and employees with regards to health, safety and welfare and the notification, and investigation of accidents, dangerous occurrences and industrial diseases. In relation to SVTP, the Act is relevant as the construction of canals, drains and ancillary facilities will require labor and use of motorized machinery. In addition, use and application of agrochemicals require safe handling and safe disposal of empty chemical containers. All these pose great environmental, health and safety hazards if not managed properly.

The ESIA and PMP assignment will propose mitigation measures to reduce accidents at work place especially during the construction phase and measures to reduce the occurrence of water borne diseases.

4.2.11 Environment Waste Management and Sanitation Regs 2008

The Environment Management (Waste Management and Sanitation) Regulations were promulgated by the Minister under section 56 of the act:

> *56.—(1) The Minister shall, on recommendation of the Authority, by regulations, make provision for the management, transportation, treatment and recycling, and reduction of waste, safe disposal of waste, and for prohibiting littering of public places*

The act further, in section 56 (2) empoweres the responsible minister in collaboration with relevant with lead agencies to:

a. formulate such measures as are necessary to regulate the collection, storage, transportation, reduction and safe disposal of waste;
b. promulgate such rules or formulate criteria and standards for the classification and analysis of waste and shall determine the method or methods for safe disposal of waste;

c. control the handling, storage, transportation, classification, importation, exportation and destruction of waste;
d. control the reduction of waste; and
e. monitor any waste disposal site and direct the control of any such site if its continued use as a waste disposal site

Sections 57 and 58 deal with powers of licencing for wastes and transportation and exportation of wastes.

4.2.12 Environmental (Management of Chemicals and toxic substances) Regulations, 2008

The Environmental (Management of Chemicals and toxic substances) Regulations, 2008 are promulgated under section 117 of the Environment Management Act of 2017. The regulations are aimed at regulating importation and exportation of wastes, management and disposal including labelling.

Section 45 of the regulations adopts offenses and penalties as establsighed under in Part XV of the Environment Management Act of 2017.

4.2.13 Workers Compensation Act 2000

The Workers' Compensation Act provides for compensation for injuries suffered or diseases contracted by workers in the course of their employment or for death resulting from such injuries or diseases; it provides for the establishment and administration of a Workers' Compensation Fund; and it provides for matters connected therewith or incidental thereto, key of which are the following:

- Eligibility for Compensation in Case of Injury other than the Contraction of a Scheduled Disease;
- Compensation for Injury Caused otherwise than by the Contraction of a Scheduled Disease;
- Calculation and Distribution of Compensation;
- Medical Aid;
- Compensation for Injury due to the Contraction of a Scheduled Disease;
- Procedure for Obtaining Compensation; and
- Administration 8. Workers' Compensation Fund

4.2.14 The Employment Act, 2000

The Employment Act establishes, reinforces, and regulates minimum standards of employment with the purpose of ensuring equity necessary for enhancing industrial peace, accelerate economic growth and social Justice and for matters connected therewith and incidental thereto. The Act covers:

- Administration;
- Employment of Young People;
- Contracts;

- Hours of Work, Weekly Rest and Leave
- Wages; and
- Discipline and Dismissal

4.2.15 The Labour Relations Act, 1996

The Labour relations act promotes sound labour relations through the protection and promotion of freedom of association, the encouragement of effective collective bargaining and the promotion of orderly and expeditious dispute settlement, conducive to social justice and economic development. The act covers the following:

- Freedom of Association;
- Trade Unions and Employers' Organizations;
- Collective bargaining and Organizational Rights;
- Dispute Settlement;
- Tripartite Labour Advisory Council; and
- Establishment of Industrial Relations Court

4.2.16 Fisheries Conservation and Management Act (1997)

The Act makes provisions for the conservation and management of fish resources in Malawi. Changing water flow in the Shire due to reduced flows could negatively affect fish spawning in the Elephant Marsh and biodiversity of the Shire River. Increased application of agrochemicals in the fields could adversely affect fish resources in the Lower Shire. The ESIA and PMP assignment proposes mitigation measures to reduce adverse impacts that could be generated by project activities especially flows reduction into the Elephant Marsh.

4.3 FUNDING AGENCY POLICIES

Due to financial assistance from the WB (and the AfDB for Phase 1), the Project will need to ensure that the project complies with the Environmental and Social policies of those respective institutions.

For Phase 1, the relevant WB Safeguard Policies were:

4.3.1 Environmental Assessment (Operational Policy 4.01)

World Bank's Environmental Assessment (EA) Operational Policy 4.01 requires that all projects proposed for Bank financing be screened for potential environmental and social impacts. The policy is triggered if a project is likely to have adverse environmental risks and impacts in its area of influence.

Under OP 4.01, the Bank classifies proposed projects into one of four categories, depending on the type, location, sensitivity, and scale of the project and the nature and magnitude of its potential environmental impacts. The SVTP is classified as Category A.

A proposed project is classified as Category "A" if it is likely to have significant adverse environmental and social impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities subject to the physical works. EA for a Category A project examines the project's potential negative and positive environmental and social impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental and social performance.

Construction of the water intake structure, bulk water irrigation infrastructure, and irrigation development on 42,000 ha in Chikwawa and Nsanje will have environmental impacts, which require mitigation. Therefore, undertaking this ESIA study for SVTP is in tandem with this Operational Policy.
OP 4.01 also requires that, prior to project appraisal, the Government of Malawi will approve and disclose the EIA report in places publicly accessible to affected groups including local NGOs. The Government of Malawi must officially submit the approved report to the Bank; and authorize the Bank to disclose the document on its Web site. In commissioning the formulation of the ESIA and by making the document available to the public, the proposed project will also be in compliance with the World Bank's Information Disclosure Policy, BP 17.50.

4.3.2 Pest Management (OP 4.09)

The procurement of any pesticide in a Bank-financed project is contingent on an assessment of the nature and degree of associated risks, taking into account the proposed use and the intended users. With respect to the classification of pesticides and their specific formulations, the Bank refers to the World Health Organization's Recommended Classification of Pesticides by Hazard and Guidelines to Classification. The following criteria apply to the selection and use of pesticides in Bank-financed projects:

They must have negligible adverse human health effects;

They must be shown to be effective against the target species;

They must have minimal effect on non-target species and the natural environment. The methods, timing, and frequency of pesticide application are aimed to minimize damage to natural enemies;

Their use must take into account the need to prevent the development of resistance in pests.

At a minimum, pesticide production, use and management should comply with FAO's Guidelines for Packaging and Storage of Pesticides, Guidelines on Good Labelling Practice for Pesticides, and Guidelines for the Disposal of Waste Pesticide Containers on the Farm. The Bank does not finance formulated products that fall in WHO Classes IA and IB, or formulations of products in Class II, if (a) the country lacks restrictions on their distribution and use; or (b) they are likely to be used by, or be accessible to, lay personnel, farmers, or others without training, equipment, and facilities to handle, store, and apply these products properly.
The proposed project will trigger OP 4.09 since there will be increased use of agro-chemicals on the irrigation fields. However, procurement of pesticides will not be financed until experience demonstrates that the local capacity exists to adequately manage their environmental and social impacts in compliance with OP 4.09.

4.3.3 Involuntary Resettlement (OP 4.12)

The objective of OP 4.12 is to avoid or minimize involuntary resettlement where feasible by exploring all viable alternative project designs. Where resettlement is unavoidable, OP 4.12 is intended to assist displaced persons in maintaining or improving their living standards. It encourages community participation in planning and implementing resettlement and in providing assistance to affected people. This policy is triggered not only if physical relocation occurs, but also by any taking of land resulting in: (i) relocation or loss of shelter; (ii) loss of assets or access to assets; and (iii) loss of income sources or means of livelihood, whether or not the affected people must move to another location. For the SVTP, a Resettlement Policy Framework (RPF) has been prepared to guide land acquisition, reorganization, and involuntary resettlement as needed.

4.3.4 Cultural Heritage (OP 4.11)

The WB's safeguard policy on cultural heritage is OP 4.11 on Physical Cultural Resources. It reads, "Physical cultural resources are important as sources of valuable scientific and historical information, as assets for economic and social development, and as integral parts of a people's cultural identity and practices". It further states that "physical cultural resources in projects proposed for Bank financing need to follow the EA sequence of: screening; developing terms of reference (TORs); collecting baseline data; impact assessment; and formulating mitigating measures and a management plan".

The identification of appropriate measures for avoiding or mitigating adverse impacts as part of the EA process is another important element of OP 4.11, which states: "These measures may range from full site protection to selective mitigation, including salvage and documentation, in cases where a portion or all of the physical cultural resources may be lost". As an integral part of the EA process, OP 4.11 states that "the borrower will need to develop a physical cultural resources management plan, that includes measures for avoiding or mitigating any adverse impacts on physical cultural resources, provisions for managing chance finds, any necessary measures for strengthening institutional capacity, and a monitoring system to track the progress of these activities".

4.3.5 Natural habitats (OP 4.04)

This policy recognizes that the conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term sustainable development.

Habitat classification as presented in the policy has been used in the ESIA. The Policy distinguishes natural habitats from manmade habitats and also describes what a "critical habitat" is. Critical habitats are (a) legally protected, (b) officially proposed for protection, (c) identified by authoritative sources for their high conservation value, or (d) recognized as protected by traditional local communities.

4.3.6 Environmental and Social Framework

The following sections present the World Bank Environmental and Social Framework (ESF) and the relevant Environmental and Social Standards (ESS) that are applicable to the project, to support the financing for Phase 2.

4.3.6.1 ESS1: Assessment and Management of Environmental and Social Risks and Impacts

This standard sets out the Government of Malawi (GoM) responsibilities for assessing, managing and monitoring environmental and social risks and impacts associated with each stage of a project supported by the Bank through Investment Project Financing (IPF), in order to achieve environmental and social outcomes consistent with the Environmental and Social Standards (ESSs).

Informed by ESS1 and relevant to this project is the inclusion of Environmental and Social Assessment (Annex 1), Environmental and Social Commitment Plan (Annex 2); and Management of Contractors (Annex 3).

4.3.6.2 ESS2: Labor and Working Conditions

ESS 2 recognizes the importance of employment creation and income generation in the pursuit of poverty reduction and inclusive economic growth. Borrowers can promote sound worker-management relationships and enhance the development benefits of a project by treating workers in the project fairly and providing safe and healthy working conditions.

The standard deals with labour conditions and management of working relationships, protection of workforce including limitations on child labour, grievance redress between employers and workforce, occupational health and safety, OHS matters relating to contract and community workers, and primary supply workers.

4.3.6.3 ESS3: Resource Efficiency and Pollution Prevention and Management

ESS3 recognizes that economic activity and urbanization often generate pollution to air, water, and land, and consume finite resources that may threaten people, ecosystem services and the environment at the local, regional, and global levels. This ESS sets out the requirements to address resource efficiency and pollution prevention and management throughout the project life-cycle.

Of relevance to the project, the standard has exacting requirements that SVTP should address, namely, pollution prevention and management, resource efficiency, water management, hazardous waste management, management of air pollution, and management of pesticides.

4.3.6.4 ESS4: Community Health and Safety

The standard addresses the health, safety, and security risks and impacts on project-affected communities and the corresponding responsibility of Borrowers to avoid or minimize such risks and impacts, with particular attention to people who, because of their particular circumstances, may be vulnerable.

This standard provides guidance to SVTP in the management of traffic and road safety, community exposure to health hazards, ecosystem services, mangement of hazardous materials, and emergency preparedness and response measures, among others.

Of particular importance to the project, the standard through Annex 1 (Safety of Dams) part B (Existing Dams and Dams Under Construction (DUC)), the following requirement are demanded of SVTP:

i. The dam is designed and its construction is supervised by competent professionals;
ii. The reports and plans related to dam safety are prepared and implemented. These reports are:
    - Plan for construction supervision and quality assurance;
    - Instrumentation plan;
    - Operation and maintenance (O&M) plan; and
    - Emergency preparedness plan.

4.3.6.5 ESS5: Land Acquisition, Restrictions on Land Use and Involuntary Resettlement –

The standard advances avoidance of involuntary resettlement where possible. Where involuntary resettlement is unavoidable, it will be minimized and appropriate measures to mitigate adverse impacts on displaced persons (and on host communities receiving displaced persons) will be carefully planned and implemented.

Annex 1 to the standard (Involuntary Resettlement) provides guidelines for activities that involve land acquisition,. SVTP has applied provisions of the annex with regard to preparation of Resettlement Framework (RF) and Process Framework (PF).

Part A of the stabdard will guide SVTP II in the preparation of Resettlement Action Plan (RAP), compensation and benefits for project affected persons, community engagement as fuided by ESS 10, grievance mechanism, and displacement.

4.3.6.6 ESS6: Biodiversity Conservation and Sustainable Management of Living Natural Resources

ESS6 recognizes that protecting and conserving biodiversity and sustainably managing living natural resources are fundamental to sustainable development and it recognizes the importance of maintaining core ecological functions of habitats, including forests, and the

biodiversity they support. ESS6 also addresses sustainable management of primary production and harvesting of living natural resources, and recognizes the need to consider the livelihood of project-affected parties, including Indigenous Peoples, whose access to, or use of, biodiversity or living natural resources may be affected by a project.

The standard affects SVTP owing to the proposed canal alignment in Lengwe National Park. Paragraphs 23, 24 and 25 that deal with activities in critical habitats have been fully applied.

4.3.6.7 ESS8: Cultural Heritage

This standard recognizes that cultural heritage provides continuity in tangible and intangible forms between the past, present and future. ESS8 sets out measures designed to protect cultural heritage throughout the project.

The standard will largely deal with tangible heritage along the construction canal although an intangible heritage in form of Khulubvi Shrine is also covered under Component 4. In line with the standard, SVTP will continue to engage with community leaders and the Department of Antiquities to identify key resources and to ensure the preservation of cultural heritage.

In ensuring compliance to this standard, SVTP will apply the Guidance Note[1] for ESS8

4.3.6.8 ESS10: Stakeholder Engagement and Information Disclosure

The standard recognizes the importance of open and transparent engagement between the Borrower and project stakeholders as an essential element of good international practice. Effective stakeholder engagement can improve the environmental and social sustainability of projects, enhance project acceptance, and make a significant contribution to successful project design and implementation.

4.3.7 Projects on International Waterways (OP7.50)

Where a project affects an International waterway, the Bank requires appropriate notification to be provided to the riparian users. Owing to the Shire river being an integral part of the Zambezi River Basin, the Government of Malawi undertook to consult the riparian states of the basin through ZAMCOR of its intention to implmenet the SVTP. This was geared at addressing any cumulative impacts associated with increased use of shared water resources. ZAMCOR did not raise any objections to the development and implementation of SVTP.

4.3.8 Safety of Dams (OP4.37, ESS4)

Projects that rely on dams are required to have adequate safety checks undertaken. Since SVTP will rely on the performance of the Kapichira Dam for the water intake, a Dam Safety assessment was undertaken on the Kapichira dam by an independent panel of experts. The report found no matters of immediate concern, but recommended a series of measures including a regular safety inspection protocol to be established. These measures have been communicated to EGENCO, the operators of the Dam and associated Hydroelectric Power station.

[1] Source: World Bank (2018), Guidance Note for Borrowers, Environmental & Social Framework for IPF Operations, ESS8: Cultural Heritage

The Kapichichira Dam suffered extensive damage that also affected SVTP intake structure owing to the impact of Cyclone Anna. The dam will require major rehabilitation in the short term, during which any outstanding recommended measures from the independent panel of experts can be addressed, to ensure compliance with ESS4.

The damages to the main dam embankment will be addressed under the proposed Malawi: Emergency Power Restoration Project. SVTP will support the mobilization of a Panel of Experts through this process of repairing the dam. To avoid further damage to the main dam until the embankment has been strengthened, the five spillway gates have been brought back to fully operational condition, and a new cofferdam will be constructed during the 2022 dry season. Once this cofferdam is in place, SVTP-1 intake construction canrecommence. The cofferdam will also protect the damaged section of the main dam embankment, and facilitate its repair.

4.3.9 AfDB Operational Safeguard 1: – Environmental and social assessment

Like ESS1 of the World Bank captioned above, the AFDB has developed Operational Safeguard 1 (OS1) that sets out the Bank's overarching requirements for borrowers or clients to identify, assess, and manage the potential environmental and social risks and impacts of a project, including climate change issues.

OS1 further captures need to assess issues of gender, vulnerability and disability by demanding the following:

- In assessing the potential impacts of Bank operations on affected communities, the borrower or client shall make use of adequate and qualified expertise to identify people and groups that may be directly, indirectly and/or disproportionately affected or marginalized by the project because of their recognized vulnerable status.
- Where groups are identified as vulnerable, the borrower or client shall implement appropriate differentiated measures so that unavoidable adverse impacts do not fall disproportionately on these vulnerable groups, and so that they are not disadvantaged in sharing development benefits and opportunities (such as roads, schools, healthcare facilities etc.).
- Emphasising the need to assess gender issues in the context of vulnerability. A gender assessment shall be made for every project and shall form the basis for project design and compensation plans that lead to enhanced gender balance.
- Finally, OS 1 states that groups that may be considered vulnerable may include social or cultural groups recognised as Indigenous Peoples. The Bank seeks to promote the safeguarding of Indigenous Peoples' lands, natural assets and other cultural heritage by its member countries and to provide special protection for projects that may involve their resettlement

OS1, further, states that the borrower or client shall be responsible for ensuring that the siting, design, construction and operation of projects should avoid significant damage to cultural heritage (both physical and intangible). Cultural heritage likely to be affected by the project shall be identified and qualified, and experienced experts shall assess the project's potential impacts on this cultural heritage.

Regarding cultural heritage, OS1 stipulates that the project shall not remove any physical cultural heritage unless the following conditions are met:

- No technically or financially feasible alternatives to removal are available;
- The overall benefits of the project substantially outweigh the anticipated cultural heritage loss from removal;
- Any removal is conducted in accordance with relevant provisions of national and/or local laws, regulations, protected area management plans and national obligations under international laws;
- Any disturbance or removal is not done until appropriate consultation with local communities has been carried out, taking full account of traditions, beliefs and cultural norms;
- Any removal employs internationally accepted best available techniques.

4.3.10`AfDB Operational safeguard 2 of the African Development Bank: Involuntary resettlement: land acquisition, population displacement and compensation

This OS relates to Bank-financed projects that cause the involuntary resettlement of people by way of land acquisition, population displacement and compensation. It seeks to ensure that when people must be displaced they are treated fairly, equitably, and in a socially and culturally sensitive manner; that they receive compensation and resettlement assistance so that their standards of living, income-earning capacity, production levels and overall means of livelihood are improved; and that they share in the benefits of the project that involves their resettlement.

In line with the framework in the involuntary resettlement policy, this OS covers economic, social and cultural impacts associated with Bank-financed projects involving involuntary loss of land, involuntary loss of other assets, or restrictions on land use and on access to local natural resources that result in:

- Relocation or loss of shelter by the people residing in the project area of influence;
- Loss of assets (including loss of structures and assets of cultural, spiritual, and other social
importance) or restriction of access to assets, including national parks and protected areas or natural resources; or
- Loss of income sources or means of livelihood as a result of the project, whether or not the people affected are required to move.

4.3.11 AfDB Operational Safeguard (OS) 3 of the African Development Bank on Biodiversity, Renewable Resources and Ecosystem Services.

OS 3 requires borrowers or clients to identify and implement measures to conserve and sustainably use natural habitats and their biodiversity, and observe, implement, and respond to requirements for the conservation and sustainable management of priority ecosystem services. Ecosystem services are treated under a separate heading (see "Ecosystem Services Assessment" below) in recognition of the fact that they are defined as the benefits that people, including businesses and development activities more generally, derive from ecosystems. Ecosystem services assessment uses a similar but distinct series of assessment

steps that draw extensively on data gathering and consultation amongst potentially affected communities

The construction of a canal through the LNP based on the Technical Feasibility Study (TFS) impacts on the vegetation thicket that is considered to be a critical habitat for the Nyala. The thicket also provides environmental benefits such as soil erosion control since the canopy reduces raindrop impact and the roots firmly hold the soil. As such, the action triggers OS3 of the Integrated Safeguard Systems of the African Development Bank in addition to Environmental and Social Standards 6 (ESS6) of the Environmental and Social Framework (ESF) of the World Bank.

4.3.12 AfDB Operational Safeguard (OS) 4 of the African Development Bank on pollution prevention and control, greenhouse gas monitoring and reporting, and resource efficiency

This operational safeguard sets out the main requirements for pollution prevention and control and resource efficiency and will be applied to management of pesticides and waste management.

4.3.13 AfDB Operational Safeguard (OS) 5 of the African Development Bank on International labor standards

OS 5 refers to a body of international labor standards derived principally from a set of International Labor Organisation (ILO) and UN Conventions. The OS focuses on requirements stemming from these international standards relating to human resource policies and procedures; working conditions and terms of employment; worker's organisations; non-discrimination and equal opportunity; retrenchment; grievance and redress mechanisms; child labor; forced labor; third party workers; and supply chain workers

Lessons from Phase 1 of SVTP regarding adherence to OHS standards have necessitated the hiring of more safeguards personnel in SVTP 2 including Health and Safety Specialists in line with OS5.

The requirements of the two standards from the two banks are similar with minor diffrences as summarized in **Error! Reference source not found.**~~**Error! Reference source not found.**~~Table 7 below:

Table 7: Comparision of ESS 6 and OS 3

World Bank ESS 6	AFDB OS 3	Comment
In Case of Critical Habitat: i. No other viable alternatives within the region exist for	**In Case of Critical Habitat:** i. The mitigation hierarchy has been implemented;	Overall, the two standards from the two banks are similar, for instance:

development of the project in habitats of lesser biodiversity value ii. All due process required under international obligations or national law required for a country to grant approval for project activities in or adjacent to a critical habitat has been complied with iii. The potential adverse impacts on the habitat will not lead to measure net reduction or negative change in those biodiversity values for which the critical habitat was designated v. The project is not anticipated to lead to a net reduction in the population of any Critically Endangered, Endangered or restricted-range species, over a reasonable timeframe v. The project will not involve significant conversion or degradation of critical habitats vi. The project's mitigation strategy will be designed to achieve net gains of those biodiversity values for	ii. The project provides clear benefits and positive outcome for biodiversity and ecosystem services; iii. The project-related activities will not have adverse effects (direct, indirect, or cumulative) on the criteria for which the critical habitat was designated; iv. The project will not have any negative effects on critically endangered or endangered species; v. The project will achieve the previous two points without offsets or a "net gain" analysis; and vi. A robust, appropriately designed and funded, long term biodiversity monitoring and evaluation programme is integrated into (i.e., provides feedback into) the client's management programme.	i. Points iii and vi for ESS 6 auger well with point iii from OS 3; ii. Point vii from ESS 6 and vi from OS 3 are similar; and iii. Points v from ESS 6 and iv from OS 3 are similar.

which the critical habitat was designated vii. A robust and appropriately designed long-term biodiversity monitoring and evaluation program aimed at assessing the status of the critical habitat is integrated into the management program.		
Legally protected and internationally recognized areas of high biodiversity value i. Demonstrate that the proposed development in such areas is legally permitted; ii. Act in a manner consistent with any government recognized management plans for such areas; iii. Consult and involve protected area sponsors and managers, project-affected parties including Indigenous Peoples, and other interested parties on planning, designing, implementing, monitoring, and evaluating the proposed project, as appropriate; and iv. Implement additional programs, as appropriate,	**Legally protected areas and internationally recognised areas** i. The borrower or client complies with national and local regulations for appropriate environmental management, and consults with relevant stakeholders during the preparation of management and mitigation measures. ii. The borrower or client ensures that any proposed development is consistent with the area's management plan or, in the absence of a management plan, with the objectives determined by the responsible natural resource,	i. Point iii of ESS 6 is similar to point i of OS 3; ii. Point ii of ESS 6 is similar to point ii of OS 3; and iii. Point iv of ESS 6 agrees with points iii and iv of OS 3

to promote and enhance the conservation aims and effective management of the area.	protected area, or wildlife agency. iii. The borrower or client also determines whether the area is critical, natural or modified, and then implements the relevant requirements of this OS; and iv. The borrower or client does not encourage the degazetting or downgrading of protected areas status	

4.3.14 Applicable International Conventions and Treaties

The Government of Malawi has ratified a number of treaties and conventions that have a bearing on this ESIA. The most notable ones are indicated in Table 8 below.

Table 8: International Conventions and Treaties with Bearing on SVTP

Convention or Treaty	Year of ratification	Key highlights of the treaty / convention
SADC Agreement on the Establishment of Zambezi Watercourse Commission (ZAMCOM)	2004	The agreement provides for the commission to harmonise the management and development of water resources in the Zambezi basin of which the Shire valley is part.
SADC Protocal on Fisheries	2006	The protocal promotes responsible and sustainable use of living aquatic resources and ecosystem in the region. This includes promoting and enhancing food security and safeguarding livelihoods of fishing communities.
Dublin Principle International Conference on Water and Development	1992	Summaries the importance of an integrated approach on water and clearly articulates the link between water resources management and the "3Es" of sustainable development; economic efficiency in water user; social equity and

		environmental ecological sustainability. This has 4 guiding principles
UN Convention on Biological Diversity	1993	To conserve biodiversity; to use biological resources sustainability; to ensure equitable distribution of the benefits of using genetic resources
African Convention on Conservation of Nature and Natural Resources	1968	All protected and sensitive areas such as forest reserves, seasonal wetlands, river crossings and rivers to be affected by this Project shall be conserved through rehabilitation and restoration. This initiative shall ensure conservation of nature and natural resources as stipulated by the Convention.
Agenda 21 UN Conference and Development	1992	Application of the integrated approaches to the development, management and use of water resources.

4.4 INSTITUTIONAL RESPONSIBILITIES FOR ESIA MONITORING AND ESMP IMPLEMENTATION

This Section identifies the institutional needs to ensure the effective implementation of the social and environmental management and monitoring program as outlined in the ESIA and ESMP so that the Project's benefits are maximised and that the Project is implemented on a sustainable basis. Recommendations are included for staff on environmental, social and health & safetymonitoring and management aspects taking into account the risks of the project and the experiences to date from implementing Phase 1. The ESMP provides project specific arrangements for monitoring.

4.4.1 National Level

By nature, this Project will be multi-sectoral and will involve a number of key government agencies, and consultation and coordination mechanisms. The main implementing agency is the Ministry of Agriculture, Water Development and Irrigation, and it coordinates overall implementation together with the Ministry of Finance, Economic Planning and Development (MoFEPD). Other agencies involved in the program are the Ministry of Natural Resources, Energy and Mining (MNREM); the Department of National Relief and Disaster Management (DNRDM); the Ministry of Lands and Housing (MLH); Ministry of Local Government and Rural Development (MLGRD); the Ministry of Transport and Public Works (MTPW); the Ministry of Tourism and Culture (MTC); Malawi Investment and Trade Center (MITC), EGENCO; the PPP Commission; the Southern Region Water Board (SRWB); and the Shire River Basin Agency/National Water Resources Authority.

SVTP has a Program Steering Committee (PSC) and Program Technical Committee (PTC) at national level, and consultative committee at district level and a technical team at local level.

The PSC provides programmatic and strategic guidance, direction and oversight to the program. The PSC is chaired by the PS of Agriculture, Irrigation and Water Development and co-chaired by the PS for Planning of the MoFEPD. It comprises the MoNREM; the MoLHUD; the MoLGRD; the MITC; the MoITT; and the PPP Commission. The Director of Irrigation Services serves as Secretary of the PSC. The PSC meets at least twice a year, or more frequently upon need, and is responsible for inter-sectoral coordination and facilitation, approval of annual program of activities and approval of work plan and budget, monitoring implementation and results (including audits), policy guidance and recommending corrective actions that may be necessary.

The Program Technical Committee (PTC), on the other hand, provides a multi-sector advisory and consultative platform to review technical reports, synthesize information and insight on program preparation and implementation issues. The PTC is co-chaired by the Director of Irrigation Services in MoAIWD and the director of planning in MoFEPD. Members include Director-level representatives of the Departments of: Water Resources (DWR); Department of Irrigation (DoI); National Parks and Wildlife (DNPW); Department of Energy (DoE); Environmental Affairs Department (EAD); Department of Surveys (DoS); Department of Fisheries (DoFi), Department of Forestry (DoF), Department of Agricultural Extension Services (DAES); Department of Youth and Gender; Department of Lands; and DNRDM; as well as representatives of EGENCO and MITC. The Project Coordinator serves as Secretary of the PTC. The PTC meets at least three times per year and is responsible for: technical guidance and oversight of program activities (including reports and studies), review and synthesis of suggestions and recommendations from studies, reports and by the consultative committee and submits these to the PSC for review and decision. The PTC may decide to form sub-committees by Component to streamline its activities beyond the joint meetings.

The Project Management Team (PMT) comprises of civil servants and recruited professionals for project management, coordination and monitoring. This team is housed in the MoAIWD.

These Ministries, agencies and committees provide oversight of the delivery of the project, including the environmental and social aspects, and meet regularly and effectively. Expereince from Phase 1 is that this is an effective management arrangement as it enables redress measures to be implemented timely.

The Ministry has experience in implementing projects in accordance with financing agencies environment and social policies and documenting compliance, including through the works undertaken on Phase 1 so far. It has regularly trained staff in ministry and districts on compliance with E&S issues, with support of MoNREM. The PMT assumes responsibility for all day to day management and coordination needs under the project, including fiduciary, safeguards, M&E, safeguards, citizen engagement and grievance redress mechanism. The PMT is comprised of competitively recruited experts and will be complemented with technical assistance on quality assurance, planning and M&E. The PMT is a fully integrated project team. Besides the recruited component leads, fiduciary staff and safeguards,

M&E/GRM staff, it includes professional staff from the main government agencies involved in the SVTP-I who are assigned to work on this project. All project operational modalities are detailed in the Project Implementation Manual, with gantt charts, flow charts, responsibilities. A component Lead is responsible for comprehensive management, liaison and coordination of the respective pillar, under the guidance of the project coordinator. The safeguards coordinators lead all implementation, monitoring and compliance documentation of the safeguards instruments and liaise frequently with the service providers on issues related to safeguards, health and safety, etc. The same applies to the M&E, Communications and GRM officer, who will be responsible for maintaining the project Management Information System, lead communications and manage the Grievance Redress Mechanism with relevant committees. The project shall maintain a GBV Service provider recruited under SVTP 1 to manage SEA and SH. The GBV Service Provider partnered with the district hospital and health centres in the omplemnattion of GBV mitigation measures. The arrangement has proved to be very strategic and worth maintaining.

The responsible Implementing Agency (the Ministry of Agriculture) has the overall responsibility for coordinating and monitoring implementation of the ESIA recommendations, as well as its required updates. This updated ESIA (and the Phase 2 ESMP) will be provided to the Director General of the Malawi Environmental Protection Authority (MEPA), who will be responsible for reviewing the ESIA through the Advisory Committee on Environment and Social Assessments (ACESA). MEPA, coordinates and facilitates sustainable management of the environment and natural resources in Malawi. As such it is responsible for harmonization of national environmental policies and legislation, enforcement of legislation, capacity building, and compliance monitoring. The Director General of MEPA may arrange for public consultations as part of the EIA process, in order to sensitise the communities and to create awareness. The ACESA may require to carry out their own site and works assessment before making the appropriate recommendations to MEPA, through the Director General. MEPA will evaluate the recommendations of the ACESA and make appropriate recommendations for approval.

The Department of National Parks and Wildlife is mandated to protect and conserve wildlife in protected areas such as National Parks and Wildlife Reserves in collaboration with other stakeholders especially boarder zone communities. It has concessionaires in some parks, notably in Majete Wildlife Reserve while maintaining overall responsibility. The DNPW has been a key consultee in the update of this ESIA, particularly with respect to the proposed works in Lengwe National Park and the Natural Resource Management proposals.

Table 9: Summary of Institutional Roles in the ESMP Process

No	Name of institution	Role in the Project	Project phases			Responsibility in ESMP
			Design	Construction	Operation	
1	Ministry of Agriculture acting through the Department of Irrigation Services (DoI) and PMU	Project anchor on behalf of Government of Malawi	√	√	√	Overall responsibility for coordinating and monitoring implementation of the ESIA recommendations, as well as its required updates Constitute Project Management Team (PMT) comprising civil servants and recruited subject matter specialists for project management, coordination and monitoring

	Project Management Team	Support the Ministry of Agriculture in coordination and monitoring of the project activities	√	√	√	Subject specific project management, coordination and monitoring

2	Malawi Environmental Protection Authority (MEPA	Statutory body to monitor compliance to environmental policy and law	√	√	√	Reviewing the ESIA through the Advisory Committee on Environment and Social Assessments(ACESA); Harmonization of national environmental policies and legislation, enforcement of legislation; Capacity building, and compliance monitoring; Arange for public consultations as part of the ESIA process, in order to sensitise the communities and to create awareness; Carry out own site and works assessment before making the appropriate recommendations to MEPA, through the Director General. MEPA will evaluate the recommendations of the ACESA and make appropriate recommendations for approval. Approve ESIA and ESMP; Monitor implementation of ESMP
3	The Program Steering Committee (PSC)	Provide programmatic and strategic guidance, direction and oversight to the program.	√	√	√	Responsible for inter-sectoral coordination and facilitation; Aapproval of annual program of activities and approval of work plan and budget; Monitoring implementation and results (including audits), policy guidance and recommending corrective actions that may be necessary.

4	Program Technical Committee (PTC)	Provide a multi-sector advisory and consultative platform to review technical reports, synthesize information and insight on program preparation and implementation issues.	√	√	√	Responsible for technical guidance and oversight of program activities (including reports and studies); Review and synthesis of suggestions and recommendations from studies, reports and by the consultative committee and submits these to the PSC for review and decision. The PTC may decide to form sub-committees by Component to streamline its activities beyond the joint meetings.
4	National Water Resources Authority	Regulation of waste disposal and water abstraction for the protection of water resources	√	√	√	Regulate water abstraction; Control of water resources pollution
	Department of National Parks and Wildlife	Conservation of wildlife in and outside protected areas of Majete, Lengwe and Elephant Marsh	√	√	√	In consultation with MEPA, review proposed project activities in protected areas; Issuance of permits in respect of restricted activities in protected areas; Contribute to the updating of the ESIA in respect of works in Majete and Lengwe
	Ministry of Labour	Promotion of occupational health and safety practices' monitoring compliances to labour and employment laws.		√	√	Enforcement of OSH regulations; Workplace registration; registration and training of workers' committee; facilitating labour dispute resolution.

	African Parks	Conservation of wildlife in and outside protected areas of Majete, and implementation of the restoration plan for Intake + 6 km	√	√	√	Ensure that the mitigation measures are adequate; Implement the mitigation measures for Majete; implementation of the restoration plan
	Ministry of Health	Promotion of public health; disease surveillance; administering medication		√	√	Raising awareness about waterborne diseases including bilharzia; Disease detection and administration of medication;
	Catholic Commission for Justice and Peace –CCJP of Chikwawa Diocese (GBV Service Provider)	Safeguarding communities and construction workers against GBV	√	√	√	Investigation and reporting of GBV, SEA, and SH cases arising from SVTP;

The details of the SVTP organogram will be developed and agreed during the development of the PAD and at appraisal time.

Chapter 5: Grievance Redress Mechanisms (GRM)

The basic principles for both African Development Bank, World Bank and all the stakeholders' requirements is that the established GRM is credible, independent and empowered, able to receive, facilitate and follow up on the resolution of affected people's grievances and concerns about the environmental and social performance of the project. The GRM shall be accessible to the stakeholders at all times during the project cycle, and all responses to grievances shall be recorded and included in project supervision formats and reports. The GRM shall be structured as below:

Mechanisms to redress grievances are a prerequisite for large infrastructure interventions where people's key economic productive assets are acquired for a public purpose. This has a likelihood of leaving the Project Affected Persons (PAPs) vulnerable to multiple risks including change of occupation, lowering of income levels and lack of support systems. Hence, it is important to integrate a grievance redress mechanism that addresses concerns of the PAPs and provides for redress effectively in a time-bound manner within the legal framework to ensure:

a) that the aggrieved person is satisfied; and
b) such grievances do not become contentious issues, leading to opposition to the proposed development Programme.

Further, it is essential that grievance redress mechanisms are devised, keeping in mind the socio-cultural setting and in accordance with the provisions of the legal system.

A grievance redress mechanism is critical to effectively addressing any issues arising during the Programme implementation; and for Programme monitoring and evaluation. Grievance Redress mechanisms (see Grievance Mechanism Checklist in Annex 5), if included in the Programme design, planning and management; help to realise the Programme objectives effectively. This requires setting up appropriate channels to address individual or community concerns, prevent adverse consequences and risks, bring out Programme implementation related issues and corrupt practices if any. Such effective mechanism also brings out positive changes in people's lives as well as enhanced feeling of being important stakeholder in the Programme. Affordable and accessible procedures for settlement of disputes arising from resettlement should include the availability of judicial recourse and community and traditional dispute settlement mechanisms.

5.1 The Aim of the grievance redress mechanism

The aim of the grievance redress mechanism is to facilitate quick and fair response, clarification and settlement; or redress to any grievances, complaints and queries; and to quickly and fairly clarify to complainants as well as stakeholders, in a manner that is acceptable to all parties. The general approach is to respond to issues and seek solutions to problems in the earliest stage and avoid taking complaints to courts for redress.

The key objectives of a grievance redress mechanism in a resettlement action plan typically include:

1. Ensuring that affected individuals or communities have easy access to the mechanism and are aware of their rights to raise grievances or complaints.
2. Establishing a transparent and accountable process that provides clear information on how grievances can be submitted, processed, and resolved.
3. Ensuring that the mechanism operates in a fair and impartial manner, treating all parties involved with respect and without bias.
4. Promoting a timely resolution of grievances, with clear timelines for acknowledgement, investigation, and response to complaints.

5. Providing appropriate remedies and compensation to address the harm or losses suffered by affected individuals or communities, in line with relevant laws, regulations, and project commitments.

6. Utilizing the mechanism to gather feedback, monitor trends, and identify systemic issues to improve future project planning and implementation.

In the implementation of the GRM for this Programme, the procedures shall ensure the following:

1. Simple, straightforward and accessible ways for raising concerns, making complaints or resolving any disputes that may arise due to the implementation of the Programme;
2. Identification and implementation of appropriate and mutually acceptable processes and actions to address complaints;
3. Feedback that is treated confidentially, assessed impartially, and handled in a transparent manner
4. Satisfaction of the complainants, with the outcomes of the corrective processes and actions;
5. Facilitate the complainants to report their grievances, queries and/or comments through the process; and
6. Avoidance of the tendency to resort to judicial proceedings.

5.2 Likely grievances

Even with adequate implementation of the RAP and appropriate compensation, involuntary resettlement inevitably gives rise to grievances among the affected population and with the developer. Usually, the grievances arise over issues ranging from rates of compensation and eligibility criteria, to disturbances and other issues during construction. The types of grievances that could occur during Programme planning and design, RAP implementation and construction stages are indicated in table 10 below.

Table 10: Potential grievances that May Arise During the RAP Process

Stage	Types of grievances (indicative)
RAP Implementation followed by Construction	i) non-payment for improvements carried out to structures post survey and valuation but prior to compensation payments; ii) mode of payment of compensation and time delays; iii) not enough work during construction and dissatisfaction over wages given; iv) wrong identification of livelihood restoration schemes, their inadequacy, training support and lack of necessary assistances; v) increased cases of HIV/AIDS due to in-migration; vi) Noise and disturbance from construction activities vii) likelihood of increase in Gender Based Violence (GBV); viii) loss of access to services and sources of livelihoods; ix) restrictions or delays on access to irrigation water and farm inputs; x) loss of property due to theft allegedly by construction personnel; xi) loss or damage to crops and property by ongoing construction work; xii) inadequate support in relocating to resettlement sites/replacement structures

Composition of Grievance Redress Mechanism

A Grievance Redress Mechanism (GRM) has been set up to address various types of grievances, relocations, and entitlements associated with the Programme. The GRM operates under the oversight of the SVTP Programme Management Team (PMT). It is led by the Social Safeguard Specialist and assisted by a Communication Officer, Environmental Safeguard Specialist, and Monitoring and Evaluation Specialist, all under the supervision of the Project Coordinator.

The composition of the grievance committee at the district and lower levels remains the same as used in phase one of the project. However, for phase two, new committees have been established specifically in areas where the project will be implemented. These committees play a crucial role in ensuring the

effective functioning of the Grievance Redress Mechanism and addressing grievances in a timely and appropriate manner.

In an effort to promote conflict resolution, Chikwawa and Nsanje have established Grievance Redress Committees (GRCs) at the community level. In Chikwawa, there are a total of 45 committees, with 41 located at the community level, 3 at the area level, and one at the District level. Similarly, in Nsanje, there are 18 committees, with 16 located at the community level, 1 at the area level, and one at the District level. On average, each committee has eight members. It is worth noting that most of these committees were pre-existing in the community, and the project adopted them, but in some cases, new committees were elected.

To ensure effective functioning of the Grievance Redress Committees (GRCs), a member of staff from the District Commissioner's (DC's) Office is assigned to each committee as the secretary. The secretary is responsible for record-keeping and follow-up on cases for timely resolution. This support ensures that the committees run smoothly, and grievances are resolved in a timely and efficient manner. As of April 2023, training had already been conducted for the GRCs in Chikwawa. In Nsanje, training is still ongoing and is expected to last until the second week of May 2023. This training will further equip the committees with the necessary skills and knowledge to carry out their duties effectively.

The main responsibilities of the PMT in the GRM include overall management of the GRM, including but not limited to managing the grievance redress process and procedures; registration of complaints; capacity building of the grievance committee(s), outreach and external communications; tracking performance and monthly reporting. The SSS is the overall responsible person for implementation of the GRM, while the Communication Officer is responsible for building community capacity on handling grievances, accessing the Shire Valley Transformation Programme Grievance Redress Mechanism and creating demand for the GRM through information, education and communication activities. The field officers under the DC’s office are responsible for mobilising and supporting communities (PAPs) to access and use the Grievance Redress Mechanism.

The PMT has operationalized the GRM structures at GVH, TA and District level to ensure that PAPs have easy access to legitimate, reliable, transparent, and efficient institutional mechanisms that are responsive to their complaints. As much as there are different tiers of the redress mechanism, PAPs will be free to use any facility they deem approachable and efficient to them. However, the design of the GRM is to ensure that grievances are resolved at the lowest tier and, as much as possible, avoid escalating cases to higher levels. But the decision to appeal to higher levels will solely lie in the hands of the aggrieved person. A PAP representative will sit in all the different grievance levels and where necessary the system will ensure that there is female, youth and the vulnerable representation by co-option. The proposed composition of the committees and their roles and responsibilities are presented in Table 11.

Table 11: Proposed Composition and roles and responsibilities of the Grievance Redress Committees

Grievance Redress Committee	Operational level	Members	Roles and Responsibilities
Community Grievance Redress Management Committee (CGRMC)	Group Village Headman/Woman	● Representative from Village Development Committee (VDC) ● Representative from Child Protection ● Representative from Women's Forum ● Representative from Community Based Organisation (CBO) ● Representative from Government – Extension worker (Secretary) ● Representative from Customary Land Committee (CLC) ● Representative from Community Policing Forum ● Representative from Youth Network ● Representative from Pastors Fraternal ● Group Village Head/ Traditional Authority ● Cooperative member Representative ● One influential person who is development oriented	● Providing local oversight for the other committees and the Shire Valley Transformation Programme (SVTP) ● Acting as the voice of the villagers and as a point of contact with the SVTP GRMC and the other committees. ● Acts as the voice of SVTP CGRMC in communicating messages to all community members, in particular women through a female committee representative. ● Overall responsibility for reporting the Programme success and grievances to SVTP CGRMC and ensuring that the grievances are addressed in a timely manner. ● Recording grievances in GRM project logbooks. ● Overall responsibility for communicating with the complainant regarding progress of the grievance resolution. ● Acts as SVTP CGRMC local monitoring and oversight on grievance management. ● Responsible for documenting community meeting minutes, where required; including taking a register of the participants. ● Responsible for organising community meetings or meetings between SVTP CGRMC and the complainant, where required. ● Responsible for organising VGRC meetings.
Area Grievance Redress Committee (AGRC)	Traditional Authority Level	● Representative from Area Development Committee (ADC) ● Representative from Child Protection ● Representative from Women's Forum ● Representative from Community Based Organisation (CBO) ● Representative from Government - Agriculture Extension Development Coordinator (Secretary)	● Receiving and redressing grievances that have been referred to the Area Grievance Redress Committee by the CGRC ● Providing direction and advice to the CGMC committee on grievance redress procedures and practices ● Referring grievances that the committee cannot redress to the DGRC ● Acts as the voice of DGRC in communicating messages to the CGRC, in particular women through a female, youth and the vulnerable committee representatives.

Grievance Redress Committee	Operational level	Members	Roles and Responsibilities
		● Representative from Customary Land Tribunal (CLT) ● Representative from Community Policing Forum ● Representative from Youth Network ● Representative from Pastors Fraternal ● Traditional Authority/Paramount Chief ● Cooperative member Representative ● One influential person who is development oriented	● Overall responsibility for monitoring and reporting the Programme success and grievances to the DGRC and ensuring that the grievances are addressed in a timely manner. ● Responsible for documenting community meeting minutes, where required; including taking a register of the participants. ● Responsible for organising community meetings or meetings between DGRC and complainants, where required. ● Responsible for organising AGRC meetings
District Grievance Redress Committee (DGRC)	District level	● Chair – Director of Planning and Development ● Co-Chair – Director of Administration ● Secretary – District Environmental officer ● District Gender officer ● Police representative ● Judiciary representative ● District Lands Officer ● Civil Society Organisation representative ● District Labour Officer ● District Social Welfare Officer ● District Community Development Officer ● Non-Governmental Organisation representative.	● The District Commissioner's office acts as the main contact for SVTP GRMC in reporting and the coordination of grievances resolving. ● Acts as the Secretariat for the DGRC and as the second point of contact for SVTP GRMC. ● Consolidates grievances and support the tracking of grievances ● Responsible for reporting on land and compensation related community grievances and for tracking the resolution of grievances and communicating with the aggrieved person ● Responsible for reporting and tracking any planning related grievances to the SVTP GRMC and providing support in establishing a resolution, where required ● Responsible for reporting and tracking any grievances related to health, safety and security; in particular, related to sexual harassment, worker-community interaction, gender-based violence or other social welfare issues to the SVTP GRMC.
Central Grievance Redress Committee	National level	● PMT – Secretariat ● Representative of the Ministry of Natural Resources and Climate Change. ● Representative of the Ministry of Civic Education and National Unity.	● Providing policy and direction to the DGRC and monitoring grievance redress activities at national level. ● Assisting in the resolution of grievances that cannot be addressed at the district level ● Organising meetings and workshops for reporting and giving feedback on grievance resolution activities at national level.

Grievance Redress Committee	Operational level	Members	Roles and Responsibilities
		● Representative of Ministry of Gender, Children, Disability and Social Welfare ● Representative of the MoA ● Representatives and Ministry of Lands, Housing and Urban Development ● Representative of the Ministry of Local Government and Rural Development	● Facilitating high level evaluation, monitoring and reporting on grievance management.

5.3 Grievance redress procedures

It is important to recognise that this GRM will cover grievances beyond land conflicts. At the same time, stakeholders and the GRM Committee members at all levels need to understand that, under the Customary Land Act (CLA), there is a structure established to handle land conflicts. These are the Customary Land Committees, Customary Land Tribunals, District Land Tribunals and Central Land Board which are at Group Village Head level, Traditional Authority, District, and national levels. Field officer and all the committees have been trained on this matter and have been made aware that it is crucial to ensure that these structures are recognised and used for grievances relating to land matters.

The success of the Programme will largely depend on the PAPs accepting the compensations and the successful redress of grievances. It is therefore necessary to provide an accessible and credible means for PAPs to pursue and report grievances. The institutions or persons where grievances can be reported to include the following:

a) Community Grievance Redress Committee;
b) Area Grievance Redress Committee;
c) District Grievance Redress Committee;
d) Central Grievance Redress Committee; and
e) The Courts of Law

Channels (modes of communication) for reporting the complaints and grievances can be verbal (in person), by telephone (calling, sending an SMS or an email), letter, official webpage or social media.

The key steps for grievance redress are elaborated as follows:

Step 1: Contact and Dialogue between the Aggrieved Party and the 'Respondent'.

Where possible, the first step in the GRM should be contact and dialogue to reach an amicable position before it is formally lodged with a GRC.

Step 2 – Lodging of grievances.

As a second step, all complaints and grievances relating to any aspect of the Programme are to be lodged to either the secretary of CGRC as receivers who will hear and try to resolve the grievance. The secretary analyses the grievance and advises the complainant on the way forward. If the grievance is addressed, there will be no further action. If the complaint is not addressed and it has been analysed that it is project related, it will be referred to the Community Grievance Redress Committee or Customary Land committee (Step 3).

Step 3 – Grievance redress at the Community Grievance Redress Committee Level

Complaints that are not resolved at Step 2 are referred to the Community Grievance Redress Committee (CGRC) which shall investigate and rule within 14 days. The CGRC shall record and maintain a register of all complaints/ grievances received so that these can be kept collectively in one place. The register will be fed into the RAP Database. At this step, all cases (except land disputes, which must be referred to the Customary Land Tribunal) are to be heard by the CGRC and addressed through consultations conducted in a transparent manner; and aimed at resolving matters through consensus. Minutes of the CGRC meetings shall be kept and if the resolution proposed by the CGRC or the Customary Land Tribunal is accepted by the PAP, the PAP will sign the grievance redress form (Annex 6) to show agreement. The grievance will subsequently be closed; otherwise, Step 4 will be followed in an appeal. A period of 14

days is provided to hear and redress the grievance. The SVTP shall facilitate the formation of the Community Grievance Redress Committee (CGRC).

Obligations of the CGRC

During the first meeting of the committee, the members shall be introduced to the chairman and elect a vice chairman and secretary from amongst themselves. The two shall serve in that capacity for one (1) year. The Committee must:

- Ensure representation of the youth, women and vulnerable groups at community meetings;
- Enforce transparency and accountability, in line with SVTP requirements at all times;
- Hold committee meetings, as follows;
  - Meet twice in a month for the first six months and ongoing during the construction phase (or more frequently if the situation demands).
  - During construction, the committee must meet monthly, or as required and agreed.
- Attend a short training session, by the Shire Valley Transformation Programme (SVTP) Grievance Redress Management Committee (GRMC), on the following;
  - Approach to the grievance process and response times;
  - Administrative framework governing the Programme, particularly the ADB and World Bank requirements;
  - Confirming the roles and responsibilities of representatives and

meeting requirements.

Step 4 – Grievance redress at Area Grievance Redress Committee level

If the complainant does not receive any response from the GVGRC within 14 days of lodging the complaint, or that the complainant is not satisfied with the response, then the issue will be appealed to the Area Grievance Redress Committee (AGRC). This committee will work hand in hand with the Customary Land Tribunal which will investigate and rule within 14 days. During the appeal to the AGRC, all the necessary details will be attached, and the Complainant will be accordingly notified of the venue, date and time set for hearing and a resolution must be made within 14 days' time. If the resolution proposed by the AGRC or the Customary Land Tribunal is accepted by the PAP, the PAP will sign the grievance form to confirm agreement; and the grievance will subsequently be closed. Otherwise, the complaint will be referred to the District Grievance Redress Committee and the District Land Tribunal.

Step 5 –Grievance redress at the District Grievance Redress Committee level

If the complainant does not receive any response from the AGRC within 14 days of lodging the complaint or if the complainant is not satisfied with the response, then the issue will be appealed to the District Grievance Redress Committee (DGRC), which shall work hand in hand with the District Land Tribunal. The DGRC is to hear and pass a resolution within 14 days. If the resolution is accepted by the PAP, the PAP is to sign the grievance form to confirm agreement; and the case will subsequently be closed; otherwise, the complaint will be referred to the Central Grievance Redress Committee (Step 6).

The DGRC will capture, and track grievances related to land, environment, development and social welfare, when such issues are reported by Project affected people or other stakeholders.

Obligations of the DGRC

The District Grievance Redress Committee must:

- Represent interests of affected communities and key stakeholders in the district and work together with the District Land Tribunal on land matters;
- Support SVTP in identification of affected persons, replacement land and land acquisition processes as and when required, in line with international requirements, with guidance from SVTP;
- Have representatives for reporting and tracking grievances arising from land acquisition and other Programme activities.
- Ensure transparency and accountability during property valuation surveys and compensation claims through public participation.
- Support SVTP with monitoring in relation to encroachment, health, safety and security issues.
- Prepare short monthly progress reports to SVTP and the District Executive Committee regarding grievances raised and resolutions.
- Hold meetings at least once a month for the first six months and throughout the construction period (or more frequently if the situation so demands);
- Decide on the frequency of meetings as deemed appropriate during operation.
- Attend a short training session that includes the following:
    - The approach to the grievance process and response times.
    - Administrative framework governing the Programme, particularly the IFC requirements.
    - Confirming the roles and responsibilities of representatives; and
    - Meeting requirements.

Step 6 – Grievance redress at the Central Grievance Redress Committee (Shire Valley Transformation Project Management Team or Ministry) level

If the resolution proposed by the DGRC is not accepted, the affected person will be allowed to appeal to the SVTP (GRMC) Technical Team or MoA. Further, the appeal can also be made to the Regional Lands Commissioner and the Central Government (Ministry of Lands, Housing and Urban Development, MoLHUD). The Central Grievance Redress Committee will work together with the Central Land Tribunal to hear the complaint and make a resolution within 14 days. If the resolution is accepted by the PAP, he/ she must sign the grievance form to confirm agreement; and the grievance will subsequently be closed; otherwise, legal action (Step 7) may be pursued.

The Shire Valley Transformation GRMC will primarily be responsible for capturing, logging, tracking and resolving grievances reported through the various mechanisms. It will also ultimately be responsible for ensuring that complainants and the Committees are fully informed and up-to-date with the resolution of such grievances.

5.4 Obligations of the SVTP GRMC

Obligations of the Grievance Redress Management Committee of the Shire Valley Transformation Programme include to:

- Work with the Central Land Tribunal on land matters;
- Ensure that Project affected communities are fully informed of the grievance redress process and means by which they can report grievances;
- Hold and document monthly meetings with committee members to gather feedback on the grievance process;
- Ensure that grievances are documented in the grievance form and log and that there is a paper trail regarding the resolution and close-out process;
- Ensure that the grievance process is accessible to all community representatives; and
- Ensure that the committees are fully aware of their roles and responsibilities, and that they are

formalised through letters of agreement.

Step 7 – Civil courts option

If the complainant is not satisfied with the decision made at any level, he/ she will be informed of his/ her rights to take the grievance to the courts of law, which include magistrate courts, the high and supreme courts of Malawi. While the complainants will be encouraged to do this as a last resort, right from the start; they will be informed of the right to take the grievances to court at any stage of grievance redress. The complainant will also be informed that they will do so at their own expense, unless the court awards damages to them. The decision of the court of law will be final.

Grievance reporting

All grievances shall initially be documented in a grievance form for the complainant to sign (by hand or thumb print). Additionally, details of the grievance should be populated into a grievance log (Annex 7) tracking for grievances. The Shire Valley Transformation Programme is responsible for ensuring that the grievance reporting forms (Annex 6) are completed on receipt of a grievance and that the log (Annex 7) is always up to date to monitor progress of outstanding issues, in order to follow up as required.

The Grievance Redress Mechanism Process is graphically presented in figure 11:

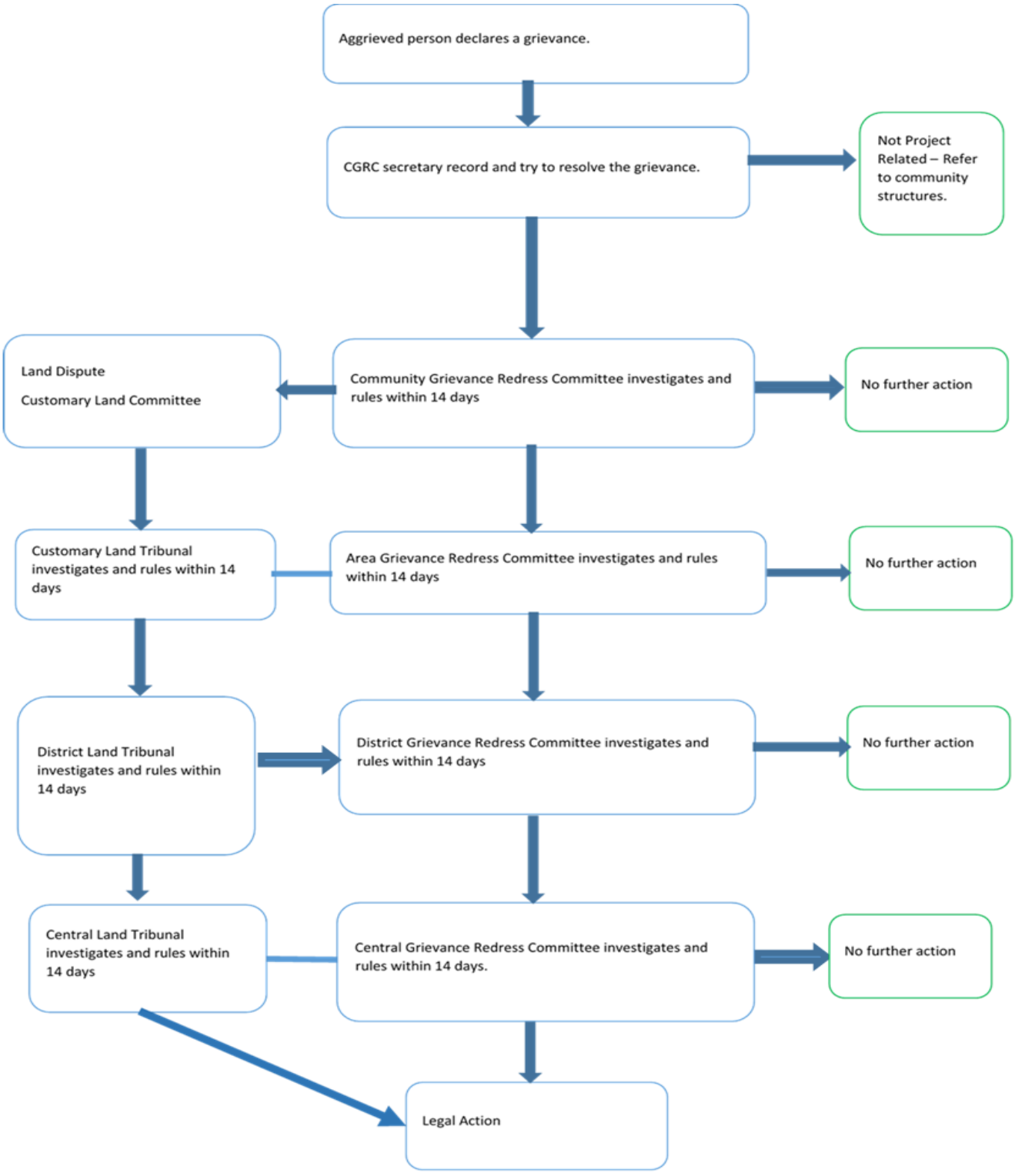


Figure 11: Grievance Redress Mechanism Figure Process

5.5 Timeframe

The total timeframe provided for the process, from the stage of recording of the grievances to their redress **14 days** per each stage. This entails that, if a grievance goes all the way to the Central Level before resolution, it will take a **maximum of 56 days.**

5.6 GRM Budget

The estimated budget allocated for supporting the activities of 63 GRC in two districts is MKW1,000,000,000.00. Chikwawa district will receive **MKW600,000,000.00** to support 45 committees, while Nsanje district will receive **MKW400,000,000.00** to support 18 committees. These figures were calculated based on the current monthly expenditure per committee, which amounts to **MKW80,000,000.00.** The estimated budget will cover expenses for one year.

5.7 GBV,SEA/SH Prevention and Response Action Plan fro SVTP 2

OS4 of the African Development Bank and ESF Guidance Note 4 – Community Health and Safety lay out the steps to be followed when developing action plans related to gender based violenve (GBV), sexual exploitation and abuse (SEA) and exual harassment (SH).

The plan will be developed stipulating the roles of SVTP, Engineer and contractor and covering the following key areas:

(i) Prepare and implement GBV/SEA, SH Action plan that, at minimum covers the following:

- Sensitisation of SVTP staff, Supervising Engineer, Contractor and Community on SEA and SH;
- Mapping GBV, SEA and SH response actors including their capacity to implement the plan;
- Development of an Accountability and Resource Framework for the plan implementation;
- Ensure safeguards specialists in the SVTP, Engineer's and contractor's teams have GBV specific skills;
- Ensure project bidding documents integrate SEA and SH requirements;
- Review the C-ESMP to ensure that appropriate mitigation measures relevant to SEA and SH are incorporated
- Women and girl's social and economic empowerment

(ii) Prepare, adopt and implement workers' code of conduct

CHAPTER 6. BIOPHYSICAL ENVIRONMENT

6.1 CLIMATE

The study area has a tropical climate marked by hot temperatures and two distinctive seasons: the dry and the rainy seasons.

The dry season starts in May and ends in October while the rainy season starts in November and ends in April.

The following graphs show the main figures related to climate: rainfall and . Data was t obtained from the Shire Valley ADD in 2022 .

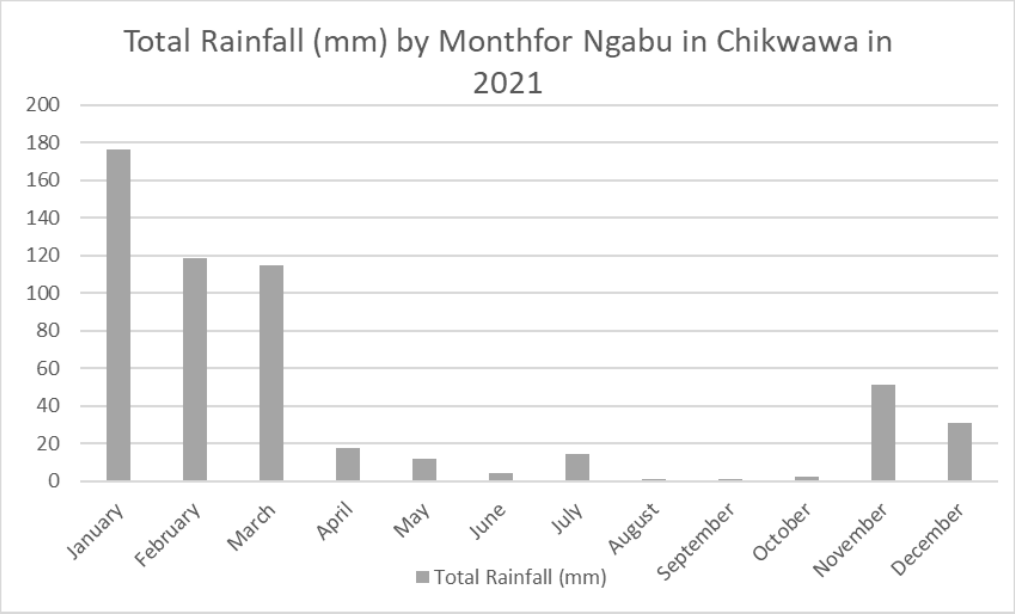


Figure 12: Monthly Rainfall for Ngabu in 2022 (source: Shire Valley ADD)

On the other hand, temperature recorded at the station is as depicted in the figure 13 below:

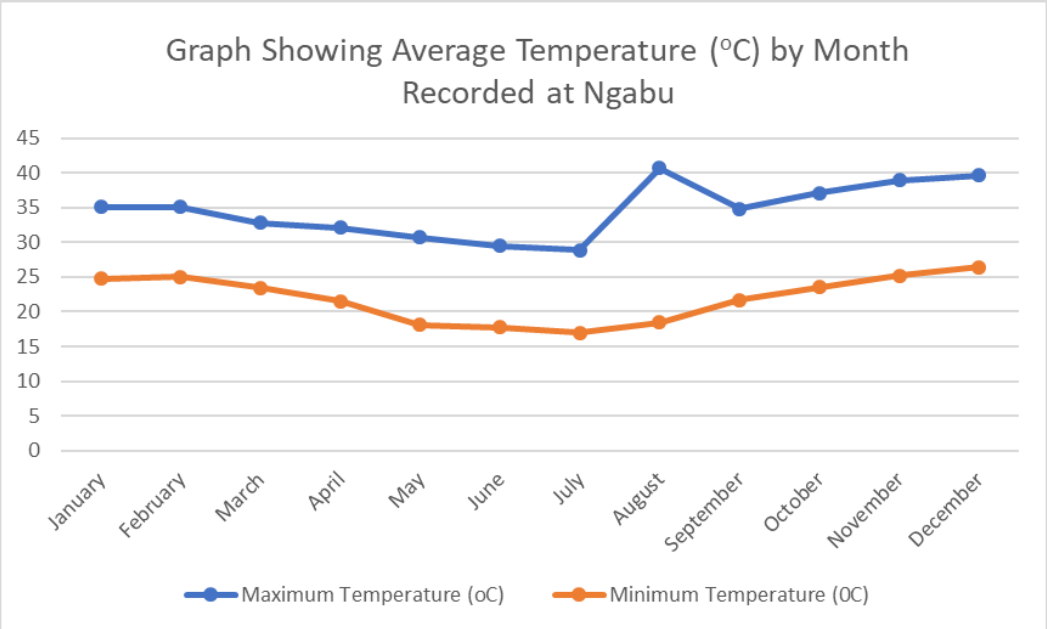


Figure 13: Monthly Minimum and Maximum Temperatures for Ngabu

EFFECTIVE RAINFALL AND EVAPOTRANSPIRATION

In the field of agriculture, the notion of effective rainfall is important as it subtracts from the amount of rainfall, the amount of water that is unusable for crop (for plant intake) due to rapid evaporation (not enough time to reach roots) deep percolation or rapid runoff to surface water. In the Study area, effective rainfall is, on a yearly average, 48% lower than rainfall, which mean that only 52% of rainfall is effective rain (BRLi, 2015).

Evapotranspiration is the process by which water is transferred from the land to the atmosphere by evaporation from soil and transpiration by plant, it therefore designates water losses. In the Study area, the balance between rainfall (intake) and evapotranspiration (offtake) only shows a surplus of water between February and April. In the dry season, soil moisture drops to zero. Surplus of water only occurs when the soil is saturated after the first heavy rains. Overall, the region is semi-arid, meaning that the Study area generally suffers from a soil moisture deficit (Per Aagaard, 2012).

6.2 LOCAL TOPOGRAPHY

The description of the topography of the Study area helps to understand the physical environment in which the Project will take place.

The Study area is included in the Lower Shire Valley, which covers the southernmost part of the Shire River after Kapichira falls.

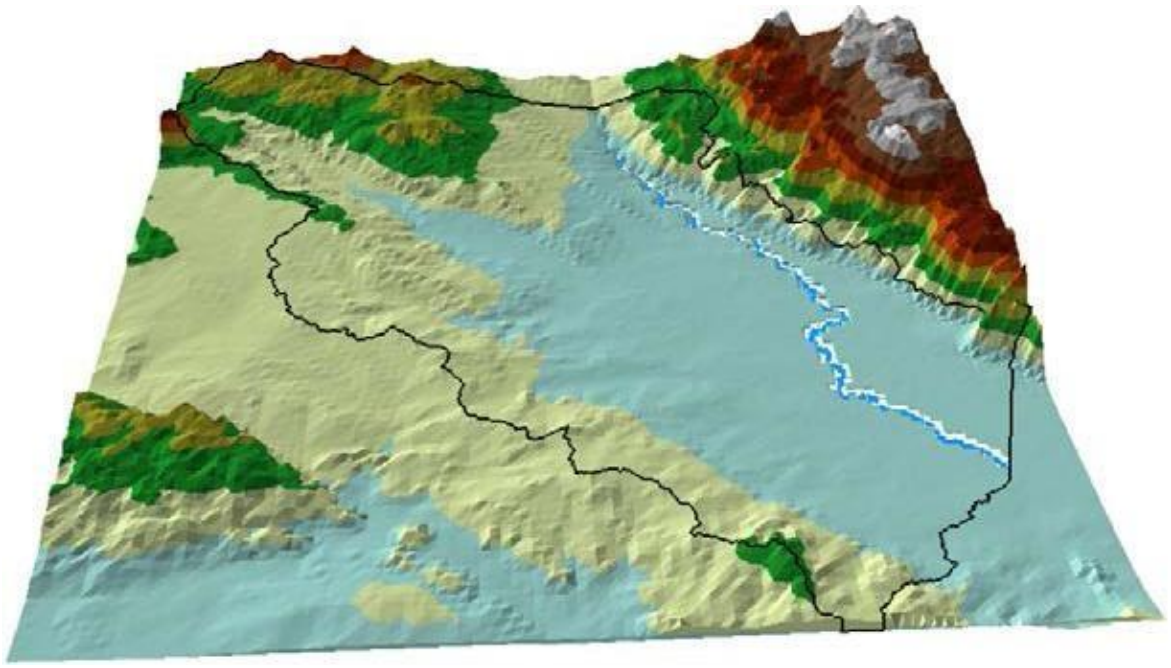
The Study area starts at the EGENCO reservoir just upstream of the Kapichira falls. At this point, where the water intake will be located, the altitude is 144 masl.

After the reservoir, the Shire River flows down the dam spillway and Kapichira falls, the altitude drops about 50 meters and the Shire in incised in a gorge 10 additional meters below ground level. The Lower Shire plain is the only area in Malawi where the elevation is below 150 masl.

Local topography is characterized by the following features:

- The Shire River, with gentle slopes after the Kapichira falls and flowing in the middle of the Study area. The river's valley has formed a vast central low land wetland called Elephant marsh surrounding the Shire River and receiving its water during the rainy season.
- Majete Wildlife Reserve in the North has a few hills reaching up to 780 masl. Majete escarpment marks the end of Majete to the North West where the Mwanza, an important tributary to Shire River, flows in a large valley.
- On the Shire left bank (to the North East): the Thyolo Escarpment with steep slopes has the highest hills of the area with summits up to 1,500 masl. Short seasonal streams with small watersheds originate in this area and quickly empty their water in the Elephant marsh during flash floods.
- To the South East, Mulaka Hills that range in the 300s masl. These hills are located in Nsanje district.
- To the West, in Lengwe National Park, the topography is flatter with spares hills (Thambani Hills, the Salambidwe Hill, the Marangwe Range and the Matundwe Range) that climb up to 300 masl. This area marks the limit of the watershed between the Zambezi River (to the West, in Mozambique) and the Shire River (to the East).

The feeder canal roughly follows the 145 masl topographic contour line toward the plain. The following figure shows the topography of Chikwawa district (Nsanje District and Mulaka Hills are not shown) Mozambique is on the left.



6.3 RIVER GEOMORPHOLOGY

The study area is included in the Lower Shire catchment from the Kapichira Hydroelectric Power Station reservoir (downstream the confluence with the Mkurumazdi River) to the end of Elephant Marsh (downstream the confluence with the Ruo River).

The Lower Shire has two distinct morphological facies:

- From Kapichira to Chikwawa, the Shire River covers a distance about 20 km falling below the surrounding land flanked by alluvial terraces.
  - The right-bank tributaries include the following intermittent rivers originating from the Majete Escarpment: Mwambezi, Masakale, Kadeya and Manyumwa.
  - The main left-bank tributary is the perennial river called Likhubula which originates from the Thyolo Escarpment.
- From Chikwawa to Chiromo, the Shire River covers a distance of about 100 km through a broad alluvial plain constituted by tertiary unconsolidated sediments.
  - The right-bank tributaries include the following intermittent rivers originating from the Thambani Hills, the Salambidwe Hill, the Marangwe Range and the Matundwe Range (in Lengwe NP area): Nthumba, Nkombedzi wa Fodya, Phwadzi, Namikalango, Nyakamba, Mikombo Chibuala, Mafume, Lalanje and Thangadzi West. The Mwanza River is the main right-bank tributary, it is intermittent and flows from the Mount Xalacongue and pours its waters into the Shire River at Nchalo.
  - The left-bank tributaries include the following intermittent rivers originating from the Thyolo Escarpment (including the Cholomwani Hills and the Kalulu Hills): Mwamphanzi, Nkhuzi, Nanzolo, Nkhate, Chilengo, Livunzu, Mulunga Wang ono, Wankwazi, Kalulu, Mbazi, Nkwezo, Milole, Milole Mwana, Mankhala, Kalulu, Thangadzi East, Chinolo, Chidima, and Phalamanga. The Ruo River is the main left-bank tributary, it is perennial and flows from the Mulanje Mountain and pours its waters into the Shire River at Chiromo.

The river beds of the Lower Shire River and its tributaries are very mobile in the alluvial plain regarding the highly erosive and spreadable soil characteristics: river bed can move, split, deepen or dig of several meters after severe floods. Sheetflood erosion is also taking place (Figures 14 and 15).

Figure 14 : River Bed Split in the Nkombedzi Wa Fodya River

Figure 15: River Bed Digging and Deepening by Erosion in the Namikalango

The overall Lower Shire River Basin from Kapichira Dam to Chiromo Bridge (including Ruo River) covers a drainage area of about 11 470 km². The main morphological characteristics (area, perimeter and Gravelius compactness coefficient) of the sub-basins are given in the Table 4

The Gravelius compactness coefficient is defined as the ratio between the perimeter of the subbasin and the circumference of the circle with the same area. This index is determined from a topographic map by measuring the perimeter of the watershed and its surface. It is close to 1 for a catchment of almost circular and therefore compact form; but greater than 1 when the basin is of elongated shape.

Table 12 : Morphological Characteristics of the Lower Shire Tributaries

	River Basin	Area (km²)	Perimeter (km)	Gravelius Coefficient
Main Right-Bank Tributaries	Mwambezi	169	103	2.2
	Masakale	107	87	2.4
	Nthumba	202	126	2.5
	Mwanza	1844	436	2.9
	Nkombedzi Wa Fodya	1057	249	2.2
	Namikalango	180	106	2.2
	Nyakamba	107	98	2.7
	Chibuala	141	95	2.3
	Mafume	96	95	2.7
	Lalanje	99	95	2.7
	Thangadzi West	407	149	2.1
Main Left-Bank Tributaries	Likhubula	600	181	2.1
	Mwamphanzi	312	150	2.4
	Nkhuzi	24	40	2.3
	Nkhate	57	57	2.1
	Chilengo	79	65	2.1
	Mulunga Wang ono	20	39	2.5
	Mulunga Wamkurd	27	42	2.3
	Wankwazi	20	32	2.0
	Mbazi	63	54	1.9
	Nkwezo	13	22	1.7
	Milole Mwana	23	38	2.2
	Kalulu	14	22	1.7
	Chinolo	10	32	2.9

Chidima	5	17	2.1
Thangadzi East	53	66	2.5
Ruo	4828	523	2.1

Source: BRLi, 2016

With the exception of the Likhubula, Mwamphanzi and Ruo, the left-bank tributaries of the Shire River are smaller than the right-bank ones.

The Gravelius compactness coefficient is superior to 1.5 for all the sub-basins, and to 2 in almost all cases. This underlines that the watersheds of the tributaries have lengthened shapes which fosters the spreading of surface runoff.

Figure 14 shows the Lower Shire River Profile from Kapichira Dam (147 masl.) to Chiromo Bridge (60 masl.).

The average slope of the Lower Shire River is extremely gentle of about 1‰.

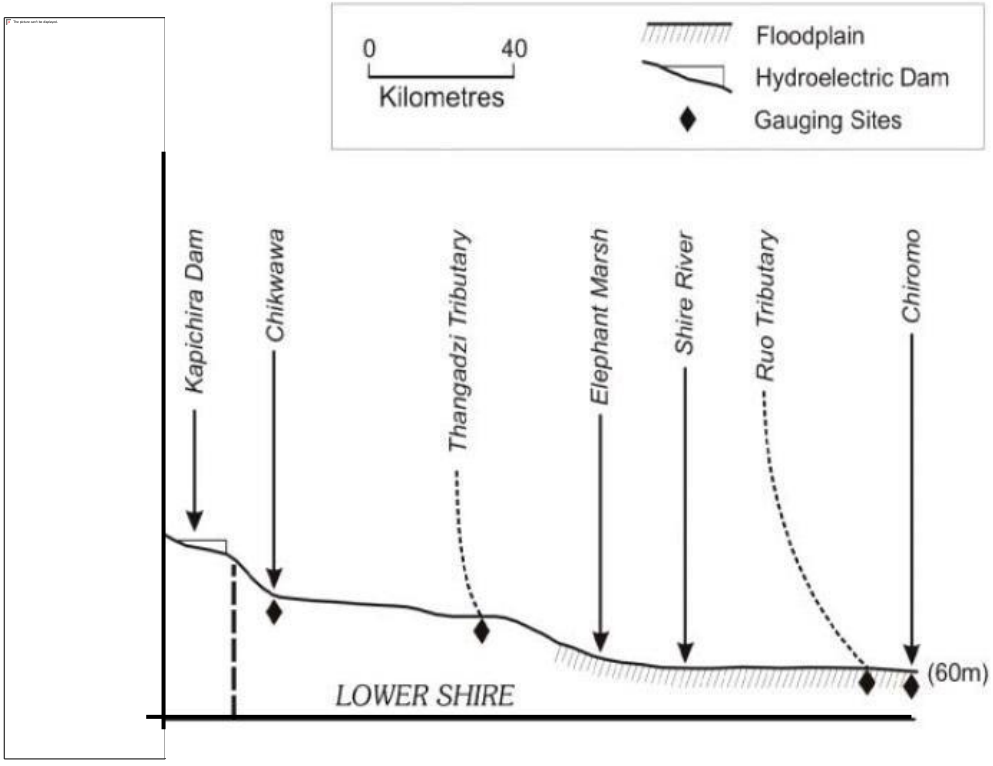


Figure 16: : Lower Shire River Profile from Kapichira Dam to Chiromo Bridge (Source : Source: NWRMP, 1986)

The Figure 20 shows the profile delineations based on Shuttle Radar Topography Mission, SRTM[2] of 4 representative tributaries: Mwanza, Ruo, Thangadzi West and East.

The average slopes and the slope breaks between the escarpments and the plain are more marked for the left-bank tributaries which accelerates the surface runoff.

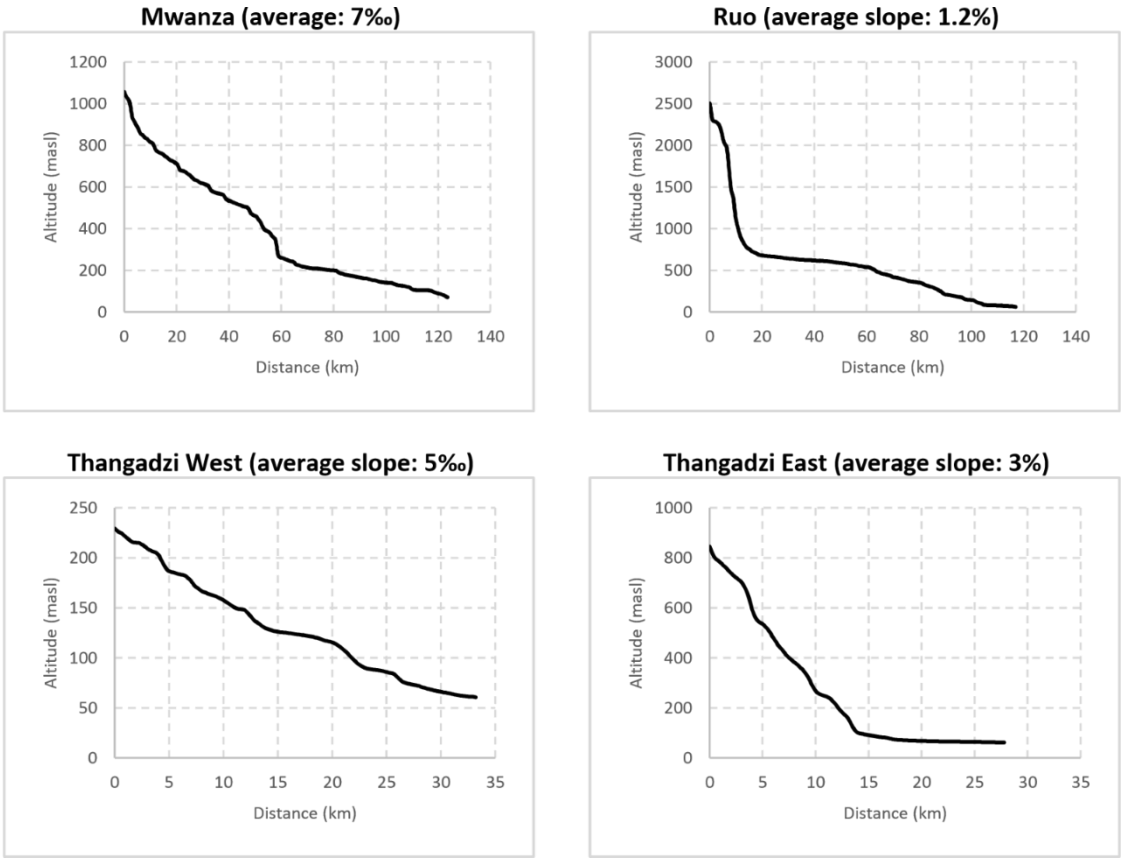


Figure 17: River Profiles of Mwanza, Ruo, Thangazi Westa and East

)

6.4 RIVER HYDROLOGY

The hydrology of the Study area is dominated by the outflows from Lake Malawi, which flows through Lake Malombo and feeds the Shire River.

WATER RESOURCES

The flow in the Shire River is highly regulated by the water level in Lake Malawi, in conjunction with the lake's natural outflow controls (a sand bar at 471.5 m above sea level

[2] Jarvis, A., H.I. Reuter, A. Nelson, E. Guevara, 2008, Hole-filled SRTM for the globe Version 4, available from the CGIAR-CSI SRTM 90m Database (http://srtm.csi.cgiar.org).

, across the mouth of the Shire), and by the artificial influence of the Kamuzu Barrage at Liwonde (ATKINS, 2011).

There are several hydropower stations and dams on the Shire River between the Lake Malawi and the Kapichira Falls: the Nkula, Tedzani and Kapichira hydropower stations. The justification for building the Kamuzu Barrage as a control gate at Liwonde was to mitigate the possibilities of failure to maintain the design flow of 170 m^3/sec for hydropower in the middle reach of the Shire River. The barrage is designed to reduce the risk to an acceptable level, by retaining water when the Lake level is relatively high and by releasing it at times when the flow would otherwise have been too low (Kumambala, 2009).

Moreover, there are two major water abstraction points that also influence the flow in the Shire River at Kapichira (NORPLAN, 2013):

- Irrigation scheme of Mtengula: 5 m^3/s for peak water demand.
- Drinking water supply for Blantyre Water Board: 2 m^3/s maximum including possible extension.

The Shire River runoff at Kapichira is therefore highly influenced by the flow regulation of the Lake Malawi and Kamuzu Barrage and water abstractions for irrigation of Mtengula and drinking water supply for Blantyre (ATKINS, 2011) and (SMEC, 2014).

To take into account this upstream influence and to be consistent with the FS, the following flow estimates have been considered for the water resources assessment:

- NORPLAN (2013) and NIRAS/DHI (2017) for the upstream part (flow at Kapichira);
- from SMEC (2014) for the downstream part (runoff for Mwanza River, right-bank and left-bank tributaries); and from
- BRLi (2016) for the Ruo River[3].

Water Resources data are covered in the chapter on hydrology.

The upstream part of the basin at Kapichira Dam controls approximately 80% of the average annual flow of the whole basin at Chiromo Bridge. The intermediary part of the basin from Kapichira to Chiromo (including Mwanza but not Ruo) only contributes for about 5%. The remaining 15% are driven by the Ruo River.

During the dry season, 95% of the total flow at Chiromo are controlled by the upstream basin at Kapichira. The contribution of the intermediary basin is close to nil and the inflow of the Ruo River brings about 5%.

During the wet season, about 75% of the total flow at Chiromo are controlled by the upstream basin at Kapichira. The contribution of the intermediary basin counts for about 5% to 10% and the inflow of the Ruo River rises up to 20% and to 25% of the peak flow.

[3] A GR2M hydrological model was implemented (Mouehli, 2003). The calibration was made with the historical time series discharge for the Ruo River at Sinoya South (4721 km^2). The statistic calculations were made for the reference period from 1979-2009 as in (JICA, 2014) and (SMEC, 2014).

Thus, on the one hand, the Elephant Marsh hydrological behaviour during the dry season is almost entirely driven by the upstream basin of the Shire River at Kapichira and consequently the main leverage for action to satisfy the minimum environmental flow for Elephant Marsh is the Kamuzu Barrage.

On the other hand, during the wet season, the Elephant Marsh inundation is mainly due to the Shire River but also to the Ruo River that brings more than the quarter of the inflow in the wetlands.

FLOODING

Floods inundate low-lying areas such as Lower Shire Valley and particularly in Chikwawa and Nsanje Districts which are more vulnerable to floods than higher elevated areas.

The places that are more exposed to the flood risk include the floodplains of the Mwanza, Nkombedzi-wa-fodya, Thangadzi West and Lalanje on the west bank of the Shire River and the places close to the confluence of the Ruo and the Shire rivers, especially Sankhulani, Makhanga and Bangula; and low-lying areas along the banks of the Shire River from Chiromo to Nsanje.

Flooding problems in the lower stretches of the Shire River and the Ruo River floodplain (Elephant Marsh) are due to the concomitance of the high-flow periods of both water courses (see previous section). The flood phenomenon is characterized by a slow dynamics with peak flow durations of one to three months.

By inundating 265 km² mainly inside the Elephant marsh and by stranding more than 20,000 people, the floods of January 2015 were the most severe and the more devastating floods in living memory in the Shire Valley. The following figures show the extent of floods.

Figure 18: Aerial View of the Shire River and Ruo at Chiromo Bridge and the Elephant Marsh

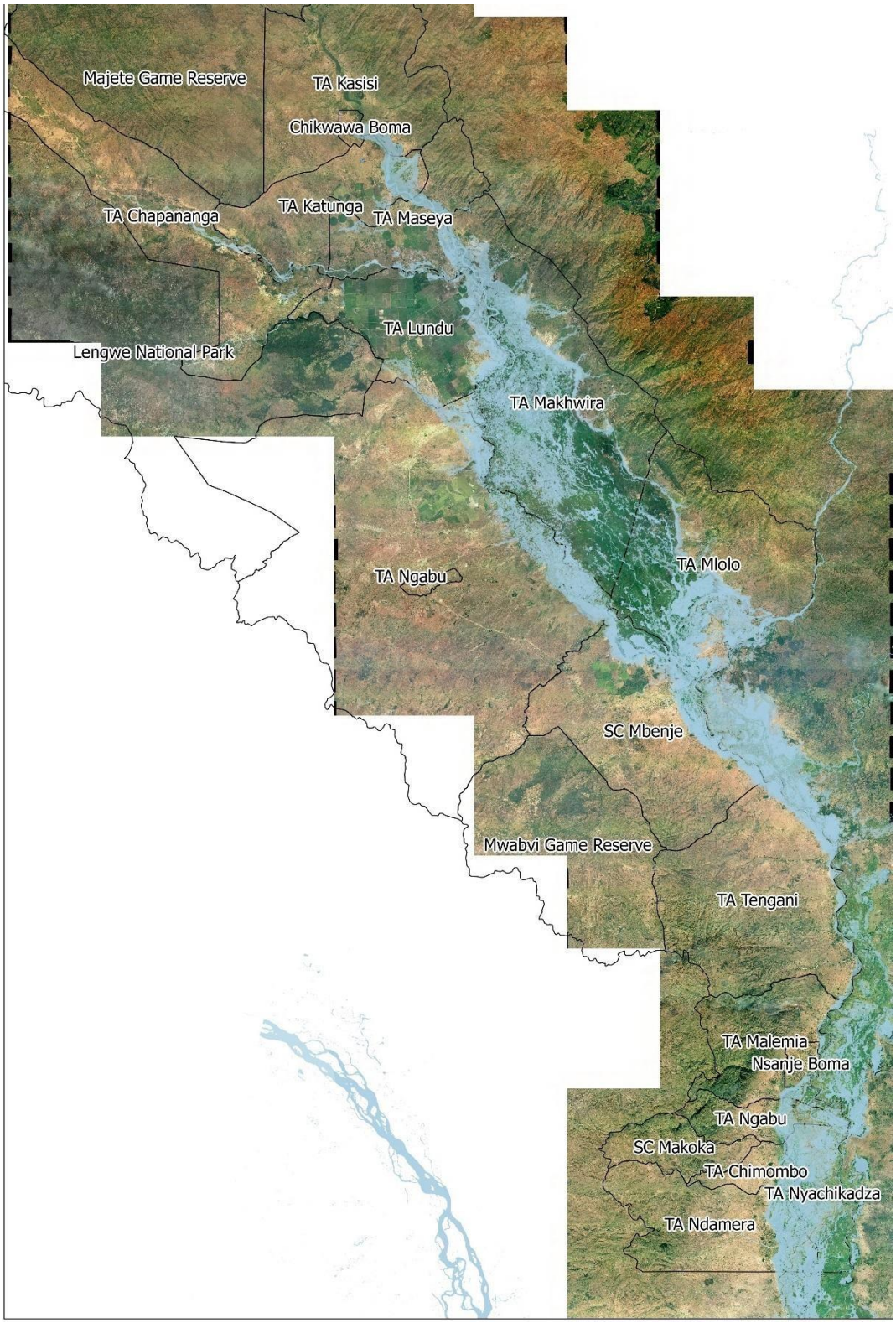


Figure 19: Extent of the January 2015 Flood (in blue, BRLi)

Due to the flow intensity of the Ruo River cascading from the Mulanje Mountain, its inflow in the Shire River is forced back at the confluence of the two rivers. The buildup of water pressure exerts an immense force on the Bangula - Makhanga road embankment, often breaching the road, as it was the case in January 2015.

Flooding problems that occur within the sub-basins of the Lower Shire River tributaries are partly a consequence of sediment deposition in river channels, reservoirs and floodplains, which originate from degraded catchments. As a result, there is substantial loss of arable land and damage to irrigation infrastructure. The flood phenomenon is characterized by fast dynamics with peak flow durations from few hours to few days and it can be described as "flash floods".

The Mwanza River causes flooding over a very wide area, extending to and covering the low-lying areas of the Lengwe National Park, the Illovo Sugar Estates and villages around Tomali, Beleu and others. In less than 24 hours, the flow can pass from zero to more than 100 m^3/s as observed for the flash flood that occurred January 27th 2016 during the baseline mission (Figure 18 and 19).

Figure 20: Mwanza River at the Bridge on the M1 Road

Figure 21: Mwanza River at the M1 Road during flooding

IMPACTS OF CYCLONES AND STORMS

Malawi has been experiencing an increase in impacts arising from cyclones. Due to Cyclone Ana, Malawi experienced heary storms that resulted in extensive flooding of the Shire River Extensive flooding occurred in the Shire occurred on 24 and 25 January 2022 and damaged Kapichira dam and SVTP intake works.

The damages to the main dam embankment (including to the fuse plug) will be addressed under the proposed Malawi: Emergency Power Restoration Project . SVTP has already supported the mobilization of a Panel of Experts (PoE) to advise on measures to repair and ensure future safety of the dam. This PoE will continue under the Emergency Power Restoration Project. To avoid further damage to the main dam until the embankment has been strengthened, the five spillway gates have been brought back to fully operational condition and a cofferdam will be constructed during the 2022 dry season to allow SVTP-1 intake construction to recommence and at the same time protect the damaged section of the main dam embankment, allowing the repairs to be made.

The photo below shows the original state of the intake area before Cyclone Ana”

Figure 22: Original State of the Intake before Cyclone Ana

Whereas the photo below depicts the state of the intake after Cyclone Ana:

Figure 23: State of the Intake after Cyclone Ana

IMPACT OF CLIMATE CHANGE

Climate change can impact the hydrological conditions through changes in precipitation and evapotranspiration. Due to the large surface area of Lake Malawi as

compared to the catchment area, the Shire River is more vulnerable to increased evaporation than most rivers of Malawi.

The IPCC Fifth Assessment Report [4] summarizes the results of 42 different Global Circulation
Models (GCMs) in the regional summary for Africa (IPCC, 2013). Table 13 below and the Figures 13,14,15 and 16 on the next pages shows the changes on an annual basis, + 2.1°C increase in temperature at the horizon 2100 and between -2% and -5% decrease in precipitation.

These simulations are based on the RCP4.5[56] emission scenario characterized by:

- Greenhouse gas emission: medium-low mitigation.
- Agricultural area: very low for both cropland and pasture.
- Air pollution: Medium.

Table 13: Temperature and Precipitation Projections by the CMIP5 Global Models for South Africa Region

RCP4.5			Temperature (°C)					Precipitation (%)				
REGION	MONTH[a]	Year	min	25%	50%	75%	max	min	25%	50%	75%	max
Southern Africa	DJF	2035	0.6	0.7	0.9	1.1	1.3	–11	–4	–2	0	3
		2065	1.0	1.4	1.7	2.0	2.6	–19	–5	–3	–1	4
		2100	1.1	1.8	2.1	2.7	3.3	–19	–7	–3	1	5
	JJA	2035	0.5	0.8	0.9	1.0	1.5	–18	–9	–4	–1	9
		2065	1.1	1.5	1.7	2.0	2.5	–29	–13	–8	–3	4
		2100	1.4	1.8	2.1	2.6	3.3	–29	–18	–9	–3	12
	Annual	2035	0.6	0.8	0.9	1.0	1.4	–13	–5	–2	0	4
		2065	1.1	1.5	1.7	2.1	2.6	–15	–7	–4	–1	4
		2100	1.4	1.8	2.1	2.7	3.3	–20	–7	–5	–1	5

The figures shown are averages over the South Africa region (Seneviratne et al., 2012) of the projections by a set of 42 global models for the RCP4.5 scenario. The area-mean temperature and precipitation responses are first averaged for each model over the 1986–2005 period from the historical simulations and the 2016–2035, 2046–2065 and 2081–2100 periods of the RCP4.5 experiments. Based on the difference between these two periods, the table shows the 25th, 50th and 75th percentiles, and the lowest and highest response among the 42 models, for temperature in degrees Celsius and precipitation as a percent change.

[4] IPCC, 2013: Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

[5] Stabilization without overshoot pathway to 4.5 W/m2 (~650 ppm CO2 eq) at stabilization after 2100 (Clarke et al.
[6] ; Smith and Wigley 2006; Wise et al. 2009) — GCAM

On one hand, the available climate projections for the Shire River basin at the horizon 2100 do not give grounds for changing the average estimates for flow and runoff. This is partly due to the fact that the Shire/Lake Malawi lies in the transition zone between South Africa climatology and East African climatology, and this probably adds a level of uncertainty.

However, on the other hand, it must be expected that the variability (which is already large) increases, and that the extremes (both floods and droughts) will be more pronounced. This variation will be more directly felt in the tributaries since the Lake will act as a buffer for most upstream variations.

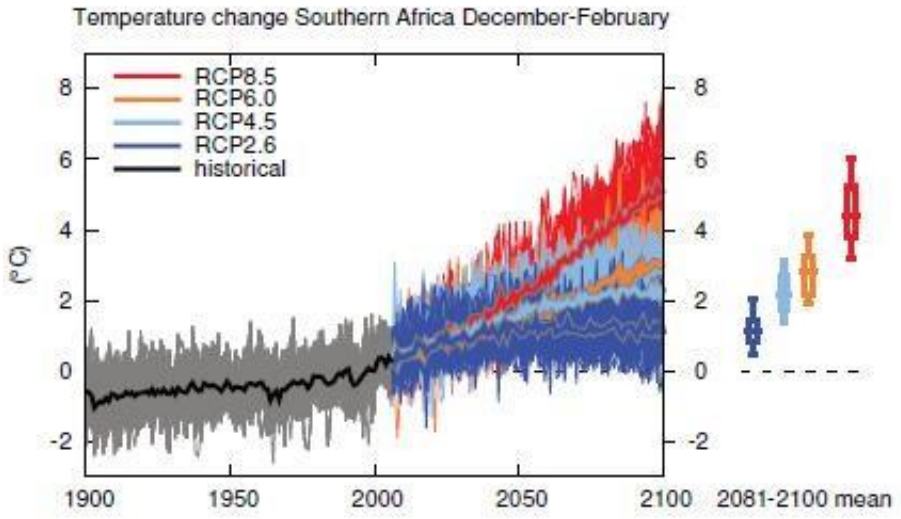


Figure 24: Time Series and Maps of Temperature Change for Southern Africa for December-February

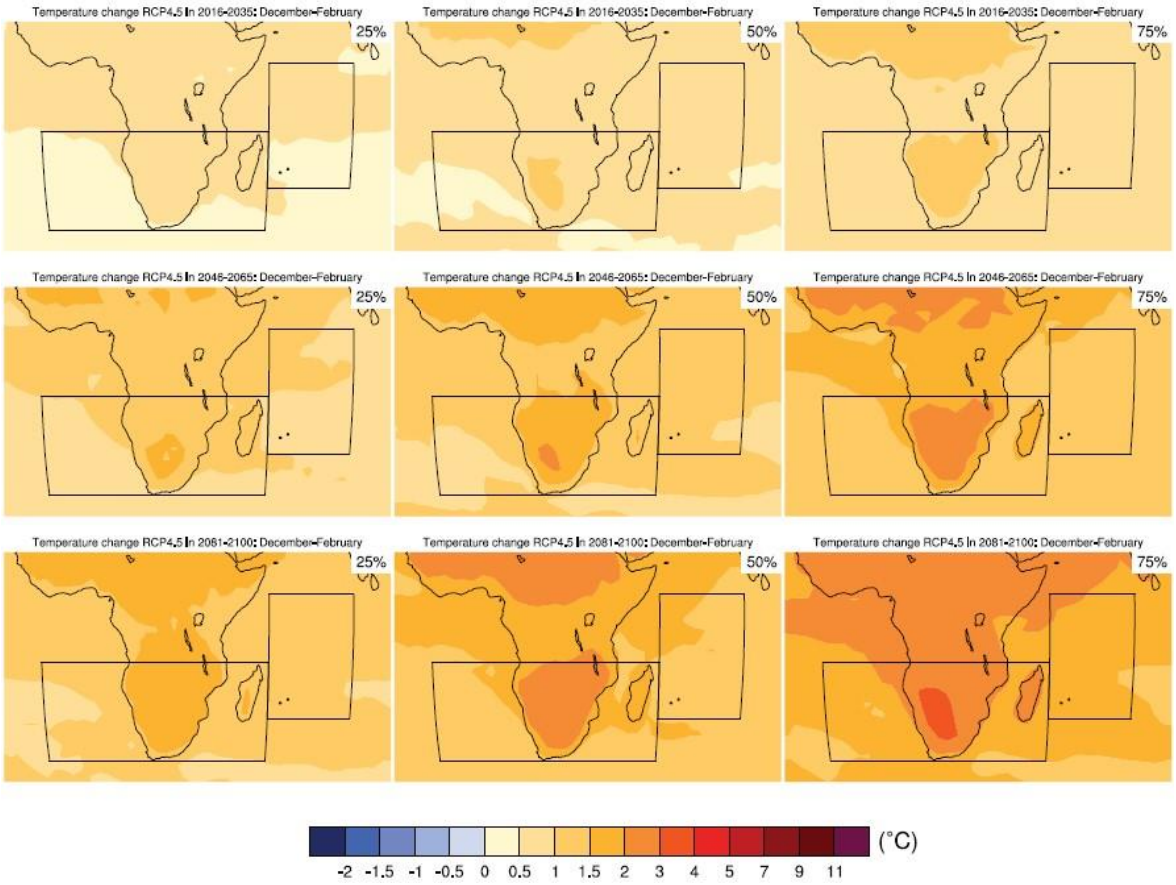


Figure 25: Time Series of temperature Change Relative to 1986 - 2005

(Top left) Time series of temperature change relative to 1986–2005 averaged over land grid points in Southern Africa (35°S to 11.4°S, 10°W to 52°E) in December to February. (Top right) Same for sea grid points in the West Indian Ocean (25°S to 5°N, 52°E to 75°E). Thin lines denote one ensemble member per model, thick lines the CMIP5 multi-model mean. On the right-hand side the 5th, 25th, 50th (median), 75th and 95th percentiles of the distribution of 20-year mean changes are given for 2081–2100 in the four RCP scenarios.

(Below) Maps of temperature changes in 2016–2035, 2046–2065 and 2081–2100 with respect to 1986–2005 in the RCP4.5 scenario. For each point, the 25th, 50th and 75th percentiles of the distribution of the CMIP5 ensemble are shown; this includes both natural variability and inter-model spread. Hatching denotes areas where the 20-year mean differences of the percentiles are less than the standard deviation of model-estimated present-day natural variability of 20-year mean differences.

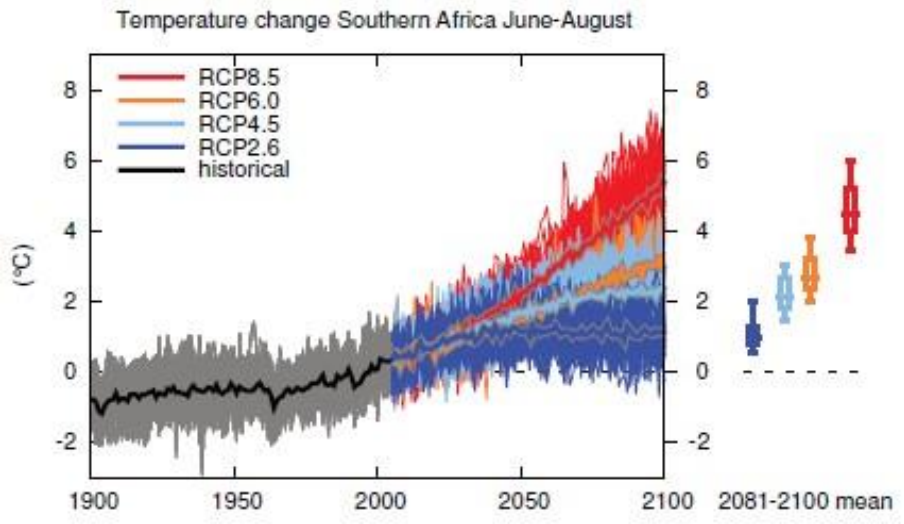


Figure 26: Time Series and Maps of Temperature Change Southern Africa June-August (Source: IPCC, 2013)

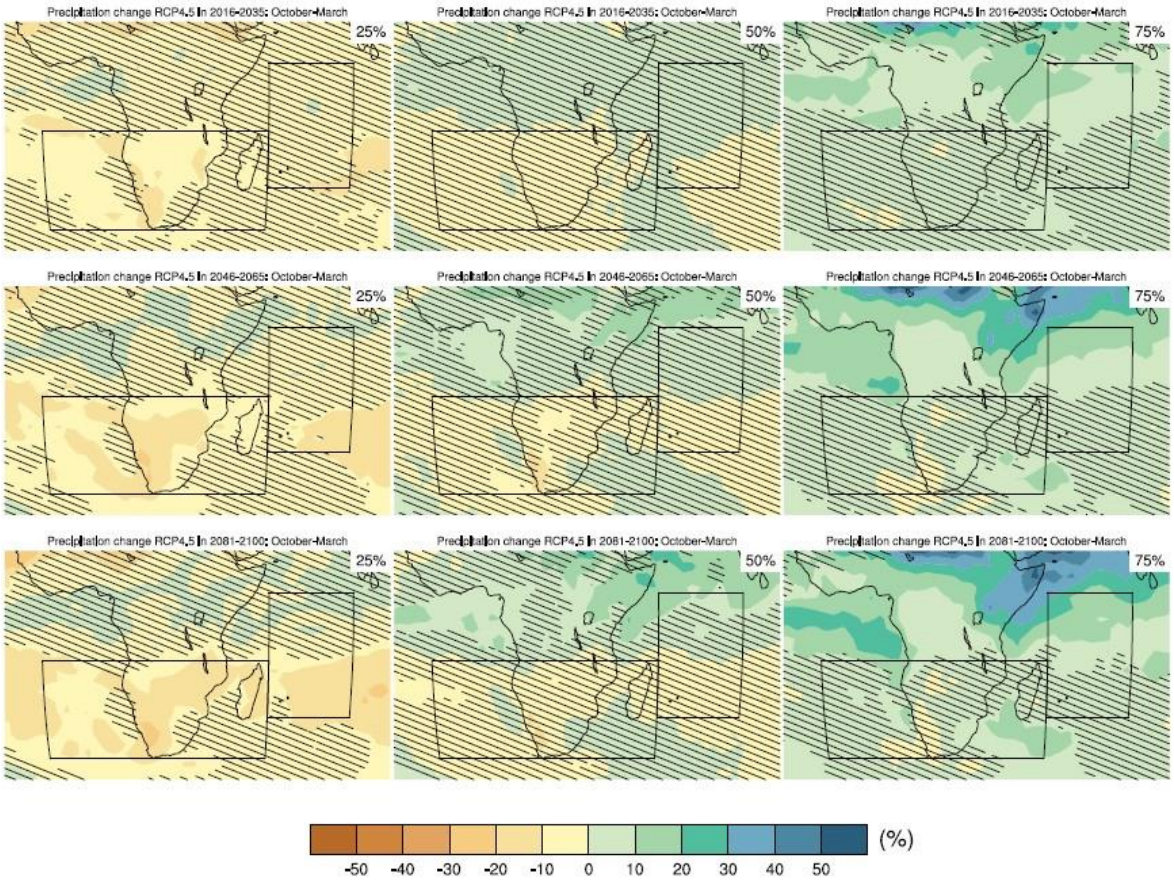


Figure 27: Time series of relative change relative to 1986–2005 in precipitation averaged over land grid points in Southern Africa

(Top left) Time series of relative change relative to 1986–2005 in precipitation averaged over land grid points in Southern Africa (35°S to 11.4°S, 10°W to 52°E) in

October to March. (Top right) Same for sea grid points in the West Indian Ocean (25°S to 5°N, 52°E to 75°E). Thin lines denote one ensemble member per model, thick lines the CMIP5 multi-model mean. On the right-hand side the 5th, 25th, 50th (median), 75th and 95th percentiles of the distribution of 20-year mean changes are given for 2081–2100 in the four RCP scenarios.

(Below) Maps of precipitation changes in 2016–2035, 2046–2065 and 2081–2100 with respect to 1986–2005 in the RCP4.5 scenario. For each point, the 25th, 50th and 75th percentiles of the distribution of the CMIP5 ensemble are shown; this includes both natural variability and inter-model spread. Hatching denotes areas where the 20-year mean differences of the percentiles are less than the standard deviation of model-estimated present-day natural variability of 20-year mean differences.

Source: IPCC, 2013

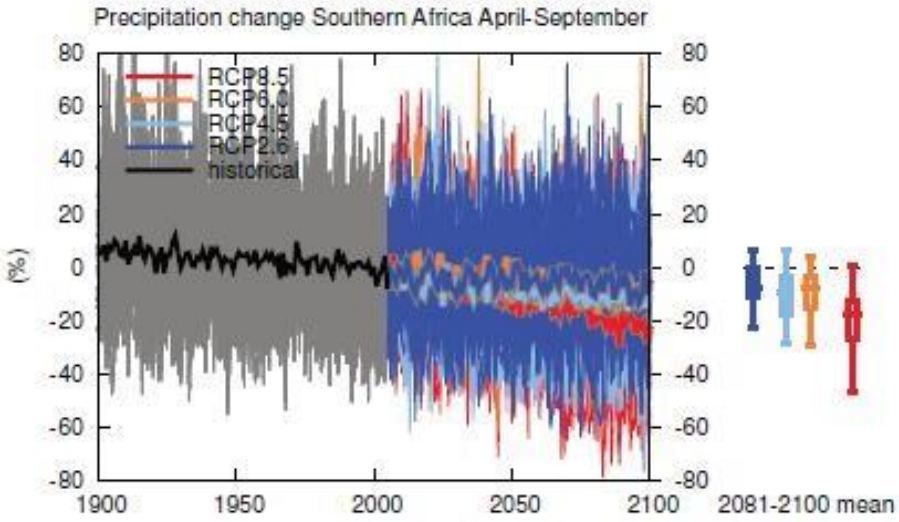


Figure 28: Time Series and Maps of Precipitation Change Southern Africa June-August (Source: IPCC, 2013)

During the preparation of SVTP Phase II, greenhouse gas (GHG) accounting was conducted for the project using EX-ACT model7. The results of the model show that the SVTP can constitute a sizeable net carbon sink of -278,099 tCO2 eq over 20 years, thus −13,905 tCO2 eq annually, due to the introduction of improved crop management practices and technologies. The cropping activities constitute an absolute carbon sink with a carbon balance of -1,040,743 tCO2 eq in the with-project scenario. The increased use of fertilizer and insecticides/herbicides, partially compensated by a reduced use of energy, would lead to an increase of 730,224 tCO_2 eq.

7 http://www.fao.org/tc/exact/ex-act-home/en/.

A detailed analysis of how the results were arrived at is shown in Annex 3.

6.5 SHIRE RIVER WATER QUALITY

Shire River water quality has been dealt with in the following studies:

- Water, Waste & Environment Consultants (2013) Shire River Basin Management Programme (Phase I) Project Final Environmental and Social Assessment Report.
- Atkins (2011) Water Resources Investment Strategy. Component 1 – Water Resources Assessment. Government of the Republic of Malawi.

Unfortunately, in these studies the level of information provided about the sampling methods does not allow to rely on their analysis as explained here below.

According to Atkins (2011), the presence of high levels of Iron (Fe) and Total Suspended Solids (TSS, mainly silt) in the Shire River makes water unsuitable for irrigation due to the risk of damage to equipment by causing clogging and deterioration of equipment or through stimulating algal growth, which in turn clogs valves, pipelines or filtering equipment. The presence of heavy load of silt will also necessitate constant mechanical removal at the water intake. Nitrate and phosphate, common pollutants in agricultural areas, were not identified as key water quality determinands causing poor or unsuitable water. Unfortunately, Atkins (2011) talks about "current water results" in the report but does not provide them.

Water, Waste & Environment Consultants (2013) presents three different water quality results in their report:

- Results for the Shire River from an old study from Saka and Ambali (1999) □
- Results for the Shire River from an old study from Lakudzala et al. (1999).
- Results for Shire tributaries, although nothing is said about the origin of the data (they were collected during the rainy season in 2012).

Some results are shown in the following tables.

Table 14: 1999 water quality for Shire River

Sample location	pH	Phosphates (mg/l)	Nitrates (mg/l)
Chikwawa bridge (Shire River)	7.28	1.12	1.12
Nchalo (Shire River)	7.42	2.94	0.94
Chiromo bridge (Shire River)	7.60	0.55	0.55

Source: adapted from Water, Waste & Environment Consultants (2013) quoted from Saka and Ambali (1999)

Table 15: 1999 Water quality for Shire River

	Parameter (mg/l)				
	Sulfate SO42-	Nitrate NO3-	Phosphate PO43-	Lead (Pb)	Mercury (Hg)
Shire River upstream from confluence with Illovo flood control drain	14.9	<0.01	Not detected	1.0	Not detected
Illovo effluent water on flood control drain	2.7	<0.01	Not detected	Not detected	Not detected
	Parameter (mg/l)				
	Sulfate SO42-	Nitrate NO3-	Phosphate PO43-	Lead (Pb)	Mercury (Hg)
Shire River downstream confluence with Illovo flood control drain	2.7	<0.01	Not detected	0.96	Not detected
Shire River downstream of Illovo	5.4	<0.01	Not detected	Not detected	Not detected

Source: adapted from Water, Waste & Environment Consultants (2013) quoted from Lakudzala et al (1999)

Due to their dates (17 years old), these results cannot be considered reliable anymore.

One time data were also collected at various points in Shire tributaries during the rainy season of 2012. Due to the high flow variability of these tributaries, these data are not ideal for an analysis of water quality. The following table presents the results, it shows that turbidity and total suspended solids have high figures, tributaries can indeed transport large quantities of material during the rainy season.

Table 16: Water quality at some Shire tributaries

Sample	TDS (ppm)	TSS (ppm)	Turbidity (NTU)	Nitrate NO_3 (mg/l)	Phosphate PO_4^{3-}(mg/l)
Mwanza river	44.98	794	253	0.765	10.80
Lower Mwanza river	84.75	2205	2813	2.875	6.87
Likhubula river	158.50	715	101	2.600	1.67
Mkulumadzi river	42.90	1150	895	0.945	1.300
Mkudzi river	155.50	439	242	1.588	3.05
Mwamphanzi river	78.00	630	402	1.625	1.57

Source: adapted from Water, Waste & Environment Consultants (2013)

There are no data for coliforms (fecal and total) although given the high population density, coliforms are a potential issue.

These water quality data have to be compared to water quality standards for aquatic ecosystem. Unfortunately, Malawi does not have any guidelines for water quality for the safeguard of ecosystems. The closest country that has such guidelines is South Africa as shown in table 11 (South Africa Department of Water Affairs and Forestry, 1996). Both Nitrate and Phosphate are important criteria since the area is intensively cultivated. In addition, parameters related to turbidity are also important since the area is subject to flash floods with high loads of sediments. The tributary rivers are Mesotrophic according to Water, Waste & Environment Consultants (2013) results for phosphate and nitrate. Mesotrophic systems are usually productive with a risk of nuisance growth of aquatic plant but low risk of toxic algal blooms. TSS values for tributary rivers are higher than the normal background concentration which also limits suitability of habitats. According to these guidelines, TDS can only be assessed using long term water quality follow-up.

Table 17: South Africa guidelines for aquatic ecosystem

Nitrate NO_3^- (mg/l)	< 0.5 mg/l Oligotrophic conditions	0.5 - 2.5 mg/l Mesotrophic conditions	2.5 - 10 mg/l Eutrophic conditions	> 10 mg/l Hypertrophic conditions
Phosphate PO_4^3(mg/l)	< 5 mg/l Oligotrophic	5 - 25 mg/l Mesotrophic	25 - 250 mg/l Eutrophic	> 250 mg/l Hypertrophic
	conditions	conditions	conditions	conditions
TSS	Background concentration is < 100 mg/l Any increase in TSS concentrations must be limited to < 10 % of the background TSS concentrations at a specific site and time			
TDS	Concentrations should not be changed by > 15 % from the normal cycles of the water body under unimpacted conditions at any time of the year; **and** the amplitude and frequency of natural cycles in TDS concentrations should not be changed.			

Regarding drinking water, Malawi has standards that are close to those from the World Health Organization. Given the baseline situation in the valley with high human pressure on water resources, domestic use standards for surface water are not attainable especially for turbidity, fecal coliform and total coliform, it is therefore not recommended to drink water from any surface water.

The Elephant Marsh General Adaptive Management Plan covering the period 2018-2022 revealed that Elephant Marsh had an average monthly Phosphorus concentration

of between 0.005 and 0.113 mg/l, between 0.1 and 0.28 mg/l of Ammonium and between 0.0075 and 0.36 mg/l of Nitrate. The study further reported that indigenous plants had a total uptake of nitrogen in the order of 475 kg N/ha/yr, while total phosphorus uptake was in the order of 77 kg P/ha/yr.

Table 18: Water Quality at Illovo Discharge Area

SAMPLE	**pH**	**SS mg/L**	**Conductivity (µs/cm^3)**	**TDS**	**BOD mg/L**	**COD mg/L**
Unscreened effluent	5.74	400	610	308	623	651
Inlet dam	5.05	552	520	261	522	577
Outlet dam	5.06	544	517	256	586	598
Dilute effluent to irrigation	6.15	96		212	288	303
Discharge point	6.85	76	765	386	283	298
River water D/S	7.1	20	302	151	162	175
River water U/S	7.03	12	300	149	277	289
MBS (National standards for Drinking water, Boreholes and Shallow wells MS733:2005)	6.0-9.5	-	3500	2000	-	-

Source: MIWD, Central Water Laboratory, 2019

Given inadequacies in surface water quality data, SVTP will conduct a baseline data collection before the first farm blocks receive irrigation water that will form the basis for water quality monitoring.

6.6 GEOLOGY

The Shire River Basin lies entirely within the Great African Rift Valley system and is characterised by a series of major and minor faults. The major faults clearly define the extent of the basin particularly in its northern, eastern and south eastern limits and have therefore been the principal factors defining the geomorphology of the basin. To the north west of the basin, there is a major fault that lies along the foot of the escarpment between the low-lying areas of the basin and the central and northern extent of the Kirk Ranges while to the north east and east, the basin is marked by another major fault that extends from near Makanjira in Mangochi to the southern limits of the Shire Highlands. The third major fault separates the Thyolo Mountains with the Lower Shire Valley in the area generally known as the East Bank.

Chief among the geological formations are alluvials which cover almost the entire area from the basin's northern limits in Mangochi to as far as Matope, with a large central portion consisting of carbonatite and agglomerate vents of the Early Cretaceous to Late Jurassic and

Basement Complex of the Early Palaeozoic to the Precambrian age. Further south below the Mwanza fault and the fault separating the low-lying areas of the Lower Shire Valley and the Shire Highlands, are alluvials and sedimentary rocks and basalts of the Quaternary and Permian ages respectively. These formations extend all the way to Marka and into Mozambique. Between these two sections and essentially covering almost the entire Middle Shire, is an area that traverses latiduninally from Mwanza to the boundary between the Shire Highlands and the Phalombe Plain that is wholly formed of Basement Complex with structural trends and continues in a south-easterly direction into Mozambique across the Ruo basin. Within this belt are found precious (ruby, sapphire) and semi-precious (sodalite, rose quartz) stones as well as kyanite, rare earths, strontianite, marble and limestone.

6.7 SOIL, EROSION, SEDIMENT TRANSPORT AND GEOLOGY

The Lower Shire valley is densely populated with over one million people living in the two most southern districts of Malawi, namely Chikwawa and Nsanje. Chikwawa and Nsanje districts form the Shire Valley Agricultural Development Division (SVADD) covering about 684,000ha. The large population pressure on the area causes severe erosion and degradation of land and water resources. In this context, the ESIA ToRs has requested to provide with a baseline characterization of soil in the Study area. In addition, this section presents the local geology and describes the pattern of erosion and sediment transport.

Soil surveys were already executed during the colonial period. The Atlas of Malawi (1983) shows a soil map based on work from the early 1960's (University of East Anglia, A.Young & P.Brown). The two major soils in the lower part of the Lower Shire Valley are Alluvial Soils and Vertisols (with gleys), being subdivisions of Calcimorphic and Hydromorphic Soils. A different Soil Map of Malawi, however with similar legend approach (based on Young/Brown) was drawn by N.W.Lowole, showing dominant Vertisols around Ngabu, and also further upslope Vertisols associated with coarser gravelly soils.

The Soil Map of the World (FAO-Unesco, 1973) shows prominent units of Vertisols and Eutric Fluvisols (in association with Solonchak) in the Lower Shire valley bottom and Chromic Cambisols in association with Chromic Luvisols on the adjacent lower hill slopes.

The FAO Soil Legend and related Land Evaluation methodology was introduced to Malawi in the 1980's and the country was subsequently systematically mapped using FAO soil classification (Govt. Malawi, 1991).

In 1991, the Government of Malawi produced a map called the "Malawi Soil Classification Map" (Land Resources Department, MoA) using the FAO soil classification.

Several CODA reports (CODA, 2005-2008) contain important soils information, in particular tender documents with soil map (CODA, 2008). These tender documents contain the results of soil surveys done by SOGREAH (1992), an Australian company using 1975 Soil Taxonomy (Soil Survey Staff, 1975, 1987, 1999) for soil classification as well as FAO Guidelines for Soil Description (1977). The area covered is located South of Chikwawa, around Kasinthula, and only forms Zone I-1 of the current Project

(North of Mwanza River, North of Illovo). The soil map is shown in the following Figures 29 and 30.

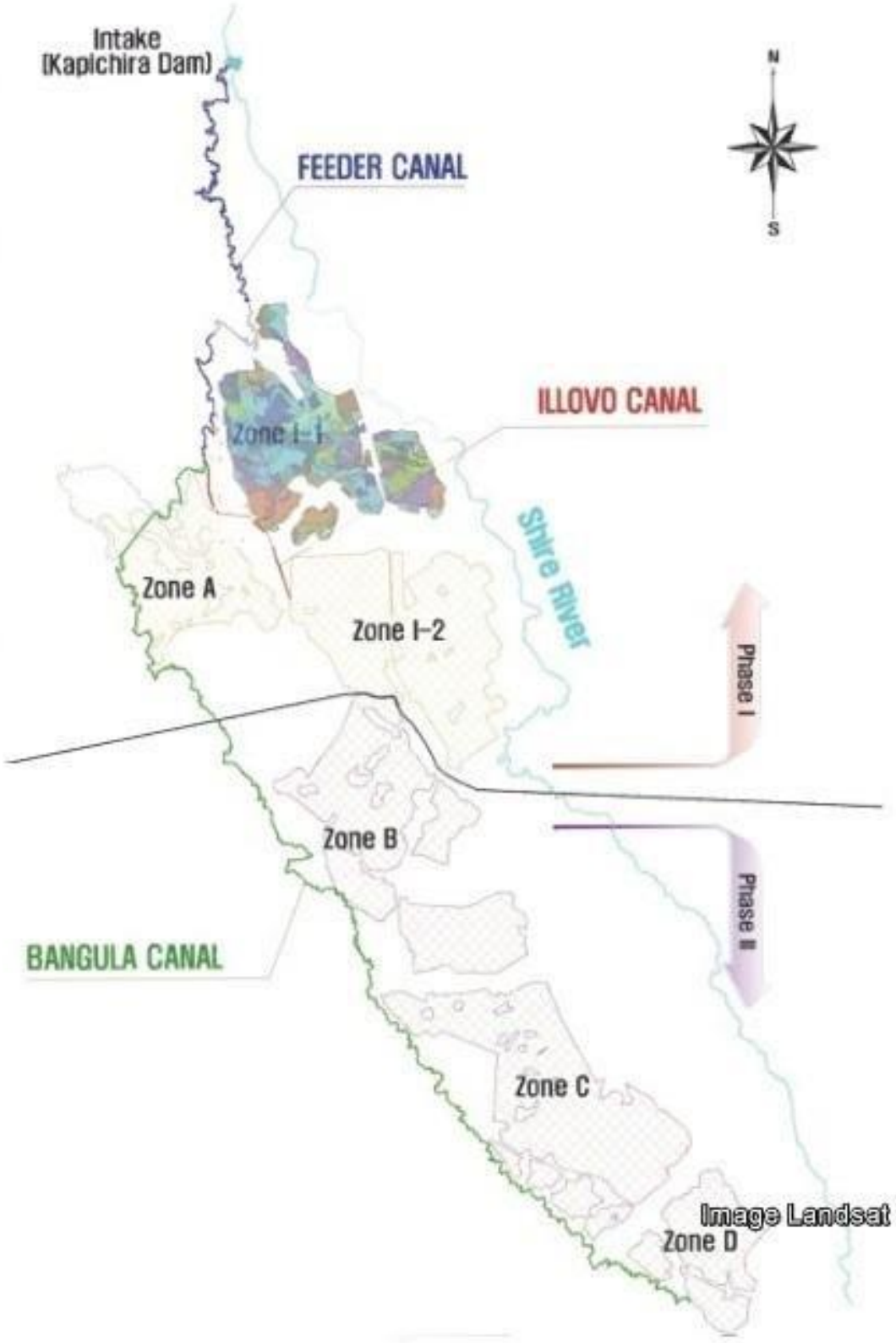


Figure 29: Zone I-1 Soil Map by CODA (2006) overlaid with current project map

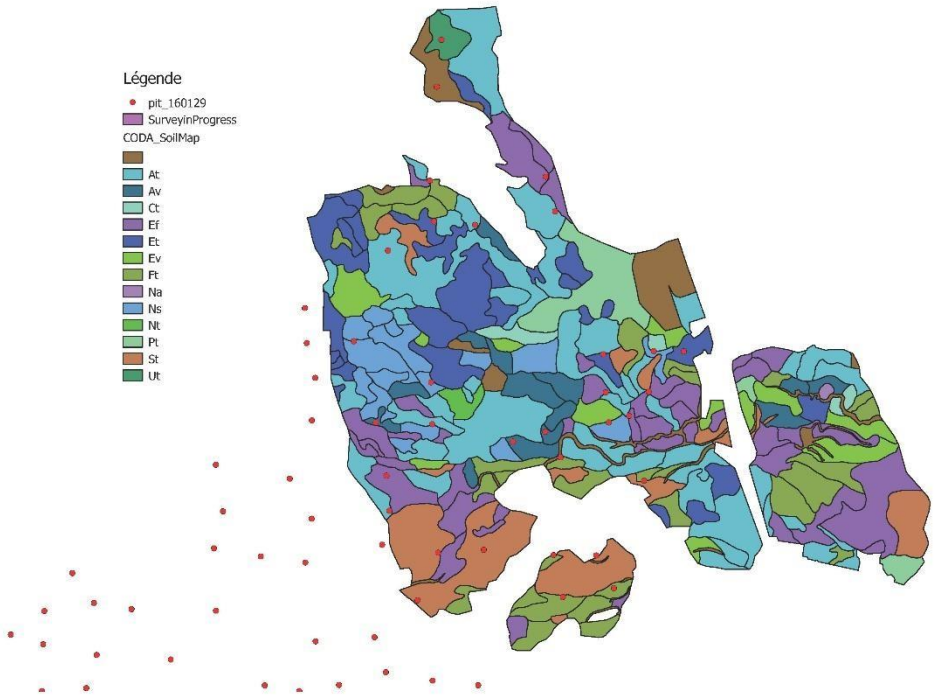


Figure 30: Zone I-1 Soil Map by CODA (2006)

The following table 19 presents the Legend of the Soil Map of the Zone I-1.

Table 19: Soil Map of Zone I-1

Order	Suborder	Great Group	Subgroup	Symbol
Entisol	Fluvent	Ustifluvent	Typic	Ft
	Psamment	Ustispamment	Typic	St
Cambisol	Ochrept	Ustochrept	Typic Fluventic Vertic	Et Ef Ev
Alfisols	Ustalf	Haplustalf	Typic Arenic Vertic	At Ar Av
		Natrustalf	Typic Salorthidic	Nt Ns
Vertisol	Ustert	Chromustert	Typic	Ct
		Pellustert	Typic	Pt

The mapped soil units are linked with physiographic elements, such as three Shire river terraces, alluvium and pediment (see glossary). One would expect different soil patterns over the upper, middle and lower Shire terraces but all three show largely the same soil variety: dominantly Haplustalfs and Ustochrepts with subordinate Ustifluvents. Pediment units have Ustrochrepts as most typical soils. The occurrence of Natrustalfs indicates local presence of soils with high sodium saturation. The dambo west of Kasinthula is the only area where Vertisols were mapped.

Accompanying soil analytical data could not be located; hence a check on classification is not possible. Although the soil map legend presents an interesting approach, clear spatial relationships between physiographic units and soils could not be confirmed.

Another CODA (2006) report (incomplete, without cover page, annexes or maps) entitled "SVTP Soil and Land Survey" presents results of soil investigation carried out in 2005. The report describes and discusses a set of 14 representative soil profiles with analytical data, located in various Project Zones. These profiles are presented as representative soil families and grouped together in main groups, such as fluvic group, salic group and vertic group. Since pit locations are not available, the information remains general. The report describes the overall variation of soils in the Lower Shire valley as deep, medium to fine textured, brown to very dark-grey in colour, and well to very poorly drained. Soils in the uplands and hills are predominantly moderately deep, medium textured, well-drained and yellowish brown (FAO: Cambisols and Luvisols). Slightly saline soils occur mostly in lower positions and depressions; otherwise soils have a slightly acidic to neutral reaction and show a deficiency in phosphor and nitrogen. The soils in the floodplains are predominantly deep medium to fine textured with variable drainage and are classified Fluvisols, Cambisols, Vertisols and Gleysols (FAO). The analyzed soil profiles do not yield alarming data in terms of salinity or alkalinity; included are three clayey profiles (50-60% clay), probably Vertisols, ph <7.5 (very slightly alkaline). This CODA (2006) report also presents results of Land Evaluation following FAO methodology.

Illovo has established an impressive soil database (Illovo, 2015). The information received includes:

- a summary report with management recommendations based on the results of soil survey and analysis (2013-15) covering the various Illovo Nchalo estates; and
- an excel file with results of soil chemical analysis of a large number of samples from soil profiles (same survey). Illovo soil maps were not made available. Illovo uses the South African Soil Classification (SA Soil Classification Working Group, 1991) which may not always be the most appropriate to define soils in other countries.

Correlation with the World Reference Base (WRB) is made, but not in any detail and the correlation contains unfortunate errors and irregularities. This is largely a result of different WRB and SA approaches in defining and interpreting diagnostic criteria especially the ones related to structure and wetness, and also horizons as argic, cambic and vertic; WRB Nitisols, Albeluvisols and Ferralsols are incorrectly interpreted and out of the question in these alluvial soils; many Arenosols do not fit textural requirements; Luvisols should not be correlated with duplex soils). However, the overall data provide important information on the status of soils and their general distribution over the various

Nchalo Estates, and hence also of the defined Phases and Zones of the Shire Valley Irrigation Project.

Illovo (2015) makes three main groups of soils (all soil profiles are described as having alluvium/colluvium parent material):

1. Well drained youthful soils (Cambisols, soil association A) constituting 59% of Estates
2. Black cracking clays (Vertisols, soil association H) comprising 22% of Estates
3. Duplex soils (Luvisols, soil association C) comprising 6% of Estates

The remaining 13% covers a variety of other soils and associations, including Calcisols, Nitisols, Gleysols, and Arenosols.

The above group percentages are weighted averages; the variability over the various estates is very large. For instance, the percentage of Vertisols over the estates is as follows: 5-10% in Nchalo, Kaombe and Kando, 39% in Kasinthula and 76% in Alumenda. 60% of Alumenda. Vertisols have a high water table with gley within 90cm, 17% have an Exchangeable Sodium Percentage (ESP) of >15, however very few profiles qualify as sodic (ESP>15). Clay contents are mostly around 50% and pH averages around 8.5 which is a common value for calcareous Vertisols in poorly drained positions. Salinity is normally low, well under level required for qualification of a salic horizon. Vertisols in estates other than Alumenda have generally somewhat lower pH and ESP values. Vertisols are reported to occur on older terrace deposits South West of Alumenda but also extensively on the lower part of the plain near Alumenda in seasonally or permanently wet areas particularly towards Elephant marsh or dambo area.

The younger and mostly weakly developed soils such as Cambisols, Arenosols and Gleysols exhibit little profile differentiation and their chemical data do not vary much (see Illovo, 2015). Other moderately developed soils are also reported, such as Luvisols, Nitisols and Calcisols. Some of these soils are highly calcareous soils (Calcisols). Salinity levels diagnostic for a salic horizon were not recorded; apart from one or two profiles the measured Electric Conductivity (EC) remained far from critical EC values. Some soils (Cambisols, Vertisols, Calcisols) may have relatively high sodium levels (ESP>10 and some with ESP>15), and could have developed a natric horizon and classify as Solonetz. However, required other characteristics for a natric (evidence of clay translocation and clay enrichment in B horizon or structure) were not evident from data and descriptions. Although there is no clear evidence of sodic soils (Solonetz), sodicity or alkalinity should always be closely monitored.

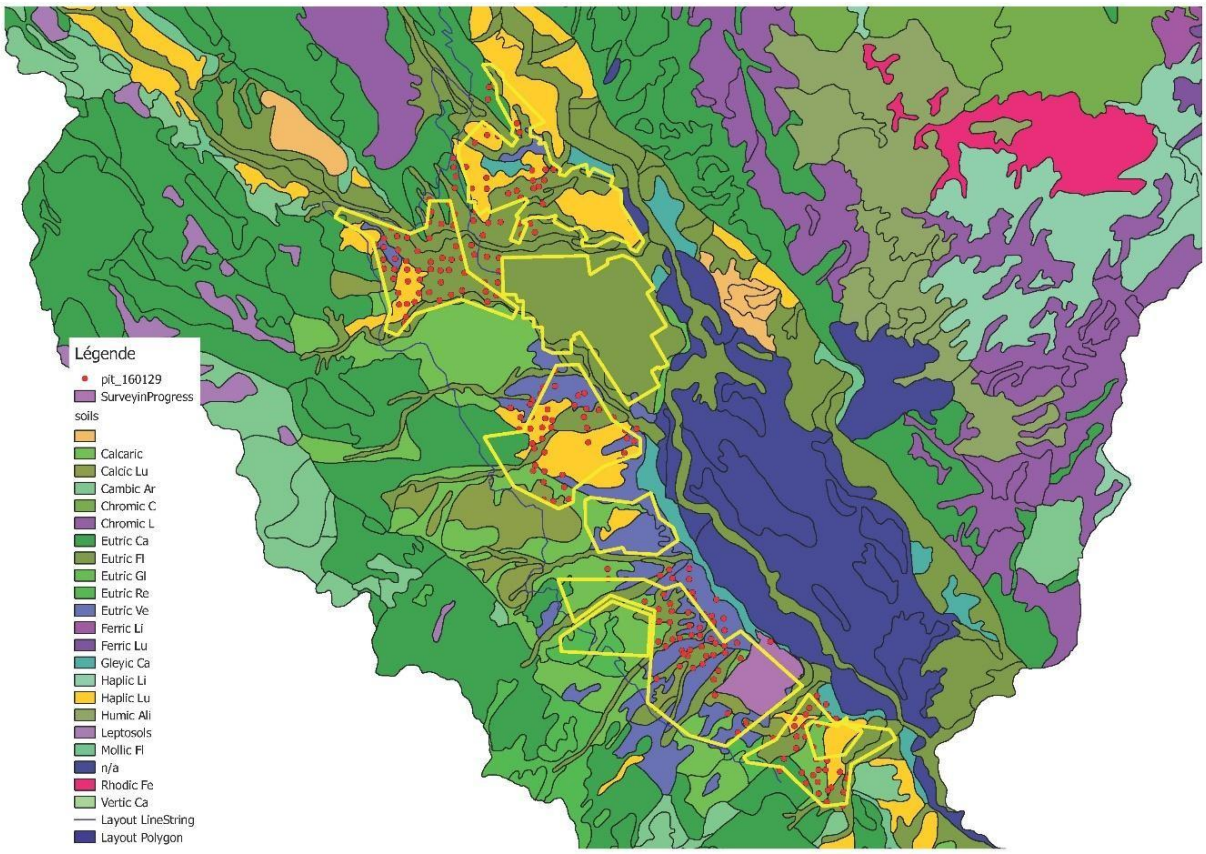


Figure 31: Soil map used by KRC (based on FAO classification)

The map below shows an already existing soil pattern with notes on areas still under survey or completed by Illovo.

The soil expert of the 2017 ESIA consultant estimated the surface of heavy Verstisol to be 4000 ha based on information available and a reconnaissance survey. It was the consultant's opinion that the occurrence of Vertisols in Areas B and C was underestimated in earlier surveys and recommended htat Vertisols need special management or in cases cannot be used. In area C, the occurrence of heavy Vertisols was shown by the Shire Valley ADD Chief Land Resources Conservation Officer in the currently abandoned research area at Ngabu. In Area B, at least two locations of strongly developed Vertisols were shown by Korea Rural Corporation Soils Specialist. KRC subsequently mapped identified Vertisols and during detailed design special measures will be developed for these areas or they will be included in set-aside lands.

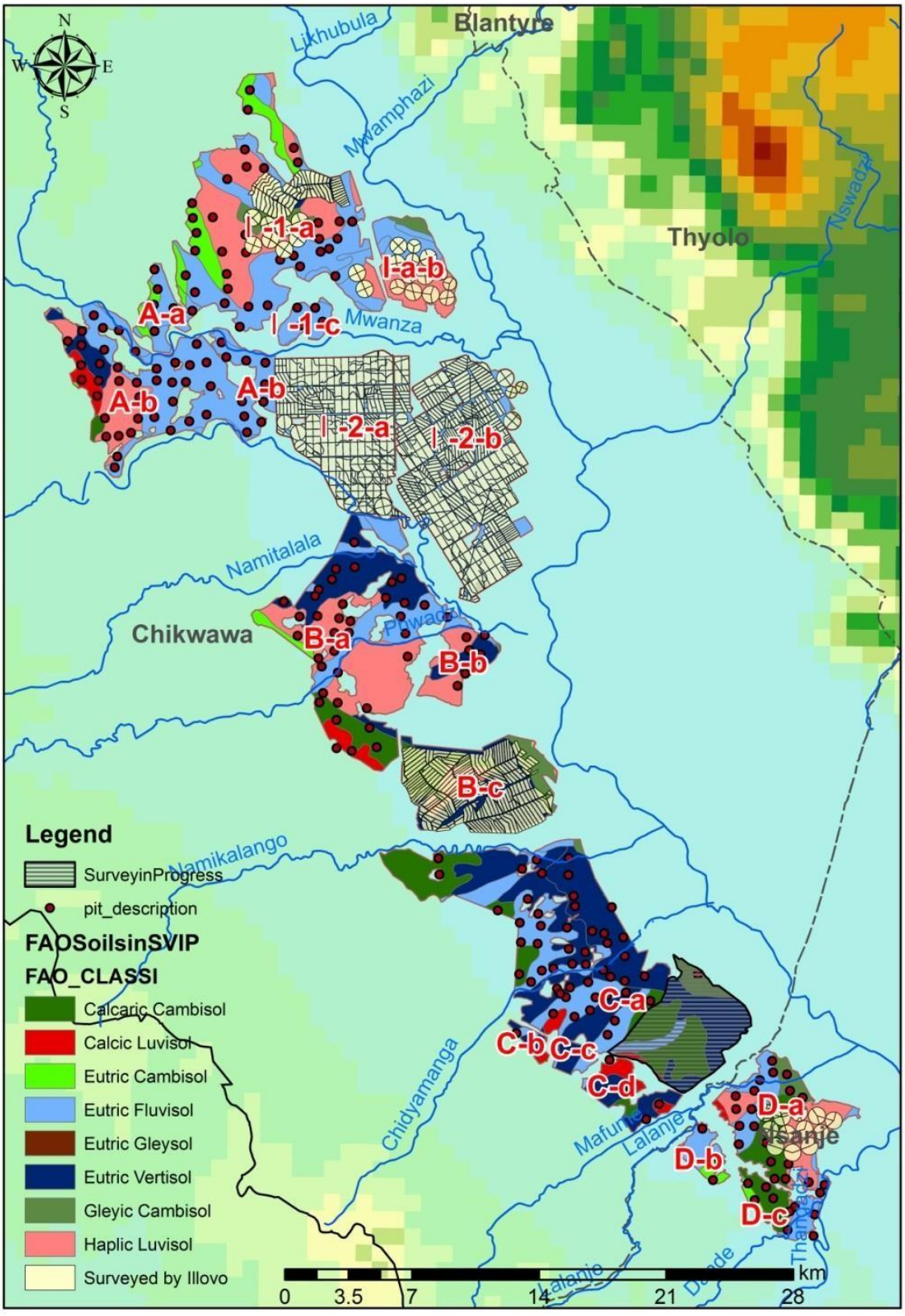


Figure 32: Soil map used by KRC (Source: FAO. 2006. AQUASTAT Country Profile – Malawi.)

6.7 AQUIFER AND GROUNDWATER

The main aquifer units in the Study area in order of increasing importance as groundwater resources, are:

- the weathered and/or fractured basement rocks;
- Karoo and Cretaceous sedimentary rocks;
- weathered and/or fractured basalts faults; and
- the unconsolidated alluvial deposits.

In the Study area geological structures such as faults, folds and fractures provide flow-paths for migration of underlying or adjacent under pressure saline groundwater within the aquifer system which causes groundwater to be brackish or saline in most areas (Monjerezi et al., 2011, 2012 and 2012a). The following figure shows the main faults of the Study area.

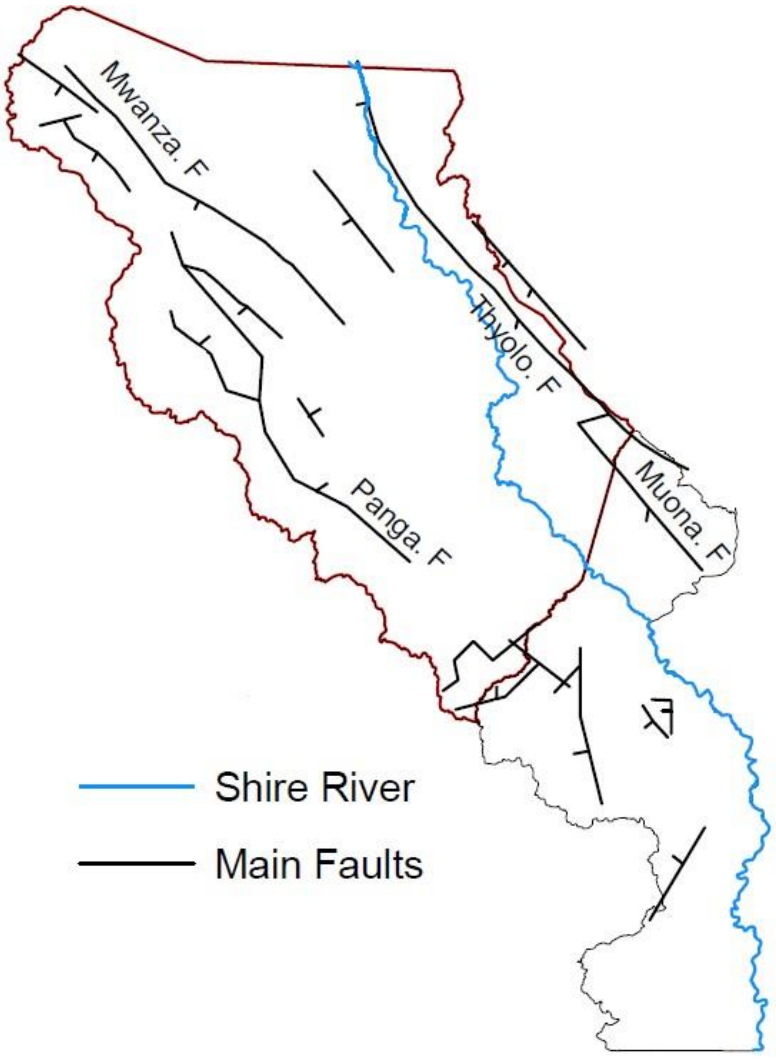


Figure 33: Main faults in the Study area (Source: Adapted from Monjerezi, 2012)

Monjerezi et al. (2011) have sampled groundwater in 247 boreholes in Chikwawa district. The results of chemical analyses and field measurements have revealed that Electric Conductivity (EC) varied considerably from 35 to 36,000 µS cm-1, and correspondingly Total Dissolved Solids ranged from 16 to 26,539 mg L-1. These two measurements are used to detect salinity in water. Based on these data, the vast majority (91%) of groundwater sampled is classified as brackish and 5% as saline. WHO guidelines for Na, Cl-, SO^{2-}_4 and Mg in drinking water (WHO, 2004) were respectively exceeded in 42%, 29%, 15% and 35% of all groundwater samples (Monjerezi et al., 2011). In addition, Barium, Boron, Chromium and Lead had concentrations exceeding WHO drinking water guidelines in 6.5%, 9.7%, 16.1% and 64.5% of all samples respectively; these toxic metals were influenced by saline content of water (Monjerezi et al., 2012a). These sampled groundwater are used by local communities as drinking water supply (there are about 305 boreholes in the district of Chikwawa and many temporary hand dug wells).

In general, the salinity in groundwater increases gradually as it flows towards Shire River. In the region, there is a spatial variation in groundwater salinity with extreme gradients in chemical composition over short distances; however there is not a significant variation with depth of groundwater (Monjerezi et al., 2011).

The high salinity close to the Shire River indicates that the river is not significantly influent to the underlying water table, suggesting a negligible or very slow movement of water from the river into the aquifer. Saline soils are found in some zones along the Elephant marsh on the Western bank (Monjerezi et al., 2011) which is caused by evaporation of brackish and saline shallow groundwater along the Mwanza Fault. The Karoo rocks are dissected by faults which are also responsible for intrusion of mineralized groundwater and soil salinization (Monjerezi et al., 2012).

The following figure shows spatial distribution of water salinity (EC in µs/cm) in relation with geological faults (Shire River is shown in the center as well as Illovo estate).

Irrigation using water brackish or saline water results in a fertility decrease of the irrigated soil.

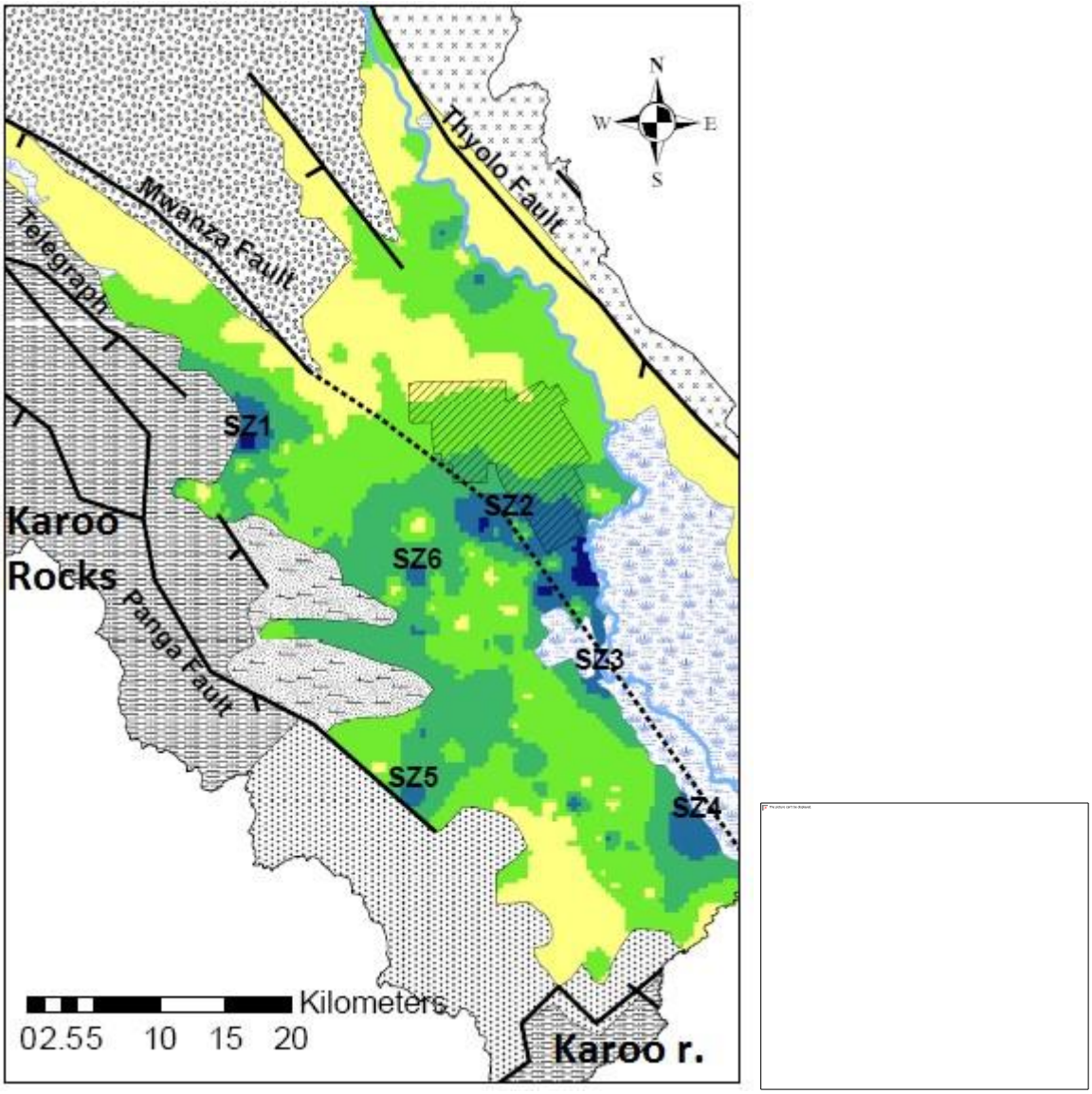


Figure 34: Electrical Conductivity (EC) of groundwater (Source: Adapted from Monjerezi et al. (2012))

6.8 NATURAL HERITAGE

This section presents various natural sites of particular landscape value and with unique natural features in the Study area.

In the Study area, three parks are gazetted, they are legally protected areas:

- Lengwe National Park;
- Majete Wildlife Reserve (formally called Majete Game Reserve);
- Mwabvi Wildlife Reserve.
- Matandwe Forest Reserve

In addition to their role as biodiversity reserve, these parks and reserves are important landscape features since they represent the last natural forested areas in the valley.

Although Elephant marsh is not gazetted under national law, it has been designated a Ramsar Site and is considered a Internationally Recognised site, for its important size and its location in the center of the valley. Elephant marsh was gazetted as a game reserve in 1897 and degazzetted in 1922 (Dudley, 1997).

To accord with the ESF (ESS6), where projects affect an area that is legally protected or internationally recognised, the World Bank requires that any activities undertaken are consistent with the legal protection status and the management objectives. Mitigation should be applied so as not to compromise the integrity, conservation objectives or biodiversity importance of the areas.

Figure 35 shows the locations of the National Parks, Wildlife Reserves, Forest Reserves and Elephant Marsh Ramsar Site within the Study area.

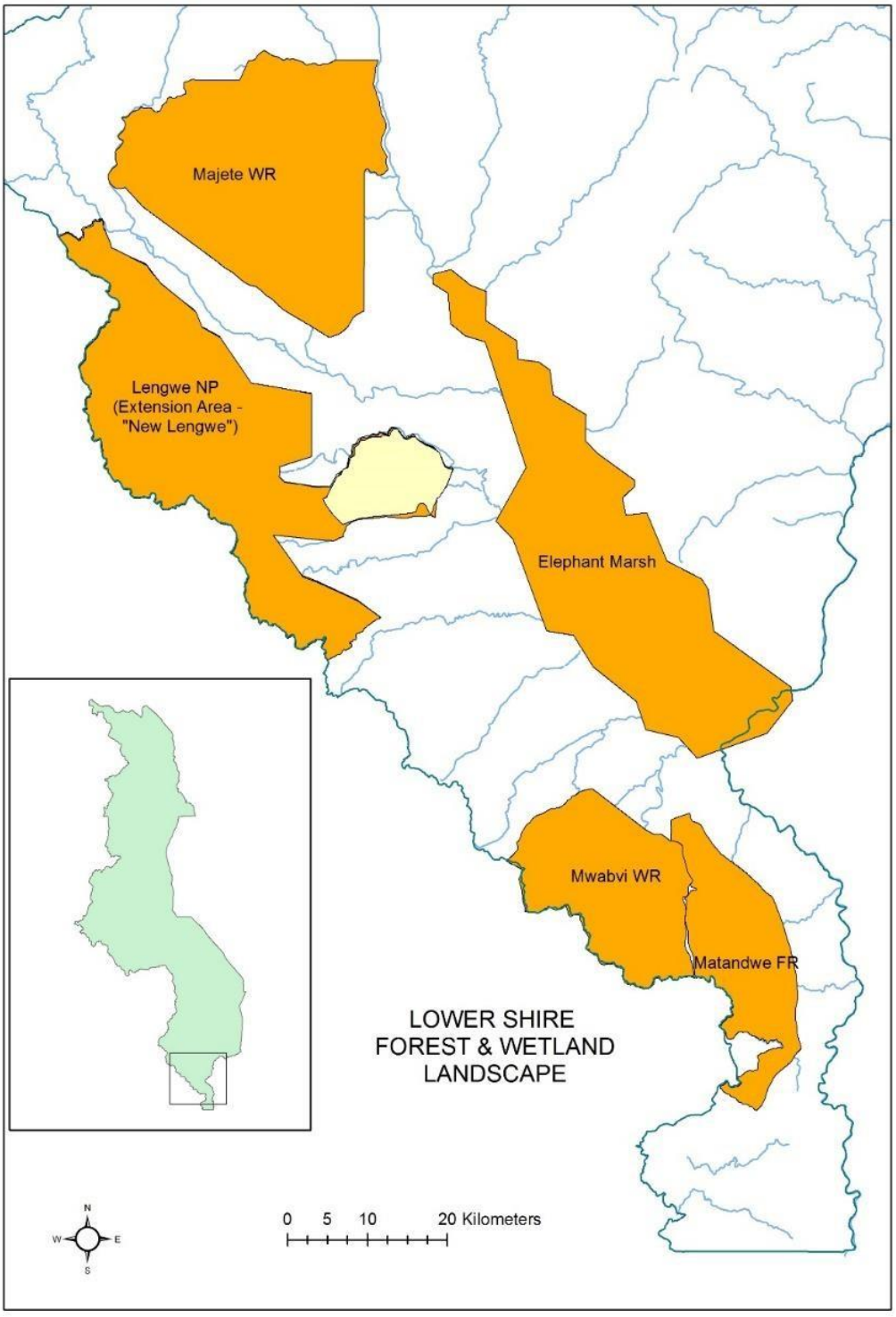


Figure 35: National Parks, Wildlife Reserves, Forest Reserves and Elephant Marsh Ramsar Site in the study area

6.8.1 MAJETE WILDLIFE RESERVE

6.8.1.1 Status of the Reserve

Majete was established as a game reserve in 1955.

Majete is a reserve under the National Parks and Wildlife Act (2017) and its boundaries are gazetted under the Government Notice No. 146 of 1976. It covers an area of 689 km^2.

The Park has been managed by African Parks since 2003. Since then, the number of tourists has significantly increased to 6000 (in 2012), 8000 (in 2015) and 11,000 (in 2019) according to Park management (personal communication). Majete is the main touristic attraction in the Lower Shire Valley.

Prior to 2003, only a few Antelope remained in Majete Wildlife Reserve due to hunting, and the forest was denuded for firewood/charcoal. African Parks fenced the park, employed more scouts, enguaged, established initiatives to support local communities, and started reintroducing animals. Elephants, lions, giraffes, cheetahs, rhino, buffalo, warthog, and in 2021 wild dogs have all been subsequently reintroduced and today the park supports more than 5000 animals of 16 species and acts as a source of animals for reintroduction for other reserves. The reserve supports approximately 300 species of bird, including four species of vulture.

AS described in ESF ESS6, the reserve comprises natural habitat, and as a result of the successful reintroduction of viable populations of a number of species listed on IUCN Red List as Critically Endangered or Endangered, it is also would be considered Critical Habitat. However, the works being undertaken through Majete Wildlife Reserve are being undertaken in according to the World Banks Safeguard Policies, and an extensive programme of mitigation and compensation measures have been agreed and are being implemented as part of SVTP-I.

6.8.1.2 Main Landscape Features

Prior to its management transfer to African Parks, Kapichira falls was the reserves main touristic attraction, particularly in the rainy season (ULG Northampton-Price Waterhouse consultants, 2000).

African Parks now manage the reserve as five zones.

- Mkulumadzi Concession Zone: this zone is an exclusive tourism area with a high-end lodge in the Mkulumadzi catchment;
- High Intensity Tourism Zone: Thawale lodge and a camp site are located in this zone, a road network is in place that allows access from Thawale and the camp site to game viewing activities. Most trails are located in this zone. The topography is largely flat and gently sloping toward the River. Kapichira falls are located in this area, it is the only place of this zone with small rocky cliffs.
- Low Intensity Tourism Zone: is zoned for low impact and low density tourism activities, water distribution and vegetation types result in low densities of animals it is therefore less suited for game viewing. This zone is kept free of permanent structures. It has a more pronounced topography. The Shire shoreline in this part of the Park is flat and sandy.

- Resource Use Zone: the Resource Use Zone is zoned for multiple consumptive resource use which includes collection of natural resources on an organised basis by registered community members such as thatching grass, reeds and bamboo.
- Utility Zone: is where the headquarter and offices are located (Mathithi headquarters).

The intake and the first 6km of the irrigation canal pass through or close to Majete Wildlife Reserve. The main terrestrial habitats found along the canal alignment are "Riverine and Alluvial Associations" and "Low Altitude Mixed Tall Deciduous Woodland". According to Sherry (1989, quoted by ULG Northampton-Price Waterhouse consultants, 2005), these habitat are dominated by the following plant species.

- Riverine and Alluvial Associations:
  - Trees : *Acacia tortilis*, *Acacia galpinii*, *Breonadia microcephala*, *Cordyla africana*, *Kigelia africana*, *Lonchocarpus capassa*, *Sterculia appendiculata* and *Hyphaene benguellensis*
  - Shrubs: *Allophylus sp*., *Cardiogyne africana*, *Combretum mossambicensis*, *C. paniculatum*, *Dalbergia arbutifolia* and *Grewia sp*.
  - Grasses : *Cynodon*, *Digitaria*, *Leptochloa*, *Panicum*, *Phragmites* and *Urochloa*
- Low Altitude Mixed Tall Deciduous Woodland are Widespread in the river valleys of the lowerlying eastern area.
  - Trees : *Adansonia digitata*, *Acacia nigrescens*, *Combretum imberbe*, *Sclerocarya caffra*, *Sterculia quinqueloba*, *Terminalia sericea* and *Xeroderris stuhlmannii*.
  - Shrubs : *Combretum mossambicensis* and *Grewia spp*.
  - Grasses : *Digitaria*, *Heteropogon* and *Urochloa*

The following picture shows the area that has been crossed by the feeder canal (taken from the fuse dike).

Figure 36: Majete at Feeder canal location (Source: BRLi (2015))

Figure 37: Kapichira falls and Shire River from Majete

6.8.1.3 Current threats and challenges

Since the park is managed by African Parks, the past threats that were related to poaching and illegal timber extraction are no longer issues. According to the Park Draft Business Plan 2015, the current challenges are coming from increasing pressure from high density population in surrounding communities. These communities have grievances in terms of benefits sharing and resources extraction that could lead to potential human wildlife conflicts and representing a poaching potential around the reserve. The park is also facing challenges that related to soil erosion (around water pond and fences) and to the constant maintenance of the 142 km of electrical fence.

Figure 52 shows the deforestation around the park. Forests are in green while deforested areas are in pink.

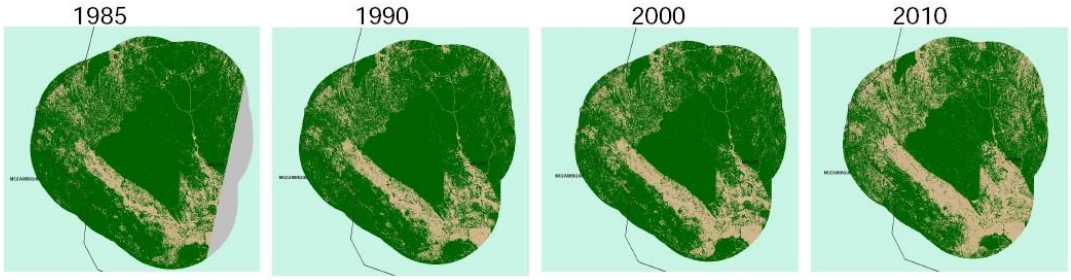


Figure 38:Changes in Forest Cover (Source: GeoterraImage, 2012)

Other challenges come from the fact that the reserve is completely fenced, severing large animal movement, creating a closed ecological system. There is no culling to regulate population, but some animals are translocated to other sites (sable, waterbuck, kudu, eland and zebra are translocated to other parks in Malawi). In 2017, 200 elephant were translocated to Nkhotakota.

HUMAN WILDLIFE CONFLICT

There is no human wildlife conflict since the park is fenced. However with the development of irrigated agriculture in the vicinity of the reserve, human wildlife conflcts could arise.

ECOLOGICAL CONTINUITY

The reserve is fenced therefore they are no movement of large mammals outside of the reserve. Inside the Park, movement of large mammals is dictated by several factors, water availability being an important one especially in the dry season. The largest water body is the Shire River with the Kapichira reservoir attracting many species. In addition, Mkurumadzi River in the Northern part of the reserve is also a perennial river. There are 13 springs and pools and 8 artificial water points (AWP) as shown in the Zoning map.

6.8.1.4 Management Objectives

The document called “Majete Wildlife Reserve, 5 years Business Plan 2015-2019” is intended to guide the management of MWR and to implement strategies. It defines the reserve’s objectives and goals. The plan priotises enhancement of biodiversity conservation and restocking of game, financial sustainability through enhanced tourism, community engagement and environmental education.

Implementation of SVTP during the Intake + 6 kilometres canal, has offered good lessons. With good planning African Parks have guided the contractor through construction works in the park, alternate water sources for game have been provided hence reducing human wildlife conflicts, upgraded tourism facilities and ranger accommodation have been put in place. It has been established that restoration activities along the canal alignment will require more

time that will transcend Phase – I and more resources should be availed. In the long tern, measures require support that enhance tourism and financial sustainability of Majete.

6.8.2 LENGWE NATIONAL PARK

6.8.2.1 Status of the Park

The park was established as a game reserve in 1928 and declared a national park in 1970. It was recognized as one of the two only places in British Colonial Africa were Nyala antelope occurred. In 1928 its size was 520 km^2. In 1975, it was extended to its actual size (UICN/UNEP Directory of Afrotropical Protected Areas, 1987) and re-declared a National Park by Establishment (Amendment) Order 1975, dated 26 August 1975, and published as Government Notice No.149 of 1975 (LNP Park Plan, 2005). The original park covered the area called the "Old Lengwe" also called the Eastern Salient while the extension called the "Uplands Unit" covers the border with Mozambique and reach North as far as the Mwanza River.

The actual size of the LNP is 887 km^2. The park is managed by the DNPW. In 2000, the number of paying visitors in the park was only 584 (LNP Park Plan, 2005). In 2015, the number of paying visitors had remained steady at 556 (LNP, General Management Plan 2016-2020, 2015).

Tourism revenue levels remain low in the park due as there is no concession fee that is supposed to be collected from the tour operator in normal circumstances, and a general decline for tourism at Lengwe and has been contributed by following factors:

- Low wildlife diversity and numbers that makes Lengwe less attractive than adjacent African Park's Majete
- Low infrastructure standards especially roads (plus bridges) that affect accessibility for game drives
- The covid 19 pandemic that has greatly affected 2020 visits such that DNPW granted a waiver for overnight visitors to Nyala Lodge

The majority of Lengwe National Park comprises Natural Habitat (as defined in ESS6), although where anthropegenic activities (including cattle grazing) has occurred, some areas of modified habitat are appearing. There is one area of habitat that is considered to be Critical Habitat according to the definition in ESS6 of the World Bank Environmental and Social Framework (ESF) and Operational safeguard 3 (OS 3) of the African Development Bank Integrated Safeguards Sytem, due to it being a habitat that is of significant importance due to the endemic and restricted-range population of Nyala that it supports. This is the area of the Thicket within Old Lengwe.

Table 20: Revenue Generation in Lengwe National Park (Source: DNPW)

Category	2016	2017	2018	2019	2020
Number of Visitors	759	775	404	296	94
Personal Entry Fee	1,211,890	1,426,985.00	694,465	722,650	358,080
Vehicle Entry Fee	550,900	610,060.00	475,405	290,150	171,550
Guide Fee	13,900	6,950.00	27,800	22,500	15,000
Total (MMK)	**1,776,690**	**2,043,995**	**1,197,670**	**1,035,300**	**544,630**
Total (US$)	**2,238**	**2,574**	**1,507**	**1,302**	**685**

5.8.2.2 Main Landscape Features

Old Lengwe, where the canal will pass, is the best preserved area of the Park and is dominated by tree savanna and thickets of high ecological value because it is one of the last remaining habitat of the Nyala. The topography is rather flat varying from 60 to 150 masl. The Wester part of the LNP, called the Uplands Unit, is gently undulating to about 300 masl with a few hills close to 400 masl.

Touristic and management infrastructures are located in the Eastern end of the park close to the park entrance gate (in the Old Lengwe). Nyala lodge has accommodation for tourists. Most trails are located in the Old Lengwe.

The park is divided into zones for management purposes, see figure 7:

- The Uplands Unit should be designated as “Wilderness Areas” with the development of base camps the only permitted infrastructures.
- “Semi-Wilderness Areas” with two sub zones:

- The "Central Wild Area", which is the main part of the Old Lengwe with the actual road network and the Nyala Lodge, used for wildlife viewing from vehicles and hides. It includes the thicket forest vegetation.
- The "Outer Wild Area", which consists of the area surrounding the Central Wild Area designated for self-catering exclusive camps.

- The "Resource Use Zones": are areas where controlled use of natural resources by the surrounding communities are permitted. These areas will be divided based on the original landholding of traditional authorities.
- "Utility Areas": are sites for management offices and visitors infrastructures. Also, the 2005 LNP Park Plan had foreseen an area further inland of Old Lengwe and a new lodge as well as new scout camps in the Uplands Unit (Center camp, Ngande, Chilangbangombe, Makungwa).

6.8.2.3 Biodiversity of Lengwe National Park

6.8.2.3.1 Vegetation of Lengwe National Park

There are four broad vegetation communities (Table 19) that occur in the park (Hall-Martin 1974, Shaxon 1977, Clarke 1983, Sherry 1996, Dowsett-Lemaire & Dowsett 2002) that will be affected by the canal construction.

Table 21: Summary of Vegetation of Lengwe

Vegetation Type	**Characteristics**
Medium-short mixed open mopane woodland	Dominated by *Combretum, Diospspyros, and Colophospermum species.* With tree density of 110 per hectare, an average height of 5 to 10 metres and an average diameter of 60 centimetres, the tree stand is old and mature.
Tall-mixed closed alluvial riverine woodland	Composed of *Acacia, Cordyla, Lonchocarpus, Hyphaene*, and *Kigelia species.* With tree density of 525 per hectare, an average height of 25 metres and an average diameter of 130 centimetres, the tree stand is old and mature.
Lowland thicket-forest	Composed of *Pterocarpus lucens, Newtonia, Lecaniodiscus,* and *Cleistochlamys species.* The vegetation is largely thorny and interspaced with *Acacia negresis*
Lowland tree savanna	*Acacia* and *Combretum species* With tree density of 28 per hectare, an average height of 5 to 10 metres and an average diameter of 140 centimetres, the tree stand ranges from mature to old.

The terrestrial habitats of LNP that will be crossed by the canal includes Acacia and Combretum savanna and large blocks of thicket which in some areas is dominated by the

shrub Small-leaved bloodwood (*Pterocarpus antunesii*). These thickets are made of dense tall shrubs or small trees between 3 and 8 meters high.

Small patches of deciduous forest also occur along the route of the canal in Old Lengwe. There is no wetland in the Park however riparian woodlands dominated by the very tall tree Sterculia appendiculata are present along the Nkombedzi Wa Fodya River. According to Dowsett and Lemaire-Dowsett, (2002), it is the best preserved riparian forest of the Park, where such communities are scares and rare. Around the Namitala River, riverine thicket dominates again. According to Dowsett and Lemaire-Dowsett, (2002), *Cola mossambicensis* as presented in the habitat map of Old Lengwe (see map) is not the correct species present along Namitala River but the area is rather dominated by *Cola clavata*.

The majority of the canal alignment will pass through open wooded grassland with sparse trees, as shown on figure 39 below.

The following picture shows the area that will be crossed by the Bangula canal in the southern part of the Park.

Figure 39: Area where the Bangula Canal crosses the park (tree savanna)

6.8.2.3.2 Fauna of Lengwe National Park

Lengwe National Park contains the northern most naturally occurring population of the Nyala antelope (*Tragelapus angasii*) originating in South Africa and extending to Zimbabwe and Mozambique before finally reaching southern Malawi. The conservation of this large mammal species is the prime objective of conservation of Lengwe and its populations is closely monitored through animal counts. Nyala have been re-introduced to Majete Wildife Reserve.

The large mammals of Lengwe National Park have been studied in some detail over the years through the annual game counts that are undertaken by DNPW and Wildlife and Environmental Society of Malawi (WESM). Animal population estimates show that impala has been the species with the highest population over the last decade, followed by buffalo *(Syncerus Caffe*). The Nyala Antelope *Tragelaphus angasi* is the third most populated species whose population has not recovered since the culling that occurred in 1990s. Nyala represents the northern most naturally occurring range for this species and has been the prime focus for the protection of the Initial Lengwe. Other large mammal species of interest that are found but in small numbers include kudu (*Tragelaphus strepsiceros*), warthog *(Phacochoerus africanus),* suni *(Neotragus moschatus)* and porcupine *(Erethizon Dorsaum).*

Areas around Lengwe are also well known as a habitat for Temminck's Ground pangolins (*Smutsia temminckii*) which have been released into Lengwe. However, there are no records for its population estimates but only its mortality. Lengwe does not have prominent carnivores, however there are some species of nocturnal carnivores such as genet *(Genetta genetta),* civet (*Civettictis civetta)* and serval cat *(Leptailurus serval).* There are also a number of other interesting mammal species to be found at Lengwe such as the Tree Hyrax *Dendrohyrax arboreus*, the Red Squirrel *Paraxerus palliates*, the Reedbuck *Redunca arundinum*, and the Night Ape *Galago moholi*.

Though there has been little effort to study mammals in the Extension Area of Lengwe, the first game count in 2019 showed that there are some remnant populations of at least klipspringer (*Oreotragus oreotragus),* bush buck (*Tragelaphus sylvaticus)* and common duicker *(Sylvicapra grimmia).* Sightings of migratory elephants and lions are occasionally reported by the Department of National Parks and Wildlife and the surrounding communities. Annex 1.1 is a summary of common mammals found in the park including their IUCN Redlist classification.

Thicket communities as found in the North-Western part of Lengwe are highly valuable habitats for many species not only mammals (such as the Nyala) but also birds who thrive in their closed canopy.

The park is endowed with over 300 bird species, that include the woolly necked stork, trumpeter hornbill, bearded scrub-robin, yellow-spotted nicator and all three species of snake eagle found in Malawi.

6.8.2.3.3 Biodiversity in the Canal Alignment in Lengwe National Park

In order to get obtain a better understanding of the effects of the canal development in Lengwe National Park, biodiversity assessments were conducted in the canal alignment within the park. The assessment was geared at informing the process of impact identification and definition of mitigation measures.

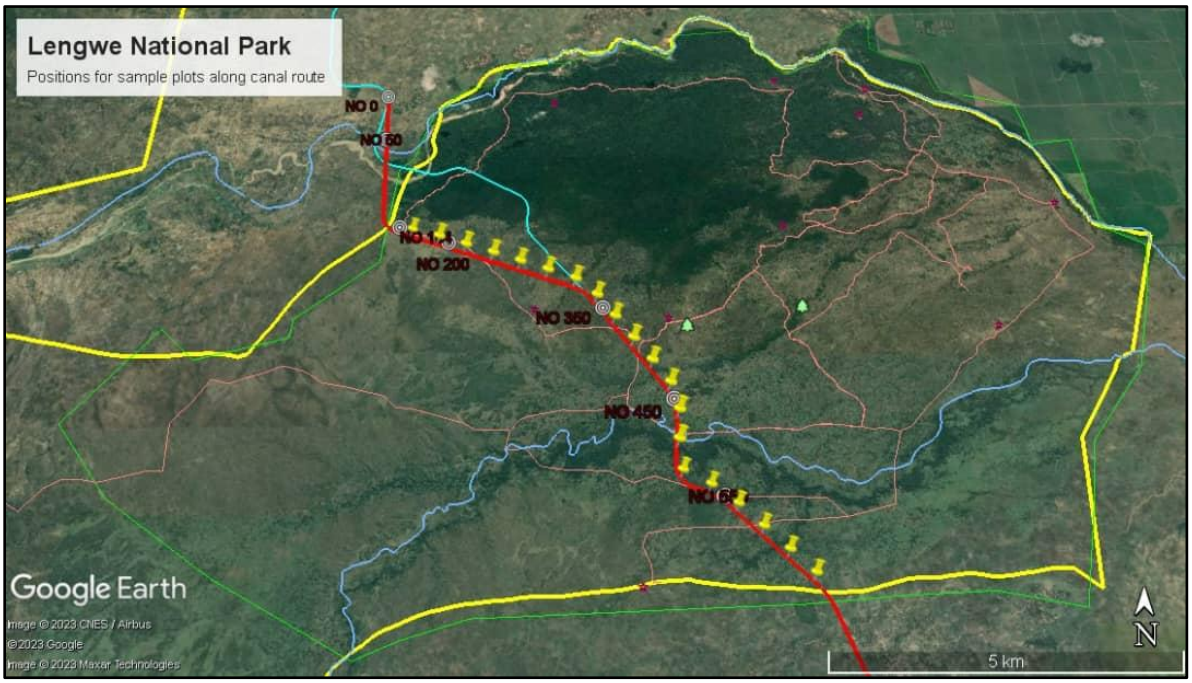


Figure 40: Map Showing Sampling Points in the Canal Alignment

6.8.2.3.4 Mammals

Twelve species of mamals were observed in the proposed canal lignments ranging from antelopes to bush pigs and buffaloes. These numbers are much less than the game population in the Old Lengwe Section where water and green grass are more abundant. Table 22 below depicts a summary of the mamals seen in the alignment

Table 22: Mammals Spotted in the Canal Alignment of LNP

No.	Local name	Scientific name	Malawi gazetted	IUCN	CITES
1	Impala	*Aepyceros melampus*	yes	LC	Not listed
2	Aardvark	*Orycteropus afer*	yes	LC	Not listed
3	Yellow baboon	*Papio cynocephalus*	yes	LC	Not listed
4	Tree Squirrel	*Paraxerus cepapi*	yes	LC	Not listed
5	Warthog	*Phacochoerus africanus*	yes	LC	Not listed
6	Bush pig	*Potamochoerus larvatus*	yes	LC	Not listed
7	Grysbok	*Raphicerus sharpei*	yes	LC	Not listed
8	Common duiker	*Slyvicapra grimmia*	yes	LC	Not listed
9	African Buffalo	*Syncerus caffer*	yes	NT	Not listed
10	Nyala	*Tragelaphus angasii*	yes	LC	Not listed
11	Bushbuck	*Tragelaphus scriptus*	yes	LC	Not listed
12	Greater kudu	*Tragelaphus strepsiceros*	yes	LC	Not listed

6.8.2.3.5 Birds

Forty-one species of birds were spotted along the canal alignments. Based on the 2017 Malawi National Parks and Wildlife Act, all bird species in the park are protected. The species were subjected to the IUCN red data analysis and a summary appears in Annex 1.4.

6.8.2.3.6 Reptiles and Amphibials

Seven species of reptiles were recorded at the project site, as shown in *Table 23.* Analysis of the conservation status of the reptile species was conducted using IUCN (http://www.iucnredlist.org/search), Red List of threatened species; CITES and Listed species and the Malawi Wildlife (Protected, Endangered and Listed Species) (Declaration) Order, 2017. Results shows that none of the recorded species are listed under IUCN and

CITES. However, according to the National Parks and Wildlife Act (Cap 66: 07), all reptile species in a protected area are listed as protected species. Lengwe National Park being a gazetted protected area it means that all the reptile species recorded are protected.

Table 23: Reptiles recorded along the canal alignment

No.	Local name	Scientific name	Malawi Gazegtted	IUCN	CITES
1	Peters' Ground Agama	*Agama armata*	Yes	LC	Not listed
2	Puff adder	*Bitis arietans*	Yes	LC	Not listed
3	Common Flap-necked Chameleon	*Chamaeleo dilepis*	Yes	LC	Not listed
4	Common Dwarf Gecko	*Lygodactylus capensis*	Yes	LC	Not listed
5	Stripe-bellied sand snake	*Psammophis subtaeniatus*	Yes	LC	Not listed
6	Eastern Vine Snake	*Thelotornis mossambicanus*	Yes	LC	Not listed
7	Variable Skink	*Trachylepis varia*	Yes	LC	Not listed

6.8.2.3.7 Plants

There are one hundred and four plant species observed in the proposed canal alignment as depicted in Appendis 1.5. Out of these species only one species, *Afzelia quanzensis Welw* has been listed as Vulnerable(VU) at National level (Msekandiana & Mlangeni (2002). *Afzelia quanzensis Welw*. The species is widely used in Malawi and it is used for timber, wood curving and charcoal. Globally it is listed as Least Concern (LC), The rest of the species are either categorized as Not Evaluated (NE) or as Least Concern (LC). Apart from *Afzelia quanzensis*, Lengwe has stands of *Colophospermum mopane* (Kirk ex Benth.) Kirk ex J.Léonard, a tree species which is highly targeted for its durable timber and charcoal. Lots of stumps were observed during fieldwork but since the area is protected, there has been a lot of natural regeneration going on and this will in the long term ensure the survival of the species.

Sixteen species were found to be crop wild relatives (Table 24 below)

Table 24: Crop Wild Relatives Found Along the Canal Alignment

NO.	NAME OF SPECIES	FAMILY	FREQUENCY	RELATIVE ABUNDANCE (%)
1	Cucumis hirsutus Sond.	Cucurbitaceae	81	28
2	Momordica foetida Schumach.	Cucurbitaceae	54	19
3	Ipomoea crassipes Hook.	Convolvulaceae	40	14
4	Vigna unguiculata (L.) Walp.	Fabaceae	33	11
5	Coccinia mildbraedii Gilg ex Harms	Cucurbitaceae	16	5
6	Hibiscus physaloides Guill. & Perr.	Malvaceae	12	4
7	Ipomoea cairica (L.) Sweet	Convolvulaceae	11	3
8	Hibiscus diversifolius Jacq.	Malvaceae	7	2
9	Coffea mufindiensis Hutch. ex Bridson	Rubiaceae	5	1
10	Ipomoea pes-caprae (L.) R.Br.	Convolvulaceae	5	1
11	Mellera submutica C.B. Clarke	Acanthaceae	4	1
12	Ipomoea sinensis (Desr.) Choisy	Convolvulaceae	3	1
13	Lippia javanica (Burm.f.) Spreng	Verbenaceae	3	1
14	Asparagus africanus Lam.	Asparagaceae	2	0
15	Convolvulus sagittatus agg.	Convolvulaceae	2	0
16	Solanum incanum L.	Solanaceae	2	0

6.8.2.3.8 Fisheries

The rivers within the park are seasonal and that there are a few refugia which keep some fish. The three prominent refugia were Main hide, Njati hide and Nyanga hide the commonest fish that is in these pools is the catfish.

6.8.3 Ecological Continuity

ECOLOGICAL CONTINUITY BETWEEN THE UPLANDS UNIT AND THE EASTERN SALIENT

LNP has two distinctive areas, the Old Lengwe which was the first National park and its western extension called the Uplands Unit that was included in the Park latter. These two areas are distinctive due to several factors:

- **Habitats**: Old Lengwe has lowland thickets – forest dominated by Pterocarpus trees and lowland tree savanna with Acacia while the western part is covered by woodland and upland woodland.
- **Water availability**: water holes are artificially providing water for wildlife in the Old Lengwe while the Uplands Unit lacks permanent water sources. After rains, there are also natural pools in Old Lengwe, in addition during the rainy season floods from Nkombedzi wa Fodya river feeds water to natural pools. Historically, the main ecological corridor for water dependent animals was between the Old Lengwe and the Shire River when most mammals were moving toward permanent water during the dry season (Dowsett and Dowsett Lemaire, 2005). The area between Lengwe and the River was covered with dense thickets allowing movement of species, now it is totally replaced by sugar plantation.
- **Park management**: Old Lengwe is more intensively scouted by rangers than the Uplands Unit. A new scount centre has been established in Western Lengwe in an effort to contain poaching. The Uplands Unit is intensively encroached by communities as deforestation for agricultural land is visible on Google Earth, human settlement is usually associated with animal poaching. In addition, an earth gravel road separating the Old Lengwe from the western part is intensively used by communities and cattle.
- **Topography**: the Old Lengwe is below 150 masl while the Upland Unit reach up to 380 masl with rocky outcrops.

The Old Lengwe has some woodlands that form part of the transition zone into the Uplands unit which maintain some form of ecological continuty. However, several wildlife species such as the Buffalo and Nyala are believed not to occur in the Uplands Unit (Dowsett and Dowsett Lemaire, 2005) although the area has not been surveyed for many years. Accordig to Max Del Buffalo, Elephants, believed to be from Mozambique, have lately been spotted in Western Lengwe.

ECOLOGICAL CONTINUITY WITHIN OLD LENGWE

Within the Old Lengwe, there is some movement of large mammals. However, most of the time they are located close to ponds in the eastern end of Old Lengwe.

The canal will pass through Old Lengwe covering a distance of 13.9 km starting at point (16º 15’ 48.03” south, 34º42’15. 79” East on the park’s northern boundary and ends at 16º 19’ 22 . 27” South, 34º45’46.65” East on the southern border .

The canal passes through a thicket of thorny vegetation for about 3 kilometres south of North Thicket Road. This thicket is an area favoured by nyala, potentially because it affords them

protection. No reliable information has been obtained to determine Nyala movement in and out of Old Lengwe (as there are no telemetric monitoring of animal movement). However, Old Lengwe is subject to floods from Nkombedzi Wa Fodya, during which animal are known to move to the Western part of the Park. In addition, discussion with the Lodge manager (Max Del Bufalo, personal communication, 2016) and field observations have revealed that animal do move westward outside the thicket for grazing; the movement is however believed to be limited. It is noted that nyala are not restricted to thickets in Majete Wildlife Reserve.

Owing to encroachment and agriculture expansion, LNP as an ecosystem has had its integrity impacted over time. An aerial survey conducted by Precision in 2021 shows that out of a total of 9,501 Ha surveyed, 94.4% has remained intact in its natural state whereas 5.6% has been modified by man representing 8,972 Ha and 529 Ha in that order.

ECOLOGICAL CONTINUITY BETWEEN LENGWE NATIONAL PARK AND MAJETE WILDLIFE RESERVE

Regarding large mammals, there is no ecological continuity for them between LNP and MWR due to the presence of a fence in MWR. LNP and MWR are only a 5 km appart in the northermost part of LNP. They are in fact only separated by the Mwanza river valley.

There is no ecological continuity for large mammals between LNP and Mwabvi Wildlife Reserve due to the density of population between the two parks. Due to the heavy population density, ecological continuity for large mammals outside parks and between parks was already at stake in the 50's, in addition poaching and animal conflicts were already taking place at that time (Mitchell, 1951).

6.8.3.1 Current threats and challenges

Illegal wood logging (for wood in Old Lengwe and for agricultural land in the Uplands Units), illegal cattle grazing in Old Lengwe, and pressure from surrounding communities in extracting resources has affected the state of LNP. In addition, illegal hunting is also severely affecting wildlife in the park. In addition, fragmentation of Old Lengwe because the natural path to the Shire River was cut by sugar plantation decades ago created a dry place where wildlife can no longer fetch for natural water. Water has been a limiting factor for wildlife since.

Using different dates on Google Earth reveals that the Uplands Unit is under recent intense illegal wood clearing activities to claim land for agricultural activities as shown in the following pictures (taken at the same location at coordinates 16°4'23.16"S; 34°27'1.59"E at the border with Mozambique). No reliable data exist to quantify encroachment, however it seems to cover around one quarter of the Uplands Unit and affects most flat land of this zone. In the Old Lengwe, where rangers are more present, there is less noticeable forest clearing for agricultural activities. LNP Park Plan (2005) highlights the lack of ranger patrols in the Uplands Unit that affects the efficiency of protecting the Park in this area.

Figure 41: LNP in 2001 (Northern part of the Uplands Unit)

Figure 42: : LNP in 2013 (Northern part of the Uplands Unit)

In addition, Old Lengwe is surrounded by Illovo sugar estate and a fence keeps wildlife from entering Illovo sugar estate. These pressures have fragmentized wildlife habitats.

HUMAN WILDLIFE CONFLICT

Buffalos are frequently reported to enter Illovo estate and destroying hectares of plantation looking for water and food during dry months. In 2005, a herd of 50 buffalos entered the estate, destroying 3,000 ha of plantation; the fence had been vandalized and destroyed (IOL news, 2005). Fencing has been installed along parts of the Lengwe National Park boundary, including along the Southern boundary (with Illovo estate) and along the northern boundary

where there is much community agriculture. However, the fence is not entire around the whole park and even the stretches that are fenced are sometimes subject to vandalism.

6.8.3.2 Management Document

The park management plan produced under the Shire River Basin Management Program (SRBMP) Component B, Sub component B4 called "Lengwe National Park, General Management Plan 2016-2020 work document" defined the overall objective to "rehabilitate LNP to a standard that allow for the efficient and effective management of its natural resources to the benefit of wildlife, communities, and tourism".

Details of the plans on how to achieve this are described in the most recent Management Plan for Lengwe covering the 2021-2025 period.

The plan seeks to realized the DNPW's policy outcomes of: Improved conservation and management of Malawi's wildlife resources; Improved private sector investment in wildlife conservation and management; Increased stakeholder participation in collaborative management of wildlife resources; and mainstreamed climate change, gender, HIV and AIDS in wildlife programs and policies.

The overall strategic objective for Lengwe National Park is to restore, conserve and manage wildlife for the benefit of the present and future generations. This will be realsied through pursuit of the following sub-objectives:

- To adequately monitor wildlife resource for efficient monitoring of the PA;
- Improve Park management & eco-tourism infrastructure;
- To develop sustainable finance mechanism for efficient management of the park;
- Reduce illegal wild life use through increased law enforcement; and
- To Improve community engagement, participation and provision of sustainable IGAs and conservation-based investment.

6.8.4 MWABVI WILDLIFE RESERVE and Matandwe Forest Reserve

These reserves will not be directly affected by construction works or the establishment of the command areas. However they provide important natural resources in the Lower Shire Valley and therefore the project will be considering how to support and enhance the nature resources in these reserves as part of Component 4 works. Given the proximity of the park to the potential irrigable areas, it is antincipated that human wildlife conflicts will increase. They contain natural habitats, although with increasing areas of modified habitats as a result of anthroopegenic activity.

6.8.4.1 Status of the Reserves

Originally called the Tangadzi Stream Reserve in 1928, Mwabvi Wildlife reserve was gazetted in 1951, in 1982 it was reduced (de-gazetted) of about 60% (UICN/UNEP Directory of Afrotropical Protected Areas, 1987). The park covers an area of 104 km^2 and is managed by the same staff as Lengwe National Park.

The Reserve is drained by the Thangadzi River which is a wide seasonal river and is crossed by several small hills that stand out with their thick tree coverage in a flat agricultural landscape.

6.8.4.2 Matandwe Forest Reserve

The reserve was gazetted in 1929 for water catchment conservation and other biodiversity services. According to the 2012 to 2017 forest reserve strategic area plans, MFR has a total area of 26,381 hectares (ha). However, this size could be much smaller than the actual size now since the reserve has been encroached and excised several times. The forest reserve is located in the Rift Valley scarp zone, comprising a range of hills including Mulaka in the north and Natundu in the south. In the northwest, the reserve is bordered by Mwabvi Wildlife Reserve. The forest reserve extends from approximately 16037'S just south of Bangula to 16055/S along Malindi river. The soils are lithosols (shallow and stony on steep slopes). The vegetation is open canopy woodland of hills and scarps dominated by Brachystegia species, especially B. boehmii and a degraded form of Uapaca kirkiana (National Atlas of Malawi, 1983).

6.8.4.3 Management Document

Recognising the benefits of a co-ordinated approach to the management of these two resources, a single Integrated Management Plan[8] has been prepared for the reserves.

The main objectives for managing the reserves vest on two pillars, namely: protected area management and community engagement.

Management objectives that foster protected area (PA) management are:

- To reduce illegal activities in MMPAC;
- Strengthen law enforcement capacity to combat illegal activities in PA;
- To improve protected area management and ecotourism infrastructure facilities and equipment;
- To adequately monitor biodiversity for efficient management of the MMPAC;
- To strengthen collaboration and coordination amongst stakeholders on PA management; and
- Improve habitat management

Objectives meant to steer community engagement, on the oethr hand, are as follows:

- To improve capacity to manage and regulate community resource use programs;
- To build capacity and improve community support and participation in sustainable management of natural resources; and

[8] Matandwe-Mwabvi Protected Area Complex (MMPAC), Integrated Management Plan, Departments Of Forestry And National Parks And Wildlife, Malawi October 2021

- To improve livelihoods for local communities through facilitating and promoting sustainable IGA's and conservation-based investments

6.8.5 ELEPHANT MARSH

Elephant Marsh is designated as a wetland of international importance under the Ramsar Convention and has recently been established as a Community Consrevation Area, following the recommendations of the work undertaken as part of the the Shire River Basin Management Program (SRBMP) "Climate resilient livelihoods and sustainable natural resources management in the Elephant Marshes, Malawi" initiative. It contains natural marshland habitats, although with increasing areas of modified habitats as a result of anthroopegenic activity.

6.8.5.1 Wetland Biodiversity of the Marsh

Elephant marsh is dominated by grasses such as the common reed (Phragmites australis), sedges (Cyperus sp.), Hippo grass (Vossia cuspidata) and the cattail (Typha sp.). Floating plant colonies are also present such as the invasive water hyacinth (Eichhornia crassipes) and the invasive water lettuce (Pistia stratiotes). Aquatic plants aredominated by the mosquito fern (Azolla nilotica) and the invasive Kariba weed (Salvinia molesta). In the marsh, there are no riparian forest and only few ligneous plants mainly palm trees.

In areas where land has been reclaimed from the wetland, rice and maize are cultivated as recession agriculture.

The most common bird species observed by the consultant during field visits in Elephant marsh are the Kingfishers (Alcedo Atthis and A. cristata), the African Fish Eagle (Haliaeetus vocifer), Cormorant (Phalacrocorax lucidus), Cattle Egret (Bubulcus ibis), Purple Heron (Ardea purpurea), African openbill (Anastomus lamelligerus) and the Coucal (Centropus sp.).

Crocodiles are common in the marsh, they were also observed by the consultant during the rainy season mission (January 2016), sandbanks of the marsh are used as nests by female crocodiles. Hippopotamus are said to be common in the marsh but the population is declining due to past animal conflicts (see next section) (Dudley, 1997).

The Elephant marsh is also an attractive habitat for herpeto fauna (reptiles and amphibians) and wetland dependent insects such as dragonflies. The ecological surveys that have been carried out in the marsh in the framework of the SRBMP (Sub-study n°4: Biodiversity surveys carried out by MRAG) provide valuable and up-to-date information on biodiversity..

- Butterflies. Based on biodiversity surveys done by MRAG Ltd (2016), butterfly surveys conducted in June 2015 collected 62 species one of which is a new record for Malawi and one of which is a new subspecies. Their habitats in Elephant marsh where area with high vegetation as well as village graveyards close to the marsh.
- Herpetofauna (reptile and amphibian). Based on biodiversity surveys done by MRAG Ltd (2016), it is considered that amphibian diversity and populations numbers still reflect in great part that originally existing in the Elephant Marsh. However, reptiles are considered to show reductions in the numbers, and possibly even local extirpation, of arboreal snakes

(Boomslang and Twig Snake), larger terrestrial species (Puff adder), and specialised aquatic species (Zambezi Flap-Shelled Terrapin and Floodplain Viper).

- Flora. Based on biodiversity surveys done by MRAG Ltd (2016), flora surveys conducted in the marsh in June 2015 identified 130 plant species.

6.8.5.2 Current Threats and Value of the Elephant Marsh

The Elephant Marsh is dependent on Shire River floods and its numerous meanders to feed water to hygrophilous plant communities and sustain habitats for herpetofauna and waterbirds. There are currently many threats to the wetland as presented in this section.

SUGAR CANE PUMPS

In the past, some Shire river meanders have been naturally blocked by sand bars or silt deposit or artificially by dikes. An example of meander blockage is illustrated in the following figure showing Alumenda feeder canal (all figures are taken at the same location). Based on photointerpretation, following a reduction of flow in Shire (probably by silt deposit or sand bars), a man made dike was built on a meander to increase flow in the Shire toward Alumenda pumping station canal, probably to bring sufficient water to sugar cane pumping stations. This derivation of water has made available new lands for agriculture in the vicinity of the blocked meander thanks to reduction in soil moisture (reduction of inundated area). Incursions of subsistence farmer in this area has locally reduced the quality of the wetland. The meander eventually became an oxbow used as drainage and irrigation; but lost all hydroconnection with the Shire River

Figure 43: Original situation with a meander of the Shire in the marsh (2010)

Figure 44: Manmade dyke to increase flow to the Shire

Figure 45: Ongoing encroachment of subsistence farmers following blockage of meander (2016)

SILT DEPOSITION

Erosion is taken place in the Shire catchment bringing heavy loads of silt to Elephant marsh through tributaries. Deforestation for charcoal business and agricultural activities on Thyolo escarpment is partly responsible for erosion in the Study area. As tributary rivers velocity decrease when entering the marsh, their transport capacity decreases as well leading to silt deposition. Sheetflood erosion (as presented in the soil section) also brings heavy loads of

suspended material in the marsh. In the marsh, erosive river bank cultivation is also responsible for the silt load.

LAND RECLAMATION FOR AGRICULTURE (DIMBA AGRICULTURE)

Many areas in the wetland have been drained to claim land for agriculture. Cultivation in the wetland takes place on every available land, the growing population in the valley has put a lot of pressure on land as shown in the following figures 56, 57 and 58 (all figures are taken at the same location).

Recent surveys show an expansion of agriculture into the wetland as confirmed byu the survey conducted by Precision in 2021. Out of a total of 5,077 Ha surveyed, only 47% had remained in its natural original form representing 2,388 Ha whereas 2689 Ha had been converted to agriculture land representing 53%.

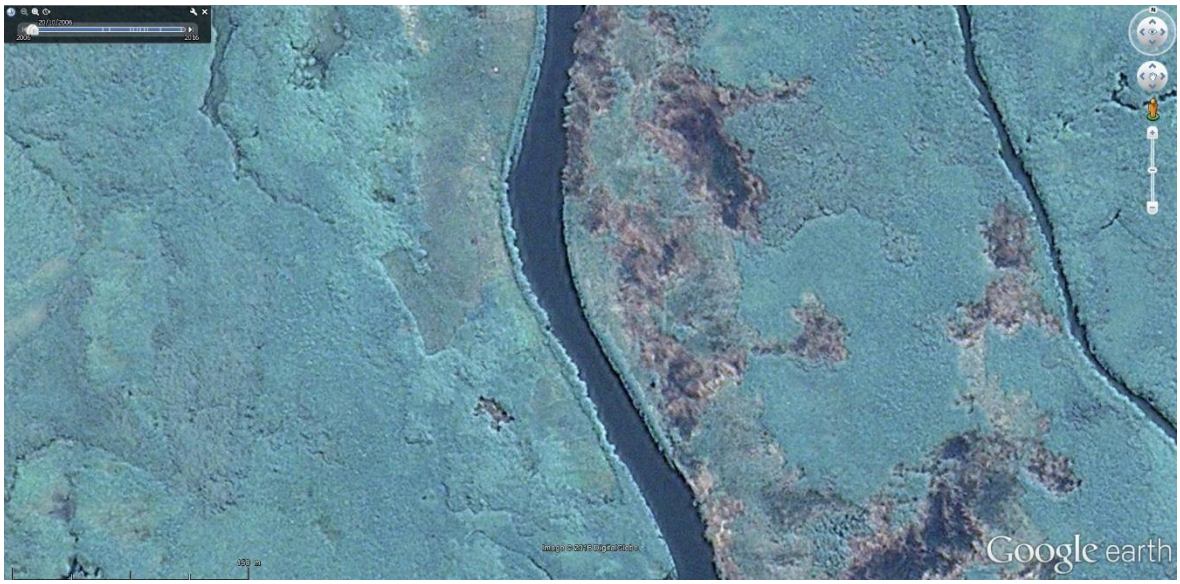


Figure 46: Original situation in the marsh (2006)

Figure 47: Beginning of encroachment (2011)

Figure 48: Ongoing encroachment (2016)

Figure 49: Agriculture expansion into Elephant Marsh (Precision 2021)

Before the existence of the Kamuzu barrage (Liwonde barrage), water in the Shire was dependent on the outflow from Lake Malawi, when the water would drop below 471.5 masl, the outflow would stop and no water was flowing in the Shire River (Norplan, 2013). According to several sources quoted by Dudley (1997), from 1908 to 1935 due to low rainfall, the outflow of Shire stopped flowing and Elephant marsh was intensively cultivated thanks to land availability during these dry years. Maize, cotton and rice were (are) the main crops in the marsh. During wet years, cultivation was very restricted due to the wetness conditions. As it is the case with many wetlands, wet conditions have a positive effect on the ecosystem but a negative effect on livelihoods. The downstream area, where pools are located is less encroached by dimba agriculture.

INVASIVE PLANTS

Water hyacinth (Eichornia crassipes) and water lettuce (Pistia stratiotes) are observed in the marsh. However, they currently do not form vast colonies (consultant observations, 2015, 2016). According to various references, in past years their invasion seemed higher. Other potential invasive plants are the water fern (Salvinia molesta), the Kariba Weed (*Salvinia molesta*), the Parrot's Feather (*Myriophyllum aquaticum*) and the Red Water Fern (*Azolla filiculoides*).

HUMAN WILDLIFE CONFLICT

Around the Elephant marsh and Shire River, populations are affected by crocodiles predation due to the fact that some communities rely on the permanent water for their livelihood or to wash clothes, bath or fetch water (since groundwater is of poor quality). In addition, dry season grazing by livestock coincides with the breeding season for crocodiles, a period when they are most active and aggressively protecting their nests or hatchlings. Some reports also

suggest that reduction in natural preys leads crocodiles to turn to humans for food (Compass, 2000).

In 1996, an aerial survey of the marsh counted 311 hippos and 249 adult crocodiles (Bartlett and Pasteur (1996) quoted by Dudley, 1997), which is much lower than the 2601 hippo counted in 1991 by Simons et al. and the 1620 counted by Mkanda in 1994. The sudden drop is believed to be caused by a drought that has led to a decrease of Shire flow and wetland size and a reduction of grassland surface leading to increased hippo-human conflicts, crop damage and uncontrolled hippos hooting that followed (Dudley, 1997). Growth of human population and conversion of grassland to agricultural lands have also led to an increase in conflicts due to crop damage by hippos (Compass, 2000).

KAPICHIRA DAM AND HYDROPOWER

The current Kapichira dam and hydropower scheme has little effect on the Elephant marsh as the dam is a run-of-the river scheme, meaning that the retention time of the water in the reservoir is very short (what comes in goes out). The Kapachira environmental assessment written in 1991 concluded on minimal impact of the hydropower scheme on the wetland unless the Lake level drops significantly. Lower fish catches, river bank erosion, reduced crocodile breeding, increase in dimba agriculture and reduction of marsh land where the main expected impacts in case of lake level drop (Dudley, et al., 1991).

ELEPHANT MARSH VALUE

The Elephant marsh is one of the most productive ecosystems in Malawi. As presented in the Socioeconomic and Aquatic ecology sections, it provides forage for livestock, fertile soils for crop production and fish. The marshes and riverside flats provide excellent folder and watering points for livestock as well as grazing sites during the dry season when the grass is more accessible. Cultivation in wetland offers year-round moisture and fertile alluvial soils increasing yield compared to rain fed summer crop. In addition to agriculture, the marsh is a place where fisheries are taking place, especially in the southern end where pools are located. One crocodile farm is also in the marsh (Shire Crocodile limited), it exports crocodile skins. The wetland also has another important function, in times of floods it acts as a vast reservoir for overspill of flood waters from both the Shire and Ruo rivers.

On the other hand, these livelihood activities affect elephant marsh. Growing land occupation in the marsh has resulted in degradation of the wetland ecosystem. It is in fact a semi-natural environment, where water availability is dictated by Kamuzu dam upstream. As mentioned earlier, water level had been subject to important natural fluctuation in the past leading to dryness conditions and increased in agricultural activities in the marsh. Since the Kamuzu dam was built, it has allowed to sustain water in the Shire River and improve ecological health of the marsh thanks to regulated water flow.

In summary, the value of the Elephant Marsh can be appreciated from the point of view of the services that the wetland provides. namely:

(i) Provisioning: the wetland is a source of Thatch grass; Fruits e.g. *Baobab fruits, ziziphus, tarmali, mpinjipinji; t*ermites; medicinal plants; water; mushrooms; fish; nyika/water lilly; reeds; palm leaves; edible insects; water bird; mice; and other Aquatic fauna such as frogs, crocodiles, hippos, monitor lizard, bull frog and crabs

(ii) Regulating services include pollination, carbon sequestration, erosion reduction, micr-climate regulation, water retention and infiltration, nutrient recycling, pest and disease control, soil formation, flood control, habitat and gene pool protection; and

(iii) Cultural / Supporting services cover tourism and research, spiritual and religious functions, mental wellbeing and health, education and research, and cultural identity and heritage.

6.8.5.3 Management of Elephant Marsh

The management of Elephant Marsh is governed by the 2018-2021 Elephant General Management Plan whose aim is s to ensure that: *The integrity of the Elephant Marsh is maintained and enhanced, together with the natural functions that these wetlands perform and the benefits that they supply, including the sustainable utilisation of wetland resources, without undermining future adaptive capacity.*

With a people-centred approach, the plan has been developed to address the identified threats which includes:

- Conservation and maintenance of wetland function within the Elephant Marsh, including measures to restore or rehabilitate some areas that have been identified in the surveys as degraded; and
- Enhancing the productivity of ecosystem services, including increasing yields, quality and value as appropriate and reducing inputs and post-harvest losses.

To realise the plan's aspirations, the following objectives are advanced:

- Develop and promote cooperative conservation of the hydrology, flora and fauna of the Elephant Marsh taking into account the full variety of wetland uses;
- Develop and promote the sustainable and wise use of wetland resources while minimising impacts by enhancing the productivity of resource utilization;
- Strengthen policies and institutional capacities for the effective management of the Elephant Marsh; and
- Strengthen the knowledge base to support conservation, management, planning and restoration efforts and raise awareness of the important role of wetlands, their ecosystem functions and livelihood values

Under Phase-I of SVTP, the following have been attained:

- Applying METT Scores, the area brought under conservation have moved upwards from 14 hactares at start of SVTP to 54 hactares against a target of 68 hactares;
- A planning and monitoring system has been established and is being used for the fisheries sector;

- Guidelines for the establishment of Community Conservation Areas (CCAs) around the Elephant Marsh have been developed and are being applied. Kaombe CCA is at advanced stage to establish the CCA.

6.8.6 ECOLOGY

This section describes the terrestrial, wetland and aquatic habitats present in the study area, considers the biodiversity value of these areas and whether there are areas of natural or critical habitat present. The World Bank ESF (ESS6) requires a differentiated risk management approach to habitats based on whether they are 'modified', 'natural', 'critical' habitats, and this chapter identifies the different habitat types that are present.

6.8.6.1 LAND COVER and habitat types

Relevant information about land cover and condition of the land in Chikwawa, including recent changes, is presented in the Atlas of Malawi Land Cover and Land Cover Change 1990-2010 (FAO, 2013). Based on this Atlas, the following table 25 below shows the main land cover per district using the FAO Land cover classification and codes. Figure 31 shows main land cover types.

Table 25:Land cover using FAO Land Cover Classification

Percentage of land cover in Chikwawa District (%)		Percentage in land cover in Nsanje District (%)	
Open Woodland with Herbaceous Layer (TREO)	40.1	Open Woodland with Herbaceous Layer (TREO)	34.0
Rainfed Herbaceous Crop(s) With Small Sized Field(s) (AGHS)	22.6	Rainfed Herbaceous Crop(s) With Small Sized Field(s) (AGHS)	29.9
Closed Herbaceous Vegetation with Sparse Trees - Trees and shrubs savannha (HBCL)	8.1	Closed Herbaceous Vegetation with Sparse Trees - Trees and shrubs savannha (HBCL)	1.5
Post Flooding Cultivation Of Small Sized	6.4	Post Flooding Cultivation Of Small Sized	3.2
Field(s) Of Herbaceous Crop(s) Cultivated Dambo (AGFL)		Field(s) Of Herbaceous Crop(s) Cultivated Dambo (AGFL)	
Rainfed Herbaceous Crop(s) With Small Sized Field(s) + Sparse Trees (AGTR)	6.4	Rainfed Herbaceous Crop(s) With Small Sized Field(s) + Sparse Trees (AGTR)	3.9
Built Up Area(s) (URBA)	3.6	Built Up Area(s) (URBA)	4.7

Closed Herbaceous Vegetation On Permanently Flooded Land Permanent marsh (HBFP)	3.4	Closed Herbaceous Vegetation On Permanently Flooded Land Permanent marsh (HBFP)	11.1
Irrigated Herbaceous Crop(s) With Large to Medium Sized Field(s) Sugar Cane (ASUG)	3.4	Irrigated Herbaceous Crop(s) With Large to Medium Sized Field(s) Sugar Cane (ASUG)	0.4
Closed Broadleaved Deciduous Trees (TREC)	2.2	Closed Broadleaved Deciduous Trees (TREC)	5.6
Closed to Open Shrubland (Thicket) (SRCO)	1.4	Closed to Open Shrubland (Thicket) (SRCO)	1.9
Other	2.4	Other	3.8

Source: Adapted from FAO (2013)

NATURAL TERRESTRIAL VEGETATION

Natural habitat is restricted to remanent pockets around cemeteries, and to the parks and reserves; even the parks and reserves have been subject to selective logging and tree removal in places, either for charcoal production to create grazing areas. The Natural Habitats that remain fall within the following FAO land cover classifications:

- Open Woodland with Herbaceous Layer (TREO): this class includes habitats that are mainly covered by trees, with open canopy and herbaceous layer. Most of the Lengwe and Majete parks and hilly area fall under this category.
- Closed Broadleaved Deciduous Trees (TREC): this class includes dense forested areas.
- Closed Herbaceous Vegetation with Sparse Trees - Trees and shrubs savannah (HBCL): this class includes dense grassland with sparse trees and shrubs.
- Closed to Open Shrubland (Thicket) (SRCO) : this class includes thickets without trees. The last large remaining thicket forest is located in Old Lengwe. It has to be considered a highly important habitat.

AQUATIC VEGETATION

This class includes transitional areas between purely aquatic ecosystem and terrestrial ecosystem with hydrophytic vegetation (vegetation dependent on damp condition), also called wetland:

- Closed Herbaceous Vegetation on Permanently Flooded Land Permanent marsh (HBFP): this class refers to wetlands such as Bangula lagoon and the Elephant marsh.

CULTIVATED AND MANAGED TERRESTRIAL AREAS

Modified habitat forms the majority of the terrestrial vegetation types in the Lower Shire Valley. These are areas where human activity has substantially modified the vegetation types through clearing for agriculture, even though the land may then be abandoned for periods of time. This class refers to areas where the natural vegetation has been removed and replaced

by other types of vegetation of anthropogenic origin mainly for agricultural activities (FAO, 2013).

- Rainfed Herbaceous Crop(s) With Small Sized Field(s) (AGHS)
- Rainfed Herbaceous Crop(s) With Small Sized Field(s) + Sparse Trees (AGTR)
- Irrigated Herbaceous Crop(s) With Large to Medium Sized Field(s) Sugar Cane (ASUG), refers to Illovo and outgrowers
- Post Flooding Cultivation Of Small Sized Field(s) Of Herbaceous Crop(s) Cultivated Dambo (AGFL): refers to "dimba agriculture" carry out in dambo and in Elephant marsh.

URBAN AREAS

This class refers to areas that have an artificial cover such as construction and towns, extraction activities (mines and quarries) (FAO, 2013). The main urban areas are Chikwawa, Nchalo, Ngabu and Bangula.

LAND COVER CHANGES

Figure hh shows the land cover and habitat types identified for the 2017 ESIA. Recognising that woodland was the only remaining natural habitat type present in the study area, the extent of the woodland remaining has been remapped for this update and is show in Figure ii. By comparing the two, it can be seen that there are no significant changes in the baseline tree cover within the study area, and although some small changes in expanse of urban areas and of modified habitat types has occurred, the ecological baseline is not considered to have significantly changed from that described in the 2017 ESIA.

6.8.6.2 Modified Habitats

The Study area is extensively used for agricultural activities and has been densely inhabited for a long time leading to changes in land cover. This population density has created pressure on ecological functions and habitats. In fact, the catchment is largely modified which means that a large loss of natural habitat, biota and basic ecosystem functions has occurred.

Modified habitats are throughout the valley, including in the hilly area of Thyolo escarpment and Mulaka Hills, where intense deforestation is taking place mainly for charcoal production. In the vast plain, where the command areas will be developed, most forests have been cleared to give way for agricultural activities. Patches of remnant forests and thickets are still present around cemeteries but have no potential to shelter any of the large mammals that are observed in the surrounding parks. A small reserve called the Nyasa Wildlife sanctuary is present in the Kaombe Sugar cane estate. Another sanctuary, the Nyala Park at Nchalo is located within Illovo Estate. In this plain, natural forests would have been classified as "Broad leaved relatively dry woodlands and intergrades to savanna" characterized by the following species: *Adansonia sp*.(Baobab) *Cordyla sp*. *Combretum sp*. and *Acacia sp*. With Acacia and Combretum as dominant ligneous species.

The density of Baobab is remarkable in several areas of the plain, perhaps reflecting its cultural status as well as limited value as a timber resource.

The main past and current threats and pressures on habitats are:

- Logging and land transformation: land transformation to claim forested areas and thickets for agriculture (or cutting wood for charcoal) has started to take place a long time ago. According to the FAO Land Cover Atlas (FAO, 2013) in Chikwawa no land cover change was observed since 2000 while in Nsanje 5 to 10 % of natural vegetation have been cleared for agricultural activities since 2000.
- Unsustainable fishing practice: the use of inappropriate fish gears such as small meshed seine nets and mosquito nets destroy the breeding grounds and catch both the juveniles and the adult fish. During upstream migration in tributaries, some fishermen install nets across rivers, catching all fishes.
- Encroachment in Parks: in many reports, encroachment is mentioned in all three parks, in Majete this situation has stopped, unfortunately it is not the case with Lengwe as presented in sections hereunder.
- Incursion in wetland by subsistence farmers: according to nineteenth century reports there was already at that time a very large population in the area occupying the Shire's banks doing dimba agriculture (Young, 1868 quoted by Dudley, 2005).

6.8.6.3 Natural TERRESTRIAL HABITATS

Natural habitats in the Study area are confined to parks and reserves, including Majete Wildlife Reserve and Lengwe National Park. Pockets of natural habitat also occur around cemeteries within the valley. These are described in detail in Chapter 9 of this ESIA. The project has in place measures to avoid the remaining areas of natural habitat as far as possible, and has designed measures to protect or enhance natural resources (including natural habitats) throughout the study area.

6.8.7 WETLAND HABITATS

This section deals with wetland habitats. The Aquatic Ecology section further details topics related the value of wetlands for fishes.

The main wetlands of the Study area are part of the Shire River floodplain. Downstream from Kapichira falls, the floodplain covers a narrow area of less than a few hundred meters wide. After
Mwanza River junction, the floodplain expands and gradually covers a wider area (called the Elephant marsh). The name Elephant marsh does not refer to a wetland entity but rather to a cultural entity, it is not an independent system with natural boundaries. It is in fact part of the larger Lower Shire floodplain. Elephant marsh stretches between the confluences of the Mwanza and Ruo Rivers with the River Shire. After the junction with Ruo, another wetland system is present: the Bangula Lagoons which is part of the Ndindi Marsh. In total, the whole Lower Shire floodplain cover about 1,100 km^2 (between Malawi and Mozambique) (Chimatiro, 2004).

During the rainy season, all seasonal tributaries of Shire River bring water to the marsh while during the dry season only Shire and Ruo feed the wetland with water. In addition, possible

seepages from the Thyolo escarpment bring water to the marsh. As mentioned earlier (see hydrology section), Elephant Marsh hydrological behaviour during the dry season is almost entirely driven by the upstream basin of the Shire River and the Kamuzu Barrage water management while during the wet season, the Elephant Marsh inundation is also caused by the Ruo River. Ruo River feeds an important pool in the marsh named "Tomaninjobi Pool" where fishing activities take place. Ruo has a wide watershed and during the dry season it joins with Shire at the outflow of the Elephant marsh. During the rainy season, it floods a vast area on the western end of the study area (at the border with Mozambique).

Outside of parks, there are no large riparian forest nor other wetland worth mentioning in the Study area. Some rivers are still bordered with a 10-15 meters wide riverine forests to maintain banks.

It has been reported from many sources quoted by Dudley (1997) that the Elephant marsh had been dry many times in the early 20th century since it was dependent on Lake Malawi level.

Dambos are broad valleys that are waterlogged for some months during the wet season, they are fed by rain water or sometimes by groundwater. Dambos geomorphology differs from rivers as they do not form bed channels. The high water table, with little lateral movement, causes anaerobic conditions in the subsoil, thus precluding most woody species. Dambos are moisture-determined habitats. However, in the Study area water does not stay long enough to allow hydrophilic plants to thrive; these are non-wetland Dambos. The biggest dambo is called Mphonza Dambo.

6.8.8 WILDLIFE

This section presents wildlife recorded from the Study area. The majority of the large mammals and rarer species are associated with the habitats within the Wildlife Reserves (particularly Majete) and National Park, although Elephant Marsh supports a number of interesting bird species.

MAJETE

In terms of wildlife, the reserve that had once lost most of its large mammals was restocked with the following mammals: leopard, lion, black rhino, elephant, buffalo, zebra, sable antelope, Lichtenstein's hartebeest, eland, impala, nyala and warthog. All of these species populations are increasing.

The main wildlife animals are with 2015 number: Black rhino (confidential), Buffalo (1319), Bushbuck (400), Bushpig (400), Crocodile (50), Duiker (800), Eland (320), Elephant (389), Grysbok (50), Hippopotamus (85), Impala (2000), Klipspringer (50), Kudu (1022), Leopard (12), Lichtenstein hartebeest (80), Lion (5), Nyala (300), Porcupine (200), Reedbuck (400), Sable (1337), Warthog (800), Waterbuck (1782) and Zebra (571) (Majete aerial census results, 2015).

The reservoir along Majete and the Shire River represent highly valuable aquatic habitats since they are vast permanent water sources for many animal and the only large water body during the dry season (elephant, hippopotamus, lion and crocodile are frequent in these areas). Birds also forage in the Shire.

LENGWE

Lengwe was created to protect the endemic Nyala as well as the thicket communities. . Wild dogs, elephant, rhinoceros, zebra, hippopotamus, sable antelope, roan antelope, waterbuck and most big cats are absent from LNP (Dowsett and Dowsett-Lemaire, 2005).

There are about 119 reported species of mammals in Lengwe National Park of which two require attention with restect to protection and habitation conservation as stipulated in the table 26 below.

Table 26: Mammals of concern found in LNP

No	SCIENTIFIC NAME	ENGLISH NAME	VERNACULAR NAME	IUCN Red Datalist
1	Manis temminckii	Pangolin	Ngaka	Vulnerable due to illegal trade
2	Syncerus caffer	Buffalo	Njati	Nearly threatened due to poaching

Source: DNPW, 2021

A detailed list of mammals of LNP is shown in Annex 1.1 for further refrence. From the annex, most of the animals are common and of least concern based on IUCN assessment.

Animal counts in Lengwe National Park

The following table presents species with special conservation status and population trend. According to Dowsett and Dowsett Lemaire (2005), in LNP population counts are made by the Department of National Parks and Wildlife (DNPW) and the Wildlife Society of Malawi (WSM). There are bias in the counts for all species and the figures vary significantly between sources and from one year to the other. One of the explanation provided by Dowsett and Dowsett Lemaire (2005) comes from the census method that differs between the DNPW and the WSM. The first uses walked transect counts while the later uses water holes counts. Both used a single method while a combination of method is more appropriate. The main bias for transect comes from the fact that some species are highly mobile and could be counted twice

(leading to overestimation). The water holes count is not precise for species that drink at night (buffalo) or that rarely drink (Impala) (leading to underestimation).

From these figures(Table 27), it can be concluded that Impala population is increasing and Nyala population increased up to the year 2017. LNP Park Plan (2021), concludes that Impala population are increasing at the expense of Nyala and that counts by the MWS are close to reality. In addition, Nyala have more specific niche requirement than Impala which makes the Impala a good competitor under variable habitats such as those fund in Old Lengwe (Mkanda, 1996). LNP Park Plan also considers Nyala absent in the Uplands Unit (Western part of the Park). Buffalos are generally absent from the Uplands Unit (Dowsett and Dowsett Lemaire, 2005) although there have been sightings of four heards as late as early 2021 (DNPW).

However, for other species the great variability makes conclusion difficult on population trend as well as on carrying capacity of the Park for these animal. Counts by the WSM show a recent drastic decrease of Impala population along with other species. According to MWS, poachers are frequently hunting in the Old Lengwe and are responsible for this significant decrease in wildlife (MWS website, 2016).

There has never been any animal re-introduction in the LNP.

Table 27: DNPW versus WESM Animal Census (Source: DNPW, 2020)

Year	Institution Responsible	Species									
		Buffalo	**Impala**	**Nyala**	**Warthog**	**Kudu**	**Bush pig**	**Bushbuck**	**Grysbok**	**Common duiker**	**Suni**
		(Syncerus caffer)	***(Aepyceros melampus)***	***(Tragelaphus angasii)***	***(Phacochoerus africanus)***	***(Tragelaphus strepsiceros)***	***(Potamochoerus larvatus)***	***(Tragelaphus scriptus)***	***(Raphicerus sharpie)***	***(Moschus grimmia)***	**(Nesotragus moschatus)**
2011	DNPW	1047	2533	565	199	144	0	0	0	0	0
	WESM	-	-	-	-	-	-	-	-	-	-
2012	DNPW	-	-	-	-	-	-	-	-	-	-
	WESM	40	418	432	80	17	0	101	0	0	3
2013	DNPW	2118	3098	511	168	120	0	24	24	6	24
	WESM	20	64	212	116	3	0	17	0	0	0
2014	DNPW	1362	3105	327	43	105	86	31	0	18	37
	WESM	0	335	321	53	11	0	118	0	0	11
2015	DNPW	850	3396	296	62	12	12	105	12	49	12
	WESM	0	104	200	24	1	0	28	0	0	5
2016	DNPW	936	3031	101	99	37	25	111	12	0	62
	WESM	0	260	149	59	5	0	140	0	0	12
2017	DNPW	776	2009	136	99	12	0	37	12	37	37
	WESM	37	127	89	5	6	0	48	0	0	4
2018	DNPW	904	2073	154	104	36	0	81	36	63	58
	WESM	3	172	86	28	10	0	71	0	0	4
2019	DNPW	936	1060	148	197	0	0	25	0	12	62
	WESM	45	99	85	23	0	5	40	0	0	5
2020	DNPW	1678	1392	86	62	99	0	49	12	49	12
	WESM	3	309	125	23	13	8	111	0	0	15

Counts from Mwabvi Wildlife Reserve and Consolidated List of Mammals

Mwabvi is endowed with a high population of buffaloes, giraffes, warthogs, antelopes among the higher herbivores (DNPW, 2020). Although there have been some cases of animal-human conflicts especially with the buffalo population, the presence of these higher herbivores is so significant as the population of such animals continues to face challenges even at the world‟s scale. These animal-human conflicts are being addressed through community awareness meetings and strengthening local governance institutions. There is tourism potential in Mwabvi Game reserve because of the geographical position which is a corridor to Mozambique. Apart from Shire River, the inland port, there were other tourist attractions such as Buffaloes, Kudus, Sable Antelopes, Impalas, and Warthogs.

Owing to the parks poor accessibility, animal counts (Table 28) are seldom conducted by both the DNPW and WESM.

Table 28: Game Count in Mwabvi Wildlife Reserve by Year

Species	**2019**	**2020**
Buffaloes	0	58
Common Duicker	2	2
Grysbok	1	0
Impala	0	12
Kudu	2	7
Suni	1	0
Bushpig	0	2
Grand Total	**6**	**81**

Source: DNPW

Dowsett and Dowsett Lemaire (2002) produced a document in which they consolidate their observations on wildlife and report observations from other wildlife experts for the three parks (Lengwe, Majete and Mwabvi) in the Study area. The following table is adapted from their work and is adds newly re-introduced wildlife in the Majete Wildlife Reserve since it has been managed by African Parks.

Table 29: Common mammals in the three parks

Family	**Species**	**Lengwe**	**Majete**	**Mwabvi**
Soricidae (shrews)	*Crocidura hirta*	OL		
Erinaceidae	Four-toed Hedgehog *Atelerix albiventris*			x
Pteropodidae	*Rousettus aegyptiacus*	x		
Nycteridae (slit-nosed bats)	*Nycteris macrotis*	x		
	Nycteris thebaica	x		
Rhinolophidae (nose-leafed bats)	*Rhinolophus fumigatus*			x
	Rhinolophus clivosus	X		
	Hipposideros commersoni	X		
	Hipposideros caffer	x		X
	Scotophilus viridis	X		

Family	Species	Lengwe	Majete	Mwabvi
Vespertilionidae (pipistrelle bats)	*Pipistrellus nanus*	X		
	Nycticeius schlieffenii	X		X
	Scotoecus albofuscus	X		
Molossidae (free-tailed bats)	*Tadarida pumila*	X		
	Tadarida condylura	X		
Lorisidae (galagos)	Greater Bushbaby *Otolemur crassicaudatus*	X	X	X
	Lesser Bushbaby *Galago moholi*	X	X	X
	Zanzibar Galago *Galagoides zanzibaricus*	X	X	X
Cercopithecidae (monkeys and baboons)	Yellow Baboon *Papio cynocephalus*	X	X	X
	Vervet Monkey *Cercopithecus pygerythrus*	X	X	X
	Blue Monkey *Cercopithecus albogularis*	X	X	X
Canidae (dogs)	Side-striped Jackal *Canis adustus*	X		X
Mustelidae (mustelids)	Cape Clawless Otter *Aonyx capensis*		X	
Viverridae (civets etc.)	Two-spotted Palm Civet *Nandinia binotata*			X
	African Civet *Civettictis civetta*	X	X	X
	Rusty-spotted Genet *Genetta rubiginosa*	X	X	X
	Bushy-tailed Mongoose *Bdeogale crassicauda*	X		X
	Large Grey Mongoose *Herpestes ichneumon*	X	X	X
	Slender Mongoose *Galerella sanguinea*	X	X	X
	White-tailed Mongoose *Ichneumia albicauda*	X		
	Banded Mongoose *Mungos mungo*	X	X	X
	Dwarf Mongoose *Helogale parvula*		X	X
Hyaenidae (hyaenas)	Spotted *Hyaena Crocuta*	X	X	X
Felidae (cats)	Leopard *Panthera pardus*	X	X (recent)	X
	Lion *Panthera leo*		X (recent)	
	Serval *Felis serval*	X	X	X
	Wild Cat *Felis libyca*	X	X	X

Family	Species	Lengwe	Majete	Mwabvi
Elephantidae (elephants)	African Elephant *Loxodonta africana*		X (recent)	
Rhinocerotidae	Black Rhino *Diceros bicornis*		X	
Family	Species	Lengwe	Majete	Mwabvi
(rhinoceroses)			(recent)	
Equidae (horses)	Burchell's Zebra *Equus burchelli*		X (recent)	
Procaviidae (hyraxes)	Yellow-spotted Dassie *Heterohyrax brucei*	X	X	X
	Tree Hyrax *Dendrohyrax arboreus*	X	X	X
Orycteropodidae (Ant bear)	Ant bear *Orycteropus afer*	X	X	X
Suidae (pigs)	Wart Hog *Phacochoerus aethiopicus*	X	X	X
	Bush Pig *Potamochoerus porcus*	X	X	X
Hippotamidae (hippopotami)	*Hippopotamus amphibius*		X	
Bovidae (antelope etc.)	Lichtenstein's Hartebeest *Sigmoceros lichtensteinii*		X (recent)	
	Grey Duiker *Sylvicapra grimmia*	X	X	X
	Klipspringer *Oreotragus*	X	X	X
	Sharpe's Grysbok *Raphicerus sharpei*	X	X	X
	Suni *Neotragus moschatus*	X	X	X
	Impala *Aepyceros melampus*	X	X	X
	Sable Antelope *Hippotragus niger*		X	X
	Buffalo *Syncerus caffer*	X	X (recent)	X
	Greater Kudu *Tragelaphus strepsiceros*	X	X	X
	Nyala *Tragelaphus angasii*	X		X
	Bushbuck *Tragelaphus scriptus*	X	X	X
	Eland *Taurotragus oryx*		X (recent)	
	Reedbuck *Redunca arundinum*	X	X	
	Waterbuck *Kobus ellipsiprymnus*		X	
Manidae (pangolins)	Pangolin *Manis temminckii*	X	X	X
Sciuridae (squirrels)	Sun Squirrel *Heliosciurus mutabilis*	X	X	X
	Bush Squirrel *Paraxerus cepapi*	X	X	X

Family	Species	Lengwe	Majete	Mwabvi
	Red Squirrel *Paraxerus palliatus*	X		X
Hystricidae (porcupines)	Porcupine *Hystrix africaeaustralis*	X	X	X
Thryonomyidae (cane rats)	Greater Cane Rat *Thryonomys swinderianus*		X	X
Bathyergidae (mole-rats)	Silvery Mole-rat *Heliophobius argenteocinereu*s			X
	Common Mole-rat Cryptomys hottentotus			X
Leporidae (hares)	Hare Lepus saxatilis	X	X	X
	Red Rock Hare *Pronolagus rupestris*	X		X
Macroscelididae (elephantshrews)	Four-toed Elephant-shrew *Petrodromus tetradactylus*	X	X	X
	Peters's Short-snouted Elephantshrew *Elephantulus fuscus*	X	X	X
	Checkered Elephant-shrew *Rhynchocyon cirnei*	X		X

Ol :Old LEngewe only, X (recent) since the change in management in Majete Wildlife Reserve

BIRDS

The number of birds occurring in the Lower Shire three reserves is very high, with between 340,350 species recorded as resident or regular migrants; another 50-60 species occur as irregular visitors or vagrants. The maintenance of important bird habitats such as well-developed deciduous forest and thicket is essential for the survival of several vulnerable bird species. Old Lengwe has the best preserved thickets in the Study area (Dowsett-Lemaire & Dowsett, 2002).

The Shire Valley is also of importance as wintering ground for a number of Palearctic migrants such as Palearctic raptors (including the IUCN endangered Steppe Eagle *Aquila nipalensis*), rollers and bee-eaters, and very large numbers of several passerine species. The very rare and IUCN endangered Basra Reed Warbler *Acrocephalus griseldis*, was observed in small numbers throughout the area (Dowsett-Lemaire & Dowsett, 2002).

Elephant Marsh qualifies as a 'wetland of international importance' based on its waterbird populations both relative to the total number of waterbirds present (>20 000) and relative to certain waterbird species exceeding the relevant 1% population thresholds[9]. The 2016 bird census in the Elephant Marsh established the existence of 20,238 bird population drawn from 199 bird species of which 68 were water birds

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[9] Anchor Environmental (2016), Biodiversity of the Elephant Marsh

Eight of the waterbird species that have been recorded at Elephant Marsh or at least in the lower Shire River area are globally threatened species. These are: Madagascar Squacco Heron, Lesser Flamingo, Wattled Crane, Southern Crowned Crane, Great Snipe, Bar-Tailed Godwit, Curlew Sandpiper and African Skimmer. However for only one of these species, African Skimmer, does the Elephant Marsh appear to be a significant locality.

6.8.9 Rare and Scarce Species in Lower Shire Valley

IUCN STATUS

The International Union for Conservation of Nature (IUCN) holds a worldwide-recognized database of species with special status called the IUCN Red List.

Searches on IUCN Red List were carried out to identify the status of species recorded from the valley, and the findings are presented in the following tables..

Table 30: IUCN status of Terrestrial Species recorded from the study area

Taxonomy	Location & system	Habitat	Assessment
Chordata (vertebrate)	Malawi, Terrestrial	Forest, Savanna, Shrubland, Grassland, Rocky areas	Extinct, Critically Endangered, Endangered, Vulnerable, Near Threatened
Common name	**Latin name**	**Habitat**	
Steppe Eagle	***Aquila nipalensis***	**Hills and mountains**	**Parleactic Migrant, Endangered**
Tawny Eagle	*Aquila rapax*	Woodlands	Resident and common in LNP, Vulnerable
Basra Reed-warbler	***Acrocephalus griseldis***	**Marshland**	**Endangered**
Southern Ground-hornbill	*Bucorvus leadbeateri*	Woodland and savanna	Vulnerable
Stierling's	*Dendropicos*	Brachystegia woodland	Near Threatened
Great spotted eagle	*Clanga clanga*	Woodland and savanna	Parleactic Migrant, Rare in LNP, Vulnerable
Lappet-faced Vulture	***Torgos tracheliotos***	**Woodland and dry savanna**	**Resident but rare in LNP, Endangered**
Purple Roller	*Eurystomus azureus*	Woodland	African migrant, Near threatened
Red-necked falcon	*Falco chicquera*	Woodlands	Resident and common in LNP, Near threatened

Taxonomy	Location & system	Habitat	Assessment
Chordata (vertebrate)	Malawi, Terrestrial	Forest, Savanna, Shrubland, Grassland, Rocky areas	Extinct, Critically Endangered, Endangered, Vulnerable, Near Threatened
Common name	**Latin name**	**Habitat**	
Southern-banded Snake Eagle	*Circaetus fasciolatus*	Woodlands	Resident and common in LNP, Near threatened
Western Red-footed Falcon	*Falco vespertinus*	Woodlands	Resident and common in LNP, Near threatened
White-headed Vulture	*Trigonoceps occipitalis*	Woodlands	Resident and common in LNP, Critically Threatened
Woolly-necked Stork	*Ciconia episcopus*	Woodlands, wetlands, grasslands	Resident but rare in LNP, Near threatened
Buffalo	*Syncerus caffer*	Woodland and savanna	Near threatened
Woodpecker	*stierlingi*		
White-backed Vulture	***Gyps africanus***	**Open wooded savanna (Acacia)**	**Critically Endangered**
Olive-headed Weaver	*Ploceus olivaceiceps*	Brachystegia woodland	Near Threatened
Martial Eagle	*Polemaetus bellicosus*	Open woodland, wooded savanna, bushy grassland	Vulnerable
Secretary bird	***Sagittarius serpentarius***	**Grasslands, lightly wooded savanna**	**Rare, Endangered**
Temminck's Ground Pangolin	*Smutsia temminckii*	Savanna woodland	Vulnerable
Crowned Eagle	*Stephanoaetus coronatus*	Forest, woodland, savanna and shrubland	Near Threatened
Bateleur	*Terathopius ecaudatus*	Grasslands, savanna	Near Threatened
African Strawcoloured Fruit-bat	*Eidolon helvum*	Riverine forest, savanna	Near Threatened
Commerson's Leafnosed Bat	*Hipposideros vittatus*	Savanna woodland habitats	Near Threatened

Taxonomy	Location & system	Habitat	Assessment
Chordata (vertebrate)	Malawi, Terrestrial	Forest, Savanna, Shrubland, Grassland, Rocky areas	Extinct, Critically Endangered, Endangered, Vulnerable, Near Threatened
Common name	**Latin name**	**Habitat**	
Elephant shrew	*Rhynchocyon cirnei shirensis*	Closed-canopy woodlands, and riparian thickets	For R. cirnei : Near Threatened For R. cirnei shirensis: not studied by IUCN but rare in the LNP (LNP Park Plan, 2005).
Black Rhinoceros	*Diceros bicornis*	Woodland, savanna and shrubland	Extinct* (re-introduced at Majete WR)
Leopard	*Panthera pardus*	Woodland, grassland savanna and forest	Near Threatened

Table 31: Terestrial Plant Species recorded from the study area: IUCN Red data List status

No	Scientific Name	English Name	IUCN Data Redlist
1	*Milicia {= Chlorophora} excelsa*		Nearly threatenedT
2	*Monodora stenopetala*	Oval green-apple	Vulnerable
3	*Baphia spp*	The camwood genus	Nearly threatened
4	*Crotalaria sp.*	The rattle-pod genus	Nearly threatened
5	*Dalbergia melanoxylon*	African blackwood	Nearly threatened
6	*Lannea schweinfurthii {stuhlmanii}*	False marula	Available in LNP but nearly threatened globally
7	*Cola mossambicensis*		Available in LNP but nearly threatened globally
8	***Clerodendrum myricoides***		**Available in LNP but**

			endangered globally

The following table shows the results for wetland species, these species are to be considered potentially present in Elephant marsh.

Table 32: IUCN status of Wetland Species recorded from the study area

Taxonomy	Location & system	Habitat	Assessment
Chordata (vertebrate)	Malawi, Freshwater	Wetlands (inland)	Extinct, Critically Endangered, Endangered, Vulnerable, Near Threatened
Common name	**Latin name**	**Habitat**	
Madagascar Pond-heron	***Ardeola idae***	**Swallow wetlands fringed with vegetation and adjacent trees**	**Endangered**
Grey Crowned-crane	***Balearica regulorum***	**wetlands such as marshes, pans and dams with tall**	**Endangered**
Blue Swallow	*Hirundo atrocaerulea*	Montane grassland	Vulnerable
African Clawless Otter	*Aonyx capensis*	Permanent river	Near Threatened
Hippopotamus	*Hippopotamus amphibius*	Wetland and permanent river	Vulnerable
Spotted-necked Otter	*Hydrictis maculicollis*	Freshwater (stream, river, reservoir)	Near Threatened

LOCALLY RARE BIRDS

According to Dowsett-Lemaire & Dowsett (2002), the Lower Shire is a biogeographical limit for a number of thicket/forest birds with restricted distribution in South-Eastern Africa. These include the Gorgeous Bush *Shrike Malaconotus viridis*, Rudd's Apalis *ruddi*, Grey Sunbird *Nectarinia veroxii*, Woodwards' Batis *fratrum*, Barred Long-tailed *Cuckoo Cercococcyx montanus* and the Black-andWhite Flycatcher *Bias musicus*; the grassland species the Lemon-breasted *Canary Serinus citrinipectus* is also a south-eastern endemic. The almost total disappearance of thicket vegetation in the Shire Valley outside wildlife reserves means that thickets in Lengwe and Mwabvi are of the utmost importance for the survival of these relatively rare species.

LOCALLY RARE PLANTS

In Majete, Kabwazi et al. (2000) notes that Holmskioldia spinescens (a deciduous shrub), Hyphaene crinata (shrub) and a Holostylon species occur in only a few areas of the reserve and should be regarded as rare.

In Lengwe, Kabwazi et al. (2000) mentions that Euphorbia lividiflora (red-flowered Euphorbia), Croton megalocarpus (tree), Croton pseudopulchellus (tree), Hygrophila pilosa (perennial herb), Maerua parviflora (shrub), Ziziphus pubescens (tree) and a species of Spermacose (Rubiacea) should be regarded as rare.

In Mwabvi Wildlife Reserve, there is a rare tree known locally as "Mwabvi" from which the name of the reserve come from.

The 2021-22 IUCN assessment adds the plants listed in Table 16 below to those requiring attention due to vulnerability and their becoming endangered.

6.8.10 AQUATIC ECOLOGY

The study area has been the subject of many studies on fishes, this section is therefore based on desktop review on the most important fish species.

6.8.10.1 Introduction

This section covers the aquatic ecology baseline with the major fish species present and a sample of some important fish species classified as 'other' fish species by the Department of Fisheries of the Lower Shire Valley. The fish species described here are mainly from the families of *Cichlidae, Cyprinidae* and *Claridae*.

Malawi is endowed with numerous water bodies that include Lakes Malawi, Malombe, Chilwa, Chiuta and the Shire River. Lake Malawi is a hot spot for fish biodiversity with an estimated over 1,000 fish species some of which are still not yet described (Ngatunga, 2001). Another important feature about the lake is that most of the fish species (over 90%) in the lake are endemic. Hence, the Lake Malawi National Park was declared a natural heritage site for fish biodiversity in the world by UNESCO.

The Malawian major water bodies are stratified for fisheries statistical and administrative reasons. In addition, Shire River is divided into 3 distinctive environments, the Upper Shire, the Middle Shire and the Lower Shire, each with distinctive features and fish species biodiversity (Osborne 2000; Tweddle & Willoughby, 1979). This section concentrates on fish from the Lower Shire.

LOWER SHIRE RIVER ECOSYTEM

The fish fauna of Malawi are divided into the Lake Malawi and the Lower Shire fish fauna. The Lake Malawi fish fauna comprise all the fish in the lake, all its tributaries and the Shire River up to the Middle Shire or the rapids.

The Lower Shire fish fauna shares the same ecology with the lower Zambezi fish species because of the absence of any physical barrier between the Lower Shire and the Zambezi River.

The Kapichira Falls and the Middle Shire rapids are physical and ecological obstacles to the upstream migration of the Lower Shire fish fauna into the Lake Malawi basin, however the only absolute barrier

to upstream fish migration is the Kapichira falls (Tweddle, Lewis, Willoughby, 1979). Thus, fish cannot migrate from the Lower Shire to the Middle Shire.

Regarding downstream migration, some fishes from Upper Shire survive when descending the falls and the EGENCO long spillway, although many are left injured and weakened from the harshness of the spillway. Therefore, the Lower Shire and associated marshes support a Lower Zambezi fish fauna, separated physically and ecologically by the rest of the Shire River. Downstream movement of species from Lake Malawi to the Lower Shire explains the presence of a few upstream species in the Lower Shire, however due to the harshness of the EGENCO spillway and the water intake of the powerstation only a few common species are present in the Lower Shire. In addition, the tiger fish from the Lower Shire and Zambezi River is such an aggressive predator that scientists believe that it is the reason why endemic fish species from upper Shire have not succeeded in colonizing Lower Shire (and not only because of the dangerous falls of Kapichira) (Tweddle, Lewis, Willoughby, 1979).

Figure 50: Spillway

5.8.10.2 Fisheries

The Lower Shire River sustains an important river-floodplain fishery (where fish production is highly dependent on the quantity of annual flooding) contributing to about 4.2% of total fish landings in the country (FAO, 2015). The fish in the Lower Shire are caught mainly for subsistence by small-scale fishermen providing livelihoods for about 1,830 people. These people are either gear owners or fishing crew members (Frames survey, 2015). The fisheries in the Lower Shire like in Lake Malawi are multi-species hence fishers use multiple gears to catch them. Fishery regulations are not well enforced.

More than 60 species are reported to be caught in the Lower Shire fishery, but only three namely, “Mlamba”, the African Catfish (*Clarias gariepinus*), “Chikano” (*Clarias ngamensis*) and “Mphende”, the Tilapia (*Oreochromis mossambicus*) are of commercial importance. Both the *Clarias gariepinus* and the *Clarias ngamensis* are considered a single species. These three contribute to 90% of the total fish catch in the Lower Shire. Tilapia constitutes about 51 % of total catches from Lower Shire River and *Clarias sp*. to 42% (FAO, 2015). Although Tilapia is a worldwide invasive species, it is endemic to the Lower Shire and the Lower Zambezi River (Chimatiro, 2004).

The most recent fish catch statistics for the major fish species in Chikhwawa and Nsanje districts are as tabulated below (Department of Fisheries, 2021):

Table 33: Fish catches in the Lower Shire between 2011 and 2020

Year	Mphende / Other tilapia	Chikano	Mlamba	Kambuzi	Others	Total (tons)
2011	13.61	0	59.65	6.3	180.41	**259.97**
2012	99.84	0	171.72	74.91	384.65	**731.12**
2013	402.94	0	164.32	48.24	49.15	**664.65**
2014	358.78	0	177.41	43.42	123.48	**703.09**
2015	350.67	76.73	157.66	40.03	100.57	**725.66**
2016	290.31	123.75	130.11	28.37	68.35	**640.89**
2017	236.43	6.34	144.42	51.96	81.44	**520.59**
2018	363.61	8.29	207.14	47.69	119.56	**746.29**
2019	510.53	13.35	454.95	52.76	260.08	**1,291.67**
2020	744.01	4.49	374.06	54.37	119.71	**1,296.64**

Source: Department of Fisheries

There was an increment in fish catches over those caught in the period 2015 to 2020. The catch was higher than the other years because water levels were low and people were using beach seine nets as well. The floods that occurred in the period favoured catching of cat fish.

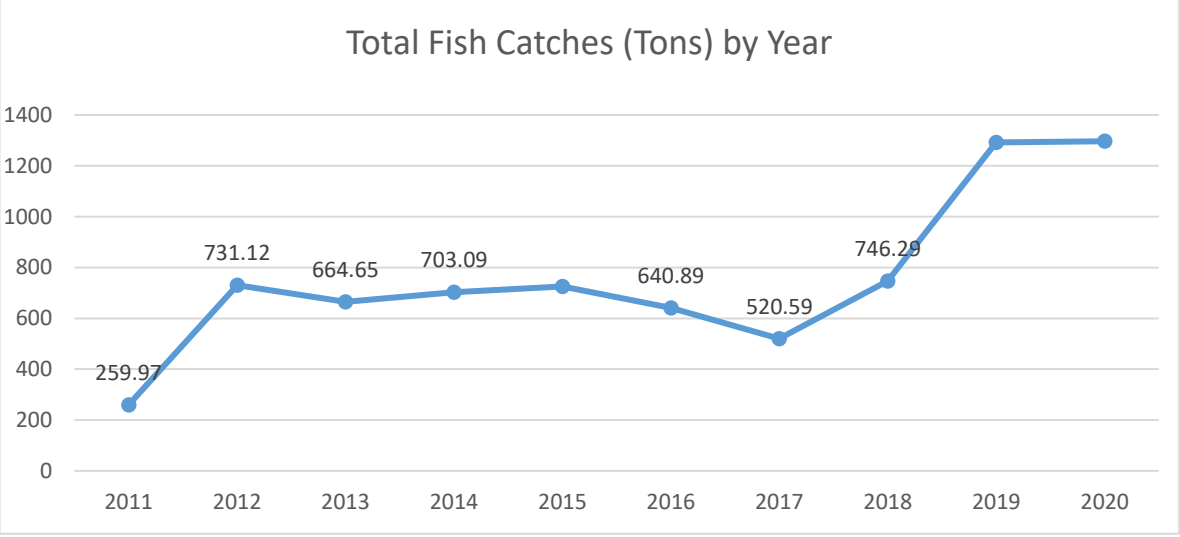


Figure 51: Graph Showing Fish catches in the Shire Valley

The main fishing methods in the Lower Shire include seine nets, gill nets, fish traps, scoop nets, cast nets and encircling fish fence. Gill nets are the commonest fishing gears used and dug-out canoes and plank boats without engines are the main fishing crafts employed.

Between January and February, 2023, a rapid assessment of fisheries resources was carried in the Elephant Marsh. Owing to flooding and heavy vegetation during the time, a few species as indicated in Table 37 below were iobserved: These are much less than what was observed in 2019 detailed assessment as spelt out in section 10.7.3 below.

Table 34: Fish Species Observed during the rapid assessment exercise

Family	**Species**	**English name**	**IUCN Red List status**
Alestidae	*Hydrocynus vittatus*	Tigerfish	Least Concern
	Micralestes acutidens	Silver robber	Least Concern
Amphiliidae	*Zaireichthys monomotapa*	Eastern sand catlet	Least Concern
Anguillidae	*Anguilla bengalensis labiata*	African mottled eel	Least Concern
Chiclidae	*Astatotilapia calliptera*	Eastern happy	Least Concern
	Coptodon rendalli	Redbreast tilapia	Least Concern
	Oreochromis mossambicus	Mozambique tilapia	Vulnerable
	Oreochromis placidus	Black tilapia	Least Concern
	Oreochromis shiranus shiranus	Shire tilapia	Least Concern
	Pseudocrenilabrus philander	Southern mouthbrooder	Least Concern
Clariidae	*Clarias gariepinus*	Sharptooth catfish	Least Concern
	Clarias ngamensis	Blunttooth catfish	Least Concern
	Clarias theodorae	Snake catfish	Least Concern
Cyprinidae	*Barbus afrohamiltoni*	Hamilton's barb	Least Concern
	Barbus cf. *lineomaculatus*	(Unnamed)	Not assessed
	Barbus cf. *viviparus*	Bowstripe barb	Not assessed
	Barbus haasianus	Sicklefin barb	Least Concern
	Barbus kerstenii	Red-spotted barb	Least Concern
	Barbus macrotaenia	Broadband barb	Least Concern
	Barbus paludinosus	Straightfin barb	Least Concern
	Barbus radiatus	Beira barb	Least Concern
	Barbus trimaculatus	Threespot barb	Least Concern

Family	Species	English name	IUCN Red List status
	Brycinus imberi	Imberi	Least Concern
	Labeo altivelis	Hunyani labeo	Least Concern
	Labeo congoro	Purple labeo	Least Concern
	Labeo cylindricus	Redeye labeo	Least Concern
	Labeobarbus johnstonii	Short-barbeled yellowfish	Least Concern
	Opsaridium microcephalum	Sanjika	Least Concern
	Opsaridium tweddleorum	Dwarf sanjika	Least Concern
Distichodontidae	*Distichodus mossambicus*	Nkupe	Least Concern
	Distichodus schenga	Chessa	Least Concern
Gobiidae	*Glossogobius callidus*	River goby	Least Concern
Malapteruridae	*Malapterurus shirensis*	Electric catfish	Least Concern
Mochokidae	*Chiloglanis* sp. nov.	Rock catlet	Not assessed
	Synodontis nebulosus	Clouded squeaker	Least Concern
	Synodontis zambezensis	Brown squeaker	Least Concern
Mormyridae	*Cyphomyrus discorhynchus*	Zambezi parrotfish	Least Concern
	Marcusenius macrolepidotus	Bulldog	Least Concern
	Mormyrops anguilloides	Cornish jack	Least Concern
	Mormyrus longirostris	Eastern bottlenose	Least Concern
Poeciliidae	*Micropanchax katangae*	Striped topminnow	Not assessed
Protopteridae	*Protopterus annectens brieni*	Lungfish	Least Concern
Schilbeidae	*Schilbe intermedius*	Silver catfish	Least Concern
Species expected but not seen during fieldwork, based on Tweddle and Willoughby (1979)			
Alestidae	*Hemigrammopetersius barnardi*	Barnard's robber	Least Concern
Amphiliidae	*Amphilius uranoscopus*	Common mountain catfish	Least Concern
Anabantidae	*Ctenopoma multispinis*	Many spined climbing perch	Least Concern
	Microctenopoma intermedium	Blackspot climbing perch	Least Concern
Clariidae	*Heterobranchus longifilis*	Vundu	Least Concern
Cyprinidae	*Barbus atkinsoni*	(Unnamed)	Least Concern
	Barbus cf. *toppini*	(Unnamed)	Not assessed

Family	Species	English name	IUCN Red List status
Gobiidae	*Glossogobius giuris*	Tank goby	Least Concern
Poeciliidae	*Micropanchax hutereaui*	Mesh-scaled topminnow	Least Concern

CHALLENGES

There is a seasonal fluctuation of fish catches linked to the flooding pattern of Shire River which is influenced in part by the operations of the Kamuzu Barrage (Chimatiro, 2004). Water Hyacinth blooms is another issue problem in the area adversely affecting the fishery. The challenge in managing fishery resources in Malawi is that the artisanal fishery which includes the Shire River is "open-access" in character. Due to weak enforcement by the Malawi Department of Fisheries, many fishers continue to fish without any access restrictions. In fact, as opposed to Lakes Malawi and Malombe, the fishery in the Shire River appears to be unregulated due to lack of enforcement.

The lagoons and marshy areas (such as Elephant marsh) are getting shallower and narrower due to soil deposition brought about by flooding. Hence huge soil deposition may in future affect the marshes which are hot spots for fish breeding in the area.

Rapid assessment surveys are very important to have a snapshot of a situation, however for a thorough understanding of the fish biota in the Elephant marsh, it is strongly recommended that a proper assessment should be done as part of the planned biodiversity monitoring in Phase 2. This assessment will use both fisheries independent and fisheries dependent methods.

6.8.10.3 Description of the Fish Species in the Lower Shire Valley

This section presents the Tilapia, the African Catfish as well as other fish species in the Lower Shire whose catch is small and are hence characterized as "others" by Fisheries Department. These "other" species include:

- Straighfin Barb, "Matemba" (*Barbus paludinosis*);
- "Nkholokolo" (*Synodontis njassae*);
- Tigerfish (*Hydrocynus vittatus*);
- Lake Salmon, "Mpasa" (*Opsaridium microlepis*);
- Redeye labeo, "Ningwi" (*Labeo cylindricus*);
- "Kadyakolo" (*Barbus eurystomus*); and
- "Ngumbo" (*Barbus Johnstonii*).

In addition, *Marcusenius macrolepidotus* an important catch of gillnet fishery is presented hereunder.

The 49 fish species presented are either the most common or the ones with special status (IUCN assessment). In the main report, the 10 most important fish species for subsistence and commercial fisheries are presented. For each fish description, the following criteria has been developed by BRLi to reflect potential issues and challenges that fishes will face due to the Project implementation. Therefore, these criteria have been considered as part of the impact assessment:

- Habitat requirements and regional extent: this criterion helps to understand where the fish is present in the region and the world. It describes in which habitat the fish is usually found;
- Water quality requirements: this criterion helps to understand what the requirements of the fish are in terms of temperature, pH or turbidity;
- Water flow requirement: this criterion describes whether the fish thrives in fast moving water of slow moving water such as pools;
- Ability to pass obstacles: this important criterion describes the ability of the fish to jump or pass over obstacles as the project will involve many infrastructures such as canal, siphon and weirs;
- Life cycle (migration, spawning and maturing): this important criterion describes the life cycle of fishes;
- Important habitats and sensitive life cycle stage: this criterion describes the important habitats and life cycle stage for each fish. The term "important" designate the predilection habitat of the fish and the sensitive phase of the fish life cycle. This criterion will help to assess the significance of impact in the impact assessment;
- Actual threats and protection status: this criterion gives an actual indication on the status of the fish and whether it is rare or has an IUCN status (based on March 2016 consultation of IUCN Red List);
- Value as food source for population and value in the food chain: this criterion describes the value of the fish as a protein source for communities;
- Distribution, status of endemicity and relative abundance: this criteria is similar to the first one, it gives additional information about the relative abundance of the fish in the Study area;
- Status (native, allochthonous or invasive): this criteria describes the fish in term of its status as native, allochthonous (introduced) or invasive (introduced and aggressively competing with other species). It also describes whether the fish, if transported outside of its natural range, may become invasive or not.

As presented earlier, many species use elephant marsh either for spawning in vegetation, or as their main habitat. The terms "marshy area", "swamps", "pools" in the following sections all refer to ecosystems that constitute the Elephant marsh.

6.8.10.4 Tilapia (Oreochromis mossambicus)

HABITAT REQUIREMENTS AND REGIONAL EXTENT

The natural native habitat of *O. mossambicus* is the eastern coastal region of Africa where the species is found in riverine and coastal lagoon habitats (Fryer and Illes, 1972). The species is found in abundance in the Lower Zambezi river in Mozambique where it has derived its name, as the Mozambique tilapia, i.e., *O. mossambicus*. The species migrated from its natural habitat in the Zambezi River and inhabits the marshy and lagoon areas of the Lower Shire Valley (Tweddle et al., 1982) where it has been confined due to the natural barrier between the Lower Shire / Zambezi fish fauna and the Lake Malawi fish fauna. The species was introduced to the US through aquaculture and has established itself through accidental or intentional introductions in the river systems of Texas, Florida and Alabama (Brown, 1961; Courtney, 1961; Bruton and Bolt, 1975). *O. mossambicus* has also been introduced in many African and Asian countries where aquaculture is being practiced.

WATER QUALITY REQUIREMENTS

Temperature

O. mossambicus is one for the tropical fin fishes of Africa. It tolerates a wide range of temperature. The optimum temperature for growth is above 19^{o}C and for reproduction is above 22^{o}C (Trewavas, 1983). These conditions are prevalent in the Lower Zambezi River and the Lower Shire. In the natural habitats, Trewavas (1983) reported that *O. mossambicus* does not tolerate temperatures below 10^{o}C.

Salinity

O. mossambicus tolerates a broad range of water salinity (Trewavas, 1983). The species thrive in fresh water up to the salinity levels of 40 ppt, it can reproduce in estuarine waters with salinity levels as high as 34.5 ppt (Knaggs, 1977; Dial and Wainright, 1983). This is one of the features common to all tilapias which enable them adapt a wide range of environmental conditions and hence their world-wide distribution (Trewavas, 1983). pH

O. mossambicus can tolerate a wide range of pH from 3.1 (acidic conditions) to 8.5 (alkaline conditions). This feature also accounts for their adaptation to a wide geographical range (Trewavas, 1983).

WATER FLOW REQUIREMENT

The *O. mossambicus* inhabits riverine and coastal lagoons (Fryer and Iles, 1972), hence does not like fast flowing waters but areas that are sheltered such as the marshes and lagoons in the rivers. In the Lower Shire, the fish inhabits the marshy areas such as Elephant and Ndindi marshes as well as the lagoons (Tweddle et al., 1982).

ABILITY TO PASS OBSTACLES

O. mossambicus as a tilapia cannot negotiate rapids as Barbus species, Opsaridium species and Labeo species (Trewavas, 1983). The *O. mossambicus* migrates to other areas when there is no physical obstacle in the water body. The *O. mossambicus* that are found in uplands is due to artificial introductions either accidentally or intentionally.

LIFE CYCLE (MIGRATION, SPAWNING AND MATURING)

Fishes in the genera “Oreochromis” are mouth brooders of eggs and young. All fish species in the family “Cichlidae” practice long-term parental care of young (Trewavas, 1983). Female *O. mossambicus* mature when they have attained a body length of 150-160 mm and males mature after attaining a longer body length of between 170 and 180 mm (Hodgkiss and Man, 1978; Arthington and Milton, 1986). However, due to the unstable flow conditions in the Lower Shire valley, the fish matures at an earlier stage (Chimatiro, 2004). The breeding season for Oreochromis species is stimulated by high minimum water temperatures (22-25^{o}C) (Trewavas, 1983) hence in the Lower Shire, Oreochromis species breed almost throughout the year due to the high temperatures, but peaking during the rainy season.

Mature males develop breeding colors, especially during the onset of the first rains and migrate to shallow waters along the river banks where they construct nests on sandy and or muddy bottoms. Mature females also develop breeding colors and are attracted to the nest by the colors of the males. When the eggs are laid on the nest, the male fertilizes them and the female picks up the fertilized eggs and incubates them in the buccal cavity situated below the lower jaw of her mouth (Trewavas, 1983). The juveniles inhabit the shallow or marshy waters and migrate to deep waters as they grow.

IMPORTANT HABITATS AND SENSITIVE LIFE CYCLE STAGE

O. mossambicus inhabits the sheltered areas of the river such as the marshy areas and lagoons. It also breeds on the shallow areas which are usually the river banks (Trewavas, 1983). Hence the marshy and lagoon areas are important habitats for all the stages of the life cycle of the species and the shallow areas and river banks are important for reproduction and recruitment of juveniles. The seining of the marshy areas and river banks especially during the breading season destroys the breeding grounds and nests of the fish.

ACTUAL THREATS AND PROTECTION STATUS

O. mossambicus is not yet red listed by IUCN but it is classified as a "Near Threatened" species. Three scenarios are putting the *O. mossambicus* under threat in the Lower Shire. The closure of the Barrage at Liwonde to regulate the water flow for generating power at Nkula, Tedzani and Kapichira results in occasional reduced water levels along the marshy areas of the Lower Shire
Valley, hence exposing the fish to fishers or predations and disturbs the breeding cycle (Tweddle, 2015). The second threat is the invasion of the water hyacinth which comes from the upper course of the Shire. These weeds invade the breeding sites of the fish. The third threat is the open access and poorly regulated fisheries that take place in the Lower Shire. Fishers are using inappropriate fish gears such as small meshed seine nets including mosquito nets. These gears destroy the breeding grounds and are non- selective, hence catch both juvenile and the adult fishes. Regarding protection status, although the fisheries regulations exist, there is weak enforcement in the area.

VALUE AS FOOD SOURCE FOR POPULATION AND VALUE IN THE FOOD CHAIN

Mphende (*Oreochromis mossambicus*) is the main fish species that has commercial value to the local fishers in the Lower Shire. Its catch from the Lower Shire constitutes to about 51 % of total catches from the area. The species is seconded only by the catfishes in terms of its commercial value in the Lower Shire Valley (Tweddle et al., 1982; Chimatiro, 2004). The species is important for both subsistence and commercial fishing. The species is also used for aquaculture at Kasinthula, Illovo and some small-scale fish farms in the Lower Shire.

Regarding the food chain *Oreochromis mossambicus* are generalists and opportunistic omnivores that consume detrital material, vegetation ranging from diatoms, macro-algae to rooted plants, invertebrates and small fish (Bowen 1979, Mook, 1983, Trewavas, 1983). Diets differ depending on location-specific resource availability. This fact was also reported by De Silva et al., (1984) who reported that *O. mossambicus* populations in different water bodies fed on different diets and trophic strategies ranged from detritivory to herbivory to near exclusive carnivory with individuals preying on small fish and invertebrates. This feature makes the fish adaptable a wide range of environmental conditions on the globe. In the Lower Shire, *O. mossambicus* is reported to feed mostly on algae, detritus and plankton, with preference to zooplankton (Pullin and Lowe McConnel, 1982). *O.*

mossambicus is caught and eaten by people, its juveniles are predated upon by scavengers such as catfishes and predators such as tiger fish and crocodiles. Hence, *O. mossambicus* is a very important fish species in the food chain in the area.

DISTRIBUTION, STATUS OF ENDEMICITY AND RELATIVE ABUNDANCE

The lower Shire area is rich in nutrients that are washed away from upland streams and are deposited in the valley. The nutrients boost the growth of phytoplankton and zooplanktons. The abundance of phytoplankton and zooplanktons which are natural food for tilapias creates a conducive environment for *O. mossambicus* to reproduce and grow in the area. The presence of marshes around Chikhwawa and Nsanje Districts such as Elephant marsh creates favorable environment for *O. mossambicus* to construct breeding nests, breed and raise its young ones without being predated hence there is high survival rate for the species from juvenile to adulthood (Tweddle et al, 1978). The Valley has several lagoons and oxbows along the Shire that also act as breeding grounds for *O. mossambicus* because these areas are shallow, have high primary productivity and hence abundant fish food is available for the fish. The fish catch statistics show that the catch of *O. mossambicus* has been stable over years. Hence, *O. mossambicus* is abundant in the Lower Shire.

STATUS (NATIVE, ALLOCHTHONOUS OR INVASIVE)

The species is native.

O. mossambicus is a prolific breeder and suppresses all other Oreochromis species in the Lower Shire, hence *O. mossambicus* remains the predominant Oreochromis species in the Lower Shire and the lower Zambezi River. In addition, *O. mossambicus* is invasive in other region of the world. It has thrived in alien environments where it has been introduced, either intentionally or accidentally (Moyle, 1976). Intentional release has often been for the purpose of plant or pest (e.g. Mosquito) control (Moyle, 1976). Intentional release has also been done to establish populations for spot fish, bait fish or commercial fish farming (Shapovalov et al., 1981). There have been accidental releases of *O. mossambicus* from hatcheries, fish farms, aquariums and zoos (Dial and Wainright, 1983; Grabowski et al., 1984; Courtenay and Stauffer, 1990).

O. mossambicus poses a threat to local native fish species through competition for food and nesting space (Courtenay et al., 1974). *Oreochromis mossambicus* has thus been nominated by the Invasive Species Specialist Group (ISSG) to be among the 100 of the world's worst invasive alien fish species (Courtinay, 1989). Although some Lake Malawi fish fauna including tilapias may manage to descend the rapids, they do not established in the Lower Shire due to the suppression by *O. mossambicus*.

6.8.10.5 Catfishes (Clarias gariepinus)

Originally, more than 100 different species of the Genus Clarias were described in Africa. However, a systematic revision based on morphological, anatomical and biographical studies has been carried out by Teugels (1982), who recognized 32 valid species. With this revision, all the large African Catfish species now belong to the subgenus Clarias. However, in the earlier systematic studies on the large African catfish species, Boulenger (1911) recognized five species within this subgenus. The five described species were: *Clarias anguillarus*, *Clarias senegalensis*, *Clarias lazera*, *Clarias mossambicus* and *Clarias gariepinus*. In 1982, Teugels revised the subgenus Clarias and found only two species (*C. gariepinus* and *C. anguillaris*), all the catfishes in the Zambezi and Lower Shire including *C. ngamensis* are now referred to as the African Catfish, *Clarias gariepinus*.

HABITAT REQUIREMENTS AND REGIONAL EXTENT

Clarias gariepinus, is one of the most important tropical catfish species and its distribution range is from the Nile to West Africa and from Algeria to Southern Africa. It also occurs in Asia Minor (Israel, Syria and South of Turkey). By contrast, *Clarias anguillaris* has a more restricted distribution and is found in Mauritania, most West African basins and in the Nile. *C. gariepinus* lives in freshwater lakes, rivers and swamps as well as man-made habitats, such as oxidation ponds or even sewage system (Teugels, 1982). Due to its importance in aquaculture, *C. gariepinus* was introduced in countries far from its natural habitat such as Brazil, Vietnam, Indonesia and India.

WATER QUALITY REQUIREMENTS

Clarias gariepinus is very tolerant to muddy water and conditions of low dissolved oxygen. Studies have shown that the species can survive turbid water where there is no oxygen at all because they are capable of respiring atmospheric air through a super-bronchial organ and can survive for days in air as long as there is moisture. This fish walks on land under damp conditions if necessary by extending pectoral spines and crawling (Skelton, 2001). The super-bronchial organ develops early in life at about 7 days after spawning when the juveniles are known as 'swim up fries' because they come to the water surface to breathe atmospheric air directly.

Furthermore, *Clarias gariepinus* can tolerate a wide range of temperature from 8^{o}C to 35^{o}C; salinity ranging from 0 to 12 ppt; and also has a wide range of pH, turbidity and tolerate high densities (Hecht et at 1988). Hence Clarias species are usually the last fish remaining when water bodies dry up, as was the case with Lake Chilwa when it dried up in 1996 (EAD, 2000).

WATER FLOW REQUIREMENT

Clarias species are the amongst the commonest fish species in rivers, lagoons and estuaries but are not representative of open lakes, though occasionally they may go into the Lake Malawi especially if they are migrating opposite the direction of the flow of flooded rivers. Hence during their normal life, *C. gariepinus* inhabits muddy and turbid areas of the rivers and is also found in large numbers in the marshy areas of the Lower Zambezi and Shire Rivers.

ABILITY TO PASS OBSTACLES

C. gariepinus migrates to higher ground to spawn by swimming against river flows during the rainy season when rivers flood. During the onset of first rains, the fishes congregate at the mouths of tributaries and the flooding stimulates their migration. They cannot climb or negotiate against physical obstacles. However, they may pass through dam walls and other obstacles if they are submerged by flooding waters.

LIFE CYCLE (MIGRATION, SPAWNING AND MATURING)

The size to first maturation of catfish in the Lower Shire is 193 cm (Chimatiro, 2004) which was within the range reported for the species in other water bodies (Bruton, 1979; Merron, 1996). Catfish resides in rivers as adult. In the Lower Shire, *C. gariepinus* grows fast during the first two years and reaches physiological maturity (Chimatiro, 2004). The fast growth rates during the first two years are typical of fish species that reside in unstable environments (Bruton and Allanson, 1974; Hecht et al., 1988). The fast growth rate enables juveniles to rapidly evade predation (Welcomme, 2001; Lowe McConnel,

1967). Both the mature males and females develop gonads which remain dormant until the onset of the rains. Final oocyte maturation is achieved when rivers flood. Spawning mostly takes place at night in the shallow, inundated areas of the rivers, lakes and streams (Quick and Bruton, 1983). Catfish lays a large number of small eggs which when fertilized stick on substrate such as vegetation (Welcomme, 2001). There is no parental care for ensuring the survival of the catfish offspring except by the careful choice of a suitable site and substrate. Development of eggs and larvae is rapid, and the larvae are capable of swimming within 48–72 hours after fertilization (Hecht et al., 1988).

IMPORTANT HABITATS AND SENSITIVE LIFE CYCLE STAGE

The important life cycle stage for *C. gariepinus* in the Lower Shire is during spawning migration. There is a need for flooding to stimulate final oocyte and gonad maturation. If there is less or no flooding or physical barriers to their shallow breeding sites then *C. gariepinus* breeding is adversely affected (Chimatiro, 2004; Tweddle, 2015). In addition, since there is no parental care of the fertilized eggs, there is a need to protect the shallow breeding sites such as the marshes so that fry to juvenile survival is optimized.

ACTUAL THREATS AND PROTECTION STATUS

The species is not IUCN red-listed, it is listed as being of "Least concern", hence the populations are healthy. It is reported that reproduction in the flood plain is governed by the flood regime in terms of timing, amplitude, pattern and duration (Jackson, 1961). In the tropical and sub-tropical rivers, fishes either migrate upstream during flooding periods in order to spawn (Kok, 1980) or span during the peak flooding without migrating (Merron, 1991). Spawning for *C. gariepinus* in the Lower Shire was reported to be synchronized with the rising and peak of the flood regime (Chimatiro, 2004; Tweddle and Willoughby 1979). Hence, rising temperature and reduction in floods constitute a disturbance to the flood plain fish species.

VALUE AS FOOD SOURCE FOR POPULATION AND VALUE IN THE FOOD CHAIN

The catches from the catfishes in the Lower Shire comprise 41% of the total catch and is superseded only by that of *O. mossambicus* (Chimatiro, 2004). Clarias species are completely omnivorous, consequently they prey, scavenge or grub on virtually any available organic food including fish, birds, frogs, small mammals, reptiles, snails, crabs, shrimps, insects, other invertebrates and plant matter such as seeds and fruit and also feeds on plankton when available (Skelton, 2001). The catfish larvae are preyed upon by dragonflies for them to complete their life cycle. Frogs, predatory fish and birds also feed on the catfish fry. Hence, the catfish is an important fish species in the food chain in the Lower Shire.

DISTRIBUTION, STATUS OF ENDEMICITY AND RELATIVE ABUNDANCE

Clarias gariepinus is indigenous in the Malawian waters and is found in almost all the riverine environments. In the Lower Shire, the *C. gariepinus* is in abundance and catches have been stable over the years, constituting the second largest catch from the *O. mossambicus.*

STATUS (NATIVE, ALLOCHTHONOUS OR INVASIVE)

The species is native.

Catfishes are opportunistic feeders and will take any fish species which is abundant. They respond quickly to newly available food sources and will change their feeding patterns to match organisms freely available. The versatility of their physical adaptations enables them to survive almost all conditions (De Moor & Bruton, 1988; Bruton, 1977). When introduced outside of its native range, their generalized feeding habits and mobility make Catfishes extremely efficient predators posing a threat to indigenous fish, amphibian and invertebrate populations. Several countries have reported adverse ecological impacts after the introduction of Catfishes. Studies conducted in 1972 in central Africa suggest that these species have profound negative ecological effects on aquatic insect communities. Insect diversity in the Coleoptera order can be reduced by up to 78% and Hemiptera by 66% by Catfishes (De Moor & Bruton, 1988; Bruton & van As., 1986). Hence *C. gariepinus* is a potential invasive species if introduced in alien areas. It has been identified as agents of loss of native biodiversity.

6.8.10.6 Straightfin Barb (Barbus paludinosis)

HABITAT REQUIREMENTS AND REGIONAL EXTENT

Barbus paludinosus (matemba) is a small fish that belong to the Cyprinidae family. It is widely distributed in Malawian waters from the upper reaches of rivers, the middle and lower reaches. Work by Tweddle et al., (1998) listed a number of Barbus species and their habitats in Malawi. They are also widely distributed within Africa and are found in Burundi, Kenya, Malawi, Tanzania and Uganda.

WATER QUALITY REQUIREMENTS

B. paludinosus is a freshwater fish species that inhabits rivers, freshwater lakes, freshwater marshes and inland deltas.

WATER FLOW REQUIREMENT

Barbus paludinosus requires fast flowing rivers for spawning within the river and spawning migration. However, for habitat it prefers marshy and protected areas (Macuiane et al., 2009).

ABILITY TO PASS OBSTACLES

Barbus paludinosus does not have the ability to pass through obstacles. However, if the obstacles are submerged with flooding waters the fish can pass through.

LIFE CYCLE (MIGRATION, SPAWNING AND MATURING)

Mature male and female *B. paludinosus* respond to the physical and chemical water quality changes and congregate at river mouths. They breed throughout the year but their breeding peaks during the rainy season. Final oocyte maturation is usually accomplished by flooding. The fish migrates to upstream and spawn where there is suitable substrate such as grass, sand or gravel. The eggs hatch and the fry feed on zooplankton and detritus. As the juveniles grow older, they descend the rivers and inhabit the main river courses, marshy areas and inland deltas (Macuiane et al., 2009).

The juveniles feed mostly on zooplankton and reaches maturity within 1 to 2 years.

IMPORTANT HABITATS AND SENSITIVE LIFE CYCLE STAGE

The *B. paludinosus* in the Lower Shire is found all over the river course. However, it likes marshy areas such as the Elephant marshes for food and shelter. Other important habitats are the mouths of tributaries where the mature male and female fish congregate before onset of rains in readiness for spawning migration. Therefore, the river mouths needs to be preserved. The breeding grounds in the upper reaches of streams where the fish breed are also important. It is documented that the fish species in the Barbus and Cyprinidae have a homing instinct hence they return to the breeding grounds where they were spawned to breed as adults (Ngatunga, 2001). It is not clear whether the fish can use alternative breeding grounds if their spawned area is destroyed and is not available.

ACTUAL THREATS AND PROTECTION STATUS

B. paludinosus is readily abundant in Malawian river system and is therefore not listed as endangered or threatened fish species by IUCN; rather it is classified as being of least concern.

VALUE AS FOOD SOURCE FOR POPULATION AND VALUE IN THE FOOD CHAIN

The catch of *B. paludinosus* in the Lower Shire is low.

B. paludinosus is caught by seine nets or fish traps for both food and sale. However, due to their low catch, the catches are mostly used for subsistence consumption. *B. paludinosus* feeds on zooplankton and detritus, is caught for food and is predated upon by scavengers such as the African catfish, predators such as crocodiles and Tiger fish. Hence, the species play an important role in the food chain in the Lower Shire.

DISTRIBUTION, STATUS OF ENDEMICITY AND RELATIVE ABUNDANCE

B. paludinosus is indigenous to Malawian water bodies both in the Lake Malawi and Lower Shire fish fauna. It is widely distributed and are in abundance hence not red listed by IUCN.

STATUS (NATIVE, ALLOCHTHONOUS OR INVASIVE)

The species is native.

B. paludinosus as well as all other fish species in the Cyprinidae are not invasive. They do not easily adapt to alien environments and easily lose out when competing with locally adapted fish species.

6.8.10.7 Synodontis njassae

HABITAT REQUIREMENTS AND REGIONAL EXTENT

S. njassae is found in the African waters in Lake Malawi, the Lower Shire and Zambezi river (Konings, 1990). Hence, the fish is endemic to the Lake Malawi and Zambezi waters.

WATER QUALITY

REQUIREMENTS pH

The *S. njassae* prefers alkaline water conditions ranging from 7.6 to 8.4 (Konings, 1990).

Temperature

The *S. njassae* prefers water temperature ranging from 23 to 28oC (Konings, 1990)

WATER FLOW REQUIREMENT

The *S. njassae* is referred to as hardy, but prefers clean and well filtered water in rivers and lakes. However, due to its hardiness it tolerates a wide range of environmental conditions (Konings, 1990).

ABILITY TO PASS OBSTACLES

S. njassae does not climb over physical obstacles, rather it is a rock dwelling and prefers to use rocks as bed cover for their dwelling environment. Therefore, the fish cannot pass through any physical obstacles (Konings, 1990).

LIFE CYCLE (MIGRATION, SPAWNING AND MATURING)

In natural environments, the fish matures after attaining 190 mm between the first and second years (Konings, 1990). The fish is found patrolling around rock piles during their normal stay in their natural environments. The species spawns between October and December in sandy and muddy substrate. It is caught in large numbers in these substrates during the breeding season at night, suggesting that the spawning activities take place during the night. The fish natural food is zooplankton and detritus when young and it also feeds on phytoplankton as it grows and matures to adulthood (Konings, 1990).

IMPORTANT HABITATS AND SENSITIVE LIFE CYCLE STAGE

The important habitat for the *S. njassae* during its normal life as adults is piles of rocks. During spawning, its important habitats are sandy and muddy substrates. Therefore, these sites need to be protected in the Lower Shire for efficient recruitment of the species. Unlike other fish species in the Cyprinidae family, *S. njassae* does not migrate upstream to breed. Therefore, its important habitat in the Lower Shire is the river course itself, where there are rocks and shelters such as marshes.

ACTUAL THREATS AND PROTECTION STATUS

According to the IUCN, the *S. njassae* is of least concern as its stocks are healthy in the Malawian waters.

VALUE AS FOOD SOURCE FOR POPULATION AND VALUE IN THE FOOD CHAIN

S. njassae is caught by fish traps especially during its breeding season both for food and for sale. However, due to their low catch, the species is mostly used for subsistence consumption. The fish

feeds on zooplankton, phytoplankton and detritus. Its young are preyed upon by scavengers and predators, hence it plays an important role in the food chain.

DISTRIBUTION, STATUS OF ENDEMICITY AND RELATIVE ABUNDANCE

S. njassae is widely distributed and in abundance in the rocky habitats in the Lake Malawi and the Lower Shire valley (Konings, 1990).

STATUS (NATIVE, ALLOCHTHONOUS OR INVASIVE)

The species is native.

The *S.njassae* is rock dwelling and has never been reported to be found outside their natural environment. It is therefore not an invasive fish species.

6.8.10.8 Tiger fish (Hydrocynus vittatus)

HABITAT REQUIREMENTS AND REGIONAL EXTENT

In Africa, tiger fishes are found in many rivers and lakes on the continent and are fierce predators with distinctive, proportionally large teeth. They are found in Congo river system and Lake Tanganyika and are the largest member of the Alestidae family. The Tiger fish in Zambezi is another famous species which is called *Hydrocynus vittatus*. This species is found in Okavango Delta, Zambezi River (Including the Lower Shire), Lake Kariba, Cabora Bassa and Jozini dam in South Africa. Both the goliath and alestidae tiger fishes are of African origin. Individual tiger fishes have interlocking, razor-sharp teeth, along with streamlined, muscular bodies and are extremely aggressive and are aquatic predators who often hunt in groups to chase the prey.

WATER QUALITY REQUIREMENTS

Hydrocynus vittatus prefers water temperatures between 19 to 28^{o}C, with stable pH that is around 7.5. It prefers two types of habitats, i.e., deep water of more than 1200 mm with fast flowing water and relatively deep (>700 mm) environments with no flow to fast flow (0-1.35 m/s). The species uses water column and over hanging vegetation for taking cover from its predators such as crocodiles (Skelton, 2001).

WATER FLOW REQUIREMENT

The water flow requirement for Tiger fish is either no flow at all (0 m/s) to fast flowing (0-1.35m/s) in the resident rivers. Hence, the fish thrives in a wide range of river flow velocities (Skelton, 2001).

ABILITY TO PASS OBSTACLES

The Tiger fish migrates to rivers and tributaries to breed during the rainy season, but it is a poor climbers of physical barriers unless the structure is completely submerged by the flooding waters. However, the fish can jump out of the water to catch low flying birds.

LIFE CYCLE (MIGRATION, SPAWNING AND MATURING)

H. vittatus matures after 2 years in its natural habitat. It breeds for just a few days each year during the rainy season, which is usually from December to January. The ripe fishes (male and females) migrate up rivers and smaller tributaries to the breeding grounds where the water is shallow and there is submerged vegetation. The male and female fishes return to the main river where the eggs hatch. The hatched larvae and fry remain in the shallow waters as Juveniles until the next flood waters force them into the main river.

IMPORTANT HABITATS AND SENSITIVE LIFE CYCLE STAGE

Adult *H. vittatus* can adapt a wide range of habitats and environmental conditions. However, they become vulnerable as they congregate along the river habitats to breed. When the ripe fish is caught, the breeding cycle is disrupted. In addition, the fish lay eggs on shallow breeding areas where submerged substrate is available. If the substrate or the breeding grounds are not available, the fish might not be able to breed. The flooding waters also assist the juveniles to return to the main river courses. Hence, flooding is very important for breeding, survival and completion of the fish life cycle.

ACTUAL THREATS AND PROTECTION STATUS

H. vittatus is widely distributed in its natural environment in the African waters. In some water bodies, the species has been locally depleted due to heavy fishing pressure that is exerted on them, however, due to its general common abundance IUCN has listed the *H. vittatus* as being of least concern for the Central, Eastern, North Eastern, Southern and West Africa, which includes the Lower Shire.

VALUE AS FOOD SOURCE FOR POPULATION AND VALUE IN THE FOOD CHAIN

H. vittatus is a very important fish species as food for the people in the Lower Shire. It is caught for subsistence use in home or for sale (commercial). It is also used for spot (angling) and hence a commercial fishery that could attract tourists. The catches of *H. vittatus* are low compared to *O. mossambicus* and Catfishes, hence the catches are lumped together with other species in the 'other' fish catches category which together contribute about 10% of the total catches in the Lower Shire area. In the Lower Shire, they are caught using hook and line, gillnets and also by nonselective gears such as seine nets. *H. vittatus* occupies a very important role in the food chain among the aquatic organisms in the Lower Shire. The fish is considered primarily as a carnivore and is one of the major predators in the Lower Shire valley. It moves in schools and prey on other fish species. It swallows the prey as a whole, hence it can predate on prey fish that is up to 40% of their body size. The main predation pressure from *H. vittatus* is upon fishes of small size, the danger of predation becoming progressively less until a critical length, usually when 18-20 cm is reached, above which a prey fish is reasonably safe from predation. Although the bulk of its diet is fish, it also consumes some detritus and plant matter displaying some omnivorous characteristics. The tiger fish in the Lower Shire comes from the Zambezi River and uses the valley to find food usually preying on the tilapias and other fish species and also for spawning. The fish breeds on the sheltered lagoons and marshy areas, as such Elephant Marsh provides a suitable environment for its breeding and raising of young ones. The fish is preyed upon by crocodiles, hence species are at the center of a very important food chain in the Lower Shire.

DISTRIBUTION, STATUS OF ENDEMICITY AND RELATIVE ABUNDANCE

H. vittatus is indigenous and widely distributed to the Lower Shire and Zambezi Rivers.

STATUS (NATIVE, ALLOCHTHONOUS OR INVASIVE)

The species is native.

H. vittatus is resident of the Lower Shire and during the normal times, it is found around the marshes (Elephant and Ndindi) in search for fish to prey upon. It is not invasive but is a predatory species. Kapichira falls is a barrier that has kept the Tiger fish from moving upstream the Lower Shire and preying on Lake Malawi fish fauna. Hence, the tiger fish is confined to the Lower Shire area in Malawi.

6.8.10.9 Lake Salmon (Opsaridium microlepis)

HABITAT REQUIREMENTS AND REGIONAL EXTENT

Opsaridium microlepis is endemic to Lake Malawi and is the largest of all bariliine cyprinids, attaining a weight of at least 4 kg. It is a pelagic (open water) predator, which spends most of its life in the lake but ascends affluent rivers to spawn. The fish lives in open waters throughout the year but congregates and run up larger affluent rivers to spawn during its breeding season, which is mostly at the end of the rainy season, i.e. from March to June. The fish mature after 2 to 3 years in the lake. In the Lower Shire valley, the fish descends from the middle Shire River (Tweddle and Lewis, 1983).

WATER QUALITY REQUIREMENTS

O. microlepis prefers pelagic or open water conditions of Lake Malawi, where it is endemic. The fish inhabits the Lake waters as adults. When it has attained sexual maturity it ascends rivers to breed and returns to the Lake. The fish prefers water temperatures 20 and 28^{o}C, a pH of around 78. The juveniles inhabit the upper river courses as yearlings and descend to the Lake when the second year floods rescind (Tweddle and Lewis, 1983).

WATER FLOW REQUIREMENT

As adults and residents of the pelagic (open water) zones of the Lake, *O. microlepis* does not have a specific water flow requirement. When the fish has ripe gonads, it requires flooding of the rivers as a stimulant for them to ascend the rivers to spawn. Mpasa is a late spawners so it does not migrate with the first flash flooding of the rivers. The spawning requirements for Mpasa is well oxygenated flowing water.

ABILITY TO PASS OBSTACLES

O. microlepis has powerful streamlined bodies that enables it to negotiate waterfalls and rapids (Tweddle and Lewis, 1983) and also speeds to catch prey fish.

LIFE CYCLE (MIGRATION, SPAWNING AND MATURING)

The fish begins to gather at river mouths at the beginning of the rainy season in December, but does not migrate up the rivers until the end of the rainy season, when the waters become clear or less turbid

and this time is around March to July. The peak breeding season is from April to June (Tweddle, 1982). Most Lake Salmon (Mpasa) that are caught from the Lake are taken from near river mouths during the breeding season. The spawning requirements for Mpasa is well oxygenated flowing water and silt free gravel through which the stream can percolate. Young *O. microlepis* stay in the river during the first 3-4 months of life and shoals of fry can be seen in shallow waters during and after the breeding season. Most juveniles of 7-20 cm descend to the lake or main river course with the onset of the first rains at an average age of 6 months. Juveniles of Mpasa are omnivorous feeding on zooplankton, phytoplankton, microphytes and insects. The fish has extended breeding season, which serves to reduce the chances of loss of a whole year class resulting from drought or other adverse conditions. *O. Microlepis* is a partial spawner that makes staggered runs and fractional spawning strategy and releases eggs in a series of spawning activities over a period of time to ensure that eggs hatch over a period of several months. Short periods of unfavorable conditions will have little effect on total recruitment (Tweedle and Lewis, 1983).

IMPORTANT HABITATS AND SENSITIVE LIFE CYCLE STAGE

The important habitats for *O. microlepis* are the river mouths during their upward migration to breeding areas or downward migration from the spawning sites. The species spawns in shallow waters upstream and it is its important habitat. Mpasa is vulnerable to catch when it migrates to the spawning grounds and when it is returning from their breeding sites upstream. The other important stage is during the juvenile stage especially when it has to spend a year in the river, waiting for the second year floods. It is possible to lose the whole year class due to drying of spawning rivers and predation.

ACTUAL THREATS AND PROTECTION STATUS

Mpasa is classified as **critically endangered** by IUCN. The population of the fish is scarce and the catch has almost collapsed because fishes were being caught during their upward migration, meaning, they were harvested before spawning. The spawning takes place in the shallow waters hence the fish are vulnerable when spawning. Fishermen are not allowed to completely close river mouths with traps to allow the fish to reach the breeding grounds. However, these regulations have not been effectively enforced.

VALUE AS FOOD SOURCE FOR POPULATION AND VALUE IN THE FOOD CHAIN

Mpasa is a pelagic predator and in the Lake. In the Lowe Shire, Mpasa feeds mostly on young of the Cichlids such as *O. mossambicus* and other tilapias. It is less abundant in the Lower Shire probably because it mostly descends from the Upper Shire and the spillway is a harsh environment for a fish. *O. microlepis* is palatable and has been caught for both subsistence and commercial fishing. Its juveniles are preyed upon by predators such as other fish species, e.g., the catfishes and frogs. The adults are preyed upon by crocodiles, hence the Mpasa occupy an important niche in the Lower Shire area.

DISTRIBUTION, STATUS OF ENDEMICITY AND RELATIVE ABUNDANCE

Mpasa is endemic to Lake Malawi but it is now less abundant in the water bodies of Malawi. Its size to first maturity has declined and its fecundity has increased suggesting that the fish has been subjected to intense fishing pressure which targets the larger fishes. In the Lower Shire, Mpasa catches are low, hence the fish catches in the Lower Shire is lumped together in the ‘other’ fish category.

STATUS (NATIVE, ALLOCHTHONOUS OR INVASIVE)

The species is native.

O. microlepis as well as all other Cyprinids are poor colonizers of alien environments. The species is a migratory predator but is not invasive. Although the species is endemic in the Lake Malawi fish fauna through "escapees" it is present in the Lower Shire River.

6.8.10.10 Redeye labeo (Labeo cylindricus)

HABITAT REQUIREMENTS AND REGIONAL EXTENT

Labeo cylindricus has a wide distribution from Chad and the Congo basin to Kenya and Southwards to Northern Natal. In Lake Malawi, this rock dwelling Labeo inhabits areas of the lake wherever a rocky substrate on which algae grows is found. It also inhabits the middle and lower reaches of rivers (e.g. the Lower Shire) where similar environmental conditions exist (Jackson, 1961).

WATER QUALITY REQUIREMENTS

Labeo cylindricus requires well oxygenated water, temperatures ranging from 20 to 28^{o}C, pH values of 7.5 to 8.5 in the lake, rivers and streams. The species is rocky dwelling in Lake Malawi and in the Lower Shire it is also found in the sheltered areas such as marshes.

WATER FLOW REQUIREMENT

For their normal life, *L. cylindricus* does not need any water flow as it inhabits the actual river courses where shelter is available in the form of rocks. However, as a fish species in the Cyprinidae family, *L. cylindricus* is stimulated to migrate to breeding sites with the first flash floods.

ABILITY TO PASS OBSTACLES

L. cylindricus is able to climb through natural physical barriers. This fish has a wide ecological tolerance and uses its mouth and broad pectoral fins to climb damp surfaces of barrage rocks and weirs (Jackson, 1959). This feature has allowed the species to survive heavy fishing pressure compared to *Labeo mesops* which has completely disappeared from the Malawian Lake and river system.

LIFE CYCLE (MIGRATION, SPAWNING AND MATURING)

The fish reaches first sexual maturity within two years after it has spawned. This species browses on the algae that grow on rocks and other places. In the Lake, the fish has a well-marked breeding season, from December to January and the breeding season is very short because the fish is a complete spawner, i.e. all the eggs in the ovary ovulate and are spawned at the same time. The fish ascends flooded rivers and weirs (Jackson, 1959) to migrate to breeding sites. The eggs are laid among rocks, where they hatch and the juveniles grow to adulthood within two years, but return to the main river course within one year.

IMPORTANT HABITATS AND SENSITIVE LIFE CYCLE STAGE

The important habitats for *L. cylindricus* are shallow rocky areas of rivers and lakes. The fish uses these habitats for both feeding on algae and also for breeding. The important life stage is when the species is migrating to breed in the spawning sites and when the eggs have hatched into fry because the fish is a complete spawner, hence once a yearling is lost, there is a loss of all the juveniles.

ACTUAL THREATS AND PROTECTION STATUS

L. cylindricus are listed as of 'least concern' by IUCN because it is found in abundance in its endemic habitats such as the Lake Malawi basin. However, there is a need to protect the rocky and marshy areas of the Lower Shire which are the breeding sites of the fish. In addition, there is a need to ensure enough flooding to induce spawning migration of the fish.

VALUE AS FOOD SOURCE FOR POPULATION AND VALUE IN THE FOOD CHAIN

L. cylindricus is consumed by people and constitute an important fish species for both food and sale. However, its full commercial utilization is limited due to their lower abundance in the Lower Shire Valley. The fish feeds on algae on rocks and hence helps to clean up rocks. The juveniles are predated upon by carnivorous fish and the adult fish are preyed upon by large predators such as Tiger fish and crocodiles. Therefore, *L. cylindricus* occupies a niche in the food chain in the Lower Shire.

DISTRIBUTION, STATUS OF ENDEMICITY AND RELATIVE ABUNDANCE

In Malawi, the *L. cylindricus* is widely distributed in Lakes Malawi, Chiuta and Chilwa; the Shire River, including the Lower Shire. The fish used to constitute an important fishery since the 1970s and now the catches have declined especially in the Lower Shire.

STATUS (NATIVE, ALLOCHTHONOUS OR INVASIVE)

The species is native.

L. cylindricus is not among the invasive fish species. It specializes in dwelling on rock or marshy and protected areas of the river courses or the main lake.

6.8.10.11 Barbus eurystomus

HABITAT REQUIREMENTS AND REGIONAL EXTENT

B. eurystomus is endemic to Lake Malawi and its tributaries. It is found in the Lower Shire through escapees from the Middle Shire because it is found in abundance in the Lake Malawi and the Upper Shire. In the Lower Shire, it inhabits the main river course but likes the marshy areas and lagoons to avoid predators

WATER QUALITY REQUIREMENTS

The water quality requirement for *B. eurystomus* is similar to other cyprinids, i.e., temperatures ranging between 19 and 28oC and pH values between 7.5 and 8.5. In the Lower Shire, it tolerates turbid water during the rainy season (Jackson, 1959).

WATER FLOW REQUIREMENT

The species inhabits sheltered areas of the rivers or the open water. Ripe males and females congregate along the river mouths just before the first rains and they are stimulated by flooding to migrate rivers to breed (Jackson, 1959).

ABILITY TO PASS OBSTACLES

B. eurystomus has a large size and do not pass through physical barriers unless the structures are submerged in water (Jackson, 1959).

LIFE CYCLE (MIGRATION, SPAWNING AND MATURING)

The fish matures within 2 years and may grow to over 50 cm in length and attain 2.5 kg in weight (Jackson, 1959). Adult fishes spend most of their lives in lakes and or main river course but prefer sheltered areas such as marshes. The fish ripes gonads at the on-set of the first rains and migrates to flooded rivers early in the rainy season to breed. Its breeding season is very short, from November to December and it is a complete spawner (Jackson, 1959).

IMPORTANT HABITATS AND SENSITIVE LIFE CYCLE STAGE

B. eurystomus is caught in large numbers near river mouths at the on-set of the rains as it prepares or migrates to breeding sites. The other important life stage is the juvenile stage because the species remains in the river for a year before it returns to the main watercourse such as the Shire. Hence, there is need for the rivers to flood so that its recruitment is completed. The species also inhabits marshes for protection.

ACTUAL THREATS AND PROTECTION STATUS

This species is not classified by the IUCN. However, there is a need to enforce fisheries regulations on migratory fish species because the fish is subjected to high fishing intensity during spawning migration. It should be a concern that there is a decline in the catches of *B. eurystomus* in the Malawian waters including the Lower Shire.

VALUE AS FOOD SOURCE FOR POPULATION AND VALUE IN THE FOOD CHAIN

Barbus eurystomus grows to large size and is commonly caught in gill nets and fish traps especially during the on-set of first rains as the fish ascends rivers to spawn. It is a very important food source for people in the Lower Shire. *B. eurystomus* mainly feeds on mollusks (Betram et al, 1942). The species is predated upon by tiger fish and crocodiles and hence occupy a niche in the food chain in the Lower Shire area.

DISTRIBUTION, STATUS OF ENDEMICITY AND RELATIVE ABUNDANCE

The *B. eurystomus* is endemic and is relatively abundant, though catches show declining trends in Lake Malawi waters including the Lower Shire. In the Lower Shire, the catches are very low, hence the fish catch statistics are lumped together with the fish species that are less abundant in the area under ‘other’ fish species category.

STATUS (NATIVE, ALLOCHTHONOUS OR INVASIVE)

The species is native.

B. eurystomus as any other fish species in the Cyprinidae family is a poor colonizer of alien environments when introduced. Hence, the species is not invasive but endemic in the Malawian waters.

6.8.10.12 Barbus johnstonii

HABITAT REQUIREMENTS AND REGIONAL EXTENT

The natural habitat for *B. johnstonii* is freshwater lakes and rivers. It is endemic to Lake Malawi and is found in the Lake Malawi and its tributaries in Tanzania and in the Lower Shire and lower Zambezi River in Mozambique (Jackson, 1959).

WATER QUALITY REQUIREMENTS

The water quality requirement for *B. johnstonii* is similar to other cyprinids, i.e., temperatures ranging between 19 and 28^{o}C and pH values between 7.5 and 8.5. In the Lower Shire, it tolerates turbid water during the rainy season (Jackson, 1959).

WATER FLOW REQUIREMENT

This freshwater fish is found in small groups in underwater habitats in rivers and lakes (Frose and Pauly 2006). Hence, there is a need to maintain adequate water levels in the Lower Shire.

ABILITY TO PASS OBSTACLES

The *B. jonhstonii* resides under water in the river course in shoals. It also migrates in groups with males and females to the breeding grounds. It cannot pass through physical barriers unless the barriers are submerged with floodwater.

LIFE CYCLE (MIGRATION, SPAWNING AND MATURING)

B. johnstonii grows to more than 30 cm in standard length and over 4 kilograms in body weight. For spawning, the species migrates towards rivers' headwaters during the rainy season. The Lake populations do not return from their spawning grounds until the dry season has started (Jackson, 1959).

IMPORTANT HABITATS AND SENSITIVE LIFE CYCLE STAGE

The important habitats for the *B. johnstonii* are the marshy areas where it resides to seek shelter in the Lower Shire. In addition, the fish stays in the breeding grounds throughout the rainy season, therefore any disturbances to the water levels in the tributaries disturb their breeding activities. The fishes are also easily caught in the shallow waters as they spend more time breeding there (Frose and Pauly 2006).

ACTUAL THREATS AND PROTECTION STATUS

B. johnstonii is listed as "Least concern" by IUCN. However, the catches in the Lower Shire have declined significantly during the recent years.

VALUE AS FOOD SOURCE FOR POPULATION AND VALUE IN THE FOOD CHAIN

B. johnstonii is omnivore, but adult fishes like to eat smaller fishes in particular. The *B. johnstonii* does not constitute an important component of the Lower Shire fisheries. It is preyed upon by predators such as Tiger fish and crocodiles. Hence, the fish plays a role in the food chain in the Lower Shire.

DISTRIBUTION, STATUS OF ENDEMICITY AND RELATIVE ABUNDANCE

The distribution of *B. johnstonii* in the Malawian waters has declined over the years. In the Lower Shire, the catches have declined, hence the species does not constitute a major fishery in the area.

STATUS (NATIVE, ALLOCHTHONOUS OR INVASIVE)

The species is native.

B. johnstonii just as any other fish species in the Cyprinidae family is a poor colonizers of alien environments when introduced. Hence, the species is not invasive but endemic in the Malawian waters.

6.8.10.13 Marcusenius macrolepidotus

HABITAT REQUIREMENTS AND REGIONAL EXTENT

M. macrolepidotus was formerly considered to be widespread but it is now restricted to the middle and Lower Zambezi river system (including the Lower Shire) and the Buzi system, south of the Zambezi (Taugels, et al. 1990).

WATER QUALITY REQUIREMENTS

The species is adapted to the freshwater demersal environment with pH ranging from 7.0 to 10; and temperature ranging from 22 to 24^{o}C.

WATER FLOW REQUIREMENT

The species inhabits well-vegetated, muddy bottom marginal habitats of rivers and flood plains. The species moves inshore after dark and has been recorded to move up tributaries in shoals during flood season.

ABILITY TO PASS OBSTACLES

The fish has no ability to negotiate physical barriers unless it is submerged in floodwater. The fish swims against the floods hence they can climb over submerged physical barriers.

LIFE CYCLE (MIGRATION, SPAWNING AND MATURING)

M. macrolepidotus breeds during the rainy season in shallow vegetated localities and the female may carry up to 6,000 eggs which spawn on the substrates usually vegetation. Juveniles grow to adults in the sheltered lagoons (Taugels, et al. 1990).

IMPORTANT HABITATS AND SENSITIVE LIFE CYCLE STAGE

The important habitats are the shallow vegetated areas in the marshy or sheltered areas such as lagoons where the fish breeds.

ACTUAL THREATS AND PROTECTION STATUS

M macrolepidotus is classified by IUCN as of least concern due to its relative abundance and wide distribution.

VALUE AS FOOD SOURCE FOR POPULATION AND VALUE IN THE FOOD CHAIN

M. macrolepidotus is classified as the fourth most important commercial fish species in the Lower Shire (gillnet fishery). The fish is caught for both subsistence and commercial fishing in the Lower Shire. The fish feeds on invertebrates, especially midge and mayfly larvae and pupae that is taken from the bottom and off plant stems, hence plays an important role in the food chain in the area (Taugels, et al. 1990).

DISTRIBUTION, STATUS OF ENDEMICITY AND RELATIVE ABUNDANCE

The fish is widely distributed in the Lowe Shire and caught in large quantities before, during and part of the rainy season at the Shire / Ruo confluence and in the open lagoons (Tweddle and Willoughby, 1979).

STATUS (NATIVE, ALLOCHTHONOUS OR

INVASIVE) The species is native.

6.8.10.14 Other fish species

This section presents fishes that are present in the Lower Shire River, but are less abundant than the previous species. Their habitats are briefly presented as well as their IUCN status (starting from near threaten). More details are provided in annex.

- ***Protopterus annectens brieni***, inhabits muddy areas. Spawns in roots of aquatic vegetation;
- ***Megalops cyprinoides***, inhabits the Shire, lagoons and swampy area. Spawns offshore;
- ***Anguilla bicolour*** and ***Anguilla nebulosa labiate***, inhabits the Lower Shire and lagoons. Classified Near threaten by the IUCN. Spawns offshore;
- ***Hippopotamyrus discorthynchus***, inhabits the Shire, lagoons and swampy area. Migrates upstream into Shire tributaries to spawn;

- ***Mormyrus longirostris***, inhabits the center of Shire rather than the banks. Migrates upstream into Shire tributaries to spawn;
- ***Alestes imberi***, inhabits lagoons and marshes. Migrates upstream into Shire tributaries and floodplain to spawn;
- ***Hemigrammopetersius barnardi***, inhabits fast flowing part of Shire. Spawns in roots of aquatic vegetation;
- ***Micralestes acutidens***, inhabits clear, and standing water (pelagic) of Shire. Migrates upstream into Shire tributaries to spawn;
- ***Distichodus mossambicus***, inhabits swift flowing water, rapids or quiet, deep, sandy or rocky pools of Shire. Migrates upstream into Shire tributaries to spawn;
- ***Barbus afrohamiltoni***, inhabits still, vegetated waters of Shire, and marginal pools and lagoons. Migrates upstream into Shire tributaries to spawn;
- ***Barbus choloensis***, inhabits of rock sills around falls. Classified as vulnerable by the IUCN due to its limited distribution. Migrates upstream into Shire tributaries to spawn;
- ***Barbus haasianus***, inhabits swamps and floodplains in well-vegetated habitats. Spawns in the Shire floodplain;
- ***Barbus kerstenii***, inhabits fast flowing, sluggish and temporary streams. Spawns in the Shire floodplain;
- ***Barbus macrotaenia***, inhabits marshy areas and slow flowing streams. Migrates upstream into Shire tributaries to spawn;
- ***Barbus marequensis***, inhabits rocky rapids and deep pools. Migrates upstream into Shire tributaries to spawn;
- ***Barbus radiatus***, inhabits marshes and marginal vegetation the Shire. Migrates upstream into Shire tributaries to spawn.
- ***Barbus trimaculatus***, inhabits shallow water near river outlets or swampy areas. Migrates upstream into Shire tributaries to spawn;
- ***Barbus lineomaculatus***, inhabits fast flowing sections of Shire. Migrates upstream into Shire tributaries to spawn;
- ***Barbus toppini***, inhabits slow flowing sections of Shire. Migrates upstream into Shire tributaries to spawn;
- ***Barbus viviparous***, inhabits flood plains of the Shire and pools and shallow streams with vegetation. Migrates upstream into Shire tributaries to spawn;
- ***Barilius zambensis***, inhabits shallow pools below rocky rapids. Migrates upstream into Shire tributaries to spawn;
- ***Labeo congoro***, inhabits strong flowing rocky stretches of Shire. Migrates upstream into Shire tributaries to spawn;
- ***Labeo altivelis***, inhabits the Shire. Migrates upstream into Shire tributaries to spawn;
- ***Leptoglanis rotundiceps***, inhabits fairly shallow water of the Shire and tributaries. Spawns in sand;
- ***Heterobanchus longifilis***, inhabits quite waters of Shire and deep pools. Migrates upstream into Shire tributaries to spawn;

- ***Malapterurus electricus***, inhabits rocks or roots in turbid or black waters with low visibility. Spawns in the Shire in dug holes;
- ***Chologlanis neumanni***, inhabits rocky and fast flowing section of Shire. Data on spawning are not available;
- ***Synodontis zambezensis***, inhabits pools and slow-flowing reaches of perennial and seasonal rivers and the Shire. Data on spawning are not available;
- ***Aplocheilichthys hutereaui***, inhabits stagnant water in pools and swamps. Spawns in the Shire floodplain;
- ***Aplocheilichthys katangae***, inhabits shallow vegetative part of Shire where it also spawns;
- ***Nothobranchius orthonotus***, inhabits temporary water pools and may also be found in swamps intermittently connected to floodplains where it also spawns in bottom sediments;
- ***Haplochromis philander***, inhabits vegetated zones of Shire where it also spawns;
- ***Psudocrenilabrus philander***, inhabits vegetated zones of Shire where it also spawns;
- ***Oreochromis placidus***, inhabits quiet pools with marginal vegetation where it also spawns;
- ***Oreochromis squamipinnis***, inhabits sheltered areas of Shire where it also spawns. The fish is classified **Endangered by IUCN**;
- ***Oreochromis shiranus***, inhabits lagoons and marshy areas where it also spawns;
- ***Tilapia rendalli***, inhabits well-vegetated water along Shire where it also spawns;
- ***Glossogobius giuris***, inhabits Bangula lagoon and marshy areas. The species migrates to the sea to spawn (amphidromous migration);
- ***Ctenopoma multispinis***, inhabits vegetated riverine backwaters, floodplain lagoons, swamps and isolated pans where it also spawns.

6.8.11 Herpetofauna

Amphibians are well represented in sub-Saharan Africa, where approximately 600 species have been recorded. Amphibians are of increasing scientific concern as global reports of declining amphibian populations continue to increase. Although there is no consensus on a single cause for this phenomenon, there is general agreement that the declines in many areas, even in pristine protected parks, are significant and do not represent simple cyclic events. Frogs have been aptly called bio-indicator species, whose abundance and diversity is a reflection of the general health and well-being of aquatic ecosystems. They are important components of wetland systems, particularly ephemeral systems in which fish are either excluded or of minor importance. In these habitats, they can be dominant predators of invertebrates, many of which may impact significantly on humans (e.g. as vectors of disease, such as mosquitoes and bilharzias snails) or their livestock and/or crops.

Reptiles also form a significant component of vertebrate faunas in Africa. With the exception of land tortoises, all terrestrial reptiles are carnivorous, although some larger lizards do supplement their diet with vegetable matter in certain seasons. Reptiles therefore play an important role in nutrient cycling within ecosystems, and in population control of their prey items. Most snakes are specialist feeders, taking specific and limited food classes, and this is often reflected in their common names, i.e. egg-eaters, slug-eaters, centipede eaters, etc. They are usually habitat generalists, occupying a wide range of habitats and vegetation types, provided their primary prey is present. In contrast, most lizards take

a wide-range of insect prey, and niche separation between sympatric species usually occurs via habitat selection and/or diel activity (e.g. most geckos are nocturnal). Congeneric species especially occupy different habitats that are determined more by the habitat physical and substrate characteristics rather than the presence of specific plants and/or soil.

The herpetofauna of Malawi in general is not well-known, and has not been recently reviewed. Mercurio (2011), in his review of Malawi amphibians, noted:

"After 145 years of herpetological studies with about 50 scientific publications only, the status of knowledge of amphibians and reptiles of Malawi….. is still rudimentary."

There is fuller documentation for amphibians than reptiles, with a number of monographic reviews of the country's frogs, either at a national level (e.g. Stewart 1967, Mercurio 2011) or as part of larger regional compilations (Poynton & Broadley 1985-1991; Channing 2002). There is no comparable national review of Malawian reptiles, although local surveys and summaries exist (e.g. Loveridge 1953a-c, Stevens 1974, Broadley 2000, etc.). The need for an updated assessment of the diversity and conservation status of reptiles and amphibians of Malawi is essential.

The first specimens collected in the Lower Shire Valley were obtained by Dr Kirk while on the Livingstone expedition (Günther 1864). Loveridge (1953a,b) reported on an expedition to Nyasaland, but did not visit the Elephant Marsh. The snakes of Malawi were covered by Sweeney (1961), whilst Stevens (1974) published an annotated checklist covering the herpetofauna of southeastern Malawi.

There are few historical herpetological surveys within the Elephant Marsh or its surroundings. Loveridge (1953c) documented a herpetological collection made by the Berner-Carr Entomological Survey of the Shire valley in 1952, and included 15 amphibians and 14 reptiles. Blaylock (1963) reported on two trips (1961-2) to the lower Shire River, including the capture of 163 snakes in 14 days from a camp 10 km upstream from Chiromo. The habitat comprised low scrub next to the swamp and included (taxonomy updated): 97 Western Green Snake Philothamnus angolensis, 31 Olive Grass Snakes Psammophis mossambicus, 10 Spotted Bush Snake Philothamnus semivariegatus, 4 Stripe-bellied Sand Snake Psammophis orientalis, 4 Brown House Snake Boaedon capensis, 3 Semiornate Snakes Meizodon semiornata, and single specimens of Mozambique Spitting Cobra Naja mossambica, Olive Marsh Snake Natriciteres olivaceus, Rhombic Egg-eater Dasypelis scabra, and the Zambezi Blind Snake Afrotyphlops mucruso. Other herpetofauna recorded included the reed frog Hyperolius marmoratus, and the lizards Trachylepis striata, T. varia and Chamaeleo dilepis. At Tengani in the lower Shire Valley below Chiromo Philothamnus semivariegatus, Psammophis orientalis, the Puff-adder Bitis arietans, the Snouted Cobra Naja annulifera, and the second Shire record of the Floodplain Viper were also collected. Broadley (1996) reported on a small herpetological collection from the Elephant Marsh (quarter degree square 1634Bd; western edge of the Elephant Marsh near the boundary of the Lengwe National Park). It included the first record from Malawi and north of the Zambezi of the water snake Lycodonomorphus obscuriventris, and prompted Broadley to raise it to a full species (it was previously a subspecies of L. whytei). It remains the only Malawi record of this rare snake. Other species from the Elephant Marsh included: the frogs Xenopus muelleri, Amietia angolensis (= A. quecketti see below), Ptychadena anchietae, Phrynobatrachus mababiensis, Afrixalus brachycnemis complex (= A. crotalus) and A. fornasinii; and the snakes Natriciteres olivacea and Crotaphopeltis hotamboeia. The herpetofauna of the entire Zambezi drainage basin was summarised by Broadley (2000), including a summary of the reptiles and amphibians from the lower Shire valley. His summary is incorporated into Tables 24 and 25, below.

Two short field surveys on the study area were conducted by MRAG (2016). The first occurred for five days (5-9 July 2015) during the dry season. A wet season survey was undertaken for five days (17-21 January 2016). All surveys used visual encounter survey methods. Diurnal searches involved active search of specific microhabitats, particularly beneath cover such as decaying logs or mats of vegetation. Nocturnal surveys for amphibians were undertaken in wetlands and surrounding woodland.

A total of 25 amphibian species was recorded, representing 74% of the known amphibian fauna of the region. Five were previously unrecorded from the Lower Shire Valley, but known from adjacent areas. Eight species previously recorded from the Lower Shire Valley and Elephant Marsh were not encountered in this study. These species may have been inactive during the survey periods or overlooked.

In contrast, only 21 species of reptiles were recorded, representing 46% of the 58 reptile species known from the Lower Shire Valley. Seven other common species were reliably reported to occur in the region. Two species were added to the regional herpetofauna list during the surveys and two species overlooked in the most recent surveys were reconfirmed.

None of the amphibian species known to occur are considered threatened or of conservation value. The existing amphibian fauna is considered to be similar to the original fauna before human impact, except for the possible reduction of tree frogs as a result of the loss of riparian trees. The reptile fauna is considered to be significantly impacted, with large snakes, particularly arboreal species, present in reduced numbers. Historical records show that two iconic reptiles of Malawi wetlands, the Zambezi Soft-Shell Terrapin *Cycloderma frenatum* and the Swamp Viper *Proatheris superciliaris*, both occurred in the Elephant Marsh region. These species were not recorded and are in danger of becoming regionally extinct, if not already so.

Large Nile crocodiles *Crocodylus niloticus* (>3 m) are still common in the Shire River and Elephant Marsh, but there are concerns for their continued survival. The main source of human-crocodile conflict and consequent hunting is the damage to gill nets set overnight for fishing. In addition, the crocodile farm in the area harvests eggs as well as a few adults for breeding stock.

Unfortunately, the lack of historical detailed surveys of the Elephant Marsh herpetofauna precludes objective assessment of the 'health' of reptile and amphibians communities in the region. No population estimates of the historical herpetofauna are available and it is therefore impossible to quantify possible reptile or amphibian declines or even local extirpation. Due to the extensive wetlands still present there is unlikely to have been extensive loss of amphibian biodiversity or numbers. The loss of their predators, such as snakes and large fish, may have led to increased juvenile recruitment as well as declines in adult mortality. However, these would be balanced by the loss of habitat stability resulting from hydrological changes such as increased flooding, greater water turbidity and siltation. The loss of trees, both along the riparian edge as well as marsh margin, may have affected the survival of tree frogs (Leptopelis sp.), which were not recorded during the present surveys. Conversely, the extensively modified marsh fringes are dried and have reduced vegetation cover than originally and this may have allowed a toads and puddle frogs to inhabit these areas in greater numbers than previously. It is thus probable that much of the original amphibian diversity in the region remains as healthy populations, and this is indicted by the high percentage (>73%) of the amphibian diversity recorded during the survey.

Anecdotal observations by a long-term (30+ years) resident with an interest in reptiles (Tony Leiato, Land Preparation Manager, Illovo; pers. comm. November 2015) indicated some potential declines in large reptiles. Puffadders were considered once very common in the 1990s in the vicinity of the Illovo sugarcane plantations, but have now become much rarer, whilst the Boomslang (Dispholidus viridis),

Twig Snake (Thelotornis capensis) and Swamp Viper (Proatheris superciliaris) have not been seen in the region in the last 30 years, although all were recorded earlier (Loveridge, 1953c; Blaylock, 1963; Broadley 2000). Similarly, the Soft-shelled Terrapin (Cycloderma frenatum) was observed in the Shire River above Chikwawa 30 years ago, but has not been seen for over 15 years. The general impression in the field during the field surveys was of reduced reptile density and diversity. Certainly, the likelihood of repeating Blaylock's (1963) capture of 163 snakes in 14 days upstream from the floodplain upstream from Chiromo now seem unlikely. No specimens of his two dominant species, the Western Green Snake (Philothamnus angolensis, 97 specimens) or Olive Grass Snake (Psammophis mossambicus, 31 specimens), were even observed during the current surveys. Many of these snakes, e.g. Boomslang. Twig snake and Spotted Bush Snake, are all arboreal and their current rarity or even absence in the Elephant Marsh, may be linked to their visibility (all are diurnal) and the loss of trees. Chameleons were also not recorded during the surveys and, again, their apparent rarity may be linked to tree loss. It is likely that there is a reduction in snake numbers due to the direct persecution by the high numbers of people now living within the marsh, and indirectly from the extensive habitat destruction and frequent fires.

In summary, is is considered that amphibian diversity and populations numbers still reflect in great part that originally existing in the Elephant Marsh. However, reptiles are considered to show reductions in the numbers, and possibly even local extirpation, of arboreal snakes (Boomslang and Twig Snake), larger terrestrial species (Puffadder), and specialised aquatic species (Zambezi FlapShelled Terrapin and Floodplain Viper).

6.8.11 Critical Habitat Assessment

ESS 6 (Biodiversity Conservation and Sustainable Management of Living Natural Resources) and OS 3 define critical natural habitats as areas with high biodiversity importance or value. They include:

a. habitats of importance to Critically Endangered or Endangered species (as listed in IUCN Red List)
b. habitats of importance to endemic or restricted-range species
c. habitats supporting globally or nationally significant concentrations of migratory or congregatory species
d. highly threatened or unique ecosystems
e. ecological functions or characteristics that are needed to maintain the viuability of the biodiversity values described in a-d.

Critically Endangered and Endangered species recorded from the study area of SVTP are described earlier in this chapter, and Chapter 9 describes the habitat types that are present.

The intake and first 2.5km of canal (including fish barrier) is currently being constructed through Majete Wildlife Reserve as part of the SVTP-I project. The works are carefully controlled to minimise impacts on the reserve (for example the canal in MWR will either be buried or walled to ensure no harm to elephants and other wildlife) and are being undertaken to the satisfaction of Arfican Parks and DNPW. In addition to the agreed mitigation measures, compensation continues to be provided as described in the ESMP for Phase 1 with the objective of maintaining the value of the park to wildlife. Information regarding the mitigation and compensation arrangements being undertaken in Majete Wildlife Reserve can be found in the Phase 1 ESMP and are not further discussed here.

Lengwe has been designated as a National Park in particularly for supporting the endemic, northern-most population of Nyala. Although the Nyala is designated Least Concern by IUCN, the endemic

population that has remained at Lengwe is of biodiversity interest. The Nyala is associated in Lengwe with a large (approximately 25km^2) area of dense thicket, potentially for the protection it provides to them. The thicket vegetation is what gives Lengwe its name and is broadleaf, closed canopy deciduous woodland and thicket comprised of various species including *Colophosprnum mopane* (Mopane), *Dalbergia melanoxylon* (Blackwood / Zebrawood), *Combretum imberbe* (Leadwood), *Cactacae kalonga*. The thicket is a large component of the best game viewing area in the Park. Because the thicket is of significance to an endemic species, it is considered to be Critical Habitat.

6.8.12 ECOLOGY STUDY LIMITATIONS

The Ecology section is based on a mix of field visits and bibliographical data. However, no invertebrate surveys data (such as insect and aquatic invertebrate) and no recent data on herpetofauna were available during original baseline. These were included from the MRAG 2016 study, which carried out detailed surveys, findings of which were included in the ESIA recommendations as relevant. In addition, there is no data on the carrying capacity of the Elephant marsh for animal at risk of conflict with human: the hippo and crocodiles.

6.8.13 Species of Conservation Interest

This section derives information from the findings of *A Review of Biodiversity Studies for Lengwe National Park and the Elephant Marsh* that was conducted prior to carrying out an addendum to this ESIA report.

Field assessment results do not show any endangered fauna species along the proposed canal. All the species are under the Least Concern (LC) category of IUCN. Nonetheless, there are some Near Threatened speces such as African Buffaloes. The bird species spoted in the area nest in the eastern part of the park.

Regarding flora, the area along the proposed canal is dominated by six tree species namely trees recorded *Ziziphus mucronata, Senegalia(Acacia) nigrescens , Lepidotrichilia volkensii, Colophospermum mopane, Vachellia (Acacia) nilotica , and Dalbergia melanoxylon* with a relative density ranging from 7 to 17% . Among these, Mopane (*Colophospermum mopane*) is endangered in Malawi (Chikuni, 1996). Species richness was the highest 934) in areas dominated by *Colophosperm mopane*.

It is expected that the canal right of way will range from 30 m to 45 m and run a total of 10.3 kilometres in the park. This will lead to clearance of 45.69 Ha of land that will require compensatory planting. Among the 58 tree species identified, the area under mopane will be the most cleared.

Eighteen species of climbers and another 33 species of herbs will be cleared during construction works. However, all these species are under Least Concern category of IUCN.

CHAPTER 7 SOCIOECONOMIC BASELINE

7.1 INTRODUCTION

This chapter includes baseline assessment of the current socioeconomic features of the Study area.

The proposed project targets close to 100,000 small holder farming households who will benefit from gravity irrigation. The Project extends between 25-40 kilometres wide from Kapichira Falls to Bangula. The crops to be grown include maize, sorghum, cotton, rice and high value crops such as tomatoes, onions, beans and sweet potatoes.

7.2 METHODOLOGY

The social baseline was collected for the 2017 ESIA through focus dissusion groups and through social and economic assessments carried out under the COWI assignment on Communication, Community Participation and Resettlement Policy Framework (COWI, 2016).

The baseline study incorporates both primary and secondary research. Primary research activities included community observations, selected focus groups meetings with community members, traditional leadership, and women's group combined with key informant interviews with district council officials, members of the civil society groups particularly non-government organizations. Information on household characteristics was obtained from surveys conducted by COWI (2016), a consultant working on communication, community participation, land tenure and resettlement policy framework who have conducted a detailed household survey within the Project area.

Focus Discussion Groups (FDGs) aimed at identifying community characteristics, opportunities, needs, priorities, issues, challenges specifically related to food security, employment, land tenure, economic activities, education, health, water and sanitation. Participants were also be asked to identify groups that may be considered vulnerable, disadvantaged and marginalized. Community observations focused on describing physical infrastructures such as health facilities, schools, transport, land use, markets, and water supply facilities. A checklist has been prepared to assist in obtaining information during community observations.

Secondary data for key socioeconomic issues with the project area was obtained through preliminary desktop research. A number of reports as described in reference section were reviewed. Data gaps identified during desktop research included the following:

- Some available data and information are too outdated for a social baseline study (6-15 years old). Normally, social data should not be older than five years considering the various socioeconomic changes that could happen within a 5-year period.
- There was lack of information on traditional authorities located within the project area. Most of the data contained general information for the district and no specific data were provided

Key secondary sources used include:

- Government of Malawi – various reports from ministries, development plans, policies, legislation, census
- Non-governmental organization and other civil society organizations publications and articles

- Academic papers and journal articles

Community observations focused on identifying physical infrastructures such as health facilities, schools, transport, land use, markets, water supply schemes, cultural sites, religious sites, and recreational sites. A checklist was prepared to assist in obtaining information during community observations.

Primary and secondary data gathered was analyzed by the rural sociologist. Quantitative and qualitative data was populated into Excel spreadsheets and organized in tables and graphs. Averages and percentages were calculated while patterns and trends were noted. Surveys responses provide valuable information on perceptions and opinions on socioeconomic conditions in the study area.

The purpose of consultations was to solicit views and opinions of different people on the proposed project; to determine how the project will affect them and how best the project will be implemented to minimize adverse social impacts on the communities within the area. The consultative meetings involved key NGOs working in the traditional area and Traditional Authorities (TAs).

Traditional leaders concern by the Project are as follow:

- TA Kasisi in Chikwawa
- TA Chapananga in Chikwawa
- TA Katunga in Chikwawa
- TA Maseya in Chikwawa
- Paramount Chief Lundu in Chikwawa
- TA Ngabu in Chikwawa
- TA Mbenje in Nsanje

TA Makhwira and TA Mlolo, on the eastern side of Elephant marsh, are outside the Project. However, some baseline information were collected for the biophysical environment.

Minutes of consultation are included in annex, the full ESIA will study the concerns raised by some of the stakeholders during surveys.

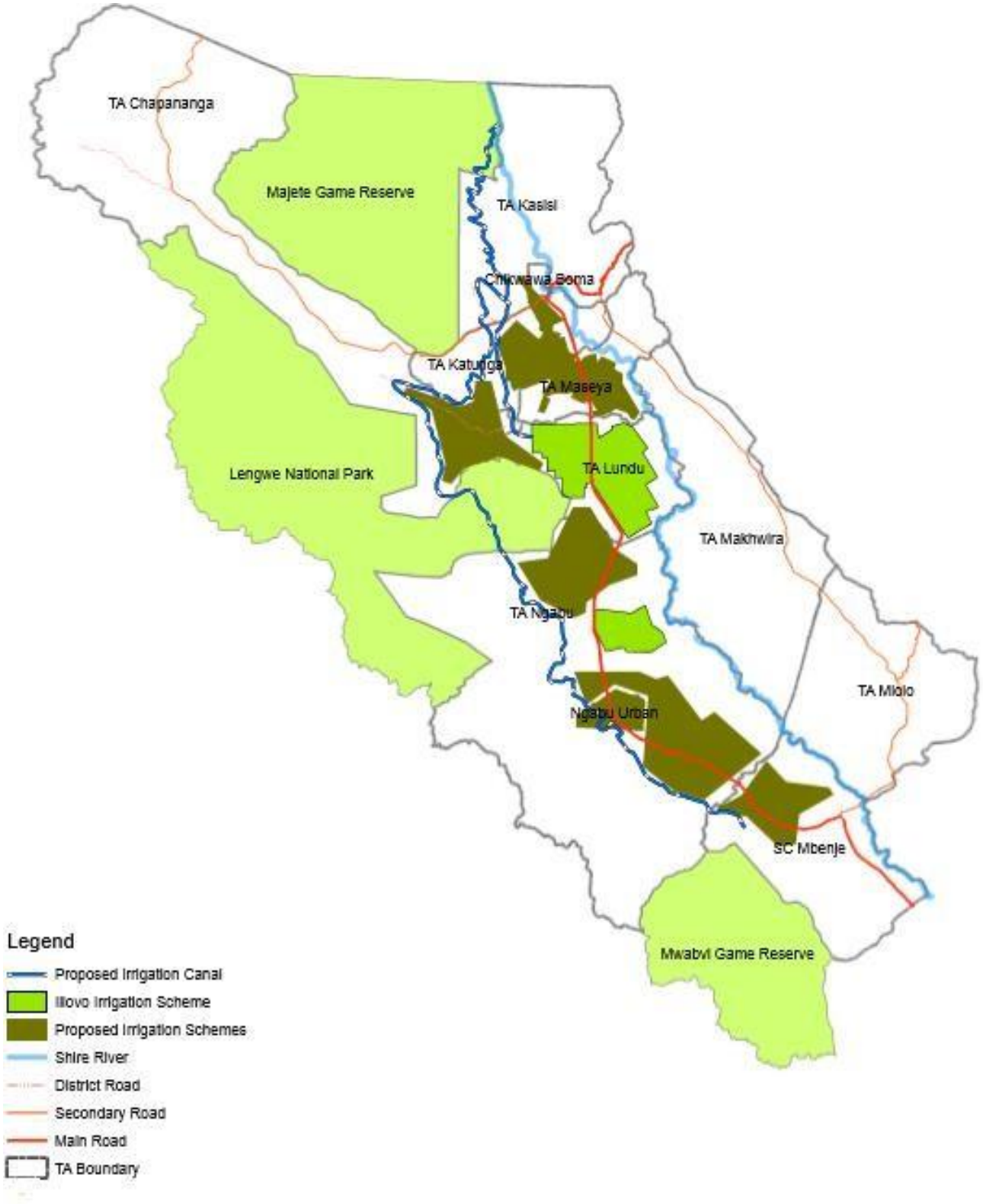


Figure 52: : Traditional Authorities

7.3. STAKEHOLDER CONSULTATIONS AND DISCLOSURE

Stakeholder consultations have been held frequently during the preparation and implementation of the project. They began in 2005 as part of the framework for the EIA and have continued throughout the assessment process, and particularly after the draft Impact Assessment report was produced, in November 2016 when the mitigation measures were presented and discussed with stakeholders, to collect their opinions. In addition, a presentation to the Task Force, World Bank and the Feasibility Consultant was done prior to the publication of the ESIA to discuss about several key issues: the tiger fish, the impact on Majete Wildlife Reserve and on Lengwe National Park and impacts on Elephant marsh. Community engagement is an essential part of the project, not only to understand the potential impacts of construction works , but also to co-ordinate and engage with stakeholders on land tenure, planning, agricultural commercialization and natural resource management measures. Much of the communication is undertaken on a day-to-day basis, although in addition, the following workshops have been held.

(i) Community & Stakeholder Workshops

Two workshops with communities in Nsanje (November 10th, 2016) and Chickwawa (November 11th 2016) Districts were held and presented by the ESIA Consultant. The objective was to expose the main conclusions from the impact assessment and the set of mitigations. Opinions and questions raised are presented in annex of this report; some of them are dealt with in the main text whenever relevant. In Nsanje, 50 people attended the workshop and in Chickwawa 37.

Other workshops and meetings were held at several occasions, including with African Parks, Jambo Africa (in charge of tourism in LNP), Wildlife and Environment Society of Malawi (WESM) and EGENCO.

Figure 53: Workshop at Nsanje (left) and Chickwawa (right) (Source: BRLi, 2016)

A number of workshops were further organized between May and June, 2021 as part of the SVTP-II formulation process. These included community consultation at GVH Njeredza and lessons learnt workshop at Phata Cooperative.

The community consultation meeting at Njeredza was geared at tapping information on how the communities were engaging with the first contractor appointed under SVTP-I and providing important lessons learned for the review and updated of the Stakeholder Engagement Plan (SEP). The workshop further interrogated the manner in which grievances were addressed between the communities and contractor. Two issues arose, namely, that the contractor delegated junior staff who do not have authority to make decision and the time for resolving issues was too long.

Another workshop with the farmers at GVH Njeredza provided more information about what was expected of farmer groups and how they would decide on crops to grow.

Figure 54: Farmer Workshop at GVH Njeredza (SVTP)

SVTP facilitated a meeting of the Phata Cooperative, Agrichem and the World Bank Mission at Phataiwth an objective of establishing lessons on how cooperatives operate in the Shire Valley and the role of service providers, i.e Agricane.

Figure 55: An Official from Agricane briefing the mission

Key lessons on establishing farmer cooperatives that were extracted included the following:

- The service provider has capacity to secure matching grants by way of loans or developing projects. The experience of Agricane has enabled the service provider to expand its services to Kasinthula;
- Both Kasinthula require some time to develop own capacity to manage the schemes. Both SVTP and Agricane will have provide more training to the cooperatives; and
- The cooperatives, Agricane and SVTP need to explore other value chains and develop markets. The current over reliance on Illovo as sole market exposes the cooperatives to external shocks. Besides other value chains may offer more return to farmers if well developed.

(ii) Workshop With Task Force in Lilongwe

A Workshop with Task Force (SVTP), the FS consultant team, with the World Bank and national stakeholders was held. It was the opportunity to exchange on the latest development of the FS, and on the key technical issues to address such as the tiger fish barrier and type of canal inside MWR.

(iii) Meetings with other projects in the Shire Valley

A number of meetings were held with stakeholders in the Shire Valley with a view to examine projects that have been implemented between 2017 and 2021 and any future projects that have a consumptive effect on the Shire River and consequently may affect the Elephant Marsh. This information is required to understand the communlative impact that may occur and their implications for the Shire river and Elephant marsh. Key Institutions consulted were as follows:

a) Malawi Watershed Services Improvement Project (MWSIP)
MWSIP is designed to improve the Shire River catchment, by encouraging habitat improvement and water retention measures that will slow the discharge rate from land to the river. No measures have yet been undertaken, although a number of measures have begun procurement.

These first measures will be undertaken upstream of the Kapichira Reservoir, and are likely to have a moderating and therefore beneficial effect on the flows reaching Kapichira. As such when these projects are delivered, water reliability is likely to improve at Kapichira.

b) Shire Biodiversity and Environmental Support Trust (BEST)
Shire BEST has been established by the Millenium Challenge Corporation (MCC) – Malawi Compact to provide emphasis on sustainable energy development. The purpose is to promote sustainability of project initiatives started by projects focusing on the Shire River Basin. Todate the trust, in collaboboration with EGENCO have embarked on catchment restoration and another with Illovo on flood management, soil stabilization and promotion of bamboo cultivation. These projects will not abstract from the River Shire and are designed to improve water retention and natural resources within the Shire catchment area. As such they are unlikely to result in any detrimental impacts that would need to be considered alongside SVTP-II.

c) Prescane
Prescane will be developing a 2,215 hactre Kama-Kasinthula Scheme, starting with 1,069 hactres in 2022. The design abstraction rate is 2.5 M^3 / second and the intake will be at the Kamuzu Bridge upstream of the Elephant Marsh. This scheme is currently in planning, and has not yet begun. The additional abstraction could have a small additional detrimental effect on Elephant Marsh, if it comes to fruitition.

Prescane, a local company (Press Holdings) to the Lower Shire River Valley, is a producer of high grade ethanol that is used for blending with petrol. As part of its expansion drive, the company is developing an irrigation scheme that will abstract 2,5 M3 per second of water from the Shire River upstream of the Elephant Marsh. Presscane also has a long-term plan to connect with the SVTP irrigation network, and therefore there will be no additional abstraction to consider in addition to that of SVTP.

d) SVADD - Divisional Irrigation Office
New development was considered with respect water abstraction from the Shire river, namely, the establishment of a small but new Chaimbatuka Irrigation Scheme.The schemes has an abstraction of 3 litres per second of water for 10 hactares and is solar powered. This is unlikely to have a significant impact on the hydrology of Elephant Marsh, even in combination with SVTP-II

e) Water Resources Authority (WRA)
The Water Resources Authority are responsible for licencing abstractions from the Shire River. Discussions with the WRA are ongoing, that maintain a register that contains details of the abstraction permits issued since 2017. This information will assist in understanding the cumulative impacts of SVTP-II on the current baseline conditions.

(iv) Meeting with the Department of National Parks and Wildlife (DNPW)

Figure 56:: DNPW Officials Visiting canal alignment site in LNP

The meeting discussed the canal route within Lengwe National Park and the associated mitigation and compensation. The feasibility study recommended the route entering the park at 16013'55.41" South and 34042'21.50" East and exiting the park at 16018'07.65" South and 34046'10.67" East, and this is marked on site. The meetings discussed options for a canal alignment at 16016'00.30" South and 34040'40.63" with an exit point at 16018'05.25" South and 34040'40.25" East, and a canal alignment that will minimize loss of thicket habitat. The optimization of the route will continue through the design development, with the assistance of DNPW.

(vi) Meetings regarding GBV

Consultation meetings to understand people's perceptions, ideas and recommendations on GBV issues in the project were done in May, 2021. The meetings were conducted with various stakeholders which included the communities around the project area, the media and other stakeholders at the Disrict Council. The main objective of these meetings was to understand from these various stakeholders looked at the social trends particularly GBV isssues, if any, since the start of the project activites. Importantly to also understand from them the proposed mitigation measures that may be needed with regard to GBV issues.

Figure 57: GBV mitigation stakeholder Consultation meeting at Mologeni

OUTCOME OF DISCUSSIONS

The discussions informed the preparation of the ESIA and its update.

For example, in discussing the detailed design of the canal inside MWR:

- The canal alignment was revised so that itis partially underground inside MWR and crosses the Mwembezi River using a siphon (more detail is provided in this report under section 4). The rationale for the latest canal alignment route and mix of open and buried canal is the presence of topographic and terrain constraints. The high cost for the buried sections do not leave much place for a completely buried canal.
- Investigations into developing the shortest possible way out of the reserve determined that the construction of the dike across the Shire river would have been required, a development that would have pushed the cost up eroding the economic sense of the project.
- The boundaries of the reserve were established so as not to be confused with the electric fences within MWR boundaries.

And also to understand how the canal can help achieve the management objectives for Lengwe National Park, through discussion with the DNPW.

The discussion with the other projects helped identify new and planned schemes or programs (not considered in the 2017 ESIA) that may affect water flow or quality in the Lower Shire Valley, and particularly on Elephant Marsh. This information was used to inform the update of the assessment of the cumulative impacts.

With respect to discussions on GBV, it became clear:

- The risk of sexual abuse should be taken seriously considering the vulnerabilities that may be there when people are looking for employment, particularly women, for example.
- Issues of child abuse also will need to be looked into as, for example, parents send little girls to sell merchandise to the campsites where they can easily be abused.
- As a way of mitigating against any probable risks, the project should ensure there is enforcement of the Code of Conduct, GBV sensitization eetings in all the project areas and the development of a shared information base for the service provider to interface with all concerned stakeholders.

7.4 CONSULTATION RESULTS

The general perception of the stakeholders about the project was positive and traditional leaders stated that the project dates back to the 60s. However, after Traditional leaders and communities were sensitized the project did not materialize. Consultations restarted in 2008 but did not continue. Since 2015 TAs have been invited to a number of meetings where they were informed that there was now commitment by both the Malawi Government and donors to implement this project. However, there is still concern among Traditional leaders and communities in the project area that these consultations may not be different from the previous ones which ended without the project being implemented. The meetings and stakeholder consultations conducted in preparation for the SVTP II echoed similar sentiments as those expressed in 2015 during the initial stakeholder consultation meetings. The key issues and questions raised by stakeholders consulted in the project area are as follows:

- Drowning of livestock in the main canal; the canal will obstruct access of livestock to communal grazing land and water.
- The canal is a drowning hazards for wildlife in Lengwe National Park attempting to cross it or falling in it.
- Splitting of Lengwe National Park into wet eastern and dry western parts by the canal. This will hinder animal migration.
- Increased cases of illegalities in Lengwe National Park through poaching and logging as the canal construction opens up the park to non DNPW staff
- Splitting of villages by the main canal is a concern.
- Local leadership should be consulted before implementation of any resettlement. The project should prioritize water distribution to smallholder farmers than private companies. Relocation of graveyards will not be accepted unless in extreme cases
- The Project should provide equal employment opportunities for men and women during construction of the canal and ancillary facilities and women shall be included in Water Users Association during operation phase.
- There were interests in knowing if farm inputs shall be provided to smallholder farmers and if the use of water from the irrigation canal shall involve any fees.
- Has the project considered flood issues in the design?
- How will the people whose houses and properties affected by main canal be compensated?

- Fear of having crocodiles occupying canals and drains. Crocodiles were actually observed by the consultant in one of the drain of Illovo during the January 2016 mission.
- How will the project benefit disabled people and youth in the area?

These issues have been considered during subsequent project design and where relevant are incorporated below in specific measures or covered by the Resettlement Policy Framework.

Table 35: Stakeholder Consultation Results

SN	STAKEHODER	MAJOR ISSUE RAISED	SUGGESTED ENHANCEMENT / MITIGATION
1	**DNPW – Lengwe National Park**	Destruction of critical habitat for Nyala; Destruction of mopane trees; Habitat destruction for wildlife; Soil Erosion; Risk of tiger fish reaching the Kapichira reservoir and Lake Malawi	Change canal alignment to avoid the critical habitat destruction; Develop and implement restoration plan; Build institutional enforcement capacity of DNPW in Lengwe National Park; Provide alternative access road in the Park;
2	**DNPW, African Parks - Majete Wildlife Reserve**	Loss of revenue from tourism; Habitat destruction for wildlife; Soil Erosion and water resources degradation; Lack of access to Kapichirwa falls and Reservoir Extended working area in the park due to Cyclone Anna impacts, Increased incidences of poaching Loss of artifacts in the Kapichira area; Lack of capacity to monitor biodiversity Risk of tiger fish reaching upper Shire River and Lake Malawi	Include loss of revenue in the compensation for Majete; Restrict clearing to canal alignment based on ESMP provisions; construction to be restricted to day time; Blasting to be conducted at times agreed with African parks; Support DNPW in acquiring the services of Biodiversity Monitoring Expert and monitoring and radio equipment; Support DNPW to strengthen enforcement capacity; Construct alternate route to Kapichira reservoir Construct tiger fish barrier to resitrict movement of tiger fish

SN	STAKEHODER	MAJOR ISSUE RAISED	SUGGESTED ENHANCEMENT / MITIGATION
3	**DESC, Chikwawa and Nsanje District Council**	Increase in employment opportunities;	Efforts must be applied to ensure local population benefits.
		Migrant workers impregnating and leaving the locals with fatherless children but also transmission of HIV/AIDS. Increased cases of GBV and child labour.	Responsible NGOs to sensitize both the locals and the construction workers Hire a GBV service provider to address GBV, SEA and SH issues related to SVTP
		Increase in cases of chistosomiasis	Support the district council in controlling schistosomiasis Raise awareness among communities and children on the risks involving bilharzia
		Accidents will increase due to speeding	Put humps and road signs to reduce over-speeding Install speed monitoring gadgets on construction vehicles
4	**Community FGD, men**	Loss of houses and buildings in the canal RoW;	Develop and implement RAP
		Increased income from compensations to damaged property: houses, farm fields and shops along canal RoW	Conduct financial literacy for PAPs Establish project GRM committees that take care of issues on how compensation is followed to avoid conflicts.
		Spread of HIV/AIDS and COVID-19 due to the coming in of migrant workers.	Assembly in collaboration with the village committee must engage in the sensitization campaigns in order to alert and equip people for their own safety

SN	STAKEHODER	MAJOR ISSUE RAISED	SUGGESTED ENHANCEMENT / MITIGATION
5	**Community FGD, women**	Increased spread of HIV/AIDS and COVID -19; Early marriages, early pregnancies, disturbs of marriages; Disturbance of classes due to students missing classes to watch the construction machinery	HIV/AIDS sensitization meeting held locally with the community chaired by the village heads and also individually as parents' advice children on the prevention of HIV/AIDS and also COVID-19; Mother group should follow up on school children to know there whereabouts, to make should they are not involved with construction workers.
		Increased business as there will be an increased demand for rent, food consumption, among other things in the community	
6	**Community FGD, youth**	Increased employment opportunities for both manual laborers and specialist in the area	Involvement of District council and local structures in monitoring the recruitment process to prevent corrupt tendencies and ensure employment of locals on the project
		Enhancement of technology in the project area as the community members will be exposed to new technologies.	The contractor should use up to date machines to enhance technological advancement of people in the area

7.5 SOCIAL INDICATORS

7.5.1 Population and demographics

The two districts in which the SVTP is earmarked are similar in many respects including population densities, level of development, education and health facilities and other socio-economic factors. With regard to demography, according to Population Projections carried out in 2018, the district population of Chikwawa is estimated to reach 603,037 in 2021 consisting of 294,922 females and 308,115 males (NSO, 2018). Much of the population is said to reside in the area of TA Ngabu. It is estimated that the population growth rate for Chikwawa District is 2.7 percent per annum which is lower than that of Malawi.

Elsewhere in Nsanje, the combined population of those that live in the urban area and its conurbations and those that were rural-based was estimated at 299,512 (NSO, 2018). The population was projected to rise to 316,213 in 2021 with a female population getting to

165,150 and male population getting to 150,963. At Traditional authority level, TAs Mlolo and Mbenje have higher population.

7.5.2 Household size

Although each of the districts will have its own average household size, it is known that the average household size for the southern region districts of Malawi is 4.3 persons compared to 4.4 for the central and 4.8 persons for the northern districts (Population and Housing Census, 2018). According to the results of the survey conducted in the area, average household size for the sampled population is 4.9 in Phase 1 and 5.1 in Phase 2 (COWI, 2016). Apparently, the difference in household size between the Study area and the Southern Region was attributed by the difference in population sample size (COWI collected sample only in the study area).

COWI survey showed that there are more men than women in the study area, which is also a difference with the 2008 census. This is in sharp contrast with the population projection arrived at by the National Statistical Office (NSO, 2018).

7.5.3 Gender aspect

The COWI household survey conducted in the project sites revealed gender inequalities in agriculture undertakings. It was observed that women spent more time on farming activities yet decisions on sale of farm produce were largely made by men. Discussions with women groups such Chambuluka, Namatchuchu, Joliji, and Misili Womens Club under Development Aid from People to People (DAPP) revealed that women carried more farming activities and household chores whilst men were engaged in casual labour in Illovo estates. Consultations with Illovo and Zikomo Cane Cutting Company, a contractor for Illovo indicated that 70 percent of casual labourers are men. It was evident that farming activities on small scale are predominantly carried out by women. On sale of farm produce and livestock, women indicated that the decision is solely made by men. Proceeds from the sales are not shared equally and rarely do men disclose to their wives the total amount realised from the sale. One major challenged raised by women was food insecurity during floods and prolonged dry periods.

This is well collaborated in the 2018 Population and Housing Census (NSO, 2018) report and the 2020 SVTP Baseline Report. With household sizes of 4.3, Chikwawa and Nsanje report high orphanhood of 15.8 and 15.5 respectively.

The 2017-2017 Integrated Household Survey (HIS) Report (NSO, 2018) shows that more men than women own land exclusively with 32.7% in Chikwawa and 31.1 in Nsanje compared to 25.8% and 18.9% for women in that respect. Land is co-owned by 19.4% and 20.5% of the residents in Chikwawa and Nsanje in that order.

An investigation was also conducted on level of engagement of women in government and NGOs sponsored projects implemented in the project area. It was observed that government sponsored projects under Local Development Fund (LDF), Malawi Social Action Fund (MASAF) promote gender equality on labour force working on such projects. The District Community Development Officer for Chikwawa indicated that in some projects the number of women working on government sponsored projects is more than that of men. Projects such as Farm Income Diversification Program (FIDP) and Ubale Project being

implemented by NGOs in the project area number of women beneficiaries is surpasses that of men. One reason is that most men are largely engaged in casual labour in Illovo Estates which pays more money than projects compared to government sponsored projects. For instance, under LDF projects the payment is MK7,200 for 12 days which is three times less what one could get from Illovo. Further, some projects do not pay cash but rather farm inputs and food and this is less attractive to men in the area who prefer getting cash.

However on decision regarding the use of land at household level, it was discovered that largely adult male (40 percent) made decisions in both phase areas of the project area. Adult male and female jointly were also predominantly involved in decisions concerning use of land.

7.5.4 Vulnerable people

Vulnerable, disadvantaged and marginalized groups which include the poor, disabled, orphans, the elderly youth, women, and children are many in the project area and these groups are impacted heavily by poverty and economic shocks. During focus group discussions conducted in traditional authorities Kasisi, Chapananga, Katunga, Maseya, Lundu, Ngabu and Mbenje, participants reported orphans and elderly as most vulnerable groups. Youth from 15 to 35 years of age are considered marginalized since they have higher levels of unemployment. Female headed households were also considered as marginalized groups as most of them do not have property and land rights due to cultural norms.

7.5.5 Education Attainment and quality

Nsanje and Chikwawa have low literacy rates of 56% and 58% respectively (NSO, 2018). In Chikwawa, it is reported that around 81% of the population have no educational qualification where as 10% have primary school qualifications. Those with Junior Certificate, MSCE and tertiary qualification are at 6%, 2% and 1 % in that order.

Net enrolment rates in primary schools in Chikwawa are higher for girls (84%) than boys that stand at 83%. In secondary schools, however, enrolment rates are higher for boys (14%) than girls (7%).

Droput rates in Chikwawa are higher at secondary school level (4%) compared to primary schools (1%).

On the other hand, in Nsanje, it is reported that around 76% of the population have no educational qualification where as 10% have primary school qualifications. Those with Junior Certificate, MSCE and tertiary qualification are at 8%, 4% and 2% in that order.

Net enrolment rates in primary schools Nsanje are higher for girls (84%) than boys that stand at 84%. In secondary schools, however, enrolment rates are higher for boys (13%) than girls (11%).

Dropout rates in Nsanje are lower in secondary schools (2.6%) compared to primary schools (3.1%)

7.5.6 Settlements and Community Organization

Settlement in the study area are largely nucleated around social infrastructures such as markets, schools and water supplies. Communities are organized according to families and relations in

the area with common cultural beliefs and language. The ethnic group in the project area is predominantly the Sena as shown in Figure 33. The Mang'anja are second largest ethnic group followed by the Lomwe. However the rest of the proportion is shared by the Ngoni, Chewa, Tonga, Tumbuka, Nyanja, Yao and other ethnic groups. Needless to say, the area has an eclectic structure of culture and traditions.

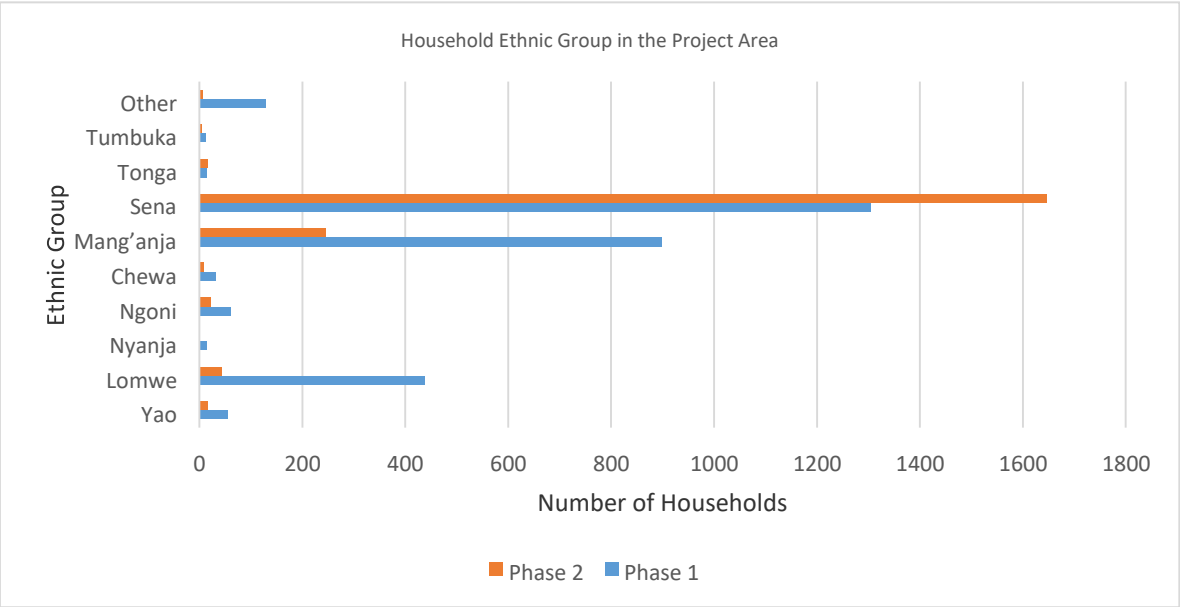


Figure 58: Household ethic groups

The majority of the residents are Christians with some Muslims and atheists. Most adults are married and a considerable number of single adults. Polygamy is practiced by a few men in the area.

7.6 INFRASTRUCTURE

7.6.1 Housing

Most dwellings in the project area are made of materials that can be sourced locally, such as bricks, grass, poles, clay (see next figures). During the field visit, it was observed that modern homes more often are made of burnt bricks, cement and roofed with corrugated iron sheets, whereas older homes are commonly made of sunburnt bricks or mud and are grass thatched. Table 14 provides a comparative analysis of population and housing characteristics of households in Chikwawa and Nsanje against households at national and regional revels.

Table 36: Population[10] and housing for Chikwawa and Nsanje against regional and national conditions

	Chikwawa	Nsanje	National average	Southern region	Observations
Levels and trends in urbanization					
Population (people) Annual growth rate (%) Population density (persons/km2)	603,037 2.5 116	316,123 2.1 154	18,898,441 2.9 186	8,420,081 2.8 244	Lower than average density and growth rate.
Urbanisation centres> 5,000 inhabitants (%)	2.3	9	19	15.9	
Housing conditions					
Household size (people)			4.6	4.3	
Occupancy tenure (%) -owned -rented -other	65.8 11.1 23.1	65.6 5.5 28.9	72.9 12.3 14.8	72.4 12.2 15.4	Owner occupancy dominant, rented dwellings is an urban phenomenon only.
Size of dwelling (%) - one room for sleeping - two rooms for sleeping	45.6 38.2	47.8 34.7	41.3 38.5	40.3 40.7	Smaller size dwelling prevalent.
State of permanency (%) -traditional dwelling -semi-permanent -permanent	39.3 14.5 46.2	35.5 17.8 46.6	31.5 23.2 45.3	28.1 23.0 48.9	Majority lives in dwellings using traditional materials and construction techniques. However, some improvements in durability since 1998.

[10] Source: NSO, Population Projections 2018-2050 Report, 2018

Construction materials (%)					
Floor	85.6	87.0	78.5	77.1	Majority of dwellings are susceptible to flood damage. Flood proofing of individual dwellings may not be feasible.
-earth, sand, dung	14.1	12.8	21.2	14.1	
-cement, bricks, etc.					
Walls	19.2	13.5	9.7	4.3	
-mud	35.9	36.6	32.3	50.7	
-unburnt bricks	38.2	44.3	58	42.2	
-burnt bricks					
Roof	74.6	76.3	53.8	66.9	
-grass thatch	24.9	23.0	45.8	32.1	
-corrugated iron					

Figure 59: Permanent dwelling and traditional dwelling in the study area

7.6.2 Access roads

The project area has 4 classes of roads namely the Main Road (M1), Secondary Roads (S152, S136 and S151), District Roads (D379, D380, D383 and D385) and numerous unclassified roads. The major road linking the urban centers is M1 which connects the project area to the major cities of Malawi. It is a new upgraded road, and the only asphalted road in the Study area, which has eased transportation problems that were experienced in the area. There are 3 Secondary Roads, 2 Tertiary Roads and 839 Unclassified Roads that are regularly maintained and connect small trading centers to major urban centers in the project area. Driving outside the M1 during rainy season could be difficult and the roads on the eastern side of Elephant marsh become impassable due to flooded tributary rivers (flash floods).

Common modes of transport in the project area, include motorcycles, bicycles (*shapa or kabaza)*, vehicles and ox-carts. Most household in the project area own push bicycles (66%) and a small percent own motorcycles and ox-carts. The common modes of transport used to access health facilities and trading centers in the area are push bicycles and motorcycles.

7.6.3 Telecommunication

The Study area is covered by mobile network from both Airtel and Telekom Networks but communities complained that the network signal is very weak especially when moving away from the M1 road. The SVTP Baseline survey conducted in 2020, indicated that 55% of the male headed households have own a cellular phone compared to 23 of the female headed households.

7.6.4 Water supply

Communities within the project side heavily rely on boreholes, public tap, protected wells and perennial rivers to draw for domestic purposes. However, households predominantly use borehole water as indicated in SVTP Baseline Report of 2020.

The report reveals that tube well or borehole were the main sources of drinking water for 76 % and 75% of male and female headed households, respectively. Most households, (about 97%) have their main sources of water within one kilometre from their homes and only a few households, that is, 2 percent and 3 percent of male and female headed households, respectively, have their main sources of water beyond one kilometer. These findings are below those reported by the 2016-2018 HIS as shown in Table below:

Table 37: Proportion of Population with access to potable water by source

Water Source	**Proportion Served**	
	Chikwawa	**Nsanje**
Improved water source	86.5	95.6
Borehole	73.9	91.6
Piped into yard	11.6	1.4
Piped into dwelling	1.0	2.5
Open well in yard	2.9	1.8
Protected well in yard	0.4	0.5
Sring, river, dam	10.2	2.1

An increase in the percentage of households with piped water within their houses, water piped into their dwelling or piped to a household yard/plot will be indicative of an improvement in households' living standards.

Figure 60: Unprotected well from river bed

7.6.5 Sanitation and hygiene

Across the Study area, households go to great efforts making water safe. It was learned in the survey that households employ a number of sanitary methods, both traditional and modern in keeping the water free from germs. The methods include: boiling, chlorination/waterguard, filtering and covering the water containers. However the most common methods employed in both phase areas was covering the container. In phase 1 42% of the people cover their container while 24% chlorinate their water with waterguard and 26% employ other methods. The proportions were virtually similar in Phase 2 (COWI, 2016). Covering water only allows to protect water from dust and insects.

The SVTP Baseline Study revealed that 74 percent and 70 percent of male and female headed households had toilet facilities in the project impact area. About 76 percent and 71 percent of male and female headed households had toilet facilities in the comparison area. This agrees with the findings from Focus Group Discussions where members expressed that ownership of toilets at household level had improved as compared to the previous years. They explained that the work was facilitated by non-governmental organisations like Goal Malawi and World Vision. As expected, the most common toilet type is the traditional type (a latrine).

The Ministry of Health aims to achieve universal and equitable access adequate sanitation and hygiene for all. This includes ending open defecation. In general, sanitation coverage in Chikwawa is higher that in Nsanje where 12.1% and 19.3% do not have access to any form of sanitation (Table 14)

Table 38: Sanitation Coverage in Chikwawa and Nsanje (Source: NSO, 2017)

Category	**Ckikwawa**	**Nsanje**
Access to improved sanitation	71%	51.7%
Flush toilet	0.7%	1.6%
VIP	0.3%	-
Tradtion pit latrine with roof	70%	50.1%

Tradtion pit latrine without roof	17.0%	29.0%
None	12.1%	19.3%

7.6.6 Health facilities

There are a number of health facilities within the project areas. Main referral health facilities within reach of the communities include Chikwawa District Hospital and Nsanje District Hospital. A number of dispensaries and clinics are located in the project area and these include Mankhokwe, Tengani, Phokera, Mitole, Nchalo and Kasinthula. Key informant interviews with health personnel at nearest health centres indicated that malaria, diarrhea, bilharzia and STIs are the most frequent diseases. According to results of the key informant interviews with health officials from nearest health centres conducted in the project area, malaria is a significant problem and the leading cause of deaths in the project area.

The Chikwawa District Health Office reported in 2016 that malaria is the most common disease in Chikwawa whereas bilharzia (Schistosomiasis) is an emerging concern.

Table 39: Common Diseases in Chikwawa

TOP MOST REPORTED DISEASES IN CHIKWAWA			
Data element	***2013/2014***	***2014/2015***	***2015/2016***
Malaria	*148,122*	*171,543*	*131,626*
Other skin conditions	*31,522*	*38,391*	*36,741*
Common injuries and wounds	*18,508*	*20,620*	*21,008*
Eye infection	*10,265*	*15,011*	*16,774*
Oral conditions	*9,231*	*8,973*	*11,240*
Case treated as STI - new	*8,317*	*8,844*	*12,183*
Dysentery	*2,982*	*4,061*	*3,926*
Ear infection	*5,210*	*3,897*	*4,710*
Schistosomiasis - new	*2,265*	*1,852*	*2,290*

The issues identified in the focus group discussions held in TAs Kasisi, Katunga, Lundu, Mbenje, Maseya, Chapananga and Ngabu as fafilitated by COWI in 2016 continue to prevail. Participants identified lack of medicine and drugs in hospital for common diseases, lack of malaria test kits, inadequate staff, lack of bed spacing, lack of equipment for sting other diseases are common major problems experienced in all six health centres.

7.6.7 Electricity supply

In the project area, urban areas and trading centres such as Chikwawa Boma, Nsanje Boma, Nchalo, Bereu, Phokera, Ngabu and Bangula are powered by Electricity Supply Commission of Malawi (EGENCO) from Kapichira powerstation. Households in most rural areas use solar

lanterns, candles and kerosene lamps for lighting in their households. The connection to national electricity grid is still low in the project area and the households indicated that electricity is still not affordable. Households in most rural areas use solar lanterns, candles and kerosene lamps for lighting in their households.

In Chikwawa, 0.3% of the population uses electricity for cooking comparead to 0.5% in Nsanje and 5.9% and 6.1% in that order for lighting. The most common source of energy for cooking is firewood both widely used in the urban and rural areas in the project area. Charcoal is used in the urban area because it is relatively expensive. Extensive dependence on firewood significantly contributes to deforestation subsequently effecting water retention processes and cause soil erosion and sedimentation.

7.6.8 Security and Crime

The Malawi Police Service is the main provider of security in Chikwawa District. There are several police facilities in the district and are in different categories. The district has 1 Police Station at the District Headquarters, 2 Police Posts at Nchalo and Ngabu, 8 Police Units at Chapananga, Gola, Changoima and Chapasuka in TA Chapananga, Goma, Thendo, Mkumaniza in T/A Ngabu, Makhwira in T/A Makhwira, Mbewe Headquarters in Paramount Chief Lundu; and 1 Police Mobile Unit camp (Mitole) situated within the District Headquarters. There are also buildings meant for Police Services at Bereu and Therere but they are not yet opened.

Chikwawa district has Group Four Security Company as the only recognized company that provides Private Security Services. It operates at ILLOVO and Presscane Companies.

The Malawi Police service introduced a new type of policing whereby the communities were sensitised on taking part/ assisting the police in policing their areas. Chikwawa Police Station is involved in this type of Policing, whereby Community policing structures were developed in all eleven T/A's (Community Policing Forum), 79 G.V.H (Crime Prevention Panel) and 593 V.H. levels (Crime Prevention Committee). Elected members at forum level were trained on concepts of community policing and told to elect and train similar structures at G/V and V/H levels. This programme is aimed at curbing crime, improving security in the district.

In SVTP 1 Security has proved to be a potential risk and several mitigation measures were implemented including hiring of security personnel and formation of a security task force to manage the security risk. The project has been working in collaboration with Malawi Police and all the other security security structures in the district on issues of security for the the project. Security and crime risks have been also acknowledged in Chapter 4 of the labour management procedures and mitigation measures have been devised, including hiring of security personnel and formation of security task force to work in liaison with community policing committees. All security operations shall comply with the World Bank's ESS4 Standards as stipulated in the ESF.

7.7 LAND

7.7.1 Land tenure

For more details on land tenure this report refers to the Resettlement Policy Framework Document. In Malawi, land is divided into four major categories: customary, government, public and private. The Land Act of 1965 and the National Land Policy of 2002 recognizes these categories of land.

A majority of the land in the SVTP area is customary land (81%), 18% being private land, and 1% other. The proportion of customary land is higher in Phase 2 (90%) than in Phase 1 (75%) probably due to the existing large estates within this area. The household survey found that 16% of the land was under disputes. The disputes were, however, not of such a magnitude to negatively affect the project. Of all the land cases, 45% of the disputes were with the neighbour, 25% with the village head, 21% within the family, and 9% with others. Land disputes are generally solved by those involved (43%), by chiefs (50%) or formally by Village Head (VH), Traditional Authority (TA) or the Courts (49%). Female headed households have a preference for settling disputes by VHs (95%) and male headed households by the VH, TA or the Courts (95%).

SVTP has instituted a Grievance Redress Mechanism (GRM) in line with the World Bank Environmental and Social Framework (ESF) by which grievances emanating from project actions are resolved.

Most of land use fall in four categories: rainfed agriculture; irrigated agriculture; livestock and grazing and fishing.

About two thirds of Shire Valley Agricultural Development Division (SVADD) is customary land, controlled by the Chiefs (Traditionnal authorities). Customary land are recognized at Traditional Authority level but not at the Department of Lands level. Land for cultivation is allocated by the chief and a farmer can claim traditional rights to land he has once farmed but no legal rights. Land not used for cultivation can freely be used by anybody for grazing. Customary land includes grazing lands, markets, grounds, graveyards.

Private land is held either under free hold title or leasehold title. Private land or estates cover only a small percentage of the ADD.

Public land is held in trust by the Government and includes Lengwe National Park, Majete and Mwabvi Wildlife Reserves, various Forest reserves, railways, roads, and towns.

Leased land includes private farm and settlements which are on private leasehold agreement within the district. The proposed project will be implemented on both customary and public land. However, land is a contentious issue in the project area and in many areas it has resulted in tensions between communities and private companies accused of grabbing land from locals. Most of the people in the project area are without recognized land tenure rights and very few have been able to secure recognized title deeds for themselves.

Securing land rights in the project area largely depends on inheritance in the project area. The Sena who follows patrilineal system kinship, land belongs to men and is transferred from fathers to sons while Mang'anja who follows matrilineal system kinship, land is transferred along matrilineal lines. In patrilineal system, women do not own land while in matrilineal kinship they have access to own land. However, from an interview that was conducted with the District Social Coordinator (DSC) and the community members, both in Chikwawa and Nsanje, 95% of the households are virilocal (household located in the village of the man) and only 5% are uxorilocal (household located in the woman's village) therefore giving much land ownership powers to men than women.

Inequalities in land distribution, access and ownership are a common problem in the area. According to the Socio-economic Baseline report of the SVTP (2020), 28 percent of the the beneficiaries in the

project area indicated being safe with respect to security of tenure of land of whom 25% were males while 34 % were females.

Customary tenure is the predominant landholding system in the SVTP , constituting 66 % of the project land area. In customary areas, land is held by families usually by a male member (81%), sometimes by a female member (15%), and less frequently both men and women (usually as spouses) are joint rights-holders to their land (4%). Of the male land owners,35% is under the age of 35 and of the female owners 29%. Almost all landholders (92%) have acquired their land by inheritance directly from either their father or mother. Almost all land has been allocated. Land scarcity means that access to land through allocation by a family head or traditional authority (chief, group village head or village head) is now uncommon. Tenure is generally perceived as secure, probably due to the centrality of inheritance law in the customary landholding system. Traditional authorities have no direct role or influence on how land is assigned to family heirs. Land transfers or sales to non-family members or to persons from outside the community or village are prohibited, unless they are sanctioned by chiefs

7.7.2 Land size

Land holding size for majority of communities in the project area ranges from 0.1 ha to 1 ha. About 43.2% of the smallholder farmers interviewed in the project area have 0.1ha or less of land for both settlement and cultivation. About 29 % of the farmers have 0.1 to 0.5 ha whilst 17.8 % of the farmers have land sizes more than 0.5 ha (COWI, 2016).

7.7.3 Land Use

7.7.3.1 Agricultural Rainfed Production

Land is mainly used for rain fed agriculture (69%) and settlement (28%). Only 2% of the land is irrigated and less than 0.5% set aside for grazing, business, renting and other uses. The better off and rich more often use their land for business, grazing and woodlots. The poor more often rent out or sell their land to obtain some cash if they are not able to develop it. Over 70% of the respondents in the household survey had 3 to 4 parcels. The total area held by households is small, 23% had a landholding of less than 0.81hectares, 19.8% had 0.81 to 1.22 hectares, and 30.7% had 1.22 to 2hectares. A parcel of land is held in the name of the head in 96% of the households. This percentage is higher in male (98%) than female (86%) headed households and lowest in young female headed households aged younger than 36 years (66%). Southern Region has the highest proportion of female owned parcels in Malawi because of the matrilineal societies living within the area. Although, the two districts have matrilineal societies, men often make decisions on land and land transactions.

Agriculture remains the single most important sector of the economy as it employs about 80% of the workforce. Chikwawa district has a total of 126,201 farm families comprised of 65 % and 35% male headed and female headed households. The Makande plain is the major area of agricultural production in the Agricultural Development Division (ADD). Mean annual rainfall is 700-800mm. Mean monthly temperature is 25-30 degrees in the growing period. Agriculture provides the major source of livelihood for the district. Food crops grown in the district include maize, rice, sorghum, various horticultural crops, and sweet potatoes.

MAIN CHALLENGES TO RAINFED PRODUCTION

Rainfall is erratic in the Study area more especially in the western bank of the Shire River. This has a big impact on food security.

MAIN PESTS AND PEST MANAGEMENT

In the Study area, the main pests of rainfed production and pest management are the following (more details in the Pest Management Plan):

- Cotton:
  - Pest: aphids and African borer are the main pests of cotton, however none of these diseases are problematic in the Study area.
  - Pest control: is made by manual spraying of chemicals, no protective clothing is used by workers.
- Cereal:
  - Pest: armyworm, stalk borer and termites are the main pests of maize and sorghum. No control is done.
  - Pest control: chemical spraying is only used in case of massive attack.
- Cereal storage:
  - Pest: the large grain borer and weevils are major pests of cereals during the storage of the grains.
  - Pest management: chemicals are widely used to control storage pests.

The Pest Management Plan (PMP), which is a separate report, will further study pests and pesticides and propose management measures for the Project.

7.7.3.2 Irrigated Agriculture

Irrigated sugarcane and other crops are grown on both sides of the Shire River. The largest and most developed of these schemes are Nchalo Sugar Estate (in total 13,805ha including Nchalo, Alumenda and several smaller estates) and Kasinthula Smallholder Irrigation Scheme (755ha) on the western bank and government schemes such as Nkhate (253ha) and Muona Irrigation Scheme (60ha) on the eastern bank. There are also a number of small-scale farmer self-help irrigation schemes using treadle pumps. Average rice yields under controlled irrigation is 3000 kg/ha for one crop. Locally two crops are achieved of either rice alone (summer + winter) or rice (summer) and maize or beans (winter).

MAIN PESTS AND PEST MANAGEMENT

In the Study area, the main pests of irrigated agriculture and pest management are the following:

- Sugar cane
  - Pest: aphids are a major problem in the area. Thrips are present and rodents are widely spread.
  - Pest control: the control of pests is done by chemical aerial spraying. Protective clothing is used in Illovo estate but not in outgrower schemes.

- Sugar diseases:
  - Diseases: smut is a major problem in the area.
  - Disease control: control is done by manual eradication of the infected plants. Hot water treatment is used for seedcane to prevent the spreading of diseases at the plantation stage.

The Pest Management Plan (PMP) will further study pests and pesticides and propose management measures for the Project.

PROSOPIS JULIFLORA

In addition, in the Study area a non-native shrub is invading several areas of arable and grazing lands. It also widely grows in ditches along the M1 road.

The shrub originates from South America and has been introduced to Malawi for life fencing for maize garden (Shackleton, 2014). Although it is invasive, it is considered a valuable shrub for several reasons : it is a source of fuelwood, a source of pole, timber and fencing for maize garden. However, it is considered as a nuisance by communities since disadvantages are more significant than their advantages (Chikuni, 2005). According to Chikuni (2005), the issues with this shrub are the following: because of its spines and rapid colonization, it blocks footpath and limits grazing areas, it also takes up land set for agriculture. In Kenya, it is also known to wound gums of goats affecting their health (Shackleton, 2014).

7.7.3.3 Livestock and Grazing

Patches of mixed low altitude savanna and severely degraded grassland are used for grazing of mainly cattle, goats, sheep and pigs. Approximately 12 percent of the farm families own livestock. The area carries one of the highest livestock populations in Malawi. With the exceptions of few ranches, livestock are kept on communal land under free range conditions. There is little productive relationship between livestock production and crop production. Occasionally crop residues and stubble are used for feeding livestock. Animal manure is rarely used to improve soil fertility for crop production.

Traditionally, livestock particularly cattle are kept for social status and only sold if cash is needed. The quantity of animals is more important than their condition and optimum exploitation for produce and cash. For this reason output from traditional animals farming is limited, despite large numbers of livestock. Meat, milk and eggs are used for home consumption and sold locally to a limited extent.

Results from COWI household surveys conducted in the area indicated that most of livestock owners graze their livestock in communal lands and this was very evident during field visit in the project area. There are a number of conflicts in the study area over livestock grazing land especially during the growing season from December to May. For the most part, cattle and goats feed on other people’s crops. Otherwise, frequency of conflicts plummet after harvesting crops. Interviews with the District Livestock Officer both in Chikwawa and Nsanje as well as community members, revealed that there are no special corridors for livestock in the study area. Livestock, pass anywhere according to the discretion of the headman and that is one of the reasons contributing to conflicts with livestock farmers and crop farmers.

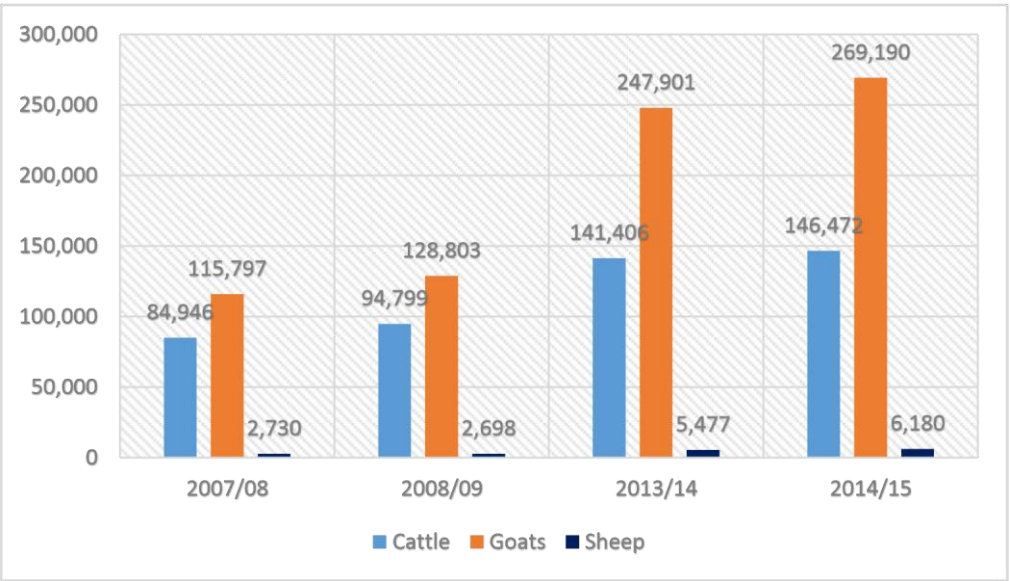


Figure 61: Livestock Population in Chikwawa

In order to safeguard grazing areas, land use plans have been developed as part of SVTP implementation in which set aside areas have been established to serve communal interests such as grazing of livestock and cememetries. Figure 62 below is an example of a landuse plan for GVH Supuni.

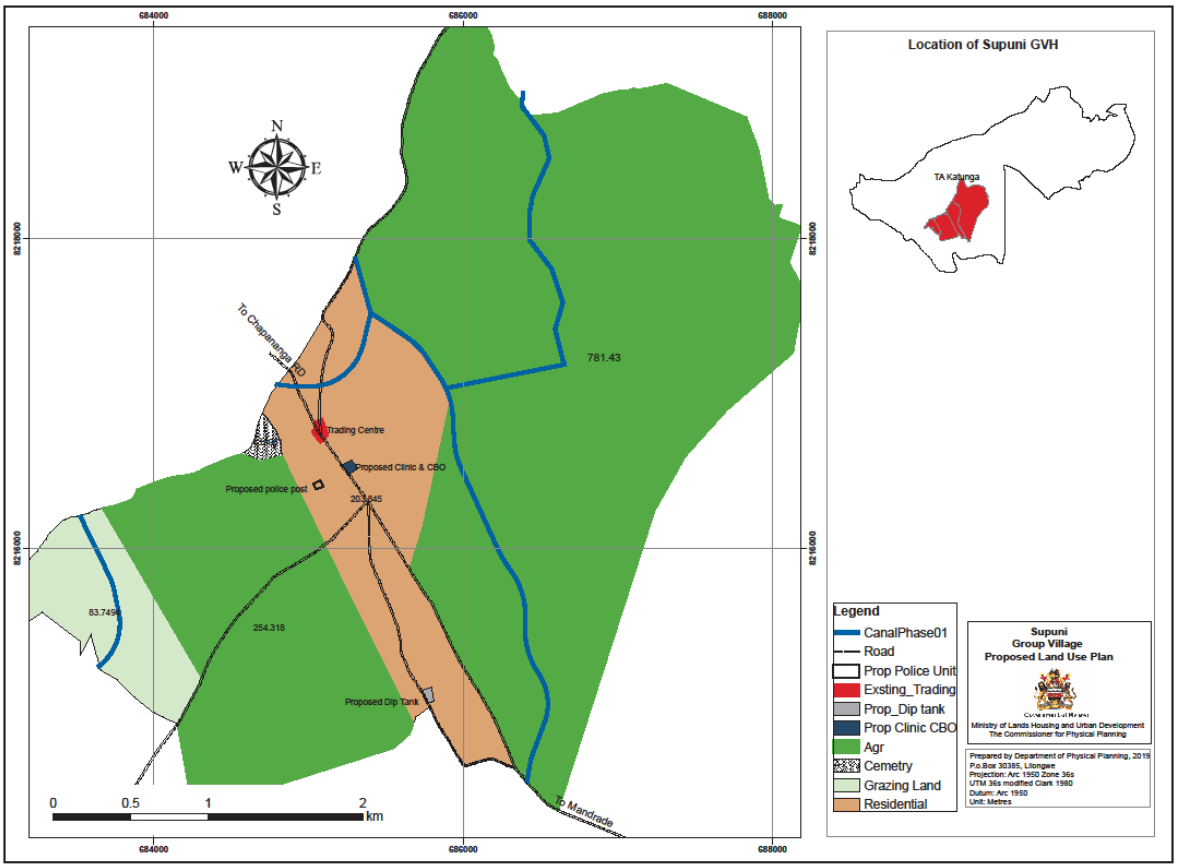


Figure 62: Land Use Plan for GVH Supuni in Chikwawa District

Table 40:: Livestock population in Chikwawa

YEAR	CATTLE	GOATS	SHEEP	PIGS	C H I C K E N S				RABBITS	G/FOWLS	TURKEYS	G/PIGS	DUCKS
					Indigenous	Broilers	Layers	BAs					
2006-2007	76588	108107	2895	19454	283353	3111	1564	6892	801	31442	211	273	23774
2007-2008	84946	115797	2730	33365	369193	3209	1373	7413	1207	41754	140	1207	29448
2008-2009	**94799**	128803	2698	40885	333782	3485	3485	8925	**1085**	47158	153	344	35289
2009-2010	101230	148765	3262	50648	397991	48628	3392	11718	1254	57995	270	217	40014
2010-2011	110553	170835	4092	57585	452457	35225	8192	13343	1946	63415	235	312	42916
2011-2012	112002	188976	4840	66014	452068	3138	1856	12659	2525	65463	198	504	49232
2012-2013	128670	219037	5367	75747	490727	3996	2154	16642	3604	63235	210	528	52479
2013-2014	133687	196443	5621	81462	501394	35225	2002	13343	3630	60211	235	423	56329
2014-2015	142893	212463	5897	86733	546229	43821	2471	12659	4218	61333	198	518	571 24
2015-2016	151229	221037	6233	92619	551205	46444	2709	16642	4961	6302	314	572	578316
2016-2017	158116	305501	7034	84983	705305	2199	2687	10152	4900	58766	310	515	59287
2017-2018	163798	324732	7722	92360	897483	3333	1483	18929	5306	52960	317	502	63440

Source: Chikwawa District Agriculture Office 2017

7.7.3.4 Gender aspect

In both Phase 1 and Phase 2 of the project area gender and decision making on land-use is dominated by adult male. Adult male make most decisions regarding land-use as presented in figures 38 and 39.

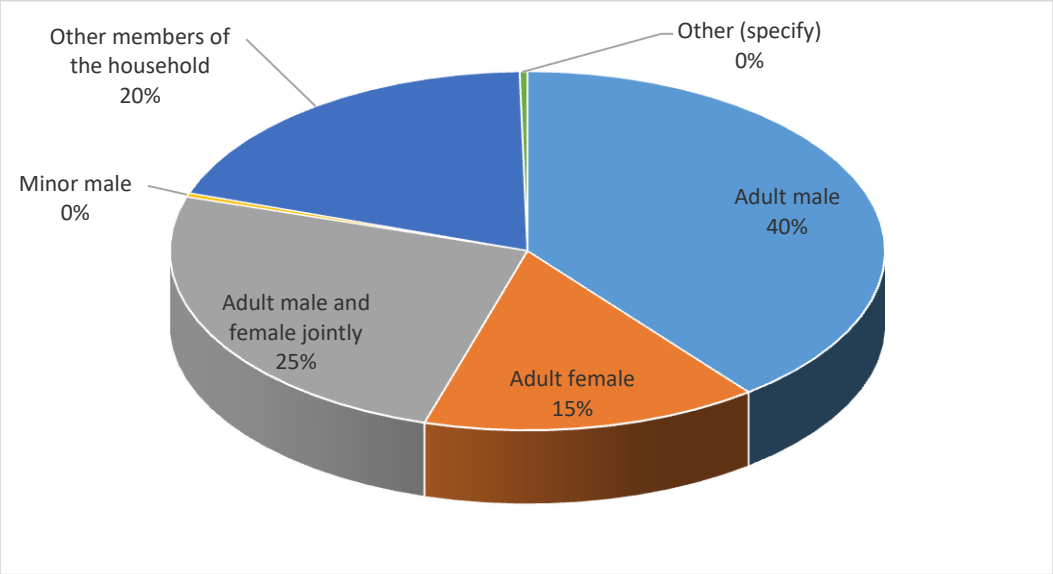


Figure 63: Gender and Decision Making on landuse at Household Level: Phase 2

7.6.3.5 Settlement Pattern

Like most of the settlement patterns, there is a propensity of dense settlements at trading centres, and business centres; the settlement pattern in the study area takes a similar setting with much of the population concentrated at Chikwawa Boma, Nchalo, Ngabu, Bangula and Nsanje Boma. Such places offer business opportunities and have medical and facilities that foster better living standards. Nchalo is the most densely populated area in the entire study area beacause of Illovo Sugar Company that offers a lot of job opportunities and a wide spectrum of business streams. On the other hand, Shire River banks are relatively populated due to farming and fishing activities. The river bank is fertile and idea for farming as well as grazing livestock. Areas further from Shire River and urban area are sparsely populated.

7.7.4 Economics

The economy of the study area is largely agro-based with households engaged in crop production. Maize is the main food crop grown in the project area while cotton is the main cash crop grown by smallholder farmers in the area though sugarcane cultivated in Illovo sugar estates could be regarded as the main cash earner in the study area. Livestock production and fish farming is also a key economic activity in the area for local masses. Areas of tourist attraction in the study area includes Lengwe National Park and Majete Wildlife Reserve have allowed the developement of economic

activities for communities such as the Majete community campsite and community based organisation which are engaged in various income generating activities. Sections below provide a discussion of main economic activities undertaken in the study area.

7.7.4.1 Crop Production

The project area is largely an agro-based economy relying heavily on rainfed agriculture except for large commercial farming being undertaken by Illovo and medium scale irrigation schemes such as Phata and Kasinthula. In addition, winter cropping contributes to both food and income security.During the 2015 to 2021 growing seasons, sweet potato has increased in production whereas maize production has declined. This vests in sweet potato becoming a coping mechanism as indicated in Table 41 and figure below.The main cash crops in the project area for smallholder farmer are cotton and pigeon peas.

Table 41: Crop Production (Mt) in Chikwawa from 2015 to 2021

	Growing Season						
Crop	2015-2016	2016-2017	2017-2018	2018-2019	2019-2020	2020-2021	**Total**
Maize	53,870	53,843	43,668	107,177	104,793	88,829	**452,180**
Rice	9,154	10,031	9,218	7,904	12,848	14,192	**63,347**
Sorghum	19,562	18,419	16,666	44,966	43,889	24,141	**167,643**
Millet	10,441	8,526	7,139	17,197	16,210	10,414	**69,927**
Cotton	9,070	12,761	7,332	11,877	40,839	14,369	**96,248**
Pigeon Peas	14,796	9,680	16,323	22,708	18,058	14,184	**95,749**
Phaseolus Beans	8,357	8,983	8,634	12,751	9,820	11,228	**59,773**
Cow Peas	5,075	4,744	4,944	6,733	7,402	6,811	**35,709**
Sesame	1,142	1,131	1,160	2,247	2,207	3,526	**11,413**
Sweet Potato	123,725	130,834	137,984	189,635	121,766	163,328	**867,272**

Sorghum remains a coping crop owing to its resilience to droughts and dry spells that frequent the project area.

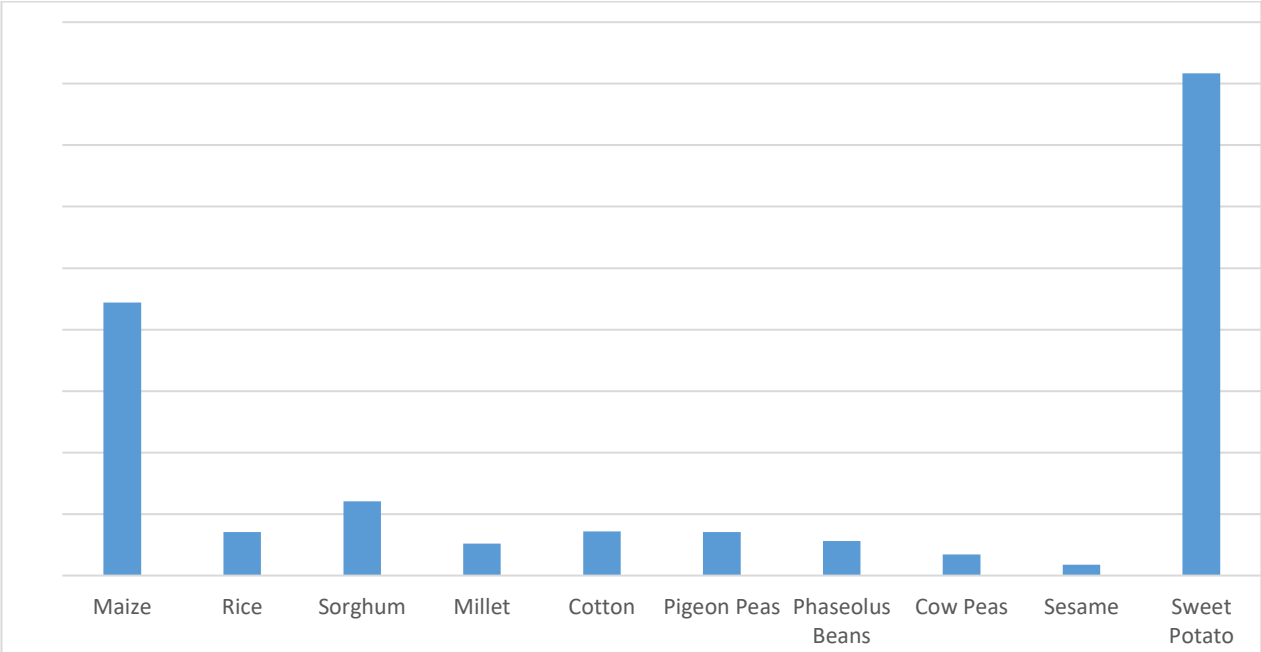


Figure 64: Crop Production in Chikwawa in 2020-2021 season

Table 42: Crop Production in Nsanje (Mt) from 2015 to 2021

	Growing Season						
Crop	**2015-2016**	**2016-2017**	**2017-2018**	**2018-2019**	**2019-2020**	**2020-2021**	**Total**
Maize	30,906	30,906	23,692	41,311	36,603	6,331	169,749
Rice	2,237	1,688	2,179	1,709	2,704	2,717	13,234
Sorghum	3,272	3,272	3,239	4,065	3,306	6,331	23,485
Millet	3,586	4,344	4,154	4,001	4,807	7,217	28,109
Cotton	113	165	227	330	801	426	2,062
Pigeon Peas	2,672	1,792	2,097	3,041	2,398	2,736	14,736
Phaseolus Beans	1,738	1,135	1,830	3,045	2,912	4,513	15,173
Cow Peas	2,440	2,444	2,488	3,342	2,980	3,133	16,827
Sesame	721	805	719	991	909	1,547	5,692
Sweet Potato	83,971	81,952	93,365	189,635	121,766	163,328	734,017

While sweet potatoes dominated production, Nsanje depicts a different picture with respect to food crops in that sorghum and millet play a more important than maize

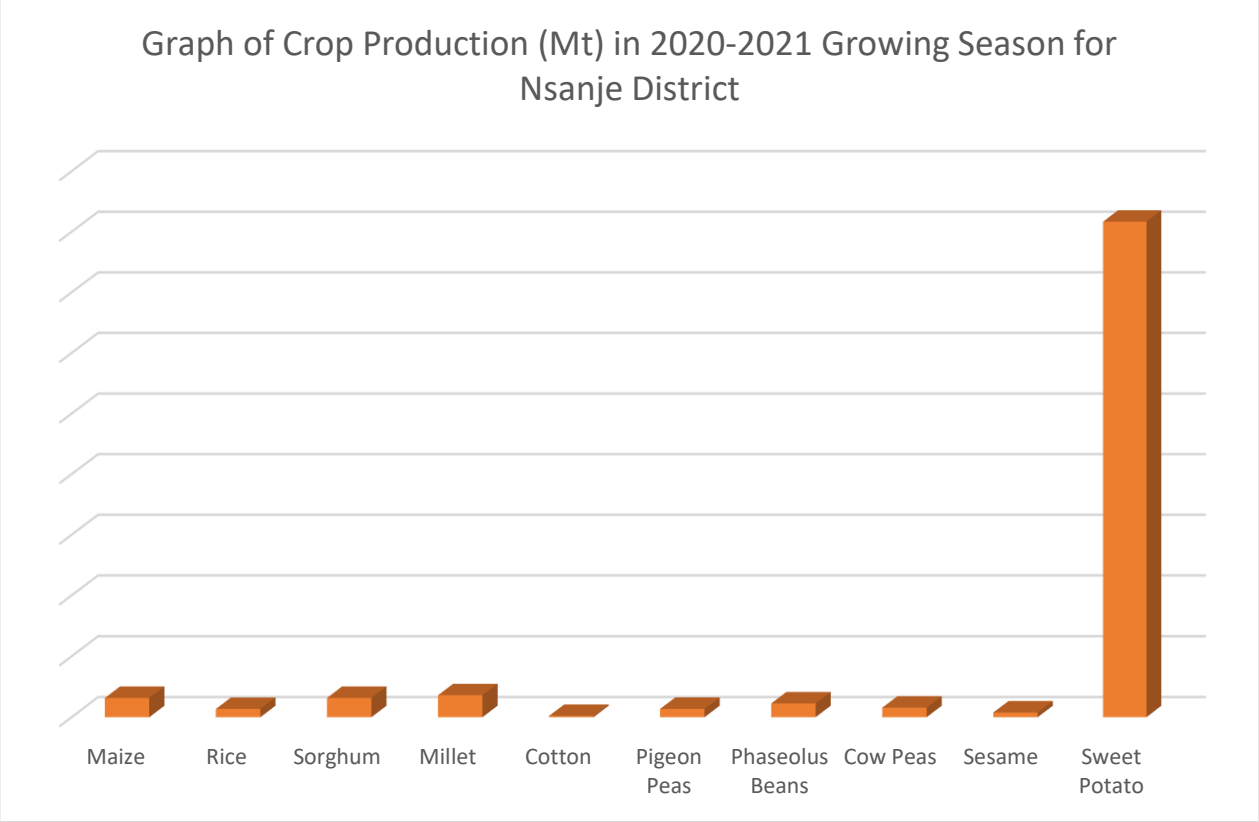


Figure 65: Crop Production in Nsanje in the 2020-2021 season

There are number of smallholder irrigation schemes in the project area which largely depend on residual moisture along Shire, Mwanza, Mkombezi, Mnthumba and Thangadzi rivers. The predominant crop in these schemes is maize and primary for food. One major challenge experienced by farmers is unreliable water from nearby wells and lack of pumping equipment to draw water from nearby rivers. At Mkombezi Irrigation Scheme, farmers divert water from Illovo canal to irrigate their crops.

7.7.4.2 Livestock production

Livestock farming is also a key economic activity in the project areas especially rearing of cattle, goats, pigs and poultry. Most of the agricultural produce sold are at the nearest trading centres. Traders from nearest townships and urban centres also flock to the project areas to purchase farm produce. Results from COWI household surveys conducted in the area indicated that most of livestock owners graze their livestock in communal lands and this was very evident during field visit in the project area.

7.7.4.3 Fishing

Fishing in the study area is largely undertaken in Shire River and in a few fish farming ponds. Fishing forms a key economic activity for households located along the Shire

River especially during periods when crop production is very low due to flooding and prolonged dry spells. Common fish found in the Shire include Clarias gariepinus (Mlamba), Clarias ngamensis and Oreochromis mossambicus. Discussions with fisheries officials in Chikwawa district indicated that the current supply of fish is low in the region as such dried fish is imported from Mozambique to meet the demand. It was estimated that the average price of fish was MK523.53 per kilogram translating into a total value of MK128,578,968 in 2014/15. Currently, there are 231 fish farmers in the study area with 51 fish ponds covering an estimated area of 25 hectares. In terms of fishery, about 1,830 people are involved in this activity benefiting an insignificant percentage of households.

More information on fish species and their value as food source is in section 8.7.

7.7.4.4 Employment

A large section of population in the study area especially those in TAs Lundu, Maseya and Katunga are employed directly by Illovo or indirectly through contractors as permanent and seasonal casual laborers. Illovo's contribution to the local economy is enormous. The company directly and indirectly employs as many as 10,000 people in Lower Shire and also supports close to 2,500 workers throughout outgrowers. The indirect labour force is outsourced during weeding harvesting and pest control. Traditional leaders and communities indicated that income earned from employment in Illovo Estates provides significant revenues for families to complement crop production in the area which at times is adversely impacted by weather shocks. Casual labour is the second largest and vital source of income for most households in the study area with 22% in phase 1 and 12% in phase 2 as shown in Figure 44.

7.7.4.5 Income

On annual incomes, about 53 percent of the respondents indicated that they make about less than MK100,000 (+/-150 $US) while 43 percent of the respondents generate about MK100,000-500,000 (150-715 $US) annually. Only 4% of the respondents indicated to generate more than MK500,000. From the survey, it was clear that about 84.3 percent of the respondents in the project area live below one dollar per day.

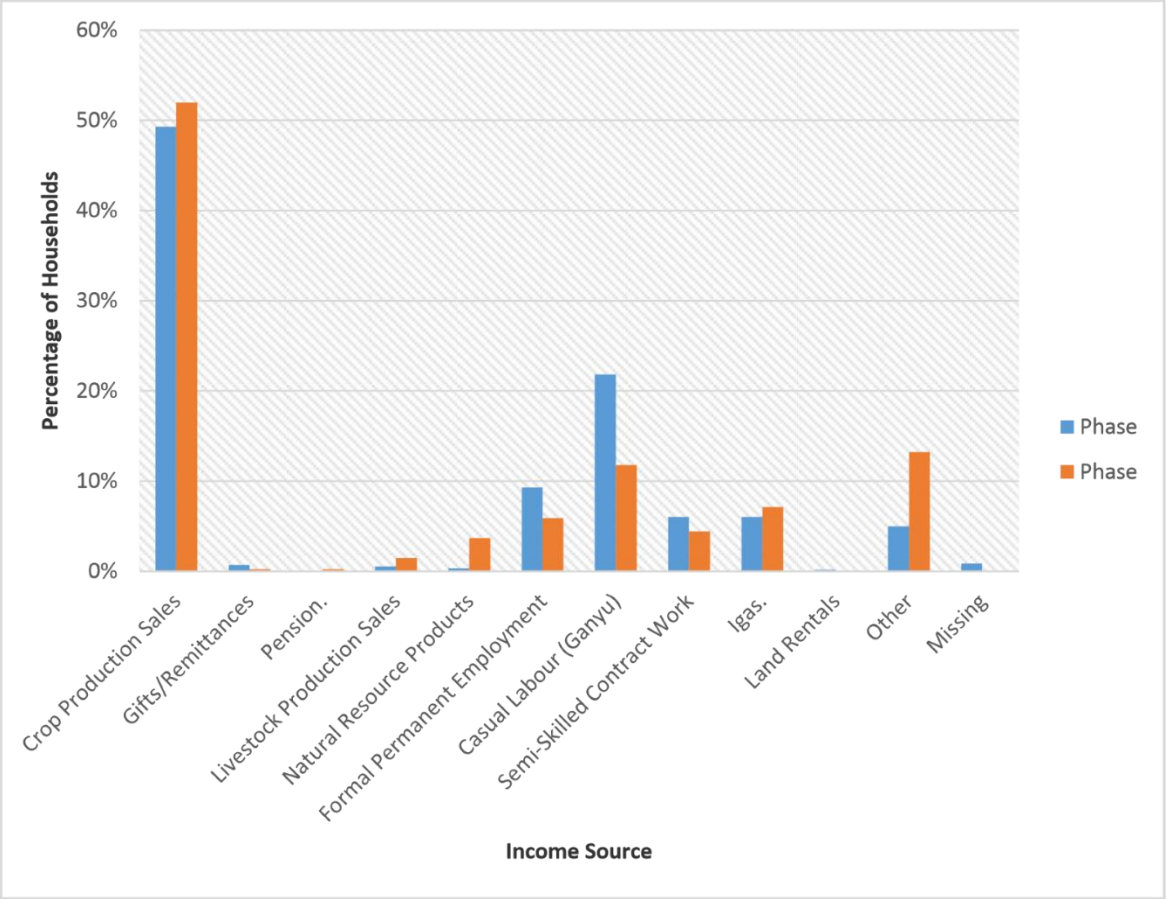


Figure 66: Source of Income

7.7.4.6 Benefits from Parks

Majete Wildlife Reserve has proved economically beneficial to surrounding communities since a number of people have been employed in the Park and earns incomes.

At the community level there is collaborative management of the Park to enhance community ownership and commitment to conserve the Park. Community members are allowed to harvest some of the products in the park such as grass and herbs. They are also allowed to place bee hives to harvest honey as an income generating activity.

Community Based Organizations (CBOs) have also been established in villages around the Park undertaking environmental and income generating activities. Profits from such activities are shared by committee members to improve their livelihoods and excess funds assist needy communities and projects. For example, Park Management have donated four maize mills to four CBOs as part of income generating activity.

In terms of corporate responsibility Majete Wildlife Reserve have managed to construct a number of school blocks and teachers houses in the area and have been paying school fees for some needy students.

Lengwe National Park has proved economically beneficial to surrounding communities as well. At the community level joint management structures were established to ensure co-management of the Park and foster community commitment to conserve the Park. Community Based Organizations (CBOs) were established in all villages which surround the Park through which Park Management support various community level development projects.

7.8 HEALTH ISSUES

7.8.1 Introduction

Malawi has a high density of population. This population is young (under 15 years represent 47% of the population) with an annually growth rate of 3.3% (Malawi National Statistical Office and ICF Macro, 2011). The greatest part of the population lives in rural areas where the country suffers from the burden of major tropical transmitted diseases like malaria and schistosomiasis. In addition, a severe food crisis affected the country in 2001-2003. This famine has had a part of responsibility in the high level of HIV infection rate through transactional sex for food or gifts (Loevinsohn, 2015).

The rapid decrease of the under-five mortality rate from 145 per 1,000 live births in 2000 to 110 in 2010 and 85 in 2014 shows a clear improvement in the health preventive and curative activities. However, with a ratio of 0.03 physicians for 1000 inhabitants, the access to high level care is difficult especially for the rural population.

In this context, the ESIA ToRs has requested to provide with a baseline characterization of health issues in the Study area. In addition, there is a common concern about the development of large scale irrigation schemes and the increase of waterborne diseases.

7.8.2 Water-Related Diseases

Some infectious diseases are related to water by their way of transmission:

- Malaria and its Anopheles mosquitoes vectors breeding in still water;
- Schistosomiasis and aquatic snails used as obligate intermediate hosts;
- Soil transmitted worms using muddy places;
- Cholera or leptospirosis germs possibly present in freshwater.

The expansion of irrigation areas can increase the intensity of transmission of these diseases. However, there is never a direct and proportional link between the quantity of surface water and the quantity of related diseases. Conversely, the scarcity of water can also increase their transmission due to population influx near the water places and associated difficulties in hygiene. The scarcity of food or money have negative effects on human behaviour. On the contrary, irrigation can have positive effects on health

through increase of money income, of food production and its regularity and through some changes in human behaviour. The vulnerability of communities to changes depends on their adaptive capacity, which requires both appropriate technology and responsive public health systems. The availability of resources depends on social stability, economic wealth, and priority allocation of resources to public health (Sutherst, 2004).

7.8.2.1 Malaria

Malaria is caused by the parasite Plasmodium falciparum. It continues to be one of the leading causes of morbidity and mortality in Malawi. It is estimated that the country experiences between 4 and 6 million episodes of malaria annually. The transmission by Anopheles gambiae s.l. and An. funestus s.l. mosquitoes is perennial with a seasonal increase during the rainy season (Mathanga et al., 2015). In Chikwawa district, the estimated entomological inoculation rate for Plasmodium falciparum is of 172 infective bites per human/year which is a high transmission rate (Boudowa et al., 2015).

As in other African countries, children under the age of five years bear the highest burden of malaria with annual incidence rates as high as 1,160 episodes per 1,000 children. Surveys carried out in primary schools show a rate of 40% to 60% of the pupils infected by Plasmodium falciparum (asymptomatic carriers) (Mathanga et al., 2012). At the same time, 20% of pregnant women are also asymptomatic carriers.

The Malawian Ministry of Health has developed a National Malaria Strategic Plan 2011-2016 to reduce its burden through improved diagnosis, appropriate treatment, and integrated vector management. It recognises the use of Long-Lasting Insecticide-treated Nets (LLIN) as an important intervention for the control of malaria. The plan includes free distribution of LLINs to children born in health facilities, to children attending their first visit under the Expanded Program on Immunization and to pregnant women at their first visit to an antenatal care clinic (Ministry of Health, 2014). The policy supports national distribution campaigns every two to three years and targets pregnant women and children under five, considered the most vulnerable populations. According to surveys, approximately 50% of children and pregnant women sleep under a treated net.

The intermittent preventive treatment strategy during pregnancy has been recommended since 1993: all pregnant women have to take at least two treatment doses of sulfadoxine-pyrimethamine during routine antenatal care visits. The last two years have seen alternative distribution channels, including community-based mechanisms. National surveys have shown that the proportion of women who took at least 2 doses of preventive treatment during pregnancy is less than 60%.

As in other Sub-Saharan countries, the clinical diagnosis of malaria has to be confirmed at all levels of health structures, using malaria rapid diagnostic tests or light microscopy. The recommended treatment regimen of uncomplicated malaria is an artemisinin-based combination therapy. The first line drug is artemether-lumefantrine. Parenteral artesunate replaces quinine as the recommended medication for the treatment of severe malaria. Theoretically, these drugs are available without

cost in health facilities. However, between 2004 and 2010, the proportion of under-five children with fever who used an anti-malarial drug the day of or day after diagnosis remained low at approximately 25%.

In Malawi, fever and malaria remain the highest reported illness at 45% of the reported illnesses. The southern region has the highest reported cases in Malawi at 46%. Chikwawa district has a prevalence rate of fever and malaria of 50.3% whereas Nsanje stands at 45.4%.

Illovo Estate distributes insecticide impregnated nets to its workers and their relatives. Of course, this distribution does not ensure a real use of the bed nets. When the weather is very hot, it is not comfortable to sleep under a net, especially in little houses with a corrugated iron roof. Out of Illovo, the free distribution of bed nets is only to pregnant women and children through the public health structures. Some surveys show that about half of the under-five sleep under a bed net but the surveys do not provide any detail on the sort of net used. An old net without impregnation by insecticide, with holes or not well tucked under mattress is ineffective against malaria transmission.

Illovo workers and relatives have an access to prompt diagnosis and treatment of a malaria attack in one of the seven clinics of the estate. The workers of the other sugar estates (outgrowers) do not have a similar access to care. As the rest of the population, they have to go to one of the health facilities. Some of these facilities have biological tests for the diagnosis and free malaria treatments. However, other facilities are without any drugs and may only refer the patients to other health centres, sometimes as far as 15 km away. Therefore, outside of Illovo Estate, malaria is not well managed in the Study area.

In fact, this link is weak because the vector mosquitoes do not breed in the channels with running water. Their larvae grow in small and shallow pools of still water, often temporary pools. It is more forest clearing to make farmland that causes an increased production of Anopheles than irrigation. These mosquitoes can however benefit from terminal channels left in non-running water or from poorly maintained drainage channels. The development of irrigation in the Chikwawa and Nsanje does not deeply upset the situation: these lands are already widely used for rain-fed crop production and are therefore a strong support for the production of Anopheles. With a transmission rate greater than 100 infected bites per person per year leading to an overload of infections, the increase in water may increase the Anopheles production in some places but will not induce a genuine change in malaria pattern.

7.8.2.2 Schistosomiasis

Schistosomiasis, also known as bilharzia, is a chronic disease caused by parasitic flat worms of Schistosoma genus. Two major forms exist in Malawi, the urogenital and the intestinal schistosomiasis caused by different Schistosoma species, *Schistosoma haematobium* and *S. mansoni*, respectively.

In order to complete their lifecycles, schistosomes worms require obligate aquatic snail hosts. Human beings are the reservoir of the parasites and the source of infection of the snails. The distribution of the susceptible populations of Bulinus and Biomphalaria snails broadly outlines the endemic areas where urogenital and intestinal schistosomiasis can occur. There is a close association between the species of parasites and the species of snails. Snail can only proliferate within narrow ranges of temperature, pH and of salinity. However, these conditions are often observed in tropical areas especially in irrigated schemes. The infection of human beings occurs through healthy skin in contact with water where infective forms of the parasites move after leaving the snails. Schistosomiasis is the group of infectious diseases the most closely linked with the use of water for agricultural production or fishing in tropical areas.

The prevalence of the infection by Schistosoma is often described as the highest in adolescents and young adults (Makaula et al., 2014). However, infection occurs as early as childhood, when children follow their mothers in activities in fresh water such as washing clothes or irrigating rice or gardening. A survey in Chikwawa district in 2012 showed that 45% of the mothers and 18% of the children were infected with urinary schistosomiasis, with a range from 5% to 60% depending on the villages. The intestinal schistosomiasis was rare in children but present in 21% of the mothers. A co-infection with both S. haematobium and S. mansoni was estimated to be 8% in mothers (Poole et al., 2014). It is a surprising observation because it was previously assumed that this area was only endemic for urogenital schistosomiasis (Chipeta et al., 2013).

The 2017-2022 district social economic profiles (SEP) for Chikwawa and Nsanje indicate that the prevalence of *Schistosomiasis in the two district is 9.5% and 10.4% in that respect.*

The workers of Illovo estate benefit from protective clothes and boots and from sensitization. In case of symptoms of schistosomiasis, they are treated in one of the clinics. Their relatives have also access to free treatment. The workers of outgrowers and also the neighbouring population may be free treated in Kasinthula bilharzias health post. A microscope examination of urine is done there but not an examination of faeces because of the lack of knowledge on intestinal schistosomiasis in the area. Seven hundred outpatients were tested in this health post in 2015 and 400 treated.

7.8.2.3 Soil-transmitted helminthiasis

Among the infections by soil-transmitted helminths, the most common are ankylostomiasis (hookworm infection) and ascariasis (ascaris worm infection).

Hookworm infection affects over half a billion people globally. These worms live in the small intestine. The most significant risk is anaemia secondary to the loss of iron and proteins in the gut. The infection is done through the skin and commonly caused by walking barefoot through wet areas contaminated with human fecal matter.

Ascariasis has no or few symptoms, especially if the number of worms is small. Symptoms increase with the number of worms present in the gut (abdominal swelling or pain, diarrhea). The infection occurs by eating food or drink contaminated with Ascaris eggs coming from human feces. About one billion people globally have ascariasis.

Various surveys in Malawi, especially in the south of the country, show evidence of low levels of prevalence for both ankylostomiasis and ascariasis, below 10% of the children are infected (Bowie et al., 2004, Phiri, 2000, and Msyamboza et al., 2010). It is slightly surprising but the results of the various surveys are similar. They are consistent with the observation of lower intestinal schistosomiasis prevalence in comparison with the urinary one. It can be partially explained by a certain use of pit latrines for defecation.

The expansion of irrigated land can foster an increase of these infections, especially by hookworms.

7.8.2.4 Onchocerciasis

Onchocerciasis – or "river blindness" – is an eye and skin disease caused by the filarial worm Onchocerca volvulus transmitted by repeated bites of infected blackflies (genus Simulium). These flies breed in fast-flowing streams. Adult flies bite mammals present near the rivers and streams. In the human body, the worms produce larvae that migrate to the skin and eyes. Infected people show symptoms such as severe itching and various skin lesions. Some infected develop eye lesions which can lead to permanent blindness.

Onchocerciasis is present in southern Malawi in the highlands area of Thyolo, Mwanza and Mulanje (Courtright et al., 1995 and Mustapha et al, 2005). Because the blackflies live near the fast-flowing streams, the flat areas are free of this disease as is the case for the existing irrigation schemes. SVTP is therefore not at risk of onchocerciasis. The feeder, the secondary and the tertiary canals will not be places for Simulium breeding because of their slow current speed. The only case where the Simulium could occur is at the weir installed to stop tiger fish invasion of the upper Shire River (if the weir creates riffles downstream).

7.8.2.5 Cholera

Cholera is an acute infectious diarrhea caused by the ingestion of food or water contaminated with a pathogenic strain of the bacterium Vibrio cholera. It affects both children and adults and can kill within hours. About 80% of people infected do not develop any symptoms, although the bacteria are present in their feces and are shed back into the environment, potentially infecting other people. The cholera transmission uses the fecal-oral route and is closely linked to inadequate environmental management where minimum requirements of clean water and sanitation are not met. Its transmission is caused by human to human contacts (dirty hands in contact with food or water). In Africa, human beings are the only reservoir of the infectious agent.

Cholera outbreaks in Malawi occurred every year since 1998 with a maximum of 33,500 cases in 2001-2002. A decrease of the annual number of cases has been observed since this period. Cholera outbreaks in the Southern region of Malawi occur during the rainy season (sometimes throughout the year), including the 2015-16 rainy season. Nsanje, Chikwawa and Blantyre districts are major hotspots. Unsafe water sources, lack of maintenance of broken boreholes, frequent breakdown of piped water supply, low coverage of pit latrines, lack of hand washing facilities, salty borehole water, cross-border spread of the disease from

Mozambique, and socio-cultural issues ("Chlorine-treated water smells and tastes bad", perception of the disease as witchcraft) are some of the causes of the persistent cholera outbreaks (Msyamboza, 2014).

Biological analysis show that the quality of drinking water from wells in southern Malawi is very poor, frequently polluted with fecal matter. Approximately 80% of the shallow wells tested in the dry season and 100% of the wells in the wet season do not meet the drinking water standard guidelines for total coliforms bacteria set by the Ministry of Water Development (Pritchard, 2007). Heavy rains are a risk factor for cholera outbreaks because they bring excreta in wells and in water collections. Cholera outbreaks can however occur independently of rain.

The irrigation is not by itself a risk factor for the spread of cholera. However, a bad use of the canals with open defecation inside the water or on the banks could increase its transmission.

7.8.2.6 Leptospirosis

Leptospirosis is caused by various bacteria of the genus Leptospira that affects humans and animals. Without treatment, leptospirosis can lead to kidney damage, meningitis, liver failure, respiratory distress, and even death. The bacteria are spread through the urine of infected animals, especially rodents, which can get into water or soil and can survive there for weeks or months. Humans may be infected through contact with water, soil, or food contaminated with the urine of animals. The bacteria enter the body through skin or mucous membranes. Leptospirosis is an occupational hazard for farmers, especially in tropical areas with wetlands. It is known to be present in some sugar cane plantations. However, data on this disease are scarce in Malawi. Bacteria have been observed in livestock but there are no data for human beings (Myburgh et al., 1989).

The use of boots and protective clothes by the farm workers reduces the risk of infection but swimming or wading in fresh water remain a risk factor.

The expansion of irrigated lands may result in cases of leptospirosis in the communities, the use of protective clothes being rare and wading being a too pleasant activity for young people. Before any excess of concern for this disease, it would be of interest to carry on serological surveys in samples of the population and also to inform the health workers. Leptospirosis attacks may be easily confused with others febrile attacks like malaria and consequently poorly treated.

7.8.3 HIV infection and AIDS

The burden of the HIV infection is high in Malawi. After a peak at probably 22.8% in 1999 among the 15-49 adults, the estimated prevalence was 10.6% in 2010 in the same population (Zulu et al., 2014). In 2012, the whole population living with HIV infection in Malawi was estimated at 1.13 million. The Southern part of the country seems be slightly more affected than the two others regions. The 2016-2017 HIS shows that in Chikwawa district, the prevalence rate was 9.5% compared to 11.7% in Nsanje. The medical personnel interviewed

during key informant interviews indicated that HIV/AIDS prevalence rates have been decreasing in the two districts though cases are frequently registered in dispensaries located close to urban centres. Deaths related to HIV/AIDS have significantly dropped in the areas because of antiretroviral therapy available in dispensaries and increased patients accessing the therapy. However, it was indicated during the FDGs that provision of voluntary counselling and testing programmes should be scaled up in the project area.

7.8.4 COVID 19

COVID-19 virus spreads primarily through respiratory droplets or contact with contaminated surfaces. The risk of exposure to COVID-19 depends on the likelihood of coming within 1 metre of others,or having frequent physical contact with people who may be infected with COVID-19, and through contact with contaminated surfaces and objects.

The project will have to adhere to all COVID 19 prevention measures to ensure that workers as well as the communities around are protected for the virus. All relevant stakeholders will be invoved in ensuring that all processes regarding prevetion or treatment of COVID 19 are put in place.

7.9. CULTURAL HERITAGE

7.9.1 INTRODUCTION

This section deals with cultural heritage in Project's study area.

The principal objectives of this section are to:

- Present existing information on cultural heritage ;
- Describe findings from field surveys ;
- Identify and describe cultural resources and their values.

This report is based on three main sources of cultural heritage surveys in the Study area:

- Cultural heritage surveys by the Malawi Department of Antiquities (MDoA) carried out from November 23 to December 13 2015.
- Cultural heritage surveys by the consultant cultural heritage specialist carried out from January 24 to February 6 2016.
- Previous cultural heritage surveys in the Chikwawa and Nsanje Districts (done at different periods for example by Robison in 1973).

The following section details the methodology of the consultant cultural heritage specialist to undertake cultural heritage assessment in the Study area.

7.9.2 METHODOLOGY AND APPROACH OF THE STUDY

The methodology of this study consisted of three distinctive components:

- Desktop assessment
- Fieldwork assessment
- Meeting with relevant stakeholders

Disussions with MDoA indicate that no new information or changes have occurred in the value that would suggest a change in archaeological conditions within the study area. Excavation of xxx sites occurred during the course of the Phase 1 works, during which artefacts were carefully excavated, documented and studied, and subsequently taken to Chiradzulu warehouse for storage.

Further excavations in advance of construction works for Phase 2 are expected to occur at 14y locations. The following description of the archaeological baseline provides the context and overall understanding of the cultural heritage of the Lower Shire Valley within the study area.

7.9.2.1 Desktop Assessment

Several types of published data were available, which includes articles and books. The consultant used the Section of Archaeology's bibliographic database at the Royal Museum of Central Africa (RMCA) in Tervuren, Belgium as well as the library of the Malawian Historical Society in Blantyre. In addition, graveyard localization for the Study area were provided by COWI consultant and the MDoA provided the consultant with their cultural heritage survey report. Even though unpublished data also exists for the Project's immediate impact area, the consultant was unable to use it as it comprises data for a doctoral research project by a postgraduate student from the University of Leiden in The Netherlands.

7.9.2.2 Fieldwork Assessment

For this study, fieldwork was carried out from January 24 until February 6, 2016. One expert and one guide/translator made up the team covering the area for both SVTP I and SVTP II

- Dr. Noemie Arazi (Cultural Heritage Specialist for the consultant and Research Associate at the University of Brussels, Belgium)
- Mr. Charles Chikwana (Junior Clerk at the District Commissioner's Office of Chikwawa)

Mr. Oris Malijani a representative from the MDoA accompanied the team during their last three days of fieldwork.

Fieldwork consisted essentially of interviews and pedestrian surveys. Interviews were conducted with Paramount Chief Lundu and Traditional Authorities as well as with elderly people and cultivators, which allowed the team to introduce themselves to the communities and access essential information on their territory. The team's work was presented as an opportunity to voice the inhabitant's concerns over cultural heritage issues such as the preservation of sacred sites. The team also explained the search for archaeological sites (stone tools, potsherds, slag, concentrations of charcoal, etc.), and their importance for

reconstructing the country's prehistory and history. All the cultural heritage sites mentioned during the interviews were visited and their geographical positions registered with a hand-held GPS.

Further to the identification of sites that have a cultural, spiritual or religious significance for local communities, a common role of field survey is also the assessment of the potential archaeological significance of places where development is proposed. This is usually connected to construction work, which in this case concerns the canal, associated infrastructure work and the clearance and leveling of land for the areas earmarked for irrigation. The assessment determines whether the area of impact is likely to contain significant archaeological resources and makes recommendations as to whether the archaeological remains can be avoided or rescue excavations are necessary before development work can commence.

Considering the vast terrain of the Study area, it was decided to cover as much ground as possible of the Canal RoW and the areas earmarked for irrigation that have not yet been visited by the MDoA.

The methodology chosen was field walking in grids or along lines called transects, which has formed the backbone of archaeological survey fieldwork, at least where visibility is fairly good. A team walks slowly through the target area looking for artifacts or other archaeological indicators on the surface. The method works best on either ploughed ground or surfaces with little vegetation. On ploughed surfaces, as the soil is turned regularly artifacts will move to the top. Each site or find spot was recorded with a handheld GPS to produce the map of cultural heritage sites (see Map of Cultural heritage sites).

7.9.3 RESULTS

The results, especially on the archaeological data, should be viewed as preliminary in nature as all interpretations are based on surface finds (no trial excavations were carried out neither any C-14 dating). Considerable numbers of sites were identified, indicating the area's wealth in cultural resources.

7.9.3.1 Desktop Assessment

Even though the Lower Shire Valley is known for boasting considerable numbers of cultural sites, only a limited amount of published data is available on its archaeology and any other types of heritage resources.

The Cultural heritage surveys by the Malawi Department of Antiquities (MDoA) carried in 2015 has identified several sites numbered CK1 to CK45 most of which are pottery sherds and stone tools likely from the Iron Age. Some findings were collected for further analysis. The cultural heritage map shows their location.

One of the most important publications on the area remains the work by Keith Robinson, who conducted extensive archaeological surveys in southern Malawi and made small-scale excavations along the Lower Shire Valley (Robinson, 1973). The main area investigated by Robinson was along the western bank of the Shire River from the Kapichira Falls in the

north to Chiromo in the south, mainly focusing on the western tributaries of the Shire, which overlay the Study area.

Robinson noted in 1973 a number of surface occurrences of stone artefacts in the nature of camp sites mainly on raised ground near streams and rivers. The usual material included white quartz, rock crystal and dolerite, which he attributed to the Late Stone Age as they contained microlithic elements. He also found cores and flakes on the Chombwa stream, which he described as Middle Stone Age, but no thorough analysis of this material nor any C-14 dating was undertaken.

Robinson's surveys mainly included the identification of Iron Age sites. The following sites are shown on the cultural heritage map and located in the Study area, some archeological sites have already been salvaged. In Chikwawa District Robinson's surveys comprise surface scatters at
Miwawa Water Hole at the southern boundary of Majete (CK2a), at Phwadzi Stream I (CK4a) and II
(CK4b), at the north and south bank of the Nkhombedzi wa Fodya stream (CK5a and CK5b), at the Madziabango stream (CK5c), at Changalumbe Bridge (CK7a), at the north bank of the Lalanje stream (CK9a). In Nsanje District Robinson found Iron Age material on the south bank of the Lulanje (NS1), at the river bank by the Thangadzi Bridge (NS2) and around Chisomba Village (NS4). He identified one shrine known as Nyangu, the ceremonial queen mother to the Kalonga of the Chewa (Maravi) peoples, situated in a grove of trees near the headquarters of Chief Chapananga (Cole-King 1973). These sites are localized on the Cultural heritage map.

Robinson's excavations were carried out at two Iron Age sites at the Phwadzi Stream (I and II), which yielded one charcoal sample that has been dated to AD 500. This date falls within the Early Iron Age period of Malawi, which extends up to the end of the first millennium AD. In southern Malawi the Early Iron Age is mostly represented by a pottery style that is known as Nkope ware. The basic vessel form of Nkope ware are globular pots with everted rims and bowls with flattened and thickened or inturned rims, mainly showing broad line incisions and comb stamped patterns (for an example of Nkope ware see next figure). The latter was made using an implement with relatively large and square teeth. At the end of the Early Iron Age appears a distinct pottery style called Kapeni ware, which is also present in the Lower Shire Valley. Kapeni pottery exhibits thin walled ceramics with everted rims, decorated with a combination of bold oblique, vertical and horizontal channeled incisions (see next figure). The Late Iron Age covers more or less the second millennium BC and includes wares known as Mawudzu (see next figure) - dated to around the 14th to 18th centuries - and Nkhudzi (see next figure) – dated to around the 18th century up to the present, which are equally present within the Project's impact area. The former exhibits straight rimmed pots, decorated with incised, impressed and stamped motifs of herring bone patterns and oblique lines, while the latter often exhibits fine, bichrome red and black pottery.

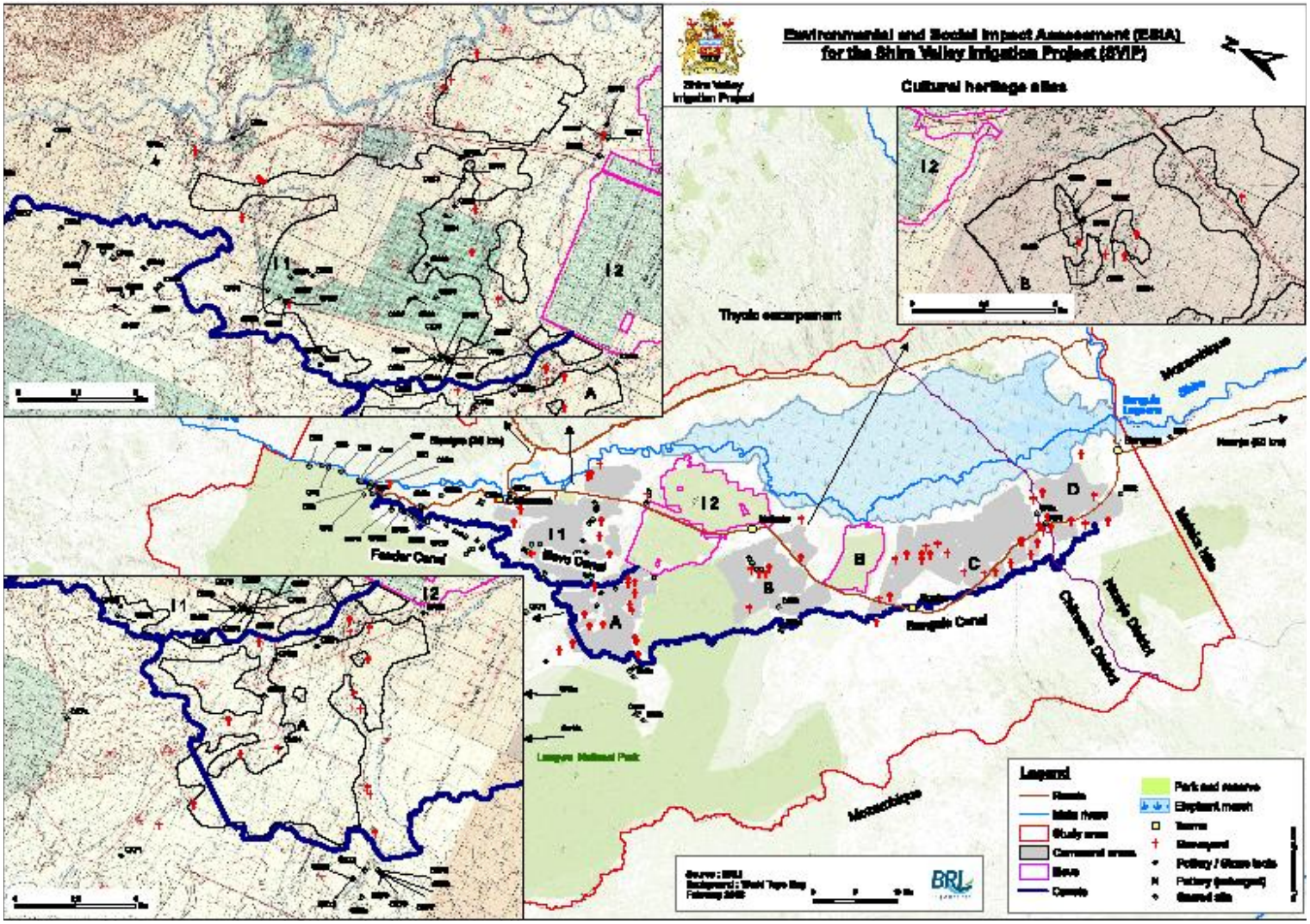


Figure 67: Areas of Artifacts in the Shire Valley

Figure 68: Examples of Nkope Pottery, Early Iron Age (Source: Rachel Warren, unknown date)

Figure 69: Examples of Kapeni Pottery, Terminal Early Iron Age (Source: Rachel Warren, unknown date)

Figure 70: Examples of Mawudzu (or Maudzu) Pottery, Late Iron Age (Source: Rachel Warren, unknown date)

Figure 71: Examples of Nkhudzi Pottery, Late Iron Age (Source: Rachel Warren, unknown date)

An important element of the Lower Shire Valley is that it was home to the Lundu Kingdom. The power of the Lundus was founded on the strategic position they occupied in relation to trade between the Portuguese and the interior and on the agricultural production of the Shire Valley that was critical to the survival of the Portuguese settlements in times of drought. Cotton was also provided for trade (Schoffeleers, 1987). According to oral traditions, a legendary figure with super human powers, known as Mbona, lived in the Lower Shire Valley during the rise of the Lundu Kingdom. Mbona is said to have had magic powers of bringing rain, creating wells of water on sandy lands, creating forests where they did not exist and hiding from enemies by turning into other creatures such as a guinea fowl. When he died his head was cut and placed at Khulubvi sacred groove, located in the Nsanje District. This place has become an important sacred site to the Mang'anja people, who inhabit the area and worship the spirit of Mbona. From this site other sacred sites developed in the Lower Shire Valley where Mang'anja people gathered to worship the spirit of Mbona. In addition to the Khulubvi sacred grove, they include the following group of sites:

- Nyandzikwi sacred site on the junction of Bangula and Maraka road in group village headman Lundu in Nsanje District
- Mwala Umodzi shrine, located near Mgwiriza Village within the course of the Thangadzi River
- Kaloga sacred cave site, located within the area near Kanyimbi village in the Mwabvi Wildlife Reserve
- Chifunda Lundu, located close to the present day headquarters of Paramount Chief Lundu

- Nkhadzi sacred site, located in the area of group village head man Ngabu in Nsanje district
- Mtsakana rain shrine, in the vicinity of group village headman Zimara, T.A. Maseya in Chikhwawa District
- Konde Dzimbiri rain shrine is located in the area of sub T.A. Mphuka in Chikhwawa District

In spite of Malawi's decline in traditional ceremonies, those sites keep their sacred character and still attract people for various traditional practices and expressions. Because of their historical importance, the Khulubvi sacred grove as well as the aforementioned associated shrines have been submitted in 2010 on the tentative list to acquire the UNESCO status of World Heritage Site,and the designation process is still underway.

Another site of cultural importance within the Project's study area is a Baobab tree within the Majete Wildlife Reserve where David Livingstone, the famous Scottish missionary, put up a camp when he visited the area. The grave of Thornton, one of the members of Livingstone's expedition, is located at Maganga village, few kilometres from Majete. The grave, also situated under a baobab tree, is a gazetted monument (Chikwawa 301: Vol. VI.No.3) but is situated outside of the Project's study area. Livingstone's Baobab tree in the Majete Wildlife Reserve, in contrast, might become part of another tentative list submission, which runs under the title of Malawi Slave Routes and Dr. David Livingstone Trail. Indeed, from the submission list it is not clear whether this specific area of Livingstone's journey falls within the trail that has been submitted for World Heritage status. It should also be mentioned that the MDoA covered this area during the first phase of their cultural heritage impact assessment but no particular mention is made on that tree. However, Park management showed the consultant the tree and the grinding stones underneath it as shown in the following picture. The Livingstone Baobab is called CKL on the cultural heritage map.

There have also been recent investigations carried out in the area, namely by Menno Welling from the University of Leiden in The Netherlands. He conducted several excavations for his doctoral degree between 2001-2005, researching the area's Lundu Kingdom. The latter was present from at least 1500 AD to 1860 AD. Welling's data however remains unpublished and as a consequence inaccessible for other researchers and/or heritage professionals.

Figure 72: : Grinding stone and "Livingston" Baobab (Source: BRLi (2015))

7.9.3.2 Fieldwork Assessment

The consultant cultural heritage specialist spent eight days on active fieldwork during which four sacred sites and thirty archaeological sites were identified. Four graveyards were also recorded as well as three find spots of isolated objects that are of scientific interest. The latter include two percussive stones and one enormous piece of slag. The full list of identified sites are shown on the cultural site map. It was decided to use the same site numbers for the consultant discoveries as the one used by the MDoA survey report in order to stay consistent (starting with CK for Chikwawa district and NS for Nsanje district).

7.9.3.2.1 Sacred Sites

In order to access and record sacred sites, the team needed to meet with Paramount Chief Lundu. In spite of two official meetings, at which Traditional Authorities (TAs) were also present, only four sacred sites were shown to the consultant Cultural Heritage Specialist.

They include a sacred forest behind Paramount Chief Lundu's Residency (also known as Mbewe ya Mitengo), Chifunda Lundu (the Lundu's former enthronement site), the site of Mawira and the sacred hill known as Mangalangala.

- Mbewe ya Mitengo (CK50) is located behind Chief Lundu's Residency (in Zone A of the Study area). According to oral traditions this is the place where the ancient Lundus resided. It was also used for sacrifices and initiations. Welling carried out archaeological excavations at Mbewe ya Mitengo. The material is exposed at the Tisunge Cultural Center, which is located just behind the site. According to Paramount Chief Lundu, Mbewe ya Mitengo is a protected site and cannot be impacted by any development. Even though we did not enter the site, we passed around it when visiting the Tisunge Cultural Center.

- Chifunda Lundu (CK51) is associated with the worship of Mbona (see previous section). It is said that Mbona rested there as he was coming from Kaphirintiwa to establish his own capital at Mbewe ya Mitengo (the present day headquarters of Paramount Chief Lundu). In the past, whenever the enthronisation of a new chief was taking place, he was supposed to be anointed at Chifunda Lundu before going to Mbewe ya Mitengo. The site displays heavy boulders underneath dense vegetation and covers around $20m^2$. No associated material culture was visible on the day of visit. The site does not seem to be in use any longer. However, according to Paramount Chief Lundu no negative impacts such as land transformation activities can be made on this site. But it does not seem in danger of any impacts as it is located outside of Zone A figure 7).
- Mawira (CK52) can be described as a water source that is of cultural significance to the area's local community. It is located in Zone A of the Study area next to the Mwanza river. Its importance is linked to the water's hot temperature, which contrasts with the cool temperatures of the Mwanza River. According to the inhabitants of Azyuda there is always water to be found at that spot even during a dry spell. The site is located in the territory which falls under the authority of Paramount Chief Lundu, who did not mention anything on that particular site. Hence, additional information is required on possible mitigation measures in case that site should be negatively impacted. On a scientific perspective, hot springs along the Mwanza are common and originate from upwelling from the Mwanza Fault, representing the most recent stages of the Cretaceous hydrothermal activity (Per Aagaard, 2011).
- Mangalangala (CK53) is a sacred hill, located close to the site of Mawira. The site was pointed out to us by the people who live in Azyuda. Even though we have not visited the hill we were able to take its coordinates as it is visible on Google Earth. The hill is considered sacred as it is visited by women who have difficulties conceiving as well as in times of drought. Again, Paramount Chief Lundu did not mention anything on this particular site during our meeting. However, given its height any future irrigation activities should leave the hill untouched.

Graveyards tend to be protected by dense vegetation in small patches of forest as access by strangers is not permitted. The map of cultural heritage shows the graveyards identified during the field work. In addition, the landuse plans developed for each community should the locations of graveyards (PLEASE CONFIRM THIS IS COR). Relocation of graveyards will not be accepted unless in extreme cases.

7.9.3.2.2 Archaeological sites

Thirty archaeological sites were identified, which mainly consist of open-air sites showing surface scatters of materials such as pottery, metal objects, slag, charcoal and earth (*daga*) house remains. They were mostly found in cultivated fields, either showing a flat or slightly elevated surface. The latter are often associated with termite mounds. As neither excavations were carried nor any C-14 dating, their age remains mostly unknown. Some sherds however appear to be relatively freshly broken at some sites and might therefore constitute modern material. Others in contrast are well embedded in the soil and might therefore be older in age. Only a handful of sites showed stylistic similarities with pottery known from dated sites. It is therefore problematic at this stage to attribute any preliminary statements on age ranges.

However, we know from Robinson's excavations that the Lower Shire Valley has been occupied since at least the Early Iron Age and even since the Middle Stone Age (as evidenced by the Tomali gravel pits at the Chomwa stream, which contain deposits of 20,000-100,000 year-old stone tools).

As regards to iron production, 'indigenous' smelting might have occurred in the study area as two occurrences of iron slag were noted (see next figure). However, none of the elderly people interviewed remembers any smelting event in the area and none knew of any of their parents who had produced iron.

Figure 73: Iron Age Slag found close to Chafudzika (CK71) ((Source: BRLi (2016))

Stone artefacts were limited to grinding and percussive stones. Even though these tools tend to be associated to the Stone Age, their use can still be observed in present-day households. We were able to see the use of a percussive stone in the manufacturing of a straw mat.

7.9.3.3 Determination of Site Significance and Values

In order to define the mitigation measures of the sites located within and/or in proximity of future development zones, sites need to be classified according to their importance and the required appropriate intervention. The following categories have been defined for the cultural resources identified in this study. Each category implies specific mitigation measures that will be defined in the ESIA:

- Low Priority Site: no special measure is necessary;
- Medium Priority Site: further monitoring during construction to ascertain final priority/importance is necessary;

- High Priority Site: protection measures shall be implanted.

The prioritization of a site is not a definite measure of its scientific importance but rather a temporary classification regarding potential and further mitigation requirements. In this regard, some high priority sites may well be re-evaluated as non-important after further study.

The criteria used to define the value of a site are multiple and complex. However, regarding the area's archaeological sites the aim is to understand both the history of the people in the region (chronology) and the way of life of past populations (palaeo-ethnography). In this context these criteria can be summarized as follows:

- Age of the finds;
- Density and/or variety of the finds;
- Context of the finds;
- Social significance of the finds.

In addition, precursory archaeological knowledge of the area can also influence the value of a site.

Age is a self-explanatory criterion: the older a site is, the more important it is. This is because old sites are rare and finding one is an opportunity to understand the distant past of an area. Most often, sites more than 15,000 years old (Early or Middle Stone Age) are found during major construction works (roads, mines, and pipelines) because they are buried deep underground.

To be considered important, a site must also present a **high density** and/or **variety of artifacts**. Isolated finds are very difficult to interpret since a representative sample of the material is needed in order to be able to understand the activities carried out at the site by prehistoric peoples.

Artifacts must also be in **primary context** (i.e. as the prehistoric people left them) in order to be exploitable from a scientific standpoint. If natural (erosion, digging animals) or anthropological phenomena have disturbed a site too heavily, the association and position of artifacts cannot be interpreted. Most of the time, a site is discovered because part of it is unearthed by erosion or digging; archaeological interventions will therefore focus on the part of the site that is still undisturbed.

Recent sites (tombs, monuments, shrines) can be of high **social significance** (i.e., be "sacred") to local populations and, in that case, should not be damaged either by archaeologists or by construction activities unless proper compensation is negotiated. In this regard, burial sites or any other sites considered as sacred by local communities are always classified as 'High priority sites that shall not be lost at all costs'.

When taken together, a preliminary site prioritization classification can be illustrated in the following table.

Table 43: Site priorization

Old Age	Primary context	High Artefact Density or Variety	High social significance	Priority
Yes	Yes	Yes	Yes	High
Yes	Yes	Yes	No	High
No	Yes	Yes	Yes	High
Yes	Yes	No	No	Medium
No	No	No	Yes	Medium
No	Yes	No	Yes	Medium
No	No	Yes	No	Low

Prior archaeological knowledge of the area where a site is found is also an important criterion. Medium Priority sites could eventually be re-classified as High Priority sites if no High Priority sites are discovered in a region that was previously unexplored.

As no excavations were carried out neither any C-14 dating, it has been difficult to make any preliminary interpretations on age ranges of the identified sites. Furthermore, pottery found on the surface has shown considerable signs of wear and erosion. This has made it difficult to identify characteristic decoration types, representative of distinct periods. The criteria of "Age of Finds" is therefore difficult to apply in this preliminary stage of the study. However, the other two criteria such as "Primary Context" and "High Artefact Density or Variety" have been useful to determine whether an archaeological site can be classified as High, Medium or Low Priority. All sacred sites have been categorized as High Priority (see above explanation).

Sites of critical value for cultural heritage are considered to be"(i) the internationally recognized heritage of communities who use, or have used within living memory the cultural heritage for long-standing cultural purposes; or (ii) legally protected cultural heritage areas, including those proposed by host governments for such designation (examples include World Heritage Sites and Nationally Protected Areas)".

Sites of the former type (i) within the study area include Mbewe ya Mitengo, Chifunda Lundu, Mawira and Mangalangala, while the latter type (ii) include the associated shrines of the Khulubvi Sacred Grove (see previous section) and Livingstone's Baobab tree in the Majete Wildlife Reserve that might be part of the Dr. Livingstone's Trail submitted on the tentative list to acquire the UNESCO status of World Heritage Site.

The Malawi Deprtment of Antiquities Museum has been doing more excavations during the implementation period and have continue to discover evidence of communal life during the iron age in the area. Most of the findings have not been of archaeological significance. They

they have however, excavated 214 artefacts including iron dagas and pottery which have been taken to their laboratories for carbon dating. The Carbon dating report is yet to be shard with the project.

7.9.4 CONCLUSION AND LIMITATIONS

CONCLUSION The findings of the cultural heritage study have revealed that the Project's impact area is endowed with cultural resources from past and present. Indeed, the archaeological material indicates that its occupational history might go as far back as the Early Iron Age.

LIMITATIONS

The vast size of the study area, and the rainy season during which the consultant Cultural heritage specialist field work was carried out have posed challenges to cover large samples of the study area. Moreover, site formation processes seem to work in such a way that many sites are eroded by weathering and sheetflood erosion, down washed and displaced along the Shire tributaries. Therefore, some sites that were identified by either the MDoA or the consultant Cultural heritage specialist (especially pottery and shreds) could be washed away before construction starts.

CHAPTER 8. ENVIRONMENT AND SOCIAL IMPACTS AND MITIGATION MEASURES

The ESIA relies on the following methods for impact assessment.

8.1 METHOD FOR THE DETERMINATION OF IMPACT SIGNIFICANCE

Impacts significance is assessed using a standardized method based on the integration of 4 criteria:

1. Affected components' value
2. Impact intensity
3. Impact extent
4. Impact duration

In addition, in order to separate risks from actual impacts, the probability of impact occurrence is assessed in all cases

CRITERIA #1 ENVIRONMENTAL AND SOCIAL COMPONENTS VALUE

Each component of the socioeconomic and biophysical environment is analysed according to its value in the study area. Value assessment is based on experts' knowledge on the component, field surveys, public consultations, discussions with NGOs, bibliographical sources, safeguards policies from the World Bank, etc. It is also a mean to put in writing stakeholders opinion about a component and to take them into account.

Value analysis does not take into account foreseen impacts, it is purely based on the component intrinsic value.

Three threshold levels are defined during the assignment: Low, Moderate and High values. A low value component does not represent an important socioeconomic or cultural feature for local communities or it does not have a high ecological value. A high value component is a significant feature for communities; it is either an important livelihood source or an element of cultural significance for communities. A high value component can also possess an important ecological value (rare plant, sensitive habitat, etc.). A high value component is also an element of particular significance for funding agencies (and presented in safeguard policies).

A moderate value is between low and high.

CRITERIA #2 IMPACT INTENSITY

Impact intensity refers to level of disruption on the component. Disruption of natural component refers to death of species, displacement, fragmentation and loss of habitats. Disruption of socioeconomic components refer to loss of income, erosion of traditional ways of life, etc. The resilience of each component to changes is also taken into account.

Three threshold levels of intensities are defined: Low, Medium and High.

A low intensity refers to an impact that will not disturb significantly livelihood and ecological elements and that will not affect the function of the component or its

characteristics. High intensity refers to an impact that takes place during a critical phase of biophysical components (breeding period, migration, spawning, etc.) or socioeconomic components (harvest, etc.). It is an impact that affects a component beyond its resilience.

A medium intensity is between low and high.

CRITERIA #3 IMPACT EXTENT

Each impact is defined by its geographical extent. Three levels are established: punctual impact, local impact and regional impact.

Punctual impacts affect a component on a very small scale of the study area, i.e. a small proportion of the study area population (people or wildlife).

Local impacts affect a component on the entire or the majority of the detailed study area in opposition to regional impacts that affect a component on a larger scale and outside the detailed study area boundaries.

CRITERIA #4 IMPACT DURATION

Each impact is described according to its duration. Temporary and permanent impacts are distinguished based on their reversibility: temporary are reversible and permanent are irreversible (or last throughout the Project lifespan).

IMPACT SIGNIFICANCE DETERMINATION

Impact significance is based on the four previous criteria. The following table presents the impact importance determination. Positive impact is assessed using the same four criteria.

Table 44: Impact Significance Determination Criteria

Intensity	Extent	Duration	Environmental and Social Component value					
			Positive impact			Negative impact		
			Low	Moderate	High	Low	Moderate	High
High	**Regional**	**Permanent**						
		Temporary						
	Local	**Permanent**						
		Temporary						
	Punctual	**Permanent**						
		Temporary						
Medium	**Regional**	**Permanent**						
		Temporary						
	Local	**Permanent**						
		Temporary						
	Punctual	**Permanent**						
		Temporary						
Low	**Regional**	**Permanent**						
		Temporary						

	Local	**Permanent**						
		Temporary						
	Punctual	**Permanent**						
		Temporary						

Impact significance	**Major -**	**Major +**
	Moderate -	**Moderate +**
	Minor -	**Minor +**
	Negligible	**Negligible**

Major impacts represent high level of perturbation of the component, these impacts are seldom mitigable and most of the times require compensation or Offsets, followed by measurable monitoring measures.

Moderate impacts represent noticeable perturbation of the component, however these impacts can be mitigated and need to be monitored.

Minor impacts, most of the time, only require mitigation measures without the need for monitoring.

Negligible impacts do not require any particular measures.

IMPACT OCCURRENCE PROBABILITY

Assessment of the probability that an impact will take place is based on consultant experience on similar assignments and each expert knowledge. It allows to develop preventive measures for risks and mitigation measures for impacts. Three thresholds are used.

Table 45: Imoact Occurence Probability Criteria

High probability	Analysis of the baseline coupled with Project characteristics concludes that the impact will take place.
Potential occurrence	Based on previous experiences, it is possible that the impact will occur.
Risk (low probability)	Analysis of baseline coupled with Project characteristics only reveals a risk of impact occurrence.

8.2 DESCRIPTION OF IMPACTING ACTIVITIES

The impact assessment is based on the following description of impacting activities, which takes into account the lessons learned from the construction of Phase 1 of SVTP..

8.2.1 Pre-construction

Pre-construction phase: this phase included all technical studies (including the ESIA and the design) as well as the tender process for the selection of a construction contractor and scheme operator. Decisions that will be taken at this stage are important milestones that could

influence the environmental and social soundness of the Project. Key activities undertaken prior to construction will include detailed design of the works (including identifying locations for quarries, borrow pits and disposal sites), land tenure and resettlement activites. \

Social and economic benefits will include employment especially for both international experts, capacity building of government officers attached to the project and clarification of issues related to the project through consultations and community engagement.

8.2.2 Construction

During the construction phase the canal infrastructure will be built. In addition, land levelling and preparation of the command areas for irrigated agriculture will be undertaken, as each of the farms becomes established.

During this time, it is antincipated that the SVTP will generate benefits that are beneficial in the Shire Valley and countrywide. Income security including forex generation are expected to be enhanced from wages and donor inflows.

Employment levels will rise as contractors and supervision engineers will hire peronnel most of whom will be Malawians.

During this time, the construction workforce will provide markets for local farm producen, acquisition of locally manufactured products like cement and property rentals.

The canal infrastructure includes the water intake, fish barrier, main and secondary canals, night storage, bridges and underpasses, siphons and culverts, and will require major workforce and machinery deployment, waterworks, earthworks and land leveling, rock blasting, vegetation removal, concrete production and quarrying for material. An estimated 14.7 Ha and 65.4 Ha of land will be cleared in Majete Wildlife Reserve and Lengwe National Park respectively. An estimated 2,4 km for Majete and 10,9 km stretch of Lengwe will be affected by the 60 m and 45m right of way (RoW) in that respect.

Rock blasting will occur where there are rock outcrops (granite). This has occurred in Majete and may also occur in Lengwe. These are impacting-generating activities.

8.2.3 Operation

Operation phase: is the operation of the irrigation scheme through the water intake (irrigation of the command area in the valley). It will also include production of various crops, establishment of Special Economic Zones (SEZ).

During this time, it is antincipated that the SVTP will generate benefits for the Shire Valley and countrywide. Food and income security including forex generation are expected to be enhanced from crop and livestock production, and wages.

Employment levels will rise as contractors and supervision engineers will hire peronnel most of whom will be Malawians.

During this time, the construction workforce will provide markets for local farm producen, acquisition of locally manufactured products like cement and property rentals. SOCFEs and SEZs will greatly add to employment.

Operation of the scheme will generate impacts and will require overpassing many challenges. Most impacts during operation will come from the flow reduction in the Shire (due to water abstraction), the presence of a long open canal, and the challenges that people will face due to radical changes in their livelihood strategies, introduction of invasive alien

species, pests However, the purpose of the Project is to bring positive economic benefits. It is also anticipated that there will be impacts related to the expansion and alteration of agricultural practices and activities, to change in types of crops cultivated and other agriproduction, and to the potential introduction of invasive species. These impacts will, however, be short term and not a threat to people's livelihoods.

8.3 Cumulative Impacts

OP 4.01 and ESF/ESS1 requires the environmental and social risk assessment of projects to consider the cumulative risks and impacts throughout the project's lifecycle. The cumulative impact assessment undertaken as part of the 2017 ESIA has been reviewed and updated as part of the current study, to take into consideration any recent projects that have occurred and to identify any projects that may be planned for the future that could also impact these key receptors. Chapter 15 presents the updated CIA.

8.4 Impact assessment of the Natural Resources Management (NRM) component

Activities planned under this component are designed to protect or improve the natural resources within the valley, including the protected areas. They will involve studies and minor works and are expected to have minimal or no negative environmental impacts, are expected to result in long term benefits. However, as the scope of these works has not yet been fully designed, each project will be screened for environmental and social risks prior to any works occurring. The screening will be sufficient to allow for appropriate best management practices regarding health and safety, waterworks, earthworks, etc. to be identified and incorporated into the works through the preparation of a specific ESMP. The project will ensure that proper mitigation measures have been put in place against all potential negative social impacts. Separate documents, the Process Framework and the Ressetlent Plan Framework have been produced, outlining all the processes to be followed in compensating or dealing with all social issues.

Examples of civil works that may be undertaken includes contruction of staff houses, drilling of bore holes and road construction. As required by national legislation, the works will be subject to full ESIA or an ESMP subject to screening by EAD.

8.5 IMPACT ASSESSMENT LIMITATION

This ESIA has considered the Detailed Design for the Phase I works, but is based on the FS design for Phase 2 works. As such it sets out requirements that need to be considered during the detailed design of the Phase 2 works, although it is not know with certainty if the precise location, nature, or scale of SVTP environmental impacts is as predicted.

8.6 PHYSICAL ENVIRONMENT IMPACT ASSESSMENT

8.6.1 INTRODUCTION

The impact assessment starts with the Physical environment, as most impacts derive from changes to physical components: water, soil, flow, etc.

LIMITATIONS

One important limitation that needs to be further refined by the Detailed Design study is the precise location of areas that may be unsuitable or challenging for irrigation due to their soil properties. This ESIA has located some heavy Vertisols, based on photointerpretation and on field work by the ESIA Soil Specialist. . The Feasibility Study consultant has carried out field testing of these heavy Vertisols and concluded that most of them are indeed irrigable with specific management measures. These measures will need to be further specified during Detailed Design. To the extent that certain project-area farm lands are not technically well suited for irrigation, they will be available for other uses such as livestock grazing or planted woodlots. In addition, certain non-irrigated Setaside Lands will keep the limited remaining areas of natural habitats from being cleared for irrigated agriculture. Impact identification matrix on the physical environment

The following impact identification matrix tabulates the components against the impacts that are considered during the preconstruction, construction and operation stages of the project..

Table 46: Impact Identification Matrix

Components	Pre-construction	Construction	Operation
Geomorphology of rivers	No impact during pre-construction phase	**Impacts from water works**: canals and water intake construction will necessitate crossing rivers for example in culverts or siphons and installing gabions to stabilize rivers. These will affect the geomorphology and water quality of rivers	**Siltation of Elephant marsh**: waterbodies, including Elephant marsh, erosion and sedimentation pattern will be modified because of changes to flow **Reservoir sedimentation pattern**: the water intake will impact reservoir sedimentation pattern

Components	Pre-construction	Construction	Operation
Hydrology			**Water abstraction** : Up to 50m^3/s will be extracted from the Shire system at Kapichira reservoir **Hydraulic transparency**: where a canal crosses a river, if culverts are not adequately designed and installed they can act as dam and flood villages upstream. Flash flood phenomenon can damage hydraulics infrastructure
Water quality		**Impacts from water works**: canals and water intake construction will necessitate crossing rivers for example using culverts, siphons and installing gabions to stabilize rivers. These will affect the geomorphology and water quality of rivers	**Water quality impairment** : the scheme will impair water quality (including groundwater) as a result of farm chemical use
Soil and groundwater		**Impacts from earthwork and land leveling** : canal construction will necessitate important excavation of earth and rocks and the command area will be levelled	**Changes in soil properties and rising water table:** irrigated agriculture can lead to several changes in soil properties (salinization, soil sodicity, waterlogging, etc.). Irrigation can rise

Components	Pre-construction	Construction	Operation
			water table (leading to salinization and waterlogged soil)

8.6.2 AFFECTED COMPONENT VALUE

The following table shows the value of components.

Table 47: Value of Components Affected

Component	Component value
Geomorphology of rivers	River geomorphology is a moderately valued component. Most rivers geomorphology are subject to important natural changes due to flash floods and erosion. Siltation of the reservoir is however an important issue
Hydrology	River hydrology is a highly valued component. Communities are directly dependent on river flow and, based on historical records, any change in the past has led to significant economic and social changes
Water quality	Water quality is a moderately valued component as there is not much attention provided to water quality in the study area although it is an important element for aquatic life
Soil & Groundwater	Soil is a highly valued component in the study area as people depend directly on its properties for agriculture

8.7 GEOMORPHOLOGY OF RIVERS

8.7.1 Description of impacting activities

The impact matrix has identified the following activities and impacts:

- During construction of the scheme, canal and water intake construction will necessitate crossing rivers and will involve water works such as building weirs, culverts, siphons and installing gabions to stabilize rivers. These will affect the geomorphology, hydrology and water quality of rivers. As noted during ESIA preparation through field observation and confirmed by satellite imagery analysis, tributary riverbeds are very mobile: river beds can move of several tens of meters after severe floods.
- During SVTP operation, some relatively minor changes might be expected in sedimentation patterns within the Elephant Marsh due to (i) modestly reduced dry season

Shire River flows and (ii) sediment arriving from irrigation drainage canals (although the irrigated farmland will be very flat and not highly erosive). The March 2017 SRBMP Management Report on Climate Resilient Livelihoods and Sustainable Natural Resources Management in the Elephant Marsh concludes that, in recent decades, changing the amount of sediment load in the marsh has had little effect on the delivery of ecosystem services. The Marsh has been remarkably resilient to sedimentation as well as flow changes, having experienced significant fluctuations in both over its recorded history.

- During operation of the scheme, the water intake will change sedimentation pattern in the reservoir (**Reservoir sedimentation pattern**). This change could lead to impact on EGENCO powerstation water intake. Sedimentation patterns are currently affecting Elephant Marsh, as described in the baseline chapter. In addition to the sediment transported along the Shire River (some of which is removed at Kapichira as part of the EGENCO management of the reservoir), sedimentation sources are the tributary rivers and streams and the run off from agricultural schemes along the East Bank of the Shire River. Proposals underway and as part of other projects (including SRBMP, MWASIP) are designed to improve agricultural practices and reduce erosion within the River Shire Catchment. Despite the scale of SVTP, it is not expected for the additional sedimentation to increase significantly the cumulative impacts of sedimentation on Elephant Marsh, although monitoring should be undertaken to confirm if changes are occurring, with a view to integrating sediment traps at outfalls, if necessary.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 48: Assessment of Impact Significance

	Impacts from water work. During construction, some actions and infrastructures will modify geomorphology of rivers	**Siltation of Elephant marsh.** During operation of the scheme, erosion and sedimentation pattern will be modified	**Reservoir sedimentation pattern.** The water intake will change sediment deposition pattern in the reservoir
Value of the affected component	Moderately valued		
Intensity	Low	Low	This impact is the subject of an independent study for the SVTP "Hydraulic Modeling of Intake for the SVTP (Artelia)". Impact assessment and mitigation have been informed by this report.
Extent	Punctual	Local	
Duration	Temporary	Permanent	
Significance	Negligible	Minor	
Occurrence probability	Potential occurrence (as the type of water works in tributary rivers are not known)	High probability	

8.7.2 Mitigation measures

Impacts from water work

The following mitigations are recommended to limit impact on geomorphology of river:

- Any work across a river will have to take its mobility into account to avoid having rivers shifting and no longer flowing through canals. Therefore, design of the river passages shall involve installing gabions or riprap on riverbanks. In addition, it is recommended not to cross a tributary river in a meander but rather where the river is flowing in a straight line.
- When finetuning the command area in the Design phase, it is recommanded to avoid developing irrigated fields too close to any river and to take into account river mobility. It is proposed to avoid all areas that are in the 1 in 10 year floods of rivers and to stabilize sharp meanders with gabions and riprap. These important aspects shall be taken into account in the Design study to safeguard rivers from being channelized and crops from floods.

Siltation of Elephant marsh

Two mitigation measures could be implemented to reduce the impact on Elephant marsh. These are related to further targeted work in the catchments and on the Kamuzu Barrage, both under the auspices of the Ministry of Agriculture, Irrigation, and Water Development:

- One is related to the Lower Shire River watershed management, which includes investments by
  MoAIWD as well as the Forestry Department under the ongoing Shire River Basin Management Project. These investments seek to reduce land degradation and enhance forest cover, thereby reducing erosion and the resulting sediment load within the Shire River and the Elephant Marsh.
- After the ongoing upgrading of the Kamuzu Barrage on the Shire River is completed, it is possible-but not guaranteed--that Barrage operations will be able to release more water during the dry season, thereby incrementally benefiting the Elephant Marsh. Located in Liwonde (well upstream of the entire SVTP project area), the Kamuzu Barrage partially regulates water levels in Lake Malawi, the primary water source for the Shire River and Elephant Marsh. This ESIA discusses the feasibility of releasing more water from Kamuzu barrage in the Hydrology section.

Although average flows will be reduced, there will still be periods of high flow during the rainy season, which will (i) flush out excess sediments from the Elephant Marsh and (ii) help restore the Marsh to its normal full size.

Other mitigations are related to best management practices in the command area such as good maintenance of drains, proper stabilization of dikes and banks, etc. Some of these will be the responsibility of the Bulk Water Operation for the SVTP scheme. It is also expected that the SRBMP will define and implement appropriate conservation measures that will also control soil erosion in the hilly upper and middle catchment areas, particularly along drainage lines and other watercourses. These measures will also help to reduce flooding and waterlogging in the lower Shire Basin. Most importantly for the Elephant Marsh, the SVTP

Natural Resources Management Component will serve to improve the protection and management of this major wetland ecosystem, facilitating more sustainable uses by restricting the clearing of marsh areas for cultivation and the potential over-harvesting of a wide range of natural resources.

8.8 HYDROLOGY

The flow data presented in this report are based on Chickawawa gauging station only and the data from gauging station in Liwonde were not used.

8.8.1 Description of impacting activities

The impact matrix has identified the following activities and impacts:

- During operation of SVTP, canal capacity will be 50m^3/s, and this is the maximum amount that will be extracted from the Shire system at Kapichira reservoir (**Water abstraction**). This is a consumptive demand as this amount will not be released directly back in the system (about half will be released back to drains and to the water table). This will lead to modest environmental impacts on Elephant Marsh and minor impacts on tourism at Kapichira Falls:
  - Although the proposed SVTP represents a significant new consumptive demand in the Shire River, the EGENCO Hydropower Station has much larger non-consumptive water demands which are likely to take precedence over irrigation requirements at times of low flows. This means that, at times of low flows, irrigation demands from the SVTP would not be exercised and flows would be maintained for power generation demands.
  - The high demand for the Kapichira Hydropower Stations also gives to rise to issues regarding sharing of water.
  - The impact of water abstraction is a transboundary impact since part of the amount that will be withdrawn from the Shire will be lost to Mozambique.
  - The presence of a water intake conveying water from the reservoir close to villages will likely create, on the long-term, new expectations and new water demands from people, industries, etc. For example, Chikwawa will receive 1,240 m^3 daily through a pipeline for drinking water. Therefore, discussions on water allocation and water rights could become more significant although the maximum capacity of the irrigation system's Main Canal intake is set at 50 m^3/s and this will not increase over time.

Hydrology impact assessment can be divided in three:

- Hydrologically negative changes downstream of EGENCO Powerstation tailrace, which could lead to impacts on the Elephant Marsh;
- Hydrologically positive changes due to the significant reduction of the use of existing pumping stations along Elephant Marsh. This will partially counter-balance the flow reduction in the marsh;
- Hydrologically negative changes below the dam and upstream of the hydropower tailrace, which will lead to dry season flow reductions over the Kapichira Falls, a tourist attraction within the Majete Wildlife Reserve.

The following figure illustrates these three types of impacts.

Figure 74: Hydrological Impacts

Impact downstream of EGENCO tailrace

The water demands for the SVTP and for the EGENCO power generation (Kapichira I installed capacity: 64.8 MW and Kapichira II, 64.8 MW) are presented in the table below (source: KRC, 2016). The flow reduction downstream of the hydropower tailrace is presented (in percentage terms). When both Phases I and II of SVTP developed, the Shire River flow reduction will be up to 9.4% downstream of the tailrace during a typically normal year and up to 12.4% during especially dry years (considering the net abstraction that reflects the conversion from current pumping to gravity-fed irrigation) (Source data & results: MoAWI Chickwawa Gauging station (1L12), 2017). although they borrow large amount of water, Kapichira I and II are not affecting Elephant Marsh since the hydropower scheme is a run-of-river scheme where all turbinated water is released downstream of the tailrace (non-consumptive demand). Figures show the "without Illovo scenario" since although it is expected for Illovo to participate in the SVTP scheme, the agreement is not completed yet.

Table 49: Water Demands for SVTP and EGENCO at Kapichira Dam

(m^3/s)	SVTP	% of average flow (Median year)*	% of average flow (dry year)	EGENCO Kapichira I+II
Jan	20.0	3.1	4.4	269.2
Feb	22.3	3.1	4.2	269.2
Mar	24.8	3.5	4.9	269.2

Apr	26.8	3.9	5.4	269.2
May	32.7	4.8	6.6	269.2
Jun	34.5	5.3	6.9	269.2
Jul	43.1	7.2	10.0	269.2
Aug	47.8	8.8	10.8	269.2
Sep	50.0	9.4	11.9	269.2
Oct	47.4	8.6	12.4	269.2
Nov	37.2	7.0	10.5	269.2
Dec	25.6	4.7	7.2	269.2

Source data & results: MoAWI Chickwawa Gauging station (1L12), 2017

- The Figure below presents the availability of water by showing the 50% (Median Q50) and 80% (Quinquennial dry year Q80%) dependable monthly flows as well as the water requirement for SVTP without or with Illovo and with Kapichira I and II.

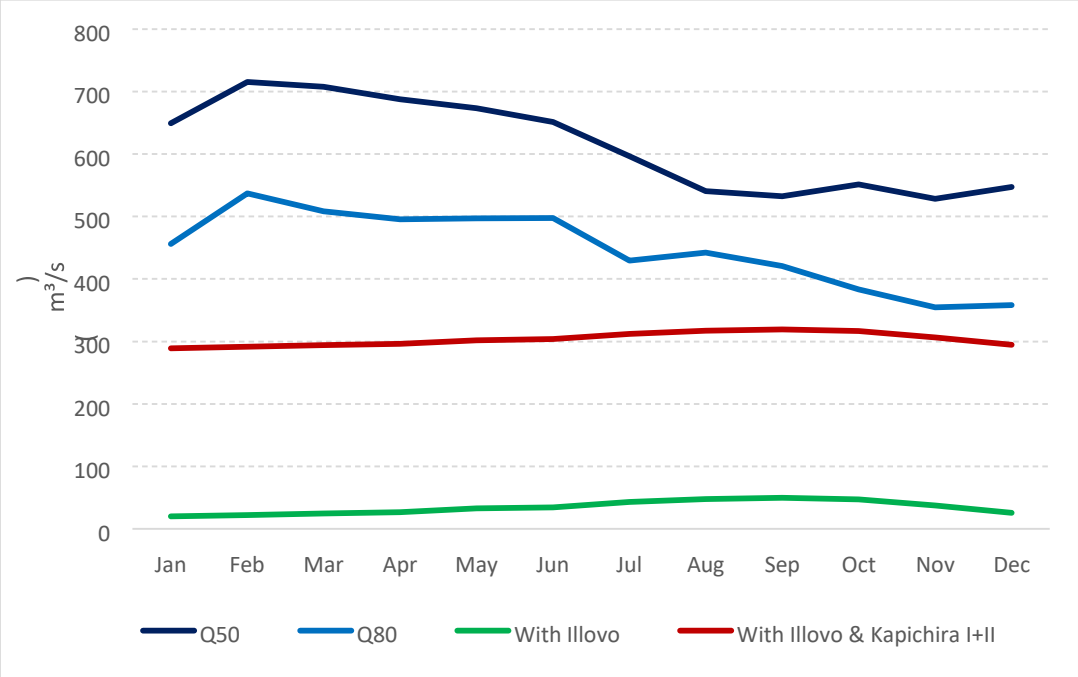


Figure 75: Water availability and demand at Kapichira Dam (using same hydrological data from DWR used in TFS)

The previous graph shows that:

- The water supply exceeds largely the irrigation requirement for SVTP without or with Illovo when taken alone.

In addition to predicion on impact, the risk of having illegal motor pumps along the stretch of the feeder canal will create additional small consumptive demands and could affect tail enders. As such, illegal water connections by communities have to be given consideration.

Partial closure of existing pumping stations along Elephant marsh

The FS report mentions that existing pumping stations could be operated when drought is expected (around once every 5 years). Occasional use of the existing pumping stations (by opposition to constant use) will reduce the effect of hydrological impact on Elephant marsh since water that will be brought by irrigation will no longer be pumped. Most stations utilization, except for Kaombe, could be reduced significantly during Phase I (sugar cane fields irrigated by Kaombe pumping station are concerned by Phase II). According to the FS report, the total amount of water pumped per average year is 9 m^3/s. During the wettest months, pumps are taking 6m^3/s and during the driest months, pumps are taking 13 m^3/s.

The "positive" impact from partial closure of pumps is small but noticeable. It represents 30% to 25% of the flow in comparison to the 20.5 to 51.3 m^3/s that will be withdrawn from the Shire system.

Impact below the dam and upstream of the hydropower tailrace: impact on Kapichira falls

This area is the most severely impacted area hydrologically. Since the scheme has been designed to optimize resource utilization with 80% assurance of supply in the critical months of September and October it is likely that flow over the falls will be very low in those months. Good records are missing for flows over the spillway, but in dry years with low lake levels (such as e.g. 2015) the flow over the falls has been known to be so low as to render the falls invisible in the dry season. It is clear from the data that the factor influencing the most the fate of the falls is the operation of the reservoir for hydropower (Kapichira I+II). As is shown in figure 8 the water availability is mainly an issue in the dry season as during the rainy season the flows are much less affected when flows in the Shire are higher and irrigation demands significantly lower. SVTP will therefore likely lead to a significant increase in the number of months per year with low flows over Kapichira Falls, the number of months being strongly dependent on reservoir management decision and future flow releases at Kamuzu Barrage.

The importance of this change is limited because:

--From a visual standpoint, the Kapichira Falls are already compromised by the view of the Kapichira Dam wall at the crest of the Falls;

--While an attractive sight overall, the Kapichira Falls are not considered to drive tourist visitation to the Majete Wildlife Reserve, which attracts tourists mainly because of its wildlife, overall scenery, and good visitor facilities. This finding was reinforced during discussions with Majete Reserve managers.

--Unlike some waterfalls with a high vertical drop, the Kapichira Falls have a gentler slope and do not have any unique "spray ecosystem" zone with distinctive plants or other species in the vicinity of the falls. A seasonal reduction in flows over the falls will therefore not significantly affect the local biodiversity.

--The tailrace of the HEP is immediately downstream of the falls where the Shire cuts a deep gorge and there will always be water at the toe of the falls. The impact is therefore limited to the area where the water cascades down rocks and boulders until it reaches the Shire. The
spatial extent of this impact is therefore very limited and over a harsh section with variable flows in the baseline situation.

Table 50: Number of months when the flow is (will be) lower than 20m3/s

Nb Months	Kapichira I+II (current situation)	Kapichira I+II & SVTP without Illovo	Kapichira I+II & SVTP with Illovo
2013	0.4	6.5	7.6
2014	0.0	9.8	9.9
2015	2.4	10.1	10.2
Mean	0.9	8.8	9.2
Min	0.0	6.5	7.6
Max	2.4	10.1	10.2

Table 51: Number of months when the flow is (will be) lower than 10m3/s

Nb Months	Kapichira I+II (current situation)	Kapichira I+II & SVTP without Illovo	Kapichira I+II & SVTP with Illovo
2013	0.4	5.8	6.6
2014	0.0	9.2	9.5
2015	1.5	10.0	10.1
~~Mean~~	0.6	8.4	8.7
Min	0.0	5.8	6.6
Max	1.5	10.0	10.1

During operation of the scheme, where canals or new farm roads cross a river, if ever culverts are not adequately designed, they can act as dam and flood villages upstream. Careful design of canals also has to take into account flash flood phenomenon that can damage the hydraulic infrastructures (**Hydraulic transparency**). All tributary rivers are reactive and have small watershed (except Mwanza and Ruo) originating in hilly areas,

flowing through the plain and then to the Elephant Marsh where Shire flows. Flash floods in these rivers lead to sudden increase of water level, with high bedload transport capacity, especially right bank rivers where topography is more pronounced. When these rivers reach the plain, their currents become weaker and sediment deposit are finer, ultimately silt plumes reach the Elephant Marsh. Erosion on hill slopes increases the phenomenon. In the plain, these tributary rivers can easily flood villages due to diffuse river beds. In addition, tributary river beds are mobile, within a few years, river bed can move of several tens of meters.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 52: mpact Assessment Criteria for Water Abstraction and Hydraulic Transparency

	Water abstraction. Up to $50m^3/s$ will be extracted from the Shire system	**Hydraulic transparency.** When crossing the canal tributary rivers can flood upstream village if culverts are not properly sized
Value of the affected component	Highly valued	
Intensity	Medium	Low
Extent	Regional	Punctual
Duration	Permanent	Temporary
Significance	Major (and cumulative)	Minor
Occurrence probability	High probability	Potential occurrence

8.8.2 Mitigation measures

Water abstraction

In the future, it might be feasible to mitigate the impacts from reduced flows to the Elephant Marsh (and in the Shire River generally below the planned irrigation intake) by releasing more water from the Kamuzu Barrage. However, this cannot be guaranteed at this time, it will depend upon (i) Lake Malawi water levels, which naturally fluctuate over time and (ii) regulation of water flows at the Kamuzu Barrage to meet electricity generation and irrigation demands..

One potential risk is having illegal pumping taking place along the western part of the canal, where no SVTP irrigation is planned (because pumping would be required). Illegal pumping using motor pumps will need to be addressed or regulated by the SVTP Bulk Water Operator to ensure that it does not significantly reduce the water available to the planned SVTP irrigation areas. In any case, since SVTP abstraction from the Shire River will be strictly limited to 50 m3/s by the size of the Main Canal intake, any unauthorized water abstraction from the canal will be an SVTP management problem but not really an environmental problem, since no additional water will be taken from the Shire River or lost to the Elephant Marsh.

For project planning purposes, it is therefore presumed that, at full SVTP development, the flows available to the Elephant Marsh will be reduced by a maximum of 32 m3/s, which

represents the maximum gross abstraction of 50 m3/s at the Main Canal intake minus the 18 m3/s currently pumped from the Shire River (mainly by Illovo Sugar) that SVTP would replace. For Phase I of SVTP development, the maximum net abstraction would be only 12 m3/s. This translates to a net abstraction at full SVTP development of not more than about 10 percent of the Shire River's flow during September, the dry season month of peak irrigation water demand.

As modeled in the hydromorphological study on the Elephant Marsh (MRAG, 2016), the impacts on Elephant Marsh of water abstraction are expected to be moderate. Based on a 33-year horizon analysis of the potential effects of alternative future scenarios of flow and/or management on the ecological condition of the Elephant Marsh, using a pre-2015 morphological template and taking into account the cumulative impacts of future basin development including SVTP, the conclusions are that:

- The Marsh is fairly resilient to short-term flow and sediment changes, having experienced significant fluctuations of both in its history.
- Development and climate change in the short term do not represent a significant threat to the long-term integrity and sustainability of the Elephant Marsh, but may represent a threat in the longer term if overlain on dry periods such as those known to have occurred in the past.
- The most immediate and significant threat to the integrity and sustainability of the Elephant Marshes is pressure from subsistence users, including the clearing of marsh vegetation for flood-recession agriculture and over-harvesting of fish and other natural resources. The MRAG report recommends improved management practices within the Elephant Marsh, many of which will be supported under the SVTP Natural Resources Management Component.

Regarding the Kapichira Falls, the current flow over the falls is controlled by EGENCO by opening the sluice gates of the Kapichira Dam on the Shire River (ATKINS, 2011 and NORPLAN, 2013). In effect, there currently appears to be no formal requirement for an environmental flow discharge at the sluice gates. The actual dry season flow over the falls is usually around $30m^3/s$ but during lower water conditions (such as in the 2016 drought), there is little or no flow now over the falls. The by-passed river section at the dam toe until the toe of the water falls is 900 meters long. After 900 m, the tailrace from the hydropower station releases all flow, restoring the original flow of the Shire River since Kapichira is a run-of-river hydropower facility (what comes in goes out quickly). It is in this by-passed section that provides an attractive view for tourists at the Majete Wildlife Reserve when water flows over the falls are high (particularly during the wet season). Historically, the falls have seen great variation in flows, particularly in the early 20^{th} century when lake levels were low and did not sustain Shire flows. In terms of mitigating such large fluctuations, Kamuzu Barrage was constructed and is currently being upgraded and an improved Shire Basin Plan and Operational Decision Support system (ODSS) is being installed for use by the MoAIWD, the Shire Basin Agency and EGENCO (former EGENCO). It will improve data driven operations of Kamuzu Barrage and downstream infrastructure and over time improve efficiency of operations, within the overall allocations set for different sectors within sustainable limits under the Shire Basin Plan, in which the allocation at Kapichira has been modeled for the critical months of September and October. In the rainy season irrigation demands drop significantly, to 20 m3/s for the month of January (for SVTP I and II combined) while flows in the river are higher, resulting in a Q80 flow over the falls of over 200 m3/s for most of the season.

The Project will support the development of operational rules for Kapichira Reservoir between EGENCO and the scheme operator under MoAIWD, based on monitoring during project duration. To inform the operating rules, the project will support monitoring of the actual flows over the fall during SVTP-I before canal operation starts, under the auspices of both EGENCO and MoAIWD to have better reference of the flow situation over the falls in the wet and dry season as well as localized biodiversity, and to include consideration for safeguarding minimum environmental releases as determined necessary over the spillway.

Regarding the transboundary impacts of SVTP, the Shire River in Malawi is part of the Zambezi basin which is under the oversight of the Zambezi Commission. The Commission has been contacted through a Riparian Notification Letter to the governments of all the other Zambezi River Basin countries (Mozambique, Tanzania, Angola, Botswana, Namibia, Zambia, and Zimbabwe) and the commission no reservations against SVTP.

Hydraulic transparency

The estimates of the frequency peak flows for the sub-basins of right-bank tributaries intersecting the SVTP canals are given in the table below (calculations based on the flood frequency relationship established by Mkhandi & Kachroo, 1998). Based on these data, culverts and under passages have to be carefully designed and super-sized to allow dry passage of wildlife, the Q100 shall be taken into account to size box culverts and culverts. Another rationale to make large culverts is that larger culverts are less likely to result in flooding of the main irrigation canals; such flooding can lead to the entry of Lower Shire/Zambezi fish species into the canal system, posing an invasive species risk for Lake Malawi. In addition, tributaries that are crossed by the primary canal have to be stabilized with gabion or rip rap and the primary canal shall always cross a river perpendicularly and in a place where the river is flowing in a straight line (to reduce the impact of river mobility). The Design study has taken this measure into account for Phase 1 and will do so for Phase 2.

Table 53: Peak flow of right bank Shire tributaries

Tributary rivers name	Catchment Area at SVTP Canal (km²)	Peak Flow (m³/s)				
		Q2	Q10	Q20	Q50	Q100
Mwambezi	160	41	111	138	171	195
Masakale	102	34	91	113	140	160
Nthumba	70	29	77	96	119	136
Mwanza	1621	112	304	377	467	535
Nkombedzi Wa Fodya	418	62	168	209	259	297
Namitalala	65	28	75	93	116	132
Phwadzi	219	47	127	158	196	224
Namikalango	140	39	105	130	161	184
Nyakamba	78	30	81	101	125	143
Mikombo	47	24	65	81	100	114
Mafume	61	27	73	90	112	128
Lalanje	77	30	81	100	124	142

8.9 WATER QUALITY

8.9.1 Description of impacting activities

The impact matrix has identified the following activities and impacts:

- During construction of the scheme, canal and water intake construction will necessitate crossing rivers and will involve building culverts, siphons and installing gabions to stabilize rivers. These will affect the water quality of rivers (**Impacts from water works**). Concrete wash water, for example, can pollute water by increasing its pH. Water works could increase turbidity, especially during construction of the water intake in the reservoir. There is a risk of oil/chemical spills from refueling of machinery and storage of fuel barrel. The following picture shows an example of inadequate oil storage taking place when machinery is working in river.

Figure 76: Poor oil management (Source: BRLi, 2015)

During operation of the scheme, drainage from irrigated fields will impair water quality (including groundwater) (**Water quality impairment**). Drainage will transport pesticides, herbicides, fertilizers and silt. The chain of consequences will be long, as these pollutants will impact aquatic life in many ways:

- Pesticides and herbicides may be toxic and some are known to induce mutation in herpetofauna and fish species and affect the food chain up to piscivorous birds and fishes;
- Fertilizers are known to induce eutrophication and changes in plant communities especially when flow is low. This could worsen invasive plant colonization of Elephant marsh;
- Silt are known to transport pollutants (as they cling on silt) and to impact fish by smothering eggs and affecting gills of many species (impacts on fish are discussed in a separate section).

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 54: Assessment Criteria for Water Works and Water Quality Impairment

	Impacts from water works. Construction activities will bring silt and other pollutants to rivers	**Water quality impairment.** Drainage in watercourses will impair water quality
Value of the affected component	Moderately valued	
Intensity	Low	Medium
Extent	Punctual	Local
Duration	Temporary	Permanent
Significance	Negligible	Moderate
Occurrence probability	Potential occurrence (as the type of water works in tributary rivers are not known)	High probability

Physical environment Impact assessment

8.9.2 Mitigation measures

IMPACTS FROM WATER WORKS

Several mitigations are possible to limit impact from water works on water quality, they apply to the construction contractor:

- Work close to tributary rivers shall be carried out during the dry season when rivers are dry
- Best management practices shall be implemented for water work, such as :
  - Mandatory use of silt floating fences in the reservoir when building the water intake;
  - Mandatory use of silt fences when working close to rivers;
  - Not store any materials within 10m of a watercourse;
  - Refueling activities away from any waterbody (at least 100 m);
  - No evacuation of concrete wash water in waterbodies;
  - Emergency spills containment kit in all vehicles and machinery.
  - Prohibit washing of project vehicles, plant and machinery in or adjacent to any water sources. All washing to be carried out at designated areas away from water sources
  - Drainage and effluent from storage, garages areas, workshops and camp sites shall be captured and treated before being discharged into the drainage systems and receiving water bodies & ensure that waste and drainage water complies with national discharge standards
  - Implement Emergency response plans during construction and operation.
- Request in tender documents that companies develop and share a method for environmentally friendly water work (reservoir and river) and spill containment, as part of the tender evaluation.

WATER QUALITY IMPAIRMENT

Several mitigations are possible to limit impact from drainage:

- Since the command area will remain at a certain distance from the marsh (to avoid floods), several settling pond could be designed to allow silt and attached pollutants to settle in ponds rather than reaching the marsh. However, this would also reduce the amount of water that returns back to the marsh and these ponds would be washed away during floods. This mitigation is therefore not recommended unless monitoring indicates that siltation and pollution from SVTP is a cause of significant change in the River Shire and Elephant Marsh.
- The Integrated Pest Management Plan has developed measures to ensure that only authorized pesticides are used.
- Measures presented in section 6.4. to limit erosion will also bring benefits to water quality.

8.10 SOIL & GROUNDWATER

8.10.1 Description of impacting activities

The impact matrix has identified the following activities and impacts:

- During construction of the scheme, canal construction will necessitate excavation of earth and the command area will be levelled (**Impacts from earthwork and land leveling**). Based on the current feasibility study (KRC, 2016), the volume of earthworks for the canal is as follows (for a lined canal, estimated based on information provided from the Feasibility study):
  - Feeder canal excavation for the canal bed: +/- 1 Mm^3
  - Feeder canal backfilling for embankment: +/- 1 Mm^3
  - Bangula canal excavation for the canal bed: +/- 0.8 Mm^3
  - Bangula canal backfilling for embankment: +/- 0.8 Mm^3
- Excavated material may not always be suitable for backfilling material, therefore there space to deposit spoil material is needed. Opening of borrow pits and quarry will lead to numerous risks on safety of local population (and possibly on habitats.
- Irrigated agriculture can lead to several changes in soil properties. Salinization, soil sodicity, waterlogging, loss of soil are common risk under gravity irrigation (**Changes in soil properties and rising water table**). In addition, there is a risk associated with the presence of poorly drained Vertisols in Zone B and C (see figure 24).
  - Salinisation and Alkalinisation: soils with a high risk of further salinisation or alkalinisation need special attention. However, available analytical data sets indicate that such areas are limited in size and can be sustainably managed with good management. Salinity levels in the project area are generally low and if levels should go up, soils can be easily flushed with excess drainage water. Alkalinity is in fact a more serious problem but occurrence of alkalinity at any serious scale is not indicated by available analytical data. Impact of the Project on soil salinisation is not expected as the Project is supposed to ensure good management levels.
  - Soil erosion: with respect to a possible increase of erosion in irrigated land, the Project is not expected to cause an increase of runoff, flooding and erosion as most land is currently already under cultivation, in a rather flat area and because it is anticipated that Project infrastructure and conservation measures will further control erosion. The great majority of land included in the Project is already used as rainfed arable land and this land will only change to another agricultural use, namely irrigated land. In fact, the project will improve the quality of land wherever possible in order to construct economically sized land parcels.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 55: Impact assessment criteria for earthworks and land levelling and changes in soil properties and rising water table

	Impacts from earthwork and land leveling. Construction of the canal system will lead to important earth movement	**Changes in soil properties and rising water table.** Several changes in soil properties could take place in the command area
Value of the affected component	Highly valued	
Intensity	High	Medium
Extent	Local	Punctual
Duration	Temporary	Permanent
Significance	Moderate	Minor
Occurrence probability	High probability	Risk (low probability)

8.10.2 Mitigation measures

IMPACTS FROM EARTHWORK AND LAND LEVELING

Several measures can be implemented during construction, they apply to the construction contractor:

- Some spoils from excavation could be used as soils for agriculture, soils could be given back to communities to level land or spread in the command area. Soil cannot be sold by the contractor to surrounding communities;
- No spoils can be stored even temporarily close to waterbodies including Elephant marsh or parks;
- Unusable spoils shall not be left in mounds but shall be flattened at the end of construction and revegetated;
- Borrow pits shall have gentle slopes to minimize the risk of injuries and death;
- Borrow pits and quarries location shall be done in consultation of local authorities to minimize impacts on land users;
- Borrow pits and quarries shall not be left unrestored at the end of work and shall be filled with unusable soil to reduce their depth or shall be transformed into wetlands or livestock drinking ponds where appropriate;

Figure 77" Borrow pit with dangerous steep slopes (left) and typical impact from blasting (right) (Source: BRLi, 2015)

Suitable borrow pits to be transformed into wetlands are those that are impermeable and filled with water even during the dry season. The following pictures shows a borrow pit where slopes could be transformed and native plant could be planted. Ideally, the wetland creates different habitats with different depth of water and limits the access to cattle.

Figure 78: Suitable borrow pit for the creation of a wetland (Source: BRLi, 2017)

CHANGES IN SOIL PROPERTIES

Monitoring of soil properties is highly recommended. Soil water levels and salinity will require very close monitoring to provide early warning of problems. It is recommended to follow typical parameters that help detect acidity or alkalinity of the soil such as pH, Cation exchange capacity (CEC), Magnesium (Mg2+), Calcium (Ca2+), Organic matter (OM), Organic carbon (OC) and Exchangeable Sodium Percentage (ESP).

Areas rated as non-suitable for irrigation within the Project area can be evaluated for other land uses, such as infrastructures but also for settlement, amenities, grazing, set aside

conservation land and forestry. It is expected that, after the land evaluation exercise of the FS or the Design study, such unsuitable areas have been identified and mapped with a definition of their characteristics. Future uses should be determined in land use plans at design phase, in which community preferences, e.g. as for forestry and woodlots can be reflected.

The planning of multi-purpose areas has also to be incorporated in overall land use planning, both inside and outside the Project area. However, it is presently not yet possible to precisely map these areas since the FS has not identified non-suitable areas. This ESIA has identified some lands that could be designated as set aside lands. They are described in a section hereunder.

Encompassing land with serious limitations or risks, such as very poorly drained areas with severe risk of flooding, will also have certain limitations for other uses. Future use of such land will have to be carefully planned for. Sustainable land use planning may help to establish a balance between all intended land uses, including large-scale agro-industry, small-scale irrigation, settlement, forestry and nature conservation.

For poorly drained Vertisols, rice could be included as a crop, for which use the current Project areas of Zone B and C could even be slightly enlarged, extended down slope or sideways. The use of rice with associated irrigation infrastructure and constructions will also help to control current severe erosion by flooding (sheet and gully erosion).

It is antincipated that under Component 3 – Agriculture Development and Commercialisation the scope of work for SOCFE Development Service Providers (SDSP) will incorporate soil assessment and crop suitability given prevalence of salinity, alkalinity, water logging and likelihood of groundwater rising. The SDSPs will thus, basing on soil characteristics in their respective irrigation blocks, formulate and implement proper and feasible mitigation measures for addressing these impacts

8.11 Risk of Conflicts over Water Use

8.11.1 Description of impacting activities

Like most irrigation development projects, the expansion irrigation as part of the SVTP2 would cause conflict over water usage such as conflict among water users (within the scheme, between upstream/ downstream users) over water allocation, maintenance issues; illegal water use, quality & inappropriate design of irrigation infrastructure, water charges, or management issues; conflict between project beneficiaries and non-beneficiaries is often inevitable.

Table 56: Assessment of Impact of Conflicts over Water Use

	Impacts of Conflicts Over Water Use. Operation of the schem will lead to conflicts over water use by different users.
Value of the affected component	Highly valued
Intensity	High
Extent	Local
Duration	Permanent
Significance	High
Occurrence probability	High probability

8.11.2 Mitigation Measures

Given the importance of the risk associated with the conflicts over water use, SVTP shall institute the following measures to ensure sustainability of the scheme:

- Ensue community participation and engagement at various phase of the project (planning ,design ,construction and operation phases)
- Establish new & strengthen the existing Irrigation water user Associations (SVTP1)
- Implementing bylaws to ensure harmonious use of water & ensuring that irrigation facilities are operated, maintained and managed sustainably
- Prepare and implement conflict analysis and prevention action plan

8.12 IMPACT ON SOCIOECONOMIC, CULTURAL AND NATURAL HERITAGE

8.12.1 INTRODUCTION

This section focuses on three elements: socioeconomic, cultural heritage and natural heritage impact and mitigation. Natural heritage refers to the two parks: Majete Wildlife Reserve (MWR) and Lengwe National Parks (LNP). Natural heritage impact assessment deals with all impacts on these parks that are not related to biodiversity such as impact on tourism, infrastructures and landscape. Impacts on biodiversity are studied in the last two chapters of this report. Other socioeconomic impacts are presented and assessed and some mitigations are provided. However, to avoid repetition with the Communications, Community Participation, Land Tenure and Resettlement, many references are made to the Resettlement Policy Framework study.

8.12.2 IMPACT IDENTIFICATION MATRIX ON SOCIOECONOMIC, CULTURAL AND NATURAL HERITAGE

Table 57: Impact Identification Matric for social economic, cultural and heritage issues

Components	Pre-construction	Construction	Operation
Settlement, community organization and land tenure	**Village reorganization and resettlement**: the project will lead to major changes in terms of land occupation and will necessitate physical and economic displacement		**Rapid social changes**: there is a risk that people do not change their lifestyle and develop skills rapidly enough to adapt to the new irrigated environment **Hinterland effect**: the development of irrigation may be associated with an increase in human activity and local economy, which may lead to additional pressure on resources (wood for charcoal, fish, etc.) and associated increase in waste products
Infrastructures		**Workers influx**: the project will require important workforce consisting of foreign workers. Land will also be required for machinery storage and workers camps. There is a risk that buildings and amenities do not respect quality standards **Permanent loss of buildings and other infrastructures**: canals could	**Inadequate maintenance of canals and infrastructures**: there is a risk that the irrigation system is not adequately and regularly maintained

Components	Pre-construction	Construction	Operation
		necessitate destroying buildings and other infrastructures **Disruption of access** : canals will cross roads, trails, path disrupting access for communities and cattle to grazing sites or to urban centers Risks associated with labour influx management and demand for local employment including the spread of infectious sexually transmitted diseases Exacerbation of GBV/SEA/SH and possible security and crime related risks	
Irrigated Agriculture		**Disturbance to existing agriculture**: The various components of project work will disturb cropping practices since some households will control physically different areas of land	**Potential delays in irrigated agriculture development**: any delays in the project completion or skills acquisition could delay the benefits

Components	Pre-construction	Construction	Operation
		Job opportunities: work will require unskilled and skilled labour for construction and thus providing employment opportunities to the communities around the project area	**Over supply of crops**: increase in production could reduce prices and affect rain fed producers **Benefits of irrigated agriculture**: the project overall goal is to benefit local communities **Reduction of fisheries**: with less water in Elephant marsh, fishery could be impacted **Impacts on livestock rearing**: The loss of most communcal grazing areas due to the formation of farm blocks will have an effect on the traditional livestocks rearing methods. The Project will require adaptation of this livelihood strategy
Community Safety and Health		**Construction risk and nuisances**: communities and workers are at risk during construction works including for canals and quarries	**Bilharzias**: The Project will lead to an increase of bilharzia in the command area **Drownings**: the presence of primary canals may lead to drownings

Components	Pre-construction	Construction	Operation
Occupational Safety and Health		Construction Risks: The risk of workers getting injured or getting infected with diseases like COVID 19	
Gender aspect			**Increase workload**: with increasing yield, the project may add to the workload of women considering that most of the agricultural work is done by women The increased influx of people from other districts could increase the risk of diseases spreading faster and the deterioration of security in the area.
			Risk of unfair distribution of benefits: access to financial services is a strong barrier to women and youth empowerment. Ther is high likelihood that women may continue to be excluded from the economic benefits of the project if measures to address this vice are not put in place.

Components	Pre-construction	Construction	Operation
Vulnerable people			**Impacts on vulnerable people**: landless people could be disadvantaged by the Project and land distribution **.** **The search for economic opportunies could increase women vulnerability to GBV/SEA/SH**
Cultural heritage		**Loss of physical cultural heritage**: the canal alignment route and borrow pits will affect some known and unknown cultural heritage sites (mainly pottery)	
Natural heritage	**Decision on the type of canal and its alignment**: decisions regarding the canal layout during the design stage will have long term impacts on parks **Tender process and selection of a construction contractor**: the tender process for the selection of the Project construction contractor represent a high risk for parks as it is	**Impact on tourism**: construction activities in MWR and LNP and close to Ng'ona lodge will have deleterious impacts on tourism **Impact on Majete buildings, roads and infrastructures** : Malaria research camp, Heritage center, Entrance gate, Wildlife research camp, Community camp site, electric fences, access road to the park, access to Kapichira falls viewing site will all be disturbed by	**Loss of ownership of park management on the western side of LNP**: with the canal severing the park in two and the weak presence of rangers in the western part of the park, management may lose "ownership" of the western part of the park **Impact on Kapichira falls attractiveness** : the viability of the falls as a sight to see for tourists may be compromised on

Components	Pre-construction	Construction	Operation
		construction of the Feeder canal	long term with reduced flows Positive economic impact as a result of park's improvement activities/projects
	a crucial step in the development of binding environmental measures	**Impact on Lengwe roads and infrastructures**: the fence and park roads will be impacted	**The presence of canals inside parks will be long-term agent of changes**: the presence of canals and other infrastructures inside parks will require additional efforts and inputs from park management in order to maintain parks' integrity. Canals may become agents of negative changes in parks as their management will have to deal with a new stakeholder (the scheme operator), whose decision and actions may negatively impact parks. In LNP, the maintenance road along the canal may be used by communities as "travel path" as it is the case with an existing road inside the park

8.12.3 AFFECTED COMPONENT VALUE

Table 58: Affected components for social economic, cultural and heritage issues

Component	Component value
Settlement, community organization and land tenure	This component, as most socioeconomic components, is highly valued since it relates to important topics for communities, stakeholders and funding agencies
Infrastructures	Infrastructures are moderately valued components. Outside of the Kapichira dam, the study area does not have buildings nor any construction of high interest.
Economics	These components, as most socioeconomic components, are highly valued since they relate to important topics for communities, stakeholders and funding agencies
Gender aspect	
Vulnerable people	
Health and safety	
Cultural heritage	
Natural heritage	

8.12.4 SETTLEMENT, COMMUNITY ORGANIZATION AND LAND TENURE

Most impacts on these topics are addressed in the study called "Preparation and implementation of a Communications, Community Participation, Land Tenure and Resettlement Policy Framework
(CCPLTRPF, COWI, 2016)" and its various components: Communication strategy, Gender and youth strategy study, Grievance redress mechanism, Resettlement Policy Framework, Stakeholders' views report.

This ESIA does not repeat the impact assessment and the proposed mitigation on gender and vulnerable people, land tenure and resettlement carried out by COWI but presents a summary of the conditions here. The initial consultations that led to the CCPLTRF report were based on the whole project and not only for SVTP-I. As such there most of the information that was collected from the stakeholders collected in the preparatory meetings for SVTP-II echoed what had already been epresssed in the 2016 ESIA Report. These requirements have been reflected in detail in other risk management documents for the project such as the RPF, PF, LMP and the SEP.

Land Use Change

The impacts related to land use change are loss of land holding and assets on land; loss of communal resources; loss of public property; disturbance to livelihoods and loss of access

to natural resource base; food security risks; impacts to social networks and community organization. Mitigation measures have been put in place to address the impacts. Impacts related to resettlement are however minimal as areas earmarked for irrigation blocks are not heavily habited – a few dwellings/structures. All relocated PAPs will be compensated for all losses incurred.

Land Tenure and Consolidation

The land tenure and consolidation impacts include social exclusion of women and vulnerable groups from land ownership, elite capture and social conflicts. The project is, however, encouraging joint land registration as far as possible. Women are encouraged are to participate in the project activities.

According to the Socio-economic Baseline report of the project (2017), a majority of the land in the SVTP area is customary land (81%), 18% being private land, and 1% other. The proportion of customary land is higher in Phase 2 (90%) than in Phase 1 (75%) probably due to the existing large estates within this area. The household survey found that 16% of the land was under disputes. The disputes were, however, not of such a magnitude to negatively affect the project. Of all the land cases, 45% of the disputes were with the neighbour, 25% with the village head, 21% within the family, and 9% with others. Land disputes are generally solved by those involved (43%), by chiefs (50%) or formally by Village Head (VH), Traditional Authority (TA) or the Courts (49%). Female headed households have a preference for settling disputes by VHs (95%) and male headed households by the VH, TA or the Courts (95%).

Land is mainly used for rain fed agriculture (69%) and settlement (28%). Only 2% of the land is irrigated and less than 0.5% set aside for grazing, business, renting and other uses. The better off and rich more often use their land for business, grazing and woodlots. The poor more often rent out or sell their land to obtain some cash if they are not able to develop it. Over 70% of the respondents in the household survey had 3 to 4 parcels. The total area held by households is small, 23% had a landholding of less than 0.81hectares, 19.8% had 0.81 to 1.22 hectares, and 30.7% had 1.22 to 2hectares. A parcel of land is held in the name of the head in 96% of the households. This percentage is higher in male (98%) than female (86%) headed households and lowest in young female headed households aged younger than 36 years (66%). Southern Region has the highest proportion of female owned parcels in Malawi because of the matrilineal societies living within the area. Although, the two districts have matrilineal societies, men often make decisions on land and land transactions.

8.12.4.1 Description of impacting activities

The impact matrix has identified the following activities and impacts:

- During pre-construction, the project will lead to major changes in terms of land occupation and will necessitate physical and economic displacement including acquisition of land for the canal and other infrastructures. According to COWI (2016), economic and/or physical resettlement will concern for Phase I 21,000 households and for Phase II 27,367 households (**Village reorganization and resettlement**). However, only 10 settlements will be directly impacted by the canal alignment and will have to be physically resettled. During construction, some lands will also be temporarily be

required. The experience with Illovo and land acquisition is still, 50 years later, in people's mind and local communities are suspicious of the government and SVTP trying to alienate customary lands. Construction will also disrupt existing access patterns.

- During construction, the Project will necessitate important workforce consisting of foreign workers. Land will be required for machinery storage and workers camps. There is also a risk that buildings and amenities do not respect quality standards (**Workers influx**). Worker influx from other regions in Malawi and from Mozambique can also lead to impacts and conflicts with local communities because of settlement, development of shanty towns, employment, sexual transmitted disease, and disrespectful behavior toward women. In addition, both Mwabvi Wildlife Reserve and LNP are at risk by people migrating to the command area and using them as sources of wood to build new houses. The same risk could come from the important resettlement activities that will take place and the need for new building material for resettled communities. Mwabvi is not surrounded by the irrigation scheme but only at 3 km from Phase II Zone D (figures 6 and 24). The Matandwe Forest Reserve, close to Mwabvi Wildlife Reserve, suffers from logging and gardens from surrounding forest dependent communities. It is also is at risk also from increase logging for building material because of its lack of official management (it is actually managed by Traditional Authorities). Mwabvi is accessible by road while the forest reserve is only accessible by trails. The two small reserve: Nyasa and Nyala wildlife reserve are privately owned and are not at risk.
- During operation of the scheme, there is a risk that farmers do not change their lifestyle and develop skills rapidly enough to adapt to the new environment (**Rapid social changes**). The entire agricultural system including its livestock components will be forced to make dramatic adjustments. These changes may overwhelm local coping mechanisms and may generate social resistance.
- During operation of the scheme, the development of irrigation may be associated with an increase in human activity and local economy, which may lead to additional pressure on resources (wood for charcoal, fish, etc.) and land (**Hinterland effect**).

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 59: Assessment of Impact Significance Associated with Village Reorganisation and resettlement, workers influx, rapid social change and hiunterland effects

	Village reorganization and resettlement. Major changes are foreseen in terms of land occupation	**Workers influx.** Land will be necessary and there is a risk that infrastructures do not respect quality standards. Influx could be associated with social impacts	**Rapid social changes.** There is a risk that people do not change their lifestyle and develop skills	**Hinterland effect.** Increase in human activity and local economy may lead to additional pressure on resources (wood for charcoal, fish, etc.) and land
Value of the affected component	Highly valued			
Intensity	High	Medium	Medium	Medium
Extent	Local	Punctual	Local	Local
Duration	Permanent	Permanent	Temporary	Permanent
Significance	Major	Moderate	Minor	Moderate
Occurrence probability	High probability	Potential occurrence	Risk (low probability)	High probability

8.12.4.2 Mitigation measures

VILLAGE REORGANIZATION AND RESETTLEMENT

The current CCPLTRPF assignment aims at identifying social impacts, collecting people's grievances and communicating about the Project. The Communication strategy report provides a tool to ensure social acceptability of the Project. The projects social impacts include labour influx, comflict over use of resources, conflict with local communities, GBV/SEA/SH, development of shanty towns, disturbance in social fabric. The ESMP has well outlined mitigation measures against these impacts such as the establishment of Grievance Redress Committees, a platform for people to raise their grievances and a channel through which issues will be resolved. The engagement of a GBV Service provider is also a way of ensuring that GBV/SEA/SH issues are handled in a professional manner. The SEP for SVTP 2 outlines a clear engagement plan and strategy as is required in the ESS10 of the World Bank ESF.

Regarding resettlement, with current knowledge, some avoidance measures were proposed by COWI at the Resettlement Policy Framework stage, the complete set of measures will be

developed in the Resettlement Action Plan (RAP) which is still to be produced once the Design studystarts.

The Resettlement Policy Framework includes a method for valuation for compensation of agricultural produces, forest and fruit trees.

WORKERS INFLUX

Recruitment policies

Recruitment policies will need to consider social issues and project acceptability. Considering the high local impact of the Project in terms of land and disruption of existing lifestyles, it is recommended to maximise local employment. Local benefits would be maximised and some of the negative impacts of construction mitigated if residents, especially the most severely project affected people (PAPs), are given priority for employment. The project will therefore prepare a labour influx plan. Measures will be put in plavce to address GBV/SEA/SH, security, crime , workers accommodationa and transportation. The need to have women and youth employment was also highlighted in the Gender and Youth Strategy (COWI, 2016). This will require:

- That the tender document for the construction contractor clearly specify a deliberate policy to target the locals where possible by bidding firms. To accomplish this, the contractor shall be encouraged to work in liason with the District Labour Office to ensure that the policy is professionally implemented. This is also a mitigation against abuse by the employers as experience has shown that ón the gate' recruitment is prone to abuse. For example, women have particularly been subject of abuse when they present themselves at the contractors campsite gate to look for employment. .
-

Land occupation

The social risks will include development of shanty towns which will in turn lead to poor health and living conditions as these are not planned areas, competition of resources, waste management and conflicts with local communities. Mechanisms shall be put in place to avoid the creation of shantytowns by people looking for employment or seeking to do business within the construction site. Such mechanisms shall include local enforcement measures and sensitisation against such a malpractice.

LNP shall be aware of the risk of workers influx and encroachment and increased logging activities in the park as some its western parts are already occupied by settlements. This risk also applies toMwabvi Wildlife Reserve and the Matandwe Forest Reserve. These reserves are located outside the Project area but close enough to be affected by population influx and associated need for building material (wood) and land (3 km from Phase II Zone D).

There is a risk of increased encroachment in Elephant marsh as well. To mitigate this impact, additional rangers provided by the DNPW shall be present in Mwabvi during the construction phase., Additional rangers shall be hired to strengthen the patrolling in the area in order to keep away illegal loggers away from the protected areas..

Workers code of conduct

All employees shall be required to sign a Code of Conduct , (Annex xxxx) The main aim of the Code of Conduct is to prevent and/or mitigate the social risks within the context of

infrastructure development interventions for the SVTP 2. The Codes of Conduct are to be adopted by contractors. The social risks that may arise include but not limited to Gender Based Violence (GBV), Violence Against Children (VAC), HIV and AIDS infection/spread, and occupational health and safety.

Contractor's Personnel shall:

1. carry out his/her duties competently and diligently.
2. comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety and well-being of other Contractor's Personnel and any other person;
3. maintain a safe working environment including by:
    a. ensuring that workplaces, machinery, equipment and processes under each person's control are safe and without risk to health;
    b. wearing required personal protective equipment;
    c. using appropriate measures relating to chemical, physical and biological substances and agents; and
    d. following applicable emergency operating procedures.
4. report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and serious danger to his/her life or health;
5. treat other people with respect, and not discriminate against specific groups such as women, people with disabilities, migrant workers or children;
6. not engage in Sexual Harassment, which means unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;
7. not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another;
8. not engage in Sexual Abuse, which means the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;
9. not engage in any form of sexual activity with individuals under the age of 18, except in case of pre-existing marriage;
10. complete relevant training courses that will be provided related to the environmental and social aspects of the Contract, including on health and safety matters, Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH);
11. report violations of this Code of Conduct; and
12. not retaliate against any person who reports violations of this Code of Conduct, whether to us or the Employer, or who makes use of the grievance mechanism for Contractor's Personnel or the project's Grievance Redress Mechanism.
13. not consume alcohol or any form of drugs while working on site, including while while riding or driving vehicles to and from the site .
14. not make any disrespectful gestures or use any swearing words to anyone either in the community, or along the access road.

15. not drive any vehicle or operate any machinery unless they are in possession of a valid licence to do so and have provided that licence beforehand to HR
16. not ride on any vehicle other than when there is a seat fitted as part of staff transport

The Contractor will prepare and implement the C-ESMP, OHS and LMP. In addition, the contractor will put in place measures to ensure compliance with community and occupational health and safety measures for prevention of accidents. Table 60 below describes the possible mitigation measures for OHS and CHS.

Table 60: Possible mitigation measures for the potential risks

Item	***Potential Risks***	***Mitigation measures***
1	*Occupation, Safety and Health Risks during construction*	(i) Provide appropriate PPE to workers; (ii) Train workers regularly on occupational safety and health risks prevention; (iii)Enforce the use of PPE by workers; (iv)Put appropriate warning signs in areas with high risk of safety; and (v) Facilitate the formation of Occupational safety, Health Welfare Committee at each construction site. (vi)Risk assessments prior to any construction activity
2	*Risk of communicable diseases-Spread of HIV/AIDS, Cholera and Malaria to workforce and Local Community*	(i) Sensitize workers and surrounding communities on different communicable diseases including Sexually Transmitted Diseases and ways of preventing them; (ii) Encourage workers and communities to go for voluntary screening/ medical check-up/testing; (iii)Provide Information, Education and Communication materials on different communicable diseases including Sexually transmitted diseases;
3	*Contractor's noncompliance with local labour laws and regulations-Lack of protection for workers*	(i) Contractors will sign Code of Conduct before commencement of construction works, which contains among other issues, labour related laws and regulations; (ii) Sensitize workers on labour related issues and regulations to ensure that the contractor is compliant.

Item	*Potential Risks*	*Mitigation measures*
4	*Increased risk of influx of migrant workers- Competition over local resources*	(i) Engage much of nonskilled labour force from surrounding communities to minimize the risk of migrant workers and associated negative impacts. In situations that the required skills are found within the surrounding communities these should be given priority;
5	*Gender Based Violence- Suppression of women rights*	(i) Sensitize surrounding communities on dangers and prevention of Gender Based Violence (ii) Provide equal employment opportunities to men, women, youth and the disabled (iii)Prepare, adopt and implement worker's code of conduct
6	*Child labor-Disturbance of child's education, health and safety*	(i) Sensitize surrounding communities on issues of child labour; (ii) Employ people that are aged 18 and above; (iii)Prepare and adopt a child labor policy
7	*Risk of contracting HIV/AIDS- Risk extended to both workforce and local Community*	(i) Sensitize workers and surrounding communities on HIV and AIDS; (ii) Provide free condoms to workers; (iii)Provide Information, Education and Communication materials on HIV and AIDS to workers
8	*Sexual Exploitation and Abuse (SEA), and Sexual Harrassment (SH)-both for workforce and local communities particularly under aged girls*	(iii) Prepare and implement GBV/SEA, SH Action plan that, at minimum covers the following: • Sensitisation of SVTP staff, Supervising Engineer, Contractor and Community on SEA and SH; • Mapping GBV, SEA and SH response actors including their capacity to implement the plan; • Development of an Accountability and Resource Framework for the plan implementation; • Ensure safeguards specialists in the SVTP, Engineer's and contractor's teams have GBV specific skills; • Ensure project bidding documents integrate SEA and SH requirements;

Item	*Potential Risks*	*Mitigation measures*
		• Review the C-ESMP to ensure that appropriate mitigation measures relevant to SEA and SH are incorporated • Women and girl's social and economic empowerment • Prepare, adopt and implement workers' code of conduct
9	Security Risk Assessment and Management	(i) Avoid or minimize the potential for community exposure to water-borne, water-based, water-related, and vector-borne diseases, and communicable diseases that could result from project activities, taking into consideration differentiated exposure to and higher sensitivity of vulnerable groups; (ii) Avoid or minimize transmission of communicable diseases that may be associated with the influx of temporary or permanent project labor. (iii) Develop emergency preparedness and response plan in collaboration with national, district and local authorities in line with the SEP covering: • Specific emergency response procedures • Trained emergency response teams • Emergency contacts and communication systems/protocols • Procedures for interaction with local and regional emergency and health authorities • Permanently stationed emergency equipment and facilities (e.g., first aid stations, fire extinguishers/hoses, sprinkler systems) • Protocols for fire truck, ambulance, and other emergency vehicle services • Evacuation routes and meeting points • Drills (annual or more frequently as necessary) (iv) Develop a Security Risk Assessment and Management Plan. The plan should cover: • An assessment of risks posed by its security arrangements to those within and outside the project site.; • Institute inquiries to ensure that those providing security are not implicated in past abuses; • Train security personnel adequately in the use of force (and where applicable, firearms), and

Item	*Potential Risks*	*Mitigation measures*
		appropriate conduct toward workers and Affected Communities; • Require security personnel to act within the applicable law; • Provide a grievance mechanism for Affected Communities to express concerns about the security arrangements and acts of security personnel.
10	*Discrimination and exclusion of vulnerable groups;*	(i) Development of WGRM (ii) Development of deliberate policy for gender equality
11	*Labor disputes and conditions of employment.*	(i) Establishment of WGRMC (ii) Development of LMP

Sexually transmitted diseases

The risk of sexually transmitted diseases such is always high in construction projects of the nature of SVTP 2 which triggers an influx of people from other areas in search of employment or business opportunities. Reducing this risk will start by sensitizing staff and neighbouring population as well providing an easy access to condoms. Prohibition of prostitution will be enforced (see code of conduct). The contractor shall have a clinic where workers shall get primary health care. Clinic staff shall be involved in the sensitisation of the workers and the neighboring communities on the prevention and treatmment of STDs.

Grievances during construction

SVTP 2 shall utilise the already developed Grievance Redress Mechanism implemented under SVTP 1. Grievance Redress Committees shall be established in all the areas surrounding the project area. The committees shall be formed at Group Village Headman Level, Traditional Authority level, District level and National Level. A comprehensive GRM mechanism has been fully described in the RPF and SEP. Every contractor shall be encouraged to form a Workers Committee which shall act as a mediator between management and the workers during conflict resolution processes.

HINTERLAND EFFECT

Providing for adequate woodlots and grazing land set-aside areas, as part of the SVTP's participatory land use planning process for the irrigated farming communities, will reduce pressures to encroach upon nearby protected areas to obtain construction wood, fuelwood, or livestock forage. Some measures of the SRBMP will also aim at improving use of natural resources especially in Elephant marsh.

8.13 INFRASTRUCTURE

8.13.1 Description of impacting activities

The impact matrix has identified the following activities and impacts:

- During construction, canals could necessitate destroying buildings and other infrastructures (**Permanent loss of buildings and other assets**). At current stage, the number of infrastructures is not precisely known as the Design study has not started. The Resettlement Policy Framework and the future Resettlement Action Plan will provide details about affected infrastructures. The risk to infrastructures could also come from blasting activities.
- During construction, the canal will cross roads, trails, path disrupting access for communities and cattle to grazing sites and urban centers (**Disruption of access**). The estimated number of affected roads and footpaths is provided in the Resettlement Policy Framework (RPF). According to the RPF, 10 tarred roads, 57 gravel roads and 17 footpaths will be severed by canals for Phases I and II. In addition, most canals (except at plot level) will become a barrier to walking and a serious hazard for cattle and people trying to cross. Personal observations from the Consultant of people and domestic animal crossing an under-construction lined canal with slope
  1H/1.5V reveal that:
  - in the absence of a nearby bridge, during construction, people are forced to cross lined canal, some of them slip especially elderly people.
  - many juvenile cows try to fetch for stagnant water and end up stuck and sometimes wounded in the canal, this happens regardless of the presence of cattle bridge. It is very difficult to take them out;
  - mature cows do not usually take risks;
  - goats have no problem entering and exiting a dry canal.

It is probable that given the time necessary to rescue the cow on the following pictures (more than 15 minutes and the help of three people and a rope), if the canal would have been filled, the animal would have probably drawned.

Figure 79: Stuck cow in a lined canal (BRLi, 2017)

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 61: Assessment of Impact Significance Related to Permanent loss of buildingd and other assets, disruption of access and Inadequate maintenance of canals and infrastructure

	Permanent loss of buildings and other assets. Canals could necessitate to pass through several buildings and assets	**Disruption of access.** Canals may sever footpaths and cattle paths	**Inadequate maintenance of canals and infrastructures.** There is a risk of canals and water intake siltation and invasion of plants in canal and drainage channel
Value of the affected component	Moderately valued		
Intensity	Low	Medium	Medium
Extent	Punctual	Local	Local
Duration	Permanent	Permanent	Permanent
Significance	Minor	Moderate	Moderate
Occurrence probability	High probability	High probability	Risk (low probability)

8.13.2 Mitigation measures

PERMANENT LOSS OF BUILDINGS AND OTHER ASSETS

As mentioned in the Resettlement Policy Framework, resettlement of people or communities is the last option that should happen. In the design of SVTP 2 efforts were made to avoid village areas and graveyards as much as possible. Changes to the original designs were proposed in oder to reduce the number of affected people. The result of the proposed changes is a reduction of affected villages from 19 to 6 and affected houses from 121 to 26 in Phase I (a similar investigation has not been done for phase 2 yet.) (COWI, 2016).

In order to mitigate destruction of structures during construction, , it will be important to assess risk to infrastructures by doing a groundtruthing survey of wells, houses, churches, buildings, etc. Groundtruthing shall involve local authorities and the construction contractor.

DISRUPTION OF ACCESS

Bridges shall be built to allow for access across canals where existing footpaths and roads are impacted (10 tarred roads, 57 gravel roads and 17 footpaths will be severed by canals). In addition, these footpaths and bridges shall be strong enough to allow cattle to pass. It is recommended that they be built as the canal progresses to avoid forcing people and cattle to travel long ways to cross the canal or crossing the trench affecting the canal banks and leading to safety risks.

People/cattle bridges shall be built every kilometre of main canals. Therefore, the Project may require up to 133 people/cattle bridges. As discussed in the baseline report, there is no

identified livestock route in the area. As such, movement of cattle is diffused in the Study area, therefore sufficient provision for additional livestock bridges shall be planned. Sensitization to livestock owner is also recommended so that they take less risk for their livestock by:

- not using canal maintenance roads with their livestock ;
- carrying out with them ropes in case of juvenile cows entering the canal

In the command area, some footpaths shall also be designed to allow people to cross secondary canals, these shall be 1.5 m wide. Spacing between these footpaths shall not be more than 1 km.

In addition, whenever a canal crosses a seasonal river, box culverts shall be large enough to allow people to walk under the canal.

It is not recommended to build people/cattle bridges in Branch canals or smaller canals as the presence of livestock in the command area will lead to conflicts with farmers.

INADEQUATE MAINTENANCE OF CANALS AND INFRASTRUCTURES

The scheme operator will be responsible for the maintenance of the main canals (lined canals), the water intake and the other associated structures, including:

- Bridges (cattle, pedestrian and vehicle) ;
- Silt traps
- Night Storage
- Safety stairs and ladders for villagers to exit in case of falls ;
- Wildlife passes ;
- Tiger fish barriers ;
- Wildlife fences;
- A trash rack against water hyacinth and debris at the water intake.

Creation of bylaws to regulate the use of the canal shall also be made to avoid people throwing garbage in the canal, building informal (and often dangerous) bridges, or degrading the canal. Therefore, maintenance shall be accompanied by some form of law enforcement.

Water user associations will be responsible for the maintenance of tertiary canals, small drains, and in field irrigation. It will also be important to train farmers and management entities in maintaining their drains and canals as well as not to use the canal as a waste dump. This is a major responsibility and requires a significant level of managerial and technical skills and physical resources (facilities and equipment). The creation and training of such water management entities is a major task and will require (i) enactment of the relevant legislation, (ii) significant social preparation, and (iii) intensive hands-on support and training at start-up and over the initial years of operation, and (iv) provision of facilities and equipment. Failure, or delay, in operationalising the on-farm management will result in inefficient use of water and poor system maintenance, with lower crop yields, wasted water, an increased risk of impeded drainage, groundwater rise and secondary salinisation, and significantly reduced project benefits.

In addition to trash rack sized to stop the water hyacinth, the current method to remove the water hyacinth at Kapichira reservoir (biocontrol using insects) shall continue on a regular basis to avoid having the plant invading canals and night storages.

8.14 Irrigated Agriculture

Most impacts on these topics are dealt with in the study called "Preparation and implementation of a Communications, Community Participation, Land Tenure and Resettlement Policy Framework" and its various components: Communication strategy, Gender and youth strategy study, Grievance redress mechanism, Resettlement Policy Framework, Stakeholders' views report.

8.14.1 Description of impacting activities

The impact matrix has identified the following activities and impacts:

- During construction, work will disturb cropping practices since some households will control physically different areas of land (**Disturbance to existing agriculture**). New lands may not be ready for cropping immediately because of timing, lack of water, or the need for land preparation including levelling, boundaries and drains.
- Work will require unskilled and skilled labour for construction creating local employments (**Job opportunities**).
- During operation of the scheme, people will have to change their habits in terms of livelihood strategies. People in the valley, while incredibly poor, adapt to their situation by having flexible livelihood choices depending on the environment. They grow cotton and maize if there is adequate rainfall. They have goats, cattle and chickens and move the cattle and goats around to whatever pasture is available. They fish in the river and floodplains. They grow maize (dimba farming) on the floodplain, following the river down so that the crops get the moisture in the soil and survive long enough to be harvested before the water table drops too low. These livelihood strategies will be profoundly modified by the project as people will rely mainly on irrigated agriculture. Any delays in the Project completion, adaptation from people to irrigated agriculture or skills acquisition could delay the benefits (**Potential delays in irrigated agriculture development**). The project relies on a knowledge-, inputs- and labour- intensive model of production at the field and household level. This model is untested at household level under the environmental, social, economic and institutional conditions prevailing in the study area. If the model is not feasible, there will also be a delay in project benefits as potential solutions are tested and applied.
- During operation of the scheme, increase in production from irrigated fields could lower price at local markets and affect rain fed producers (**Over supply of crops**).
- The project overall goal is to benefits local communities (**Benefits of irrigated agriculture**). The Project positive impact in term of income will bring indirect changes such as improved health and education, new agribusiness investments, economic development and increase in wage labor.

- During operation of the scheme, with less water in the Shire River, fishery in Elephant marsh could be impacted (**Reduction of fisheries**). Currently, fisheries are already declining due to rapid human population growth, there is also an issue with regulation and use of illegal gears. The project impact will create an additional pressure on this resource. Fishing is a particularly important livelihood activity in the eastern and southern parts of the marsh. The value of the fish caught from the marsh could be between US$1.5 – 8.8 Million per year (Anchor Environmental Consulting, 2016). The DRIFT report (Ecosystem Functional Model by Southern Waters in association with Streamflow Solutions, Anchor Environmental and MRAG for the SRBMP, 2016) does not foresee a reduction of open water surface (but depth) in the marsh (where most fishery takes place) however it foresees a reduction in rooted vegetation where spawning takes place.

The project construction and operation will require adaptation of livestock rearing activities (**Impacts on livestock rearing**). The canals and command areas will represent obstacles to movement of cattle mainly toward Elephant marsh and will reduce the land available for grazing. The presence of vast irrigated areas could lead to conflict between cattle owners and farmers. In addition, smallholder livestock farmers fear that they might be deprived of access to crop residues from SVTP which are likely to be sold to the highest bidder.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 62: Assessment of Impact Significance with respect to disturbance to exisiting agriculture, job opportunities and potential delays in irrigated agricultrure

	Disturbance to existing agriculture. New lands may not be ready for cropping immediately because of timing, lack of water, or the need for land preparation including levelling, boundaries and drains	**Job opportunities.** Work will require unskilled and skilled labour for construction	**Potential delays in irrigated agriculture development.** Any delays in the project completion or skills acquisition could delay the benefits
Value of the affected component	Highly valued		
Intensity	Medium	Medium	Medium
Extent	Local	Local	Local
Duration	Temporary	Temporary	Temporary
Significance	Minor	Minor (positive)	Minor
Occurrence probability	High probability	High probability	Potential occurrence

Table 63: Assessment of Impact Significance Related to oversupply of crops, benefits of irrigated agriculture, reduction of fisheries and livestock rearing

	Over supply of crops. Increase in production	**Benefits of irrigated agriculture.** The	**Reduction of fisheries.** Fishery could be	**Impacts on livestock** The **rearing.**
	could ɔwer prices and fed affect rain producers	project overall goal is to benefits local communities	impacted by SVTP	project will require adaptation of livestock rearing activities
Value of the affected component	Highly valued			
Intensity	Medium	High	Low	Medium
Extent	Regional	Local	Punctual	Local
Duration	Permanent	Permanent	Permanent	Permanent
Significance	Major	Major (positive)	Minor	Moderate
Occurrence probability	Risk (low probability)	High probability	Potential occurrence	High probability

8.14.2 Mitigation measures

DISTURBANCE TO EXISTING AGRICULTURE

According to the Resettlement Policy Framework (RPF), loss of annual crops would be avoided by starting the project after the harvest. In addition, the RPF has recommended the construction of bridges and footpaths across the canal to allow people to continue accessing their fields or to commute. These passages shall be built as the canal progresses and not at the end to avoid creating a long trench with dangerous embankments.

Land acquisition and land consolidation shall be planned in advance of construction, so that farmers have some time to adjust to their farming new conditions before the additional stress of physical construction. Land acquisition shall be phased according to the Project (Phases I and II).

JOB OPPORTUNITIES

As mentioned in the previous section, job creation shall bring benefits to the community as long as local employment is favored.

POTENTIAL DELAYS IN IRRIGATED AGRICULTURE DEVELOPMENT

Resources shall be provided to support the delivery of advisory services, adaptive research and development, the strengthening of research-extension-farmer linkages, the improvement of market linkages, and increased pluralism in market delivery. These resources could be provided by the Ministry of Agriculture, Irrigation and Water Development and the Proposed organizational setup presented in the Agricultural Development Planning Strategy study (PWC, 2016).

OVER SUPPLY OF CROPS

In order to avoid oversupply of crops at local market, the project shall focus on exporting crops and food processing. . Measures to mitigate the impact are developed in the in the Agricultural Development Planning Strategy study (PWC, 2016).

BENEFITS OF IRRIGATED AGRICULTURE

The overall goal of the Project is to increase livelihood of communities. The benefit from the Project will also influence several other socioeconomic indicators: general health and education level of the community, etc. These positive side-effects can be numerous and relatively easily achieved:

- Greater food security than rain-fed production and increase in the monetary income will reduce poverty and food shortage.
- Change in behaviour and acceptance of new mentality particularly associated with health.
- Increased access to efficient health system.
- Better access to schools.
- Development of agribusiness in the area.

Enhancement measures are well detailed in the Agricultural Development Planning Strategy where efficient organization of producers are proposed. Institutional measures will also be developed as well as assistance and training to producers once the Project starts.

REDUCTION OF FISHERIES

Impacts on fisheries has been compensated by creating fish farms in Phase 1. Factors to consider for fish farming are presented in the "Agricultural Development Planning Strategy" study (PWC, 2016). SVTP-II will expand fish farming in the command area so as to enhance income and food security.

IMPACTS ON LIVESTOCK REARING

Mitigation for smallholder livestock farmers were discussed in consultation meetings by the consultant in charge of the Agricultural Development Planning Strategy (PWC, 2016). The following mitigations reflect smallholder grievances:

- Construction of drinking spots along the main canals. Drinking spots shall take the form of pipes or cattle troughs. One cattle trough should be installed at each village at a location outside of it and on both side of the main canals. A first estimate would be 40

cattle troughs (20 on the western side and 20 on the eastern side) of which 10 will be in Phase 1. These troughs shall be made of concrete to limit seepage and the quality of concrete shall be equal to the quality of the lining for the canal. Their size shall be around 5 by 5 meters.

- Phasing the installation of people/cattle bridges as canal construction progresses is being undertaken to avoid creating a long trench without any passage for cattle.
- Construction of people/cattle bridges. People/cattle bridges shall be installed at each km along the main canals (a total of 133 people/cattle bridges),. Bridges shall be made of concrete and include high walls to avoid accidents. Establishment of conflict management structures at village level and guidelines to deal with farmer's conflicts.
- Formalization of the marketing of crop residues and organic manure to foster strong collaboration between livestock and irrigation farmers and to ensure reciprocal gesture in the disposal of crop residues by crop farmers in exchange for manure.
- In order to ensure that crop residues are available to smallholder farmers, small scale farmers shall have access to the crop residues realized from crops grown on their traditional land parcels.
- Some lands that cannot be farmed (see section on set-aside land) shall be designated as grazing areas and, if possible, planted with grass in consultation with livestock owners.
- Command areas form vast continuous patches of land outside of roads, urban places and rivers. They offer very few direct access to Elephant marsh grazing sites. It will therefore be important to designate cattle corridors so livestock can access the marsh. This will not only reduce the risk of conflicts between farmers and livestock owners but also the risk of conflicts with people living in urban place (Nchalo, Ngabu, Chikwawa). At this stage, these corridors cannot be proposed, but the Detailed Design study for Secondary Canals and infield works shall take this measure into consideration.

8.15 HEALTH AND SAFETY

8.15.1 Description of impacting activities

The impact matrix has identified the following activities and impacts:

- During construction, the public and workers are at risk from construction work along canals (**Construction risk and nuisances**). The main risks are related to collision and dust from vehicles and trucks. Other risks related to worker safety include:
  - Risk of public entering unfenced construction sites with dangerous machinery, blasting etc
  - Risk of construction materials extending beyond site boundaries and causing a hazard and nuisance to neighbours
  - Risk of falling into excavations, particularly at night
  - Risk of ground collapse in excavations
  - Risk of cement burns from prolonged working with wet concrete
  - Risk of disease and illness due to improper welfare facilities along the linear construction site

- Risk of drowning in water filled structures
- Risk of electrocution
- Risk of injury working with steel rebar
- Health hazards associated with working with hydrocarbons, paints, solvents, waterproofing and other construction chemicals
- Risk of silicosis and other health hazards from inhalation of dust
-

- During operation of the scheme, an increase of waterborne disease in the command area, mainly bilharzia, is expected (**Bilharzias**). Other diseases could see their prevalence increased due to the Project, for example as a result of coming into contact with chemicals used for pest management or weed control. The improper use of farm chemicals and fertilizers can also present an explosion risk.
- During operation of the scheme, the presence of canals and night storage may lead to drownings (**Drownings**).


Figure 80: Trucks and pedestrians sharing construction roads & rubbish in construction camps (Source: BRLi, 2015)

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 64: Assessment of Impact Significance for construction risk and nuisances, bilharzia and drowning

	Construction risk and nuisances. The public and workers are at risk from construction works along canals	**Bilharzias.** An increase of bilharzia in the command area is expected	**Drownings.** The presence of main canals may lead to drownings
Value of the affected component	Highly valued		
Intensity	Medium	Medium	High
Extent	Punctual	Local	Local
Duration	Temporary	Permanent	Permanent
Significance	Major	Moderate	Major

Occurrence probability	Potential occurrence	High probability	Potential occurrence

8.15.2 Mitigation measures

CONSTRUCTION RISK AND NUISANCES

The Contractor shall be required to undertake a risk assessment of all activities and design safe systems of work prior to undertakeing any activites. The apporoach to the risk assessment and arrangements for the safe system of work should be described in the OHS Manual, which is to be prepared, reviewed and approved prior to the start of any works. Key considerations will be:

- Vehicle speed and dust control on public roads (for example, dust control through the use of Venase where this doesn't present a risk to adjacent watercourses or disrupt wildlife)
- Provision of worker transport
- Trucks to be fitted with cargo nets/sheeting to prevent fall of materials
- Blasting protocol, that includes advance notice and checks to confirm absence of public and workers from blast zone
- Fencing signs and barriers to prevent unauthorized access to dangerous areas
- Shoring and supports in excavations
- Edge protection, fencing, lighting and warning signage for excavations
- Segregated pedestrian and vehicle routes
- Provision of appropriate and best practice PPE to respond to the risk assessment, including appropriate gloves and boots to prevent contact with wet cement
- Welfare facilities, including 'portaloos', hand washing facilities, cooking and eating facilities at regular locations along the work site
- Bunded and secure storage facilities for all chemicals, fuels and hazardous materials, with MSDS sheets and clear labelling of all containers
- Waste management processes, including for the safe collection, storage and disposal of hazardous materials
- Life preservers, throw ropes, fencing and warning signs to be present near areas of open water
- First aid and medical facilities equipped to respond to potential injuries at each worksite
- System for reporting, recording and investigating near misses, minor injuries and lost time injuries
- Emergency preparedness plans
- Reporting mechanisms for unsafe working practices, free from threat of retribution
- Induction, training and safety awaress schemes, including incentives and rewards

Figure 81: Working in damp condition around a pumping station (Source: BRLi, 2016)

The Supervisor Engineers TOR shall be explicit on the need to supervise health and safety and required the Supervising Engineer to have access to suitably experienced health and safety specialists to review and approve contractor submissions (OHSM, method statements, safe systems of work), to participate in training of workers, to audit and supervise the safety of construction activities, and to undertake investigations into incidents to ensure root causes of incidents can be properly established and system changes identified.

The bid documents shall require the contractor to prepare a Method Statement Implementation Plan for undertaking safe excavations, and shall require the operator to submit details of their safety protocols for working near water. These submissions from the bidders shall be considered as part of the bid evaluation process.

BILHARZIAS (ALSO CALLED SCHISTOSOMIASIS)

In order to reduce the burden of schistosomiasis, the following actions shall be implemented:

1) reduction of the contact between water and human by the use of boots and protective clothes. This reduction of contacts with water is feasible with farm workers but not with children and adolescents.

2) reduction of the infection of the snail's fauna by avoiding defecating in or near water and avoiding urinating in water. Health sensitization is the only efficient way to reduce the release of feces or urine in water. It only can be obtained by a long-term strategy of education including scholar education.

3) the elimination of the snails by molluscicides. This action is neither realistic nor sustainable at the scale of thousand hectares of irrigated area and hundreds of kilometers of canals. However, thorough and regular maintenance of the canals by the scheme operator and farmers, particularly the elimination of aquatic plants, reduces the proliferation of snails. Drying up canals during several weeks is also efficient. This will be done for secondary and tertiary canals after the dry season.

4) preventive mass campaigns of treatment with praziquantel. To be efficient, these campaigns have to be done with the entire population and repeated each year. Praziquantel is not an expensive drug and it is well-tolerated. It is effective against both urinary and

intestinal schistosomiasis, resulting in a reduction of the severe forms but not in an interruption of their transmission.

OTHER WATERBORNE DISEASES NOT DIRECTLY LINKED TO IRRIGATION SCHEMES

Soil-transmitted helminthiasis

Measures against **soil-transmitted helminthiasis** are:

- use of pit latrines for defecation
- washing hand after defecation
- protection of the feet by shoes
- protection of the food from flies

These measures are possible with the workers and generally with adults but more difficult to obtain from the children and adolescents. Systematic mass treatment with a deworming drug is not useful because of the apparently low level of parasitism in the area. Surveys among pupils would be of interest to confirm this low prevalence.

Cholera

Regarding **Cholera**, its prevention is similar with intestinal schistosomiasis but with a stronger implication: schistosomiasis is a chronic disease which does not kill (or rarely after a long delay without treatment) while cholera can kill in few hours. Defecation in pit latrines, hand washing with soap, access to clean water are the main weapons to prevent cholera transmission.

Cholera transmission is prevented by sanitation and by personal hygiene actions:

- Use of latrines for defecation or at least, defecation away from houses, paths, water pools and supplies, places where children play, etc. and covering feces with earth or sand ("The cat method" for ending open defecation).
- Handwashing with water and soap after defecation and before any contact with food or drink. Washing is efficient with any ordinary soap even with dirty water.
- Drinking safe water and safe water use for cooking, teeth brushing, children bathing. The easiest way to obtain safe water is to put 2 at 3 ppm of chlorine (five to ten drops of bleach for 10 litters of water). The disinfecting power of free chlorine persists from 24 to 48 hours. Malaria

As mentioned in the Baseline report, **Malaria** is not directly linked to irrigation schemes as the area is already surrounded by puddles, wetlands and dambos. Suppressing its transmission, given the environmental conditions of South Malawi lowlands, is not possible at the present time. However, the incidence of malaria attacks and their severity can be reduced.

The main action to minimize the incidence is to reduce the contacts between Anopheles mosquitoes and human beings by the use of insecticide treated bed nets during the night. The nets should be in good condition, well bordered. Depending on the insecticide, the fabric

and the manner of impregnation, this impregnation is efficient to repulse mosquitoes during six months to two years at best. Selling nets is more effective than distributing them for free (often, free mosquitos nets end up being sold as fish nets for quick cash). The increase in cash income associated with awareness can promote these purchases. The irrigation project may be a good opportunity to promote health education and use of bed nets for all, not only for children and pregnant women. House-spraying is not realistic, less efficient and use much more insecticide than the impregnation of the nets.

The best way to reduce malaria attack severity is a prompt and exact diagnosis and a prompt treatment by an effective drug. The Malawian ministry of health guidelines prescribe to use an oral artemisin combined therapy like arthemeter plus lumefantrine for uncomplicated attacks and parenteral artesunate for the severe ones. These drugs are highly effective. The prevention of the effects of malaria during pregnancy on the foetus is done by a preventive intermittent treatment with sulfadoxine-pyremithamine. At present time, various health structures in the Study area do not have any anti-malarial drugs. Improvement of the health structures in staff and in equipment is absolutely necessary to reduce malaria burden. However, nothing can be done regarding canal or drain design or the irrigation techniques to reduce the prevalence of malaria.

Onchocerciasis

Regarding **Onchocerciasis**, because of the strong link between the *Simulium* blackflies and running water in streams and rivers, there is no risk of invasion by these vectors of onchocerciasis in the lowlands along the bank of the Shire River and canals. The possible presence of *Simulium* larvae at the tiger fish barrier is more anecdotic than of health interest.

DROWNINGS

It is recommended to carry out sensitization at primary schools to inform children about the danger of canals. Children are curious and will inevitably “test” the canal; sensitization shall be on going and shall use simple illustrations and involve teachers.

It is also recommended to build large concrete stairs at each village crossed by a main canal (Feeder, Bangula and Supini). The primary purpose of these stairs would be to allow people to access water without danger. These stairs shall be large enough so that people can use them to fetch for water and clean their clothes (10 meters wide). An estimate, based on density of villages around main canals, gives about 40 stairs for the whole scheme (20 on the western bank and 20 on the eastern bank). It is not recommended to:

- build stairs on both side of a canal at any location, it could be interpreted as an invitation to cross the canal (especially at time of low low).
- build stairs north of Chikwawa as the area has very little population density (although this may change in the near future).
- decrease the slope of the canal bank as the canal could become available to cattle. Experience from a long canal in Namibia has revealed that not much could be done to evacuate a drowning adult cow anyway. In areas where ramps with gentle slope will be built for canal maintenance, the concrete shall have a higher coefficient of friction or shall be textured to improve grip (with a broom), gritty material can also be added to the

surface. This way, if an animal comes to drink it will have a better grip to exit the area. Access for cattle to these ramps shall not be encouraged (fence, etc.).

Stairs shall only be built at village level to maintain a certain level of control over the use of canal. To reduce the incidence of drowning, fixed ladders shall be fixed every 500 m on both side of the canal along the full length of the Feeder, Bangula and Supini canals (with alternating position as well). Fixed ladders shall be installed in night storages as well (as mentioned in the FS). Due to their greater depth night storages shall also be fenced.

It is also recommended that the general population be informed about the presence of the canal and the restriction of access and use that apply to people (no fishing, no canoe, no motor pump, etc.).

The water intake shall never operate rapidly; gates shall be opened progressively to avoid creating a sudden increase of water in the canal.

Discussions with irrigation specialists have raised one limitation with fixed ladders : as they are made of iron they often are stolen. Alternatives to iron shall be studied such as hard plastic (replaceable plastic railing) or recycled half rubber tires embedded in the concrete lining (with holes to avoid retaining stagnant water). Notches can also be made directly in the concrete to offer some grip to people trying to exit the canal.

8.16 GENDER ASPECT AND VULNERABLE PEOPLE

8.16.1 Description of impacting activities

- With increasing yield, the project may add a burden to the workload of women (**Increase workload for women**). However, on the other hand with **improve access to water** thanks to the presence of canals, women will travel shorter distance to get domestic water (fetching for water is “traditionally” done by women). Water shortage and distance to travel to collect water are serious constraints in the study area.
- Access to financial services is a strong barrier to women and youth empowerment (**Risk of unfair distribution of benefits**). Women often depend on their own capital and other informal sources of capital. In the study area, businesses owned by women are less likely to be registered by government authorities compared to those operated by men. This makes women less likely to access credit from formal banks as they would not have certificates of registration.
- Landless people and squatters could be disadvantaged by the project (**Impacts on vulnerable people**).

Table 65: Assessment Matric for increased workload for women, improved access to water, risk of unfair distribution nof benefits and impacts on vulnerable people

Increase workload for women.	The Project may become a burden to the workload of women but on the other hand time spent to get water should decrease with **Improved access to water**	**Risk of unfair distribution of benefits.** Access to financial services is a strong barrier to women and youth empowerment	**Impacts on vulnerable people.** The Project benefits may not reach vulnerable people
Value of the affected component	Highly valued		
Intensity	Low (the negative impact is counterbalanced by the positive effect)	Medium	Medium
Extent	Local	Local	Local
Duration	Permanent	Permanent	Permanent
Significance	Minor (positive)	Moderate	Moderate
Occurrence probability	Potential occurrence		Potential occurrence

8.16.2 Mitigation Measures

The Gender and Youth Strategy Study (COWI, 2016) has developed a series of measures to mitigate impacts from the Project in the "Proposed guidelines and activities" section. These measures aim at the preparatory phase as well as the Project implementation stage.

The following are mitigation measures that are developed in the Gender and Youth Strategy Study (COWI, 2016).

PREPARATION PHASE

Preparation phase are measures that were already implemented by the consultant (COWI, 2016).

Recruitment and capacity of consulting /project teams/missions

- Ensure that all terms of reference for consultants and staff have a gender aspect/expert in them ;

- Train/orient all project staff and consultants on gender and youth issues, including orienting them on SVTP ;
- Where possible, ensure that the composition of staff at all levels is at least 50% women, to be in line with the 50:50 policies.

Implementation of stakeholder consultation process, community mobilisation and engagement for the SVTP

- Implement communication activities at all levels in the project area (ADC and VDC levels)
- Develop community mobilisation guidelines that incorporate gender issues.
- Ensure information education and communication materials are accessible to the illiterate, especially women.
- Ensure women, youth and the poor are included in all field level activities, meetings and capacity building processes.

Preparatory studies, baselines data collection, analysis and reporting

- Orient all enumerators on gender and youth issues related to Chikwawa and Nsanje
- Ensure that all data collection instruments are able to collect gender and youth disaggregated data.
    - Ensure that all data collection tools are gender/youth-audited by the CCPLTRPF Gender and Youth Expert
- Ensure that data is analysed and disaggregated by sex and age to capture gender and youth issues.

Institutional development and formation of irrigation options, water user institutions, SVTP governance and management committees

- Ensure that gender and youth issues are used as criteria for choosing the SVTP irrigation institutional model.
- Ensure that women, youth and poor people are represented and actively participate in irrigation management entities
- Train all irrigation management entities on gender and youth issues
- Ensure women, youths and poor are included in the management, governance, implementation and technical teams of SVTP
- Build capacity of individual farmers on gender and youth issues, including decision making at household level
- Ensure no discriminatory practices are being used to limit participation of women and youth.
- Ensure that voices of women, youths and poor are heard by management of the water management entity
- Implement positive discrimination, if the irrigation or water users committees do not have representation from women, youths and the poor

Land redistribution, resettlement policy framework and grievance mechanism

- Ensure that PAPs are gender, age and poverty defined, so that it is known who is most affected by resettlement
- Ensure that women, youths and poor are also provided with land in the schemes. Government can lease off land and reallocate equitably amongst beneficiaries.
- Ensure that women and youths and poor who lose land are appropriately compensated. During compensation, ensure that all household members have access and control of the compensation by adopting a household livelihood and planning approach that is being implemented in Chikwawa by the Ministry through IRLAD project.
- Ensure that District Council teams, Committees and experts that value lost assets during compensation, value land as well, not just structures on it.
- Ensure that District Council teams, Committees and experts that value lost assets during resettlement planning do not sexually abuse women or girls (or any form of gender based violence)
- Ensure that land assessment teams include women and youths and ensure that land losses of female headed households are assessed by female officials/experts. Whoever does the valuation should be gender trained.
- Ensure that gender and youths sensitive spaces are created for women to lodge their grievances on unfair practices.
- Ensure that grievances by women are handled by women. Traditional leaders should ensure that women are included in any primary justice structures that they have in place or are to be created.
- Encourage land being registered jointly in the name of the woman and the man.

Impact on Socioeconomic, Cultural and Natural Heritage

Monitoring and evaluation of gender and youth activities

- Ensure that the intervention logic of any project being designed has SMART and gender and youth sensitive indicators and take into account poverty
- Ensure that monitoring the progress made in applying gender and youth approaches in irrigation projects is regularly undertaken.
- Ensure that all indicators at input, output, outcome and impact level are disaggregated by gender, age, household headship, location and marital status, where necessary. Indicators that can be used are included in the annexes.
- Ensure that programme targets are gender and youth disaggregated
- Ensure that monitoring and evaluation terms of reference and teams have gender and youth expertise.

PROJECT CONSTRUCTION AND OPERATION PHASE

Policy level commitment to mainstream gender and youth issues in the SVTP

- Promote SVTP as multiple-use (irrigation, domestic and livestock uses) irrigation and water programme.
- Ensure that women enjoy de jure and de facto equality in access to land and other property, including inheritance and purchase.
- When water management institutions do not have any or few women and youth, introduce appropriate institutional measures, such as minimum quotas for women and youth to increase participation of women and youths
- Provide improved coordination among concerned water management institution to facilitate the implementation of multiple-use water projects.
- Support equal employment opportunities in water management institution for both genders and for youth and older people.
- Provide and support capacity building around gender and youth issues in water management entities with particular attention to extension staff.
- Ensure effective linkages with gender and youth ministries and CSOs

Land administration, allocation and tenure arrangements for women, youth and poor people

- Conduct participatory assessments to understand the social organization of agricultural production and the specific gender and youth division of labour in the project area.
- Implement mechanisms to ensure that the landless are also provided land and participate in irrigation activities
- If irrigation schemes involve land titling or retitling, new land titles should be granted to women or to husbands and wives jointly. Youth should also be included.
- Disaggregate land ownership data by gender and age to understand land ownership issues amongst women and youth.
- Conduct local/grassroots advocacy work with traditional leaders to improve land ownership by women and jointly by woman and man
- Ensure that irrigation schemes have both commercial as well food security objectives by adopting integrated farming systems, nor jus commercial mono-cropping

Construction of various irrigation infrastructure and installation of equipment

- Ensure that women and youth are involved so that they also benefit from the employment created, where feasible.

  Ensure gender sensitive resettlement in terms of targeting, compensation and provision of services to new locations.
- Provide social safeguards to protect women and girls from being sexually abused

Gender and youth division of labour

- The irrigation scheme should provide labour for irrigation activities in the farm. The irrigation model should not allow farmers to work using their own labour in the blocks.

- Ensure that planners involved in the projects are aware of women's and youth contributions to farm and household production to enable them design plans that are appropriate for women.
- Irrigation designs should carefully evaluate the availability of women's and men's work in the family and expected impacts of intervention on women's and men's income, time use, and social power.
- Community labour contribution to irrigation projects should take into consideration the contribution of women and men at household level. Where possible, this labour should be for to compensate for time lost.
- Provide appropriate labour and time saving technologies to those beneficiaries, especially those who are already overburdened with labour at household level.

Access and control over economic and social benefits from participation irrigation services

- Income from irrigation at household level should be transparently used by adopting participatory expenditure management at household level
- Provide equal access to training, finance/credit and related irrigations services for men, women and youths.
- Provide training opportunities for the youth and women in advocacy and engagement and inclusion
- Provision and promotion of (agriculture-related) vocational skills for youths which will enhance the growth of the sector
- Monitor use of irrigation income/earnings at household level

Water user organizations and other institutional arrangements.

- Ensure that by-laws of irrigation schemes/WUAs or its constitution provide equal opportunities for all members. Ensure that it has some affirmative actions that favour the disadvantaged groups.
- Ensure that there are no discriminatory practices that are being used to limit participation of women and youth, even when bylaws provide for equal opportunity. These may include high membership fees, landlessness, access to water etc.
- Implement positive discrimination, if the criteria for irrigation scheme or WUA membership is discriminatory

Socio-economic empowerment of women and youths in and around irrigation schemes

- Improving access to finance to enable women and youths participate in irrigation technology and value addition
- Integrate/promote village loans and savings and income generating activities in irrigation schemes
- Training women and men on human rights and the importance of women's participation in decision making at all level

Introducing functional literacy classes in water management institutions to improve women's and illiterate men's ability to read and write so that they can effectively participate in agricultural decision making processes

Designing and implementing multiple use irrigation services

- Implement a strong consultation process during the planning and implementation stages to understand gender dynamics
- During implementation, conduct training programs addressed to women to help them manage and maintain the points of supply will also be necessary. Ensure that planners understand women's and girls' water needs as women and girls will be the main users of those watering points
- Translate multiple water needs into affordable small- and medium-scale technical irrigation designs
- Ensure that water points are created for domestic and other social uses, especially livestock.
- Introduce community water points because tap water may not be feasible as houses are not mostly permanent.

Irrigation scheme management and farmer management

- Ensure that all farmers consolidate their land so that no single farmers is identified by or works on their own land.
- When forming groups, ensure that membership fees are affordable and those that cannot afford are supported with cash transfers to be able to pay
- Adopt management arrangements that have been used for the Phata Irrigation Schemes where possible
- Ensure that farmers are organised in a way that ensure women and youth participate in the activities of the scheme and benefit from it
- Implement gender training programmes for staff and communities around the schemes
- Implement gender sensitive transparent and accountable irrigation revenue management
- Adopt agronomic principles that use technology other manual labour and ensure that farmers are paid when they provide labour.

Reaching the poorest and most vulnerable groups

- Ensure that the vulnerable and often-overlooked groups such as women, youths, PLHIV, elderly, landless workers and poor women farmers are included in all stages, including during consultation, resettlement and land reallocation, during implementation and monitoring and evaluation.
- In order to determine the vulnerablesrapid vulnerability assessments should be included in the consultation processes.

Monitoring and evaluation of gender and youth activities

- Ensure that the intervention logic of any project being designed has SMART and gender and youth sensitive indicators
- Ensure that monitoring the progress made in applying gender and youth approaches in irrigation projects is regularly undertaken.
- Ensure that all indicators at input, output, outcome and impact level are disaggregated by gender, age, household headship, location and marital status, where necessary. Indicators that can be used are included in the annexes.
- Ensure that programme targets are gender and youth disaggregated

  Ensure that monitoring and evaluation terms of reference and teams have gender expertise.

Gender and youth capacity building and sensitization at various level

- Cabinet level:
  - Presidential directives
  - Gender and youth briefings and awareness sessions
  - Policy briefs on gender and youth
- Ministries and departments:
  - Establish focal points in ministries
  - Train planning and monitoring and evaluation officers on gender and youth
  - Joint planning and monitoring teams - Technical support on gender and youth
- District Executive Committee Members :
  - Allocate resources for gender and youth analysis, gender and youth training and mainstreaming
  - Train of the District Executive Committee on gender and youth
  - Establish focal points in sectors
  - Joint planning and monitoring teams - Technical support on gender and youth
- Community structures :
  - Orient local leaders (such as Councillors, Traditional Leaders, Religious Leaders on gender and youth issues and women's and youth' rights
  - Train of the ADCs, VDC and AECs on gender and youth
  - Conduct gender and youth analysis together with District and Community Teams
  - Train community-based volunteers in gender and youth issues such as gender and youth participation in decision making
  - Conduct participatory gender and youth analysis, planning and monitoring at community level
  - Establish local gender and youth forums or advocacy groups
- Household level :
  - Sensitisation of men, women and youth on the roles and importance of women and youth and women's and youth' rights

In addition, impact on landless and vulnerable people is addressed in the Resettlement Policy Framework (COWI, 2016), this will be further be studied once the Resettlement Action Plan is produced.

8.17 CULTURAL HERITAGE

8.17.1 Archaeology and Cultural Heritage

Detailed work was undertaken during the preparation of the ESIA to identify locations of cultural heritage importance and are areas of potential buried archaeology. Surveys of the areas to be affected either by canal infrastructure or the creation of the command areas were undertaken (as described in the ESIA) following which salvage archaeology was undertaken within Phase 1 area to rescue and safeguard high priority artifacts prior to the start of construction. The reason for that is that Malawi's national heritage legislation requires rescue excavations of sites at risk of destruction from development.

In addition, a chance finds procedure was implemented during the construction works in Phase 1. This procedure has been revised to include ESS8 Guidance Note and AFDB OS1 Guidance Materials on Chance Find Proceduresn in Phase 2, under the same management arrangements and using the same providers for the Archaeological rescue works

8.17.2 Rescue of Archaeological Investigations in Phase 2

Archaeological sites that will be impacted negatively by the Project's activities in Phase 2 and that indicate high scientific value for study and analysis will also undergo excavations before any land transformation activities commence. This program will be facilitated by PMT, who will engage the Department of Antiquities to undertake the works. The MDoA under the auspices of the Ministry of Culture is responsible for issuing of permits to conduct archaeological excavations in Malawi, and PMT will liaise with MDoA to obtain the necessary permit prior to commencement of the rescue.

Locations for Archaeological Rescue Excavations

The presumption is to preserve known areas of interest insitu, without disturbing them. However, sites that are categorized in the ESIA as being of high priority will undergo controlled archaeological rescue excavations, where they occur in areas that will be affected by construction activity. Based on the FS canal alignment and command areas, and the site prioritization classification described in the ESIA, the sites listed in Table 6 would be expected to undergo rescue excavations before Project launch. However, only once the detailed design is complete will the investigations be undertaken, to ensure that only those features on the actual Canal alignment routes and affected by the actual localization of command areas will be rescued.

Table 9: High Priority sites that may be affected in Phase 2

High Priority Sites	Data	Coordinates & location	Impacted by the Project
CK46	Decorated pottery. Elevated open air site behind PAPa James' concession; dense surface scatters of archaeological material	698155 E 8212354 N Zone I 1, Mwanza River	Yes (Situated in irrigation zone)
CK55	Decorated pottery, stone artefacts, daga remains (house remains). Flat open air site in cultivated field with dense surface scatters of archaeological material	687513 E 8222782 N Zone I 1 Nthumbe River	Yes (45 m west of current Canal RoW)

CK62	Decorated pottery, daga remains (house remains). Elevated open air site with dense surface scatters of archaeological material	688002 E 8214624 N Zone A Mologeni Village	Yes (55 m east of current Canal RoW)
CK64	Decorated pottery, daga remains (house remains). Elevated open air site with associated termite mound; dense surface scatters of archaeological material	688010 E 8214841 N Zone A Mologeni Village	Unclear (ca. 125 m west of current Canal RoW)
CK76	Pottery well embedded in the soil (primary context). Flat open air site behind modern household; dense scatters of archaeological material	680679 E 8205290 N Zone A Ndakwera Village	Unclear (at the edge of irrigation area)
CK77	Pottery well embedded in the soil (primary context). Flat open air site in between modern households; dense scatters of archaeological material	680669 E 8205162 N Zone A Ndakwera Village	Unclear (25 m west of irrigation area)

The archaeological sites listed in Table 6 are considered as high priority for controlled archaeological excavations as they exhibit dense scatters of surface material as well as decorated pottery that is well embedded in the soil. Investigating these sites will hopefully yield an undisturbed stratigraphic sequence for purposes of site reconstruction and dating.

Excavating High Priority Sites

High priority sites will be excavated by hand, using trowels, hand mattocks, shovels, etc. by natural and/or arbitrary levels. All soil will be screened with sieves. During the course of the excavations, artifacts such as pottery, chipped stone, and slag will be collected for processing. If present, bone, shell, charcoal (for radiocarbon dating), and other organic materials will also be collected. Soil samples may be collected for later processing for extraction of datable carbon or to assist in the identification of various stratigraphic levels. Complete and accurate notes of field procedures and results will be maintained and excavations documented with photographic maps, profiles, and plan drawings.

Laboratory Processing and Curation

Laboratory analysis is an interpretive step in an archaeological investigation. While on-site evaluation collects data, laboratory processing and analysis summarizes these data and allows meaningful statements regarding the site. Laboratory processing will include washing, sorting, cataloging, and tabulation of collected materials. These may be considered preliminary steps to analysis.

All artifacts and copies of all site forms, notes, reports, photographs, and maps generated from the identification, management, and analysis of cultural properties will remain the property of Malawi and will be deposited at MDoA. Some artifacts could also be displayed at the Tisunge! Lower Shire Heritage Centre at the entrance of LNP.

Specialized Analysis of Collected Artifacts

If feasible in Malawi, collected artifacts could be further analysed using various techniques ranging from visual analysis by specialists to specialized dating techniques (*e.g.,* C-14 analysis) (at specialized facilities). A major emphasis of analysis is the dating of sites. Dating techniques may include:

- Analysis of diagnostic artifacts, such as ceramics, and chipped and ground tools
- Radiocarbon dating, and
- Analysis of geological strata.
- Another emphasis would be the faunal analysis of bone material, pollen and/or soil analysis

Rescue Archaeology Report Preparation

Report preparation and scientific analyses will conform to current internationally accepted practices. Publications in peer-reviewed journals and conference papers on the results of the studies are a positive way in which the Project can meet its obligations regarding transmitting heritage information to the wider public.

8.17.3 Archaeological Monitoring, Contractor Awareness Training and Chance Finds Procedure

In areas affected by works in Phase 2, the initial clearance and top-soil strip shall be supervised, and a Chance Finds Procedure shall be required. To ensure this is effective, the Contractor's workers will be trained to know what to look for.

8.17.3.1 Archaeological Monitoring of Land Transformation Activities

Recognizing archaeological features poses a great challenge to the untrained eye, a professional team from MDoA will be engaged to carry out an initial one to two months period of archaeological supervision and monitoring when works start at Phase 2. This team will also provide training and awareness to Contractor personnel, and particularly the Contractor's Environment Specialist who will be responsible for ensuring all relevant workers are briefed.

The types of remains that might be uncovered during land-transformation activities include:

- Unknown burial places: They often have negligible surface visibility and can be encountered in many locations. Human bones, in an archaeological context, are normally light brown to dark brown, and are often easily distinguishable from surrounding sediments. In contrast to most of the animal bones that would be present in a midden deposit, human bones are usually intact. However, many human burials can be incomplete or contain scattered, partially decayed bones that fragment easily. Also present may be funerary objects associated with the burial. All burial sites must be reported immediately.
- Archaeological deposits: archaeological deposits can be darker than surrounding sediments and can be distinguished from natural soils by the following attributes, individually or in combination: black soil, patches of reddish brown or yellow-brown fire-stained (oxidized) sediments, scatters or concentrations of archaeological material such as pottery, stone tools, metal implements and slag.

Monitoring land-clearing activities will assist in determining if deeply buried subsurface deposits are present within the Project area. Monitoring is defined as active observation of earth-moving or other work that could adversely affect cultural resources within the Project Area and includes, as warranted by circumstances: observation, data recording, data recovery, archaeological excavation, photography, laboratory analysis and cataloguing, ancillary special studies, and production of a written report that meets current professional archaeological standards. Such monitoring activities are conducted by qualified archaeologists from MDoA.

Monitoring, will achieve several objectives:

- To ensure that a site is avoided (including checking to ensure the boundaries of a site are properly fenced, or marked) and/or not inadvertently damaged if it is buried;
- During and just after surface clearing activities, to collect surface artifacts and record features uncovered during clearing, and
- During earth moving activities (grading, trenching) to assess if buried sites are present.

To facilitate this, archaeological monitoring will occur during the clearance of vegetation and topsoil strip of the canal infrastructure works, as specified by the archaeological specialists.

If potentially important cultural materials are encountered during construction, work will halt, and the immediate area protected until the archaeological monitoring team evaluates the find. If the Project archaeologist determines that the discovery is important, appropriate salvage excavations will be formulated and implemented (see below "Salvage Excavations").

8.17.3.2 Report Preparation

The archaeological specialists will be required to prepare a report detailing the works and scientific analyses performed. The report will conform to current internationally accepted practices. Publications in peer-reviewed journals and conference papers on the results of the studies are a positive way in which the Project can meet its obligations regarding transmitting heritage information to the wider public.

8.17.3.4 Contractor Training and Awareness Program

The archaeological specialists will train the Contractors' personnel involved in site clearance and soil strip, and the Contractor's Environment Specialist, on the works that they are doing, the arrangements that they have for the works and on the identification of artifactual materials and bones, which might be found in the Project area. The archeological specialist will also train the Contractor's personnel on the Chance Finds Procedure for reporting the discovery to supervisory personnel. The training will make it clear that any artifacts discovered are the property of Malawi, and after recording, analysis, and cataloguing that they will be prepared for curation at a national institution.

8.17.3.5 Chance Finds Procedure and Salvage Excavation

In line OS1 of the African Development Bank[11], *a chance find procedure is a project-specific procedure that outlines what will happen if previously unknown heritage resources, particularly archaeological resources, are encountered during project construction or operation*.

The procedure includes record keeping and expert verification procedures, chain of custody instructions for movable finds, cultural heritage awareness raising sessions for the construction workforce, and clear criteria for potential temporary work stoppages that could be required for rapid resolution of issues related to the finds. It is important that this procedure outlines the roles and responsibilities and the response times required from both project staff, and any relevant heritage authority, as well as any agreed consultation procedures.

In line with OS1, the project shall not remove any physical cultural heritage unless the following conditions are met:

- No technically or financially feasible alternatives to removal are available.
- The overall benefits of the project substantially outweigh the anticipated cultural heritage loss from removal.
- Any removal is conducted in accordance with relevant provisions of national and/or local laws, regulations, protected area management plans and national obligations under international laws.
- Any disturbance or removal is not done until appropriate consultation with local communities has been carried out, taking full account of traditions, beliefs and cultural norms.
- Any removal employs internationally accepted best available techniques.

Considering the considerable volume of soil that will be excavated, the Project will apply a chance finds procedure, to set out what is to be done when cultural heritage objects are unexpectedly uncovered during works, especially during the absence of an archaeological monitoring team.

In pursuit of OS1, SVTP will ensure that the following procedures are followed:

- Work should be stopped in the vicinity of the finding (very often work can be continued at another part of the project to avoid costly delays)

[11] AFDB (2015), Integrated safeguard Systems Guidance Materials, Volume 2

- Notify the Supervising Engineer or his/her designee. The finding should be treated as a cultural heritage incident and reported.
- Notify the Malawi Department of Antiquities in the case of any archaeological or palaeontological finds.
- Use heritage experts and relevant community members to assess the significance of the discovery, and report it as required by law.
- Seek advice from the Supverising Engineer on the right way to manage the discovery. The Supervising Engineer, will provide the advice following consultation with the relevant community groups and/or relevant archaeologists.
- Resume work if permitted and agreed by the Supervising Engineer, following clearance of the Department of Antiquities.

8.17.3.6 Salvage Excavation

Data collection during excavation can provide important information concerning a site. Examination of the pit excavation profile often reveals a range of features, which may not be obvious in smaller excavation units. Cleaning and examination of the excavation profile can reveal buried sites, features (e.g., hearths, pits), and concentrations of artifacts. Based on the type of artifacts and features found, samples of artifacts, and soils may be removed for further analysis and processing; detailed photographs should be made, and profile drawings completed.

Sites deemed as of high priority for salvage excavation, will be tagged and potentially damaging activities in the vicinity will be halted to allow the monitoring team enough time to salvage-excavate the discovered features. Sites that are problematic to classify may undergo shovel test pits. Shovel test pits or augers may be used to excavate small holes to a depth of approximately one meter below surface during surface survey activities. The purpose of these excavations will be to rapidly verify the horizontal and vertical extent of a site's cultural properties and its scientific importance.

The main purposes of archaeological rescue excavations are to:

- Determine depth of cultural deposits;
- Determine presence/absence of various kinds of artifacts, charcoal, structural remains, and human remains;
- Delineate further site boundaries;
- Delineate further site age;
- Collect special samples (radiocarbon, slag, pollen, etc.).

8.17.4 Description of impacting activities

The impact matrix has identified the following activities and impacts:

During construction, excavation of the canal will affect some known and unknown cultural heritage sites mainly pottery (**Loss of physical cultural heritage**). No sacred sites will be affected by the canals. Based on COWI work (2016):

- The actual main canal alignment is not running through graveyards with the exception of one case where a branch canal is crossing a graveyard. The canal alignment is proposed to be modified to avoid this situation.
- Religious structures, such as local churches and other places of worship, were also recorded as points of special interest during the land use mapping by COWI. A significant number of religious structures were identified, but none will be affected by the main canal or the branch canal alignments.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 66: Assessment if Impact Significance for Loss of physical cultural heritage

	Loss of physical cultural heritage. During construction, excavation of the canal will affect some known and unknown cultural heritage sites.
Value of the affected component	Highly valued
Intensity	Low
Extent	Punctual
Duration	Permanent
Significance	Minor
Occurrence probability	High probability

8.17.5 Mitigation measures

Due to the identification of 87 cultural heritage sites (46 by the MDoA and 41 by BRLi), of which more than half might be impacted by the Project's land-transformation activities, mitigation measures will be necessary.

The World Bank's ESS 8 (Cultural Heritage) states that "as an integral part of the EA process, the borrower develops a physical cultural resources management plan that includes measures for avoiding or mitigating any adverse impacts on physical cultural resources, provisions for managing chance finds, any necessary measures for strengthening institutional capacity, and a monitoring system to track the progress of these activities". This management plan needs to be consistent with the country's overall policy framework and national legislation and needs to take into account institutional capabilities with regard to physical cultural resources.

SVTP will, in addition to ESS8, apply the Operational Safegard 1 (OS1) of the African Development Bank in guiding contractors on chance find procedures.

Concerning the institutional capabilities of managing physical cultural resources, it is important to mention that Malawi has limited financial and professional resources to implement holistic cultural heritage management projects. Under these circumstances, a strategy of avoidance of all sites as the primary goal of the project, is not achievable. The fact that considerable numbers of archaeological sites have been discovered and many more sites may be buried underneath the surface, indicates the high probability that the sites buried underneath the surface will be revealed once land-transformation activities start.

PHASE 1: PRE-CONSTRUCTION DATA COLLECTION

The following measures shall be implemented before construction starts:

- **Artifact collection** using hand excavated shovel pits or augers to assess the depth of sites and range of artifacts and controlled excavation of high priority sites. One element is to be noted: many of these sites were identified in or along rivers in 2016 by the consultant and there is a chance that flash floods have washed them away;

- All artifacts collected shall be catalogued and described, and curated in Malawi through a governmental institution (MDoA). Artifacts could be exposed in the valley at the Tisunge! Lower Shire Heritage Centre at the entrance of LNP;
- Appropriate analyses of collected artifacts such as ceramics, copper objects and slag, etc. will be completed as they are collected;
- A report will be issued describing and interpreting the cultural resources found and placing them within a broader cultural-historical framework; and
- Publication of results in peer-reviewed journals.

PHASE 2: MITIGATION PLAN DURING CONSTRUCTION (FOR DETAILS SEE MANAGEMENT PLAN)

During construction, the following mitigations shall be implemented:

- Contractor training and awareness program based on identified cultural sites, sacred sites and graveyards;
- Selective archaeological monitoring of surface clearing and earth work during construction in areas with poor surface visibility and/or a high probability for cultural resources buried below the surface; assessment of artifacts recovered during land transformation activities; training of Malawian students in archaeological monitoring;
- Salvage excavations at sites deemed as of high priority;
- Once the initial period of archaeological monitoring and salvage excavations is over, the Project will apply Chance Find Procedures as stipulated in the construction contract including the Works Requirements and Management Strategies and Implementation Plans (MSIP).

8.18 NATURAL HERITAGE

This section describes impacts on parks on a socioeconomic aspect (tourism, management and infrastructures). The section on "Terrestrial habitat and wildlife" discusses impacts on parks from an ecological point of view (wildlife movement, etc.).

Measures have been developed in close consultation with concerned park management.

8.18.1 Description of impacting activities

The impact matrix has identified several activities and impacts presented in the following sections.

8.18.1.1 Decision on the type of canal and its alignment route

During pre-construction stage (design stage), decisions regarding the canal layout will have long term consequences on parks. The current canal alignment route (based on the FS) is 2.45km inside Majete Wildlife Reserve and 14km inside Lengwe National Park (Bangula canal). Technical studies have evaluated the feasibility of several options inside Majete to minimize impacts. Detailed design studies are underway for Main Canal 2 that includes the

LNP section. This section presents some base case scenarios that were taken into consideration during the detailed design of the canal through Majete Wildlife Reserve, and will be considered further for the detailed design of Phase 2.

OPEN VERSUS CLOSED CANAL

Table 67: Impacts Assessment of Open versus unopen canal in MWR and LNP

Majete Wildlife Reserve (managed by African Parks)	**Lengwe National Park (managed by the Government)**

An open canal leads to significant impacts as:
- An open canal is not compatible with touristic activities as the Feeder canal passes in the "High Intensity Tourism Zone" and that it will have to be heavily fenced or walled to keep large animals (elephants, hippo, crocodiles, etc.) from entering the canal and :
  - Risking their life (the canal will be a death trap)
  - Damaging the canal
  - Using the canal as a pathway to access areas outside the reserve and entering in conflict with communities
 	
An open canal will represent a physical and aesthetic barrier for tourists; MWR will lose its attractiveness in the eastern side of the Park.
 	
From discussion with African Parks, a closed canal is the favored of the two options as it will minimize impacts on several level (tourism, wildlife movement, risk of drowning, etc.)
	An open canal leads to impacts as:
	- The open Bangula canal will pass through the "Central Wildlife Viewing Area" which is the area where most wildlife are located and tourists are visiting the park. An open canal may lead to, depending on its layout, significant wildlife drownings.
	
	However, in LNP, an open canal can be seen as an opportunity to provide water for wildlife since the park suffers from water shortage.

EARTH VERSUS LINED

Table 68: Impacts assessment of earth versus lined canal in MWR and LNP

Majete Wildlife Reserve (managed by African Parks)	Lengwe National Park (managed by the Government)

Earth canals look more natural than lined canals. Therefore, having a lined canal has an impact on landscape. Lining in canal is one of the factor that leads to drownings as concrete gets slippery and the smooth surface of concrete does not allow animal to have a good grip.

CURRENT ALIGNMENT ROUTE OF THE CANAL

Table 69: Impact assessment of current alignment canal in MWR and LNP

Majete Wildlife Reserve (managed by African Parks)	Lengwe National Park (managed by the Government)
The current alignment route of the canal which runs along a 2.45 km route inside MWR could	The current alignment route of the canal which runs along a 14 km route inside LNP leads to
be optimized to short cut the reserve as it leads to numerous impacts (as presented in sections hereunder).	numerous impacts. However, there is no possible short cuts for a gravity canal (as presented in sections hereunder). A canal may become an opportunity for wildlife if properly designed, as water is scares in LNP.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 707~~068~~: Impact Assessment Matrix for canal and its alignment

	Decision on the type of canal and its alignment. Decisions regarding the canal layout during the design stage will have long term impacts on parks
Value of the affected component	Highly valued
Intensity	High
Extent	Local
Duration	Permanent
Significance	Major
Occurrence probability	Potential occurrence (as no decision will probably be made before the Design study)

8.18.1.2 Tender process and selection of a construction contractor

During pre-construction phase, the tender process for the selection of the project construction contractor represents a high risk for parks (and all other social and environmental components) as it is a crucial step in binding environmental measures. This tender process represents a high risk for MWR and LNP for several reasons:

- The construction contractor may not have any environmental sensitivity nor a proactive attitude (no environmental policies or no expert among its staff, etc.), or may not have any experience in work in sensitive areas such as parks.

- The tender document and the contractor's contract may not include sufficient binding environmental measures or may not have any leverages in case of non-compliances.
- Parks management need efficient and clear lines of communication with contractor and the Supervising Engineer, in the event of non-compliance with requirements.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 71: Assessment of Impact Significance based on tender process and selection of construction contractor

	Tender process and selection of a construction contractor. The tender process for the selection of the Project construction contractor represent a high risk for parks as it is a crucial step in the development of binding environmental measures
Value of the affected component	Highly valued
Intensity	High
Extent	Local
Duration	Temporary
Significance	Major
Occurrence probability	Risk (low probability)

8.18.1.3 Impact on tourism

Construction activities in MWR and LNP will have a detrimental impact on the enjoyment of the parks, and is expected to affect tourism from a financial point of view, especially at MWR since:

- Aesthetic aspects of tourism will be compromised at the Kapichira dam with the water intake structure and make this location no longer viable for tourism.
- Work will create visual disturbances to visitors and impact the natural experience during the construction process. Physical excavation, blasting and terracing along the path of the canal and access roads will affect landscape.
- Noise from equipment will impact visitors experience at day visitor center, headquarters and Thawale lodge. The path of the canal passes close to the community campsite and during construction will make this a very unattractive destination and as a result affect business at the campsite. The revenue from this campsite goes directly to the community which they utilize for social welfare and community projects. This revenue will be significantly impacted due to loss of business during construction.
- Work will lead to intense truck traffic inside MWR, most likely along Mkulumadzi Road (because of topographic constraints and cliffs, the access road along the Feeder canal route will most likely not be practicable for trucks). An estimate of 100,000 m^3 will be excavated for the canal in addition to the 560,000 m^3 to 640,000 m^3 of dredged sediment at the reservoir (water intake) (Artelia, 2016). Depending on the duration of work inside MWR, this will lead to a tremendous amount of trucks passing inside the reserve as shown in the following table.

Table 72: Estimation of the number of trucks

Indicative work duration inside MWR*	Number of trucks passing through the reserve (given a load of 25 m^3 per truck) for a total of 100,000 m^3 of earth (canal excavation in MWR) + 560,000 m^3 to 640,000 m^3 of dredged sediment
1 year	420 trucks travelling for 6 days in a week represents an average of 70 loaded trucks per day or about 6 trucks per hour or about 1 loaded truck every 10 minutes. Trucks will travel back, therefore the number of loaded and unloaded trucks passing through the reserve will be about 1 truck every 5-8 minutes, 21850 trucks per year are estimated to be employed in a year.
2 years	420 trucks travelling on week days represents about 70 loaded trucks per day or about 6 per hour or about 1 loaded truck every 10 minutes. Trucks will travel back, therefore the number of loaded and unloaded trucks passing through the reserve will be about 1 truck every 10 minutes

- The visual, aesthetic and noise impacts will make MWR a less attractive destination for tourists than other parks during the construction process (the number of paying tourists was around 8000 for the year 2015).
- LNP will be affected but to a lesser extent since construction will take place far from the main activities which are concentrated at the eastern end of Old Lengwe. In addition, LNP does not attract as many visitors as indicated below.

Table 73: Revenue Generation in LNP (source: DNPW)

	Year				
Category	**2016**	**2017**	**2018**	**2019**	**2020**
Number of Visitors	759	775	404	296	94
Personal Entry Fee	1,211,890	1,426,985.00	694,465	722,650	358,080
Vehicle Entry Fee	550,900	610,060.00	475,405	290,150	171,550
Guide Fee	13,900	6,950.00	27,800	22,500	15,000
TOTAL MK	**1,776,690**	**2,043,995**	**1,197,670**	**1,035,300**	**544,630**
Totals USD	**2,238**	**2,574**	**1,507**	**1,302**	**685**

Boat trips in MWR will not be affected during the construction process since the jetty is located on the other side of the spur dike (training dike) opposite to the water intake.

Ng'ona lodge (also called Mwembezi lodge) is a private property (the land tenure was not verified by the consultant, the owner of the lodge declared she owns the land around the lodge) that will be affected by work as the road that leads to the lodge will be used by machinery and trucks, this road follows flat land and cannot be diverted due to changing topography. The owner of the Lodge was met at time of the Consultant last mission to present the impacts.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 74: Assessment of Impact Significance on Tourism

	Impact on tourism
Value of the affected component	Highly valued
Intensity	High for MWR, Low of LNP and Ng'ona lodge
Extent	Local
Duration	Temporary
Significance	Moderate (MWR) / Minor (LNP and Ng'ona lodge)
Occurrence probability	High probability

8.18.1.4 Impact on Majete buildings, roads and infrastructures

During the FS, it was feared that construction of the canal would negatively impact on several buildings and infrastructures of Majete Wildlife Reserve, namely, Malaria research camp, Heritage center, Entrance gate, Wildlife research camp, Community camp site, electric fences, access road to the park, access road to Kapichira falls viewing site are the closest infrastructures to the future canal. Certain tourism roads will no longer be viable during construction because they will be used by construction machinery or very close to the construction site (Hall-Martin, start of Mkulumadzi road along Shire and Kapichira falls road). Chikwawa to Majete main road (D135) condition will be affected due to regular use of heavy construction equipment and passage of trucks. Many electric fences will directly be affected in areas where the canal crosses (exit point of reserve close to office, entrance and exit points at the entrance gate complex and along Mwambezi river), shutting down electric fences during construction may lead to animal escape outside MWR. Boreholes for drinking water (for reserve staff housing) could be damaged due to blasting. The following figures are buildings that are relatively close to open section of the canal (based on information provided by the FS report).

- **Office building located 120 meters from the canal:** the contractor applied controlled blasting of the rock material and there was no damage to office building;

- **Entrance gate positioned at 400 meters:** This was used only during the first stages of construction. The canal alignment is the one being used and the entrance gate has not suffered an damage;

- **Heritage center at 425 meters from the cana:** Being furthest from the canal, there are no reported cases of damage that can be attributed to the construction works;
- **Community camp site at 225 meters (and 200 from the buried section of the canal):** the site did not have reported negative impacts;
- **Wildlife research camp at 290 meters**: it survived the impacts of the construction works and remains in good shape;
- **Certain tourism roads will no longer be viable during construction:** An alternate 2.2 kilometre road has been constructed including the Paul Taylor bridge for use by tourists to Kapichira reservoir and Hamilton Falls;
- **Chikwawa to Majete main road (D135) condition will be affected:** The road is regularly refurbished to maintain its usability collaboratively between the contractor and EGENCO;
- **Many electric fences will directly be affected in areas where the canal crosses (exit point of reserve close to office:** SVTP supported the shifting and construction of the new electrictric fences
- **Entrance and exit points at the entrance gate complex and along Mwambezi river), shutting down electric fences during construction may lead to animal escape outside MWR:** There have no reported cases of animal escape nor human wildlife conflict since the start of construction works;
- **Boreholes for drinking water (for reserve staff housing) could be damaged due to blasting**

  SVTP provided financial resources for drilling 3 boreholes as part of mitigations measures and enhancement of park management under Sub-Component 2.2 of SVTP-I.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 75: Impact assessment for Majete buildings, roads and infrstructure

	Impact on Majete buildings, roads and infrastructures. Infrastructures will be disturbed by construction of the Feeder canal
Value of the affected component	Highly valued
Intensity	Medium
Extent	Punctual
Duration	Permanent
Significance	Moderate
Occurrence probability	High probability

8.18.1.5 Impact on Kapichira Falls attractiveness

The small reservoir is created by EGENCO dam to feed the hydropower plant. At the dam wall, a flow over Kapichira Falls that bypasses the turbines is currently released by sluice gates.

During SVTP operation, the attractiveness of Kapichira Falls as a tourist attraction will be reduced over more months of the year. With a flow of less than 10 m^3/s, due to the presence of large boulders, the falls become more or less "invisible" to visitors

Figure 82: "Invisible" falls at 5m3/s (November 2016) (Source: BRLi, 2016)

The number of months in which this may occur is expected to increase from about 6.6 months (as in 2013) to over 10.1 months in dry years when both SVTP I and SVTP II are constructed. This is a noticeable difference from the baseline situation as effectively there will be no environmental flow over the Falls in the dry season, leaving only a flow during the rainy season. However, in terms of their attractiveness for tourism, the most impressive flows over the Falls are during the rainy season, when the difference in flow with and without SVTP will not be very noticeable. It is also important to note that, based on discussions with Majete Wildlife Reserve managers, tourist visitation to Majete is not dependent upon the Kapichira Falls. Although these falls are an attractive spot to visit within the Reserve (and most impressive during the wet season), tourist visitation to the Reserve is driven by other factors--notably Majete's diverse and abundant wildlife, extensive natural habitats, and comfortable facilities.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 76:Impact on Kapichira falls attractiveness

	Impact on Kapichira falls attractiveness. With SVTP, the attractiveness of the falls from a tourism standpoint will be less (due to reduced flows) except during the wet season (JanuaryMarch).
Value of the affected component	Highly valued
Intensity	Medium

Extent	Punctual
Duration	Permanent
Significance	Moderate
Occurrence probability	High probability

7.18.1.6 Impact on Lengwe roads and infrastructures

Construction of Bangula canal will have an impact on fences and access roads of Lengwe National Park. The canal crosses paths inside the park at 4 locations:

- North Thicket Drive,
- South Thicket Road,
- Makanga Drive
- Tsanya Drive

These paths are used by tourist to travel in Old Lengwe. They were upgraded with World Bank funds (SRBMP) in 2015.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 77: Impact assessment for LNP roads and infrastructure

	Impact on Lengwe roads and infrastructures. The fence and park roads will be impacted
Value of the affected component	Highly valued
Intensity	Medium
Extent	Local
Duration	Temporary
Significance	Moderate
Occurrence probability	High probability

8.18.1.7 Loss of access for park management on the western side of LNP

Construction and operation of Bangula canal will split the park in two and could hamper the passage of rangers and aggravate the weak message of ownership that management sends, due to low presence of rangers in the western part of the park. The park has porous boundaries and surrounding villages do not fully accept the presence of a park (personal communication with park staff, 2015) as many use it as grazing area (personal observation, 2015, LNP General Management Plan GEF, 2016), as a source of timber (personal observation, 2015, satellite imagery interpretation, 2016) and as a source of bush meat

(WESM, 2016). Deforestation, poaching and village encroachment are identified as the most threatening ecological issues of LNP by the general management plan (GEF, 2016). If the canal crosses the Park, a new infrastructure inside the Park, it may be interpreted by villages as a message that park management is "letting go" the western part of the park, leading to increasing occupation in this area and utilization of the Park resources. The presence of a canal could also become very attractive for livestock owner as watering point, further increasing the presence of cattle in the park.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 78: Impact assessment on loss of ownership of park management on the western side of LNP

	Loss of ownership of park management on the western side of Lengwe. Construction and operation of the Bangula canal will split the park in two, communities may interpret this to mean weak ownership **by DNPW**
Value of the affected component	Highly value
Intensity	Medium
Extent	Local
Duration	Permanent
Significance	Moderate
Occurrence probability	Potential occurrence

8.18.1.8 The presence of a canal inside parks will be long-term agent of changes

Three new situations will bring challenges to park management:

- the presence a linear infrastructure inside parks ;
- the presence of new stakeholders with different interests ;
- new chains of responsibilities in decision making process.

The presence of a canal and the water intake will require additional efforts and inputs from MWR and LNP management in order to maintain parks' integrity. Negative impacts from linear infrastructures crossing natural habitats are well documented in Africa and the Feeder and Bangula canals will probably not be the exceptions. These canals may become agents of negative changes as management will have to deal with new stakeholders (the construction contractor and the scheme operator during operation), who's interests and actions may negatively impact them. Operation may also bring unexpected impacts from surrounding communities with increase encroachment as it is the case with linear infrastructures. In addition, there is a possibility that new impacts arise due to changes in layout, changes in scheme operator and unexpected events. If any such unexpected event takes place, the decision making chain of responsibilities may be too complex to allow parks to rapidly take action because of the presence of new stakeholders with fundamentally different interests:

- the construction contractor who's interest will be to deliver infrastructures within the timescale and the allocated budget;
- the scheme operator who's interest will be to ensure delivery of water to water user associations within its budget (and, without proper sharing of information, may not be aware of all environmental and social risks);
- park management who's interest is the safeguard of wildlife and habitats while maintaining tourism financially viable.

Other risks may come from mitigation measures themselves as they may not work on the short and long terms since they are no or few return of experiences in Africa for many of the proposed mitigations (for example, the fish barrier and wildlife passes are not proven in Africa). The maintenance road along the canal will also represent an agent of change especially in LNP where communities may wish to use it as a travel path, as it is the case with an existing "unformal" road inside the park. The following are examples of unpredictable impacts that could arise:

- Changes in wildlife behaviors regarding the canal: wildlife entering the canal to travel (causing damages to structures, leading to wildlife-human conflicts, etc.);
- The canal becoming very attractive to wildlife as drinking spots, as the quality of water will be better than in the reservoir or puddles from boreholes;
- Accident involving wildlife: what will happen if an antelope falls in the canal, breaks its legs and needs assistance to be extracted from the canal? What will happen if an animal drowns and dies in the canal? Who will pay for such unexpected impacts, who will extract the dead animals from the canal? How will maintenance interventions on the canal be planned? Who will pay for maintenance of wildlife passes? An animal in distress in a canal could give parks a bad image is the situation is filmed and published on social media, etc.
- Poaching from maintenance staff: what will happen if an employee of the irrigation operator is caught poaching?

All these represent risks that are difficult to assess.

In LNP, there is a risk that the Project aggravates existing issues in the Park:

- There is a risk that livestock use wildlife passes or drink from the canal, as currently in some areas cattle rearing takes place inside the park and law enforcement do not seem to efficiently fight this (farmers are even burning grazing sites inside the park to prepare for the rainy season);
- There is a risk that poachers have an easier time hunting wildlife close to the canal as it may become a drinking spot;
- There is a risk that the canal may be used by villagers either to shortcut their travels (to the other side of the park) or to fetch for water.
- There is a risk that buffalos be tempted to exit the park and enter in surrounding fields. It has been reported that, in 2013, buffalos entered Illovo fields and remain there for a while causing damages to crops.

Table 79: The presence of a canal inside parks will be long-term agent of changes

	The presence of a canal inside parks will be long-term agent of changes. The presence of canals and other infrastructures inside parks will require additional efforts and inputs from park management in order to maintain parks' integrity
Value of the affected component	Highly valued
Intensity	Medium
Extent	Local
Duration	Permanent
Significance	Moderate
Occurrence probability	Potential occurrence

8.18.1.9 Summary of impact significance

Table 80: Summary of Impact Significance

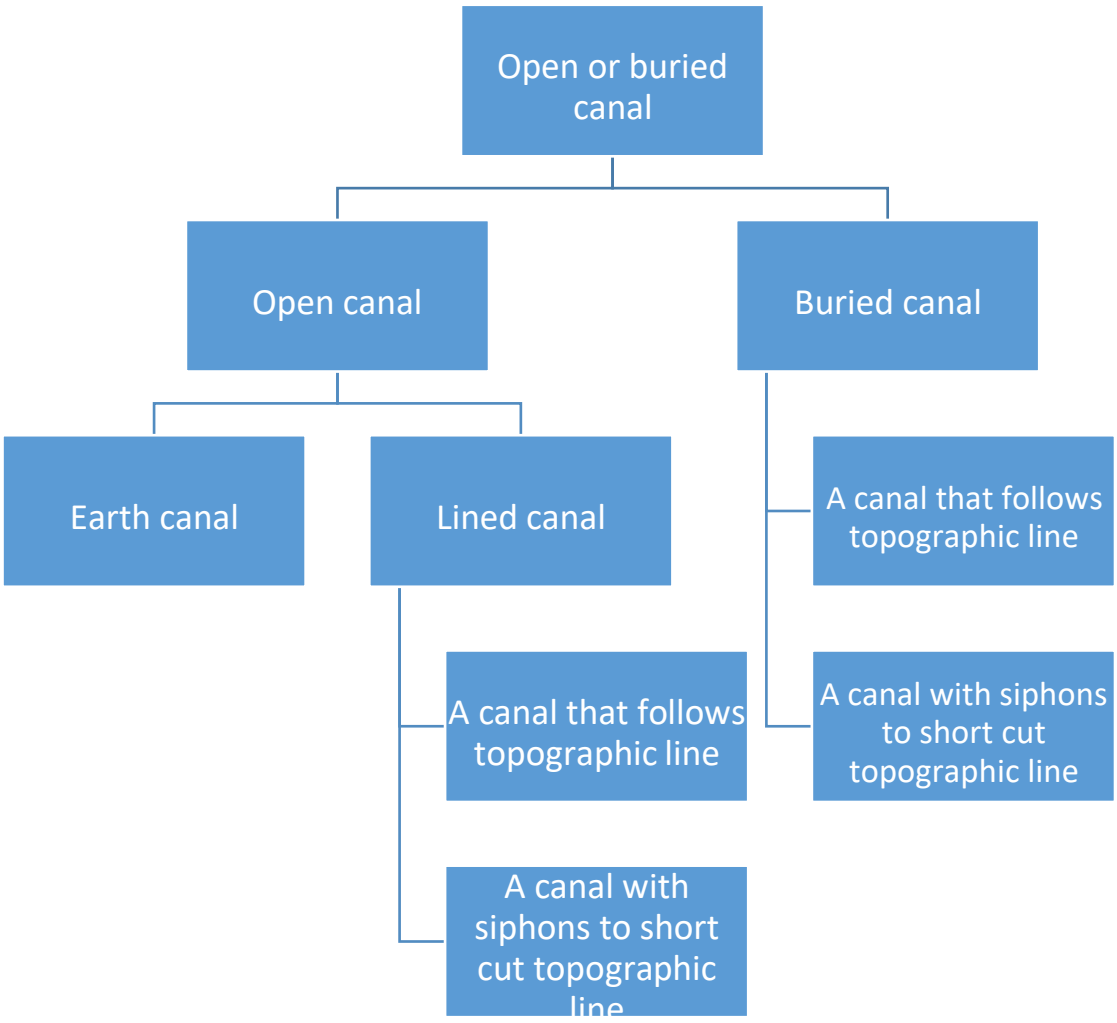
Impacts	Significance	Occurrence probability
Decision on the type of canal and its alignment route: Decisions regarding the canal layout during the design stage will have long term impacts on parks	Major	Potential occurrence
Decision on the status of canals inside parks: the presence of canals inside parks will require a clear definition of their status	Moderate	Potential occurrence
Tender process and selection of a construction contractor: the tender process for the selection of the project construction contractor represent a high risk for parks as it is a crucial step in development of binding environmental measures	Major	Risk (low probability)
Impact on tourism: Touristic activities will be compromised during construction activities across MWR and LNP and Ng'ona lodge	Moderate (MWR) / Minor (LNP and Ng'ona lodge)	High probability
Impact on Majete buildings, roads and infrastructures: Infrastructures will be disturbed by construction of the Feeder canal	Moderate	High probability
Impact on Kapichira falls attractiveness: The viability of the falls as a sight to see for tourists may be compromised on long term with reduced flows	Moderate	High probability
Impact on Lengwe roads and infrastructures: Construction of the Bangula canal will have an impact on fences and access roads of Lengwe National Park	Moderate	High probability
Loss of ownership of park management on the western side of Lengwe: Construction and operation of the Bangula canal will split the park in two, this could be interpreted as a message of weak ownership	Moderate	Potential occurrence
The presence of a canal inside parks will be long-term agent of changes: The presence of canals and other infrastructure inside parks will require additional efforts and inputs from park management in order to maintain parks' integrity	Moderate	Potential occurrence

8.18.2 Mitigation measures

8.18.2.1 Decision on the type of canal and its alignment route

Several avoidance and mitigation measures were considered during the design development of the layout of the canal. The following sections show the different options that were considered prior to arriving at the final design for the canal.

CANAL OPTIONS



Open versus buried canal

MWR: To avoid open canal through MWR, the Designer favored a part buried and part walled/fenced canal in the area where the canal runs within the park fences.

The buried canal sections have been designed to sustain the passage of vehicles and large animals such as elephants. The walls and fences along the open stretches of the canal have been provided to prevent animals from accidentally falling into the canal.

LNP: Although the design is not yet progressed, there is less incentive to have a closed canal in Lengwe mainly because wildlife suffers from water shortage and a well-designed canal

could even be an opportunity to have more water available for wildlife. More water could event lead to an increase of the carrying capacity of the Park.

Earth versus lined canal

MWR & LNP: an earth canal looks more natural than a lined canal and is an option still being considered for LNP. Since soil permeability is very high in MWR, water leakage would be an issue for an earth canal in this location, and it was decided to line the canal. In addition, given the presence of large mammals in MWR who enjoy using watercourses to bath such as elephant and hippopotamus, an earth canal was expected to fail repetedly due to damage by animals.

The FS has stated that soil properties allow for an earth canal in LNP (on the basis of two permeability tests) and this will continue to be considered during design development.

Changing the alignment route to reduce impacts (MWR)

As it is gravity fed, the canal has to follow topographic contour lines. The question of changing the alignment route to short cut topographic lines were addressed and the FS has identified areas where an inverted siphon will allow to short cut topographic lines. In addition, in many areas, the micro topography is very irregular as shown in the following figure along the canal foreseen alignment route meaning the level will be influenced by the need to achieve a cut and fill balance, and minimise the import or export of spoil to the wildlife reserve.

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Figure 83: Example of the micro topography along one km of the Feeder canal (between KP 2.8 and 3.6)

Figure 84: : FS Alignment of the Feeder canal inside MWR (source: BRLi, 2016)

A water intake on the left bank of the reservoir beside EGENCO water intake

The need for a canal inside MWR was considerredduring the design development, and particularly during mitigation workshops (November 2016). One consideration was moving the water intake to the left bank of the reservoir with an aqueduct crossing Shire River around the EGENCO tailrace. The riverbed and banks at this location are made of large rocks, and having the intake at this location would avoid the need to enter MWR. Unfortunately, due to the lower topography on the east bank of Shire, this option would have a significant economic expense for an irrigation scheme that revolves around gravity irrigation. In addition, EGENCO has the intention to develop more infrastructures on this site. Therefore mitigating a canal option inside of MWR was cosndiered the feasible option.

Summary of options for a canal inside MWR

A number of different options were considered for the canal through MWR, considering environmental, tourism, technical and economic criteria, before arriving at the alignment that has been constructed, including:

(i) location of the intake at Kapichira Dam, rather than Hamilton Rapids to greatly reduce the impact on MWR (adopted);

(ii) location of the intake on the Left (East) Bank of the Shire River, completely out of MWR (rejected due to high cost and significant technical limitations with a canal crossing the Shire);

(iii) location of the intake below Kapichira Dam (rejected, because pumping stations would be required, which would substantially raise the operating costs for the new irrigation farmers and make the project less financially viable); and

(iv) locating all of the Main Canal underground within the Majete Reserve (rejected because it would complicate construction of the invasive fish barrier, because the planned decorative walls will effectively prevent most wildlife from entering the canal, and because of the high investment and maintenance costs associated with underground canal).

The guiding principle has been to optimize the canal alignment so there is as little canal as feasible inside of MWR, as much as possible is buriedand it is as far as possible from the reserve buildings (entrance gate, etc.).

CONCLUSION

These options were presented to African Parks as part as stakeholder consultation, during the design development, for example recognizing the preference for a buried canal would be better than a lined canal, but if stretches of the canal were to be open, there would be vehicle and wildlife passes and walls/fences installed to avoid drowning. These requirements have been met in the design that is being constructed, such that the entire length of the Main Canal within Majete is either buried, covered, or walled off to prevent wildlife (including all large mammals) from falling into the canal.

African Parks has plans to develop two areas impacted by the Feeder canal

It must be noted, that there is a large portion of MWR that is not fenced, but still falls under the MWR management to the East of the main road where the proposed canal will now run through. MWR reserves the right to develop this area and has a plan to do so. African Parks has approved one project within MWR boundary: a small area for non-dangerous wildlife observation (antelopes, etc.) for school trips and children. This area is located on the Feeder canal alignment route between KP 1.25 and 1.65. In this area, the canal will be open and and incorporates mitigation to minimise children and animal drowning.

The construction of an artificial wetland was proposed in ESMP for Phase 1 to provide water for wildlife by creating a small wetland which would become an important asset. The wetland was designed to be around 30 meters in diameter and would have been lined with concrete to avoid seepage, with a depth of 0.5 m, it would have required about 350 m^3 of water from the canal, filled every two days, this would be the equivalent of 1230 m^3 per week (or 0.002 m^3/s) which is negligible in regard to the volume of water in the canal. On the request of African Parks and DNPW, the wetland was removed as it would have necessitated clearance of large area in the park and its justification was weak because the Shire river and Kapichira reservoir are in proximity as sources of water.

Another project is under study along the canal alignment route: the development of housing and lodge units at the southern tip of MWR.

Buried canals reduce aesthetical impacts and erase the need for wildlife passes. However, a buried canal does not mitigate all impacts such as those related to construction activities since it requires blasting activities.

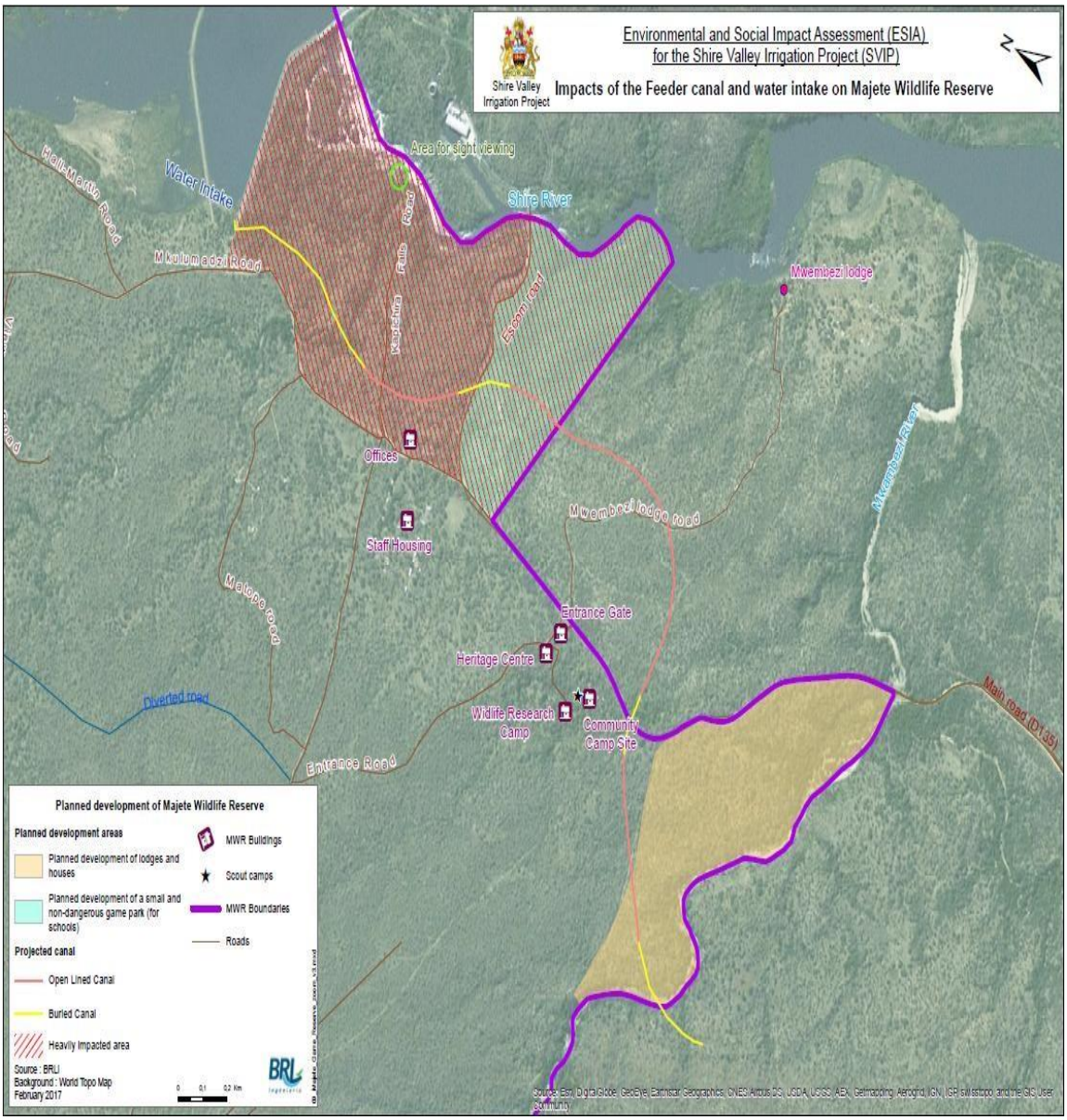

Figure 85: : Planned Developments in MWR

CHANGING THE ALIGNMENT ROUTE TO REDUCE IMPACTS (LNP)

When undertaking the development of the detailed design in Lengwe National Park, topographic constraints (as illustrated on the topographic map below) as well as the impact on the environment need to be considered. The objective will be to optimize the alignment so that it has minimcal impact on thicket habitat and other areas of particular importance for wildlife.

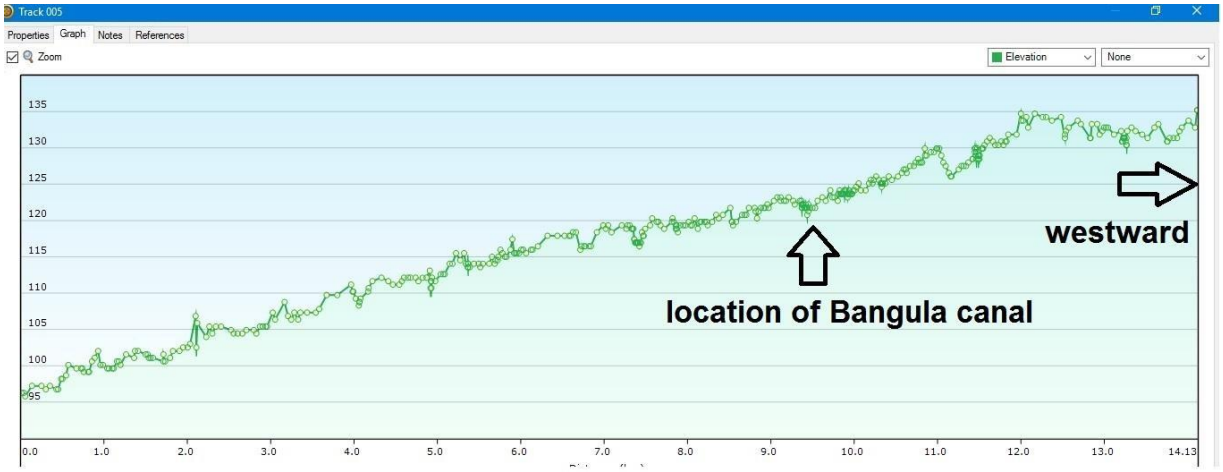

Figure 86:Elevation constraints in LNP

7.18.2.2 Decision on the status of canals inside parks

The canals shall remain within the MWR and LNP "administration" and the right-of-way of canals shall not be alienated from MWR and LNP. Access to the intake and canals for maintenance will be managed in accordance with African Parks and LNP access restrictions (and inspection to avoid poaching). This means that there shall not be any independent access gate to canal maintenance road inside MWR and LNP. Scheme operator staff shall enter and exit parks by following conditions stipulated in the MoUs between DNPW, African Parks and the operator.

In case of wildlife passages (and other civil engineering infrastructures within the park), the MOU shall clearly define the roles and responsibilities of the parties with respect to ongoing maintenance. For example, the operator will be responsible for the structural integrity of the structures and any vegetation of features that may affect this, however the surfacing or surface vegetation on overpasses will be the responsibility of the relevant park authority. TheMemorandum of Understanding between the project operator and African Parks/LNP will ensure long-term commitments.

7.18.2.3 Tender process and selection of a construction contractor

The tender process for the pre-selection and selection of a construction contractor is a crucial step, it is at this stage that risks can be partly managed. It is therefore strongly recommended that:

- the tender document requires that the construction contractor has several references in work in parks or environmentally sensitive areas and that these references be verified to ensure that work went well (reputation of the contractor shall be checked before the selection). In order to verify the contactor's reputation the following method shall be applied:

    - The bidding document and contract shall reflect the new requirements of the World Bank as highlighted in the document "Summary of Environmental, Social, Health and Safety (ESHS)

  Enhancements Standard Procurement Documents (SPDs) & Standard Bidding Documents (SBDs)" One of its requirement is that: "Applicants/Bidders/Proposers are now required to make a declaration listing any civil works contracts that have been suspended or terminated by an employer and/or performance security called by an employer, for ESHS reason/s."

    - The Procurement specialist shall include "qualification criteria" such as :
        - Number of past failures to complete the contract.
        - Length of time in business.
        - Self-assessment of past client relationship
        - Self-assessment of other relationships (surrounding communities and stakeholders) presenting past claims by NGOs, claims by traditional authorities, etc.
        - Description of past injuries where the bidder is required to provide with a list of past injuries and deaths on construction site
        - Past projects concerned by an ESIA, ESMP and RAP and monitoring and auditing activities
    - A "Tender Panel" shall be put in place for any pre-qualification process. This panel shall assist the Procurement Specialist in the evaluation of each criteria.
    - For each of these criteria, the bidder shall provide answers and the tender panel will confirm if the bidders have met the qualification criteria. Investigation could be done by the procurement specialist in compliance with national regulation.
- the tender document will include all applicable environmental and social measures from the Environmental and Social Management Plan (ESMP).
- the tender document will quantifies needs in terms of mitigation to ensure that the contractor adequately budgets mitigations such as rehabilitation of areas affected by earth work.
- the tender document requires the contractor to have a environmental specialist in its staff (in addition to a social and health and safety specialist) that reports to and consults with African Parks and LNP on a regular basis.
- the contract includes sufficient leverages in cases where the contractor does not respect the various site sensitivities. For example, withholding of payment for noncompliances.
- local law enforcement will be involved in cases of serious unlawful activities such as poaching and SEAH.
- that the tender document and the contract will clearly state roles and authority of African Parks and LNP (DNPW) as well as chains of responsibilities during construction.

- the contract will include obligation of termination for work in a set timeframe (and details of any compensation for African Parks and DNPW in the event of the the completion date being missed will be set out in the ESMP).
- In addition, DNPW shall be deeply involved in the development of the detailed design for the canal through Lengwe National Park.
- African Parks and the DNPW shall have the full authority to stop work and request quick action in cases of serious non-compliances and offences; to this end they shall establish close working relationships with the Supervising Engineer.

8.18.2.4 Impact on tourism

The following mitigations will reduce impacts on tourism:

- The most important mitigation is the provision of funds for compensation due to loss of business. With about 1 truck passing every 10 minutes, tourism will be affected and, even if work is confined, wildlife will probably hide further inside the reserve (this leads to other impacts as detailed in Chapter 8). A fund for losses shall be provided for the time of construction in addition to fund to produce pamphlets or online advertisements prior to work and after work is over to present the work and to advertise the reserve after work (distribution of vouchers, etc.)..
- During operation, the transportation of dredged sediment from Kapichira Reservoir, discussion shall be engaged at Government level about ways to dispose of this sediment so it is not stored or disposed within the MWR. This will be covered, as necessary in a Dredged Materials Management Plan to be developed by the Operator and EGENCO.
- African Parks requested that particularly noisy construction operations are restricted to between January and February which has the fewest tourists In addition, noisy operations (blasting, dredging, etc.) will be preplanned with warnings, and shall not take place during Friday through Sunday and holidays (days which receive a majority of the overall tourist visitation) in other months of the year. To minimize disturbance to wildlife as well as tourists, blasting will only be allowed during 11 am to 2 pm (the hottest hours of the day, with generally the least wildlife activity).
- Earth works shall be limited to the path of the canal and all bare soil shall be rehabilitated at post construction in consultation with African Parks. The same rule applies to LNP and rehabilitation shall be done in consultation with DNPW. This requires that DNPW, African Parks and the contractors should identify storage areas outside the parks unless, otherwise, agreed in advance.
- Excavated materials shall be dumped in predetermined area such as a quarry, outside MWR/LNP or only in designated areas specified by African Parks/DNPW.
- Surplus materials suitable for road surfacing shall be used for upgrade of road surfaces in MWR/LNP under the supervision of MWR management/DNPW.
- The contractor will have to restore the road from Chickwawa to the reserve and budget this restoration.
- Temporary construction roads and tracks shall be limited to immediately adjacent site along the canal in the predefined footprint (10m) from the canal path, these roads

and tracks shall be rehabilitated upon completion of construction based on decision by AP (either decommissioned or kept and upgraded for visitors).

- The dredger for the water intake (as part of the preparation for the water intake) shall operate during week days and during day time as construction works are not permitted at night inside MWR. Dredged spoils cannot be stored in MWR (even temporarily).
- The FS report has recommended that noise and dust barriers be installed close to MWR offices and community camps to reduce visual, air quality and noise impacts. African Parks, however, indicated that the noise barriers did not reflect an economic sense as noice would still be heard despite the capital intensive nature of the barriers. On this premise, the noise barriers were foregone.
- Other compensation proposed by MWR management include:
  - Grading the actual road from Chickwawa to the reserve. This is done jointly with EGENCO.
  - Providing a pipeline to extract some water from the canal for water supply for MWR staff village of around 30 households. The actual borehole for the staff village gives yield issues in the dry season.

- Ng'ona lodge (also called Mwembezi lodge) is a private property and the impact from the canal construction and the canal RoW shall be assessed in development of the RAP. Mitigation and compensation includes dust control (with the same frequency as MWR), access road repair, compensation for loss of business, production of information pamphlet for clients, compensation for loss of tree, etc. The lodge will however probably not be affected by noise (as it is located 30m lower than the canal).

7.18.2.5 Impact on Majete buildings, roads and infrastructures

Since the Feeder canal is passing very close to many MWR buildings, mitigation and compensation in case of damages to building and infrastructures should be planned:

- None of the Majete buildings have been affected by the construction works to date in Phase 1.
- Hall Martin drive has been rerouted by the contractor, under the direction of African Parks, to maintain tourist routes through the park, and to keep away from the construction areas. Roads that cross the construction areas have been shut to tourist traffic. A vehicle bridge is being installed at Kapichira falls road and on the road to Ng'ona lodge (outside MWR property).
- The Contractor is regularly maintaining Chikwawa to Majete main road (D135) in good condition, although dust remains an issue. Dust control measures are regularly put in place along Chikwawa to Majete main road (and within the park), although even with project vehicles abiding with speed limits, dust can still be generated by project and public vehicles using the road.
- Compensation has been provided to African Parks for new fencing alongside the works.

- A pipeline to bring water to the rangers housing compound (about 30 houses) is within the detail design, but not yet cosntructed.

8.18.2.6 Impact on Kapichira falls attractiveness

An interesting mitigation that was considered would be to implement timed releases at the sluice gates and to inform MWR visitors on time and season where the falls will be visible. Timed releases of flow is however not recommended since:

- effective coordination of timing of flow releases between EGENCO and African Parks would entail high transaction costs and limited likelihood of real success (visually impressive flows at a guaranteed, pre-arranged time of day are not very likely to happen in practice);
- daily flushing of the falls would be harmful to aquatic and terrestrial wildlife adapted to the dry season Kapichira Falls environment of relatively dry falls with numerous dry boulders and some trickles and pools of water.

As mentioned above, the most impressive flows over the falls will remain during the rainy season which will be less impacted by SVTP.

8.18.2.7 Impact on Lengwe roads and infrastructures

Where Bangula canal crosses roads, a vehicle bridge shall be installed. Based on available map of the park, there are four roads that will need to cross the canal:

- North Thicket Drive
- South Thicket Road
- Makanga Drive
- Tsanya Drive

In addition, the project may impact boreholes for watering point that were funded by the SRBMP. These will have to be avoided or rebuilt to a new location if necessary since Bangula canal may also be utilized to create watering points.

Access to the canal RoW by the construction contractor shall be done from outside of the Park (northern and southern part) and not from existing touristic roads. However, during operation, access to the canal service road shall be done by the Park's entrance only and not by an independent road.

8.18.2.8 Loss of ownership of park management on the western side of Lengwe

As part of mitigation for SVTP impacts, a permanent ranger camp for a team of rangers should be installed along the Bangula canal to keep poachers and settlers away. In that case, it is suggested to install this scout camp close to a wildlife pass as presented in the next sections. Park management also has to require its staff to move further west from their usual rounds.

8.18.2.9 The presence of a canal inside parks will be long-term agent of changes

In order to prepare for long term risks and to ensure that stakeholders interests and mainly those of parks are not affected by others, clear chain of responsibilities have to

be defined taking into account all possible situations and “worst case scenarios”. A Memorandum of Understanding (MoU) shall be signed between African Parks and the scheme operator for MWR and between the Department of National Parks and Wildlife (DNPW) and the scheme operator for LNP to ensure long-term commitments. It is recommended that this MoU clearly states that African Parks and the DNPW shall never be responsible for animal damages to project infrastructures and that maintenance of all wildlife passes and other infrastructures proposed in this ESIA shall be done (and budgeted) by the scheme operator (including the fences or walls around the canal).

Regarding LNP, it is recommended to:

- Establish 3 ranger camps at the canal entrance and exit and one in the extention area following the DNPW standard of 6 houses per camp as minimum requirement.
- Install an artificial wetland on the eastern side of the canal;
- Align mitigation measures with the General Management Plan of LNP (GEF,20210), and thereby assist some of the existing problems (including poaching, illegal wood clearing, lack of reliable fence and buffalo entering Illovo field, current issue with Bailey Bridge that has collapsed, lack of field equipment, vehicles and communication equipment, road surfaces etc.) to ensure that they are not aggravated as part of the project. :
  - Installing fences to keep wildlife within the park and outside of the construction area.
  - Provision of security rangers for construction staff
  - Building a new bridge across Nkombedzi Wa Fodya River to replace the current Bailey Bridge (however this will be done before Phase II because it is completely destroyed). Design studies are now underway for this bridge supported by Sub-Component 2.2 of SVTP-I.
  - Improving existing infrastructures and equipment of the park, including roads.
  - Improving existing drinking spots for wildlife by providing 10 water holes.

8.19. ECOLOGY IMPACT ASSESSMENT

8.19.1 INTRODUCTION

This section deals with impacts of the Project on biodiversity. The following impact identification matrix tabulates the components against the impacts that are considered during the preconstruction, construction and operation stages of the project.

8.19.2 IMPACT IDENTIFICATION MATRIX ON ECOLOGY

Table 81: Impact Identification Matrix on Ecology of Shire Valley

	Pre-construction	Construction	Operation
Land cover	No impact during pre-construction phase	**Rapid change in land cover**: the Project will lead to significant changes in land cover	
		Loss of Critical Habitat (thicket) in LNP: the project may result in impacts to the expanse of thicket in Old Lengwe, which is one of the reasons for designation of the park and is key habitat to an endemic population of Nyala. Loss of Critical Habitat in Majete Wildlife Reserve: the canal takes land from Majete Wildlife Reserve that is used by re-introduced critically endangered and endangered species (impact of SVTP-I, for which mitigation is incorporated in works being undertaken).	

Terrestrial habitats and wildlife		**Disturbances of wildlife and vegetation**: work will generate noise and disturbance to habitats and startling wildlife	**Habitat fragmentation**: with the canal passing through MWR and LNP, wildlife habitats will be fragmentized **Drowning hazard for wildlife**: open canals represent a drowning hazard for wildlife
Wetland habitats and wildlife			**Changes in plant composition in Elephant marsh**: reduction of flow due to abstraction of $50m^3/s$ will affect plant composition **Wildlife-human conflict**: There is a risk that hippos and crocodiles enter the drains and cause wildlife – human conflicts (and casualties). Irrigated field will become very attractive for wildlife in the vicinity of MWR and LNP.
Aquatic habitats and fish		**Disturbance to fish migration to spawning sites:** works in temporary rivers could lead to disturbances of fish migration	**Risk of Tiger fish invasion in the upper Shire:** floods from the Shire in canals could lead to invasion of the Tiger fish in Lake Malawi **Reduction of suitable habitat for fish in the Elephant marsh:** reduction of flow

			will lead to decrease of suitable habitats in the marsh **Disturbance to fish migration to spawning sites:** permanent infrastructures and channelization of tributary rivers could disturb fish migration to spawning sites

In addition, the Shire Valley has some natural habitats outside of protected areas that require protection even after irrigation development. The table below depicts sizes of such areas:

Table 82: Area (Ha) of significant ecological areas outside protected areas

Ecosystem type	Area in development footprint (ha)			
	Natural	Degraded	Not natural	TOTAL
North Zambezian undifferentiated woodland	33	568	31 668	32 269
Edaphic grassland on drainage	72	452	6 139	6 663
Shire catchment rivers	0	106	1 642	1 748
Elephant Marsh wetlands	10	64	373	447
Lower Shire swamp	0	0	1	1
Deciduous forest and thicket	0	0	1	1
TOTAL	115	1 190	39 824	41 126

The areas where these natural habitats occur were identified through desk study (examination of aerial photographs and satellite images, and were ground truthed through field survey. For example, this satellite image confirms that some small parts of the proposed irrigation area adjacent to Lengwe National Park remain in natural or moderately degraded condition. These are primarily patches of the Endangered *North Zambezian undifferentiated woodland* and *Edaphic grassland on drainage* ecosystem types as shown below.

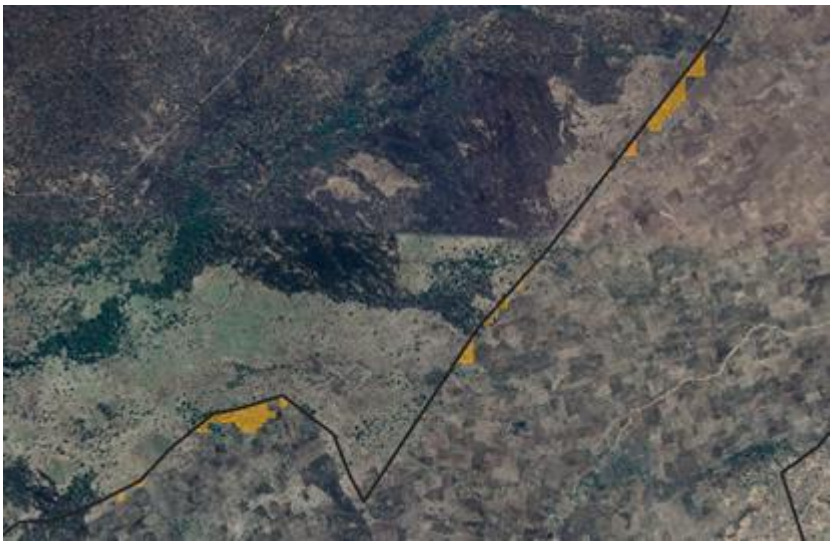

Figure 87: Endangered North Zambezian undifferentiated woodland and Edaphic grassland on drainage ecosystem

Small areas of natural and degraded ecosystems types, including *Elephant Marsh wetlands* and *Edaphic grasslands on drainage* occur at the borders of the existing Alimenda Estate as shown below.

Figure 88: Elephant Marsh wetlands and Edaphic grasslands

Similarly, in the far southern parts of the proposed irrigation area, there remain patches of natural and degraded ecosystems surrounding Kaombe Estate.

Figure 89: Natural and degraded ecosystems surrounding Kaombe Estate

Along the eastern boundary of the southern portions of the irrigation areas, there are patches of land in natural (and degraded) condition belonging to a variety of habitat types. These areas have been retained around the introduction of irrigated agriculture.

8.19.3 AFFECTED COMPONENT VALUE

Table 83: affected component values of the Shire Valley

Component	Component value
Land cover	Land cover is weakly valued since the area is an agricultural area with heavy pressure on land cover from this activity
Terrestrial habitats and wildlife	These three components are highly valued as natural habitats are fragile and the thicket in LNP is considered critical habitat.
Wetland habitats and wildlife	
Aquatic habitats and fish	

8.20 LAND COVER

DESCRIPTION OF IMPACTING ACTIVITIES

The impact matrix has identified the following activities and impacts:

The project construction and operation will lead to significant changes in land cover (**Rapid change in land cover**). Based on an average right-of-way (RoW) of 45 m around main canal for Phase 2 and the detailed design for Phase 1, and the extent of the command areas shown in Figure 12, the project will permanently change approximately 34 571 ha of land cover types (FAO, 2013) to irrigated crops and, to a lesser extent, to canals and maintenance roads.

However, most of the land cover type affected are already cultivated or urbanized, and the project has ensured through the agricultural commercialization manuals that no natural habitat types will be lost from the command areas. Despite this, about 4900 ha of natural habitat will be lost to the canal infrastructure as it passes through approximately 2.5km of

Majete Wildlife Reserve and 14km of Lengwe National Park, and compensation for this loss is to be provided. Table 36 below lists the areas of each land cover type that occurs within each command area (but it should be noted that this does not mean that it will be lost to the farm layout).

Table 84: Land cover changes

Land Cover types	Command areas and canals	Area (ha)
Built Up Area(s). These are urbanized areas (Nchalo, Ngabu, Chikwawa, Bangula etc.)	A	486.6
	B	913.9
	C	570.0
	D	738.4
	I 1	312.6
	I 2	190.0
	Bangula canal	59.0
	TOTAL	**3270,5**
Closed Broadleaved Deciduous Trees. This class includes dense forested areas (natural or semi natural)	I 1	12.3
	I 2	70.6
	Bangula canal	13.4
	TOTAL	**96,3**
Closed Herbaceous. This class includes dense grassland with sparse trees and shrubs (natural or semi natural)	B	13.1
	C	1 357.0
	A	19.1
	B	645.5
	C	950.5
	D	201.6
	I 1	208.0
	I 2	29.2
	Bangula canal	10.4
	Feeder canal	10.8
	TOTAL	**2088,2**
Open Woodland with Herbaceous Layer. This class includes habitats that are mainly covered by trees with open canopy and herbaceous layer. Most of LNP, MWR and hilly areas fall under this category (natural or semi natural)	A	442.5
	B	28.0
	D	988.0
	I 1	648.7
	I 2	199.8
	Feeder canal	120.5
	Supini canal	7.1

Land Cover types	Command areas and canals	Area (ha)
	Bangula canal	87.8
	TOTAL	**2522,4**
Post Flooding Cultivation. Refers to “dimba agriculture” carry out in dambo	A	861.2
	I 1	103.9
	I 2	188.9
	Supini canal	19.5
	Bangula canal	7.1
	TOTAL	**1180,6**
Rainfed Herbaceous Crop(s). Refers to areas of rainfed agriculture	A	2 886.4
	B	2 037.5
	C	7 736.5
Land Cover types	**Command areas and canals**	**Area (ha)**
	D	1 490.8
	I 1	2 732.3
	I 2	255.4
	A	130.7
	B	3 179.3
	I 1	3 114.7
	Feeder canal	70.9
	Supini canal	24.1
	Bangula canal	243.0
	TOTAL	**23 901,60**
Rivers	A	141.8
	Feeder canal	7.7
	Bangula canal	1.3
	TOTAL	**150,8**
Other	I 1	**3.9**
	GRAND TOTAL	**34 571,30**

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 858583: Assessment of Impact Significance for rapid change in land cover

	Rapid change in land cover. The command area will lead to significant changes in land cover
Value of the affected component	Weakly valued (highly valued land cover types such as those found in LNP and MWR are discussed in the terrestrial habitat section)
Intensity	High
Extent	Local
Duration	Permanent
Significance	Moderate
Occurrence probability	High probability

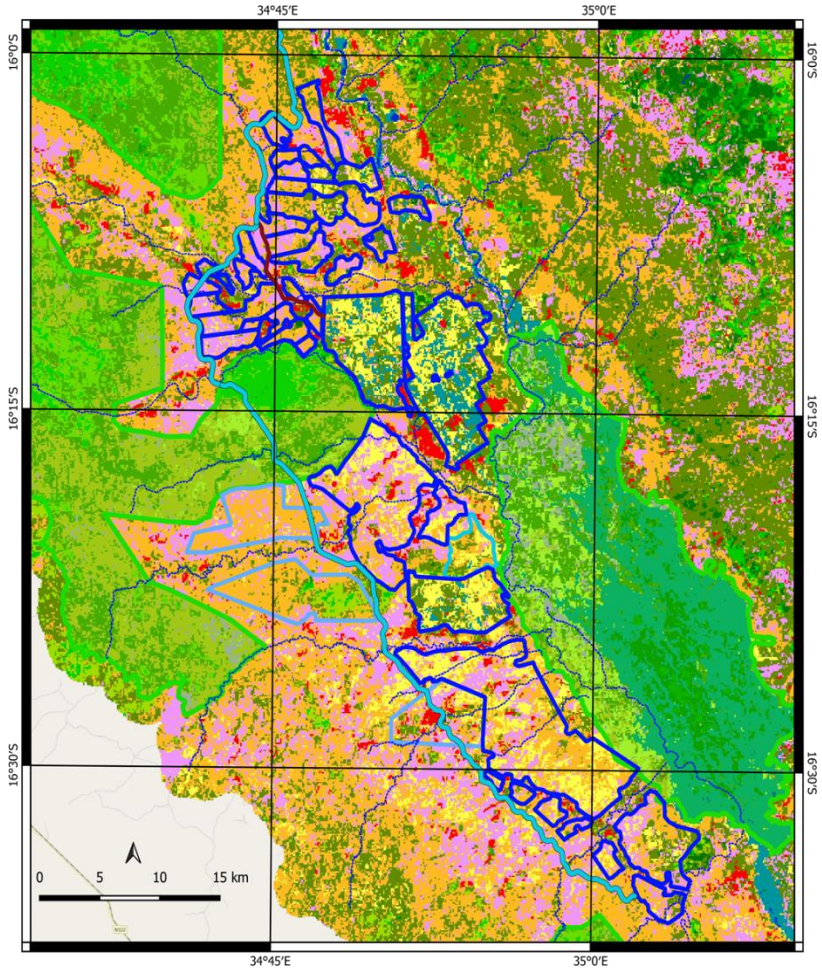

Figure 90: Landcover Map in Command Area (Source: Precision, 2021)

MITIGATION MEASURES

Most changes to land cover are inevitable. However, impacts within Majete Wildlife Reserve and Lengwe National Park shall be compensated by planting schemes to enhance the areas and assist them in achieving their management objectives. Add description

In addition, farm layouts within the command areas will be advised so they do not affect natural habitat, as part of the fine tuning.

In addition, large baobab and small communal forests shall be avoided (not clear-cut) when developing the command area. It is recommended, that before clearing forest or bushes, the following protocol be followed by the Engineer in charge of work plans and supervision of work:

- Make sure that there are no protected trees, shrubs or plants (National Parks and Wildlife Act (Act No. 11 of 1992) by requesting a clearance from the Department of National Parks and Wildlife (DPNW);
- Establish contact with the DNPW to know what is the procedure in case of protected tree in the canal right of way;
- Make sure that all cut trees return to their owners;
- Make sure that borrow pits, roads and other infrastructures do not destroy protected trees or community forests.

The following two pictures show, based on the consultant's return of experience in construction of irrigation schemes, two failed mitigation measures to safeguard protected trees and the reason why they failed. They are shown as examples to avoid.

Figure 91: A Poorly Pretected Tree (Source: BRLi, 2017)

The construction contractor took the advice from the Engineer to protect the tree at the borrow pit site because of its protected status.

However, the contractor's poor judgement and lack of environmental sensitivity has left the tree dead in one season. Roots were dried by exposed sun (the mound is about 5 meters high). What should have been done: a protection area of at least 10 meters should have been delineated with construction fences, and the slope should have been more gentle to avoid affecting soil property where the tree is rooted.

Figure 92: A well protected tree

The protected tree was in the way of the canal, the project spend tens of thousands to avoid it by creating a bend in the canal route. However, nearby excavation, the drainage ditch on the left, compaction and earth fill to create the maintenance road have left the soil impervious to water and has created drainage. The tree died in one season.

What should have been done: the avoidance measures shall not have been implemented and the tree should have either been cut and the lost compensated in close consultation with authorities or the access road should not have completely surrounded the tree. Any action leading to changes in soil properties will affect vegetation.

8.21 Terrestrial Habitats And Wildlife

This section describes impacts on parks on an ecological point of view (wildlife movement, etc.) The section on "Natural heritage" discusses impacts on parks from a socioeconomic perspective (tourism, management and infrastructure).

The impact matrix has identified the following activities and impacts.

8.21.1 LOSS OF CRITICAL NATURAL HABITAT

As discussed in Chapter 10, on the basis of the presence of an endemic population of Nyala, the thicket habitat in Lengwe National Park is considered to be Critical Habitat according to

the definition in ESS6. The alignment of the canal set out in the FS will pass through the western edge of the thicket requiring loss of about 24.8ha (~1% of the total area of thicket). In addition, there will be an additional approximately 25ha fragment of thicket remaining on the west side of the canal, which will be fragmented from the main area of thicket by the canal. In isolation, this fragmented area may be too small to support viable populations of Nyala and other thicket dependent species, and therefore is also considered as part of the habitat loss, resulting in about ~2% of the entire thicket area being lost to the canal infrastructure.

The existing areas of the different thicket types are as follows:

- 28.74 ha of Sterculia appendiculata riverine thickets,
- 260.11 ha of Small-leaved bloodwood thickets, and
- 278.35 ha of Acacia nigrescens thicket

Further discussion regarding the impacts on the fragmented areas is provided in section 14.5.3, below.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 86: Assessment of impact significance for Loss of Critical Habitat (thicket) in LNP

	Loss of Critical Habitat (thicket) in LNP: the project may result in impacts to the expanse of thicket in Old Lengwe, which is one of the reasons for designation of the park and is key habitat to an endemic population of Nyala
Value of the affected component	Highly valued
Intensity	Medium
Extent	Punctual
Duration	Permanent
Significance	Major
Occurrence probability	High probability

Four options have been invetigated regarding the canal alignment in Lengwe National parks at the preliminary stage as depicted in Annex 2, namely:

Option 1: Involves the canal alignment of 14 km in Lengwe Pational Park of which about 2.5 km pasess through the thicket. This option would lead to less excavation because it is relatively flat and would as such impose less with respect to soil spoil management.

The issue to be resolved is that the canal would affect a stretch of the thicket in Lengwe that is considered part of a critical habitat for Nyala.

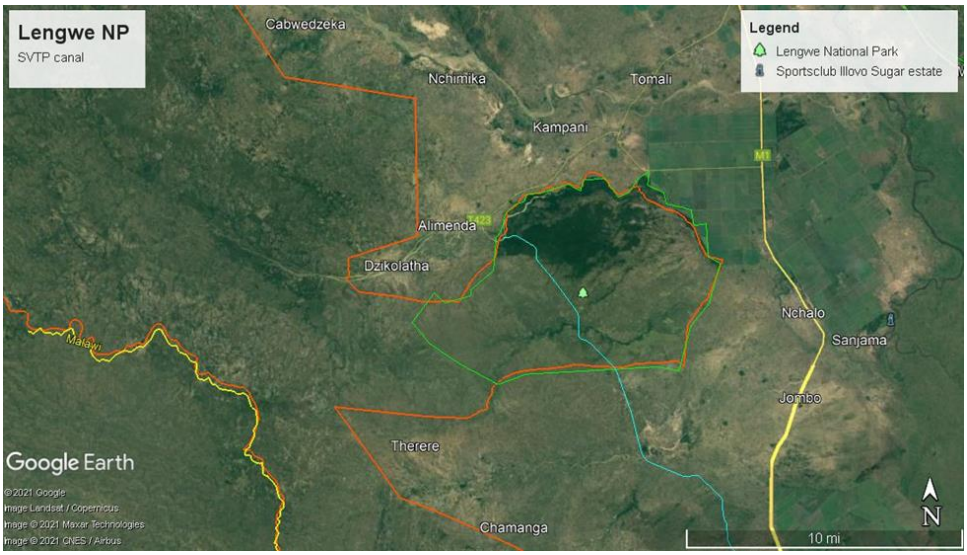

Figure 93: Option 1 for Canal Route

Option 1, New Route 1: Proposes aligning the canal west of the option 1 proposal. This option would avoid passing through the thicket in Lengwe National Park and of about the same length. The canal would not affect the thicket but the proposed alignment would involve more excavation and require measures for soil spoil and management.

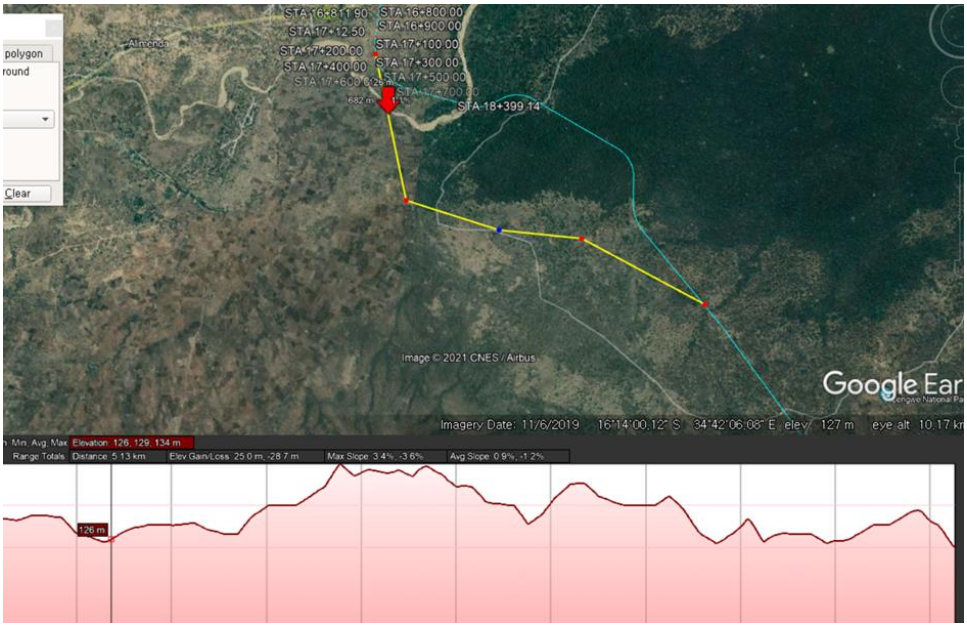

Figure 94: Option 1, New Route 1

The choice of Option1, New Route 1 was arrived at to align to the requirements of the Government of Malawi, the World Bank and African Development Bank. In line with both the World Bank's ESS6 and AFDB's OS3, SVTP shall:

- Ensure that an optimal option that avoids destruction of the critical habitat is advanced;
- The selected option ensure technical, economic and environmental sustainability;
- Will prepare a Biodiversity Management Plan (BMP) to describe the design develop and the mitigation measures needed to protect the National Park. SVTP will support the implementation of the plan, including the necessary measures to minimise fragmentation, ensure the carrying capacity of the thicket remains adequate to support the endemic Nyala, and to facilitate Biodiversity Monitoring during the project, all with the agreement of DNPW. The ESMP provides more details on the approach to the BMP and measures in Lengwe National Park.

The key construction characteristics for the options are summarized in Table….. below and as will be appreciatedchoice of Option 1, New Route 1 come at a higher cost than the original alignment.

Table 87: Construction Characteristics by Four Canal Options in LNP

	Unit	**Alignment 1 (Original Route – Open Lined Canal)**	**Alignment 2**		**Alignment 3 (New Route 2 – Open Lined Canal)**
			Option 1 (New Route 1 – Open Lined Canal)	**Option 2 (New Route 1 – Open Canal + Conduit)**	
Length outside National Park	m	1,300	2,460	2,460	5,980
Length inside National Park	m	11,520	10,330	10,330	10,800
Length of open canal in National Park	m	11,020	9,830	6,230	10,300
Length of covered canal in National Park	m	500	500	4,100	500
Area of Natural Habitat lost permanently	m^2	280,500	456,900	408,100	972,000
Area of Natural Habitat lost temporarily	m^2	85,000	127,900	127,900	167,800

Area of Critical Habitat permanent lost	m^2	142,560	-	-	-
Area of Critical Habitat temporarily lost	m^2	43,200	-	-	-
Area of compensation planting	m^2	423,060	456,900	408,100	972,000
Gradient of side slopes achieved (minimum 1:2.5)		Not Acceptable	Not Acceptable	Not Acceptable	Not Acceptable
Volume of spoil to be removed	m^3	1,063,416	1,680,337	1,011,292	23,120,161
Approximate cost (Lengwe Section 14km)	USD	10,456,509	12,292,489	24,762,679	130,686,882

8.21.2 Disturbances of wildlife and vegetation

During construction of the scheme, work will generate noise and necessitate forest clearing in the right-of-way (RoW) destroying some habitats and startling wildlife. In LNP, the canal RoW will destroy about 24.8 ha of thickets and 34.9 ha of tree savanna. In MWR, the canal RoW will destroy 25 ha of forest. Construction activities will have several impacts on wildlife and vegetation:

- Scaring of wildlife (and potential casualties) due to construction in an area where they are accustomed to access without disturbance (this will have direct impact on tourism as well, as wildlife observation will decrease). In MWR, some animals have moved inside the reserve whereas those that are more tolerant to humans and noise visit the construction area from time to time. Due to lack of fences in many areas in LNP, some wildlife may be tempted to exit the park and lead to human-animal conflicts (especially buffalos);
- Persecution of slow moving animal (snakes) from workers;
- Changes in habitat quality (risk of invasive plants colonization on bare soil and risk of increasing turbidity in the reservoir due to waterworks). The invasive tree *Prosopis glandulosa* was often observed in the Study area, this tree often colonizes ditches;
- Animals will not be able to cross canals under construction to access Shire river below the Kapichira dam wall (MWR) and to access the western part of Old Lengwe (LNP) as the excavation will create an impassable trench;

- Increased poaching risk with foreign and transient construction crews operating in and adjacent to MWR and LNP.
- Old Lengwe is already surrounded by heavy anthropogenic activities (such as the Illovo scheme) and villages that create pressure on the ecosystem. The additional command areas that are to be created by SVTP-I and SVTP-II adjacent and close to Lengwe National Park will provide further pressure on the Park
- In addition, resettlement activities will take place in the command area. Resettlements are known to increase pressure on natural resources mainly trees for logs to rebuild houses and on available land to resettle people. This impact is difficult to assess but was raised by a traditional authority during a consultation meeting with COWI consultants (COWI, 2016). LNP, Mwabvi Wildlife Reserve and Matandwe Forest Reserve which are close to the SVTP-II are at risk.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 88: Assessment of Impact Significance for Disturbances of wildlife and vegetation

	Disturbances of wildlife and vegetation. Forest clearing will permanently destroy valuable habitats and work will startle wildlife
Value of the affected component	Highly valued
Intensity	Medium
Extent	Punctual
Duration	Permanent
Significance	Moderate
Occurrence probability	High probability

8.21.3 Habitat Fragmentation

Canal construction and operation will fragment wildlife habitats in Lengwe National Park and Majete Wildlife Reserve. Open stretches of canal will form a barrier to movement of some species, and other species may fail in their attempts to cross the canal.

Fragmented habitat areas are separated from their main units and will no longer form continuous habitats. Habitat fragmentation can lead to the "edge effects" along forested areas. The edge is the area where natural habitats come in contact with manmade habitats or infrastructures (canal, road, transmission line, etc.). Edge effect causes abrupt changes in vegetation covers and reduces the true surface of forest, leading to colonization of new species. Edge effect also leads to local changes in soil characteristic from a cooler, darker and moister to a warmer, more exposed and dryer environment due to solar radiation. This change brings higher mortality of trees and shrubs along the edge. Habitat fragmentation can lead to changes beyond the line of contact with construction activities.

In Majete Wildlife Reserve, the entire length of the canal will be in siphon form and underground and as such is not expected to present barrier to animal movement. This excludes the flume that will be open but fenced to prevent animals falling into canal.

As for Lengwe National Park, an option of open canal was adopted as this would provide water to wildlife in the water deficient areas, In addition, a biodiversity management plan (BMP) will be developed and implemented for the park. SVTP will support DNPW by facilitating the hiring of Biodiversity Monitoring Specialist. The lining of the canal will be designed to enable some species of larger animals to cross (to minimise fragmentation effects) and in addition, SVTP will include over and under passes at designated places, selected in liaison with DNPW, to enable animals that are not able to use wet crossings to cross the canal. The design will be developed to include these features and minimise the fragmentation effects of the canal during implementation, as stipulated in the ESMP. These will be discussed further in the BMP.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 89: ssessment of impact significance for habitat fragmentation

	Habitat fragmentation. Canals will permanently fragmentize habitats especially in parks
Value of the affected component	Highly valued
Intensity	High
Extent	Punctual
Duration	Permanent
Significance	Major
Occurrence probability	High probability

8.21. 4 Drowning hazard for wildlife

During operation of the scheme, the open canal will represent a hazard for the two following reasons:

- animals will inevitably fetch for water in main canals as the water will be clearer than in any other water sources and more easily available especially during the dry season. The Feeder canal will convey up to 50m^3/s during the peak of the dry season which is also a stressful time for wildlife.
- with a lined canal, banks will be slippery and any animals that enter the canal will struggle to escape by climbing up the banks due to lack of grip. This represents a risk for animal health even when water level is low as animals could get stuckand die from the heat or starvation. Snakes are known to “fall” and not be able to escape as well (Namibia Environment and Wildlife Society, 2016). Slopes of 1 Vertical / 1.5 Horizontal and upto 1 Vertical / 2 Horizontal would be especially difficult for wildlife to escape.

One example in Namibia shows that without proper planning and implementation of mitigation measures, canals can become death traps for thousands of wildlife. The Grootfontein – Omatako Canal (260 km) was built in the 80’s, it is an open lined canal with steep and lined slopes (U-shaped canal). This canal is going through game farms as well as other natural habitats severing migration route of grazing animals. The canal was built 30 years ago and is still in operation. A newspaper from Johannesburg (the Star of Johannesburg, 1990) mentioned that the number of dead animal was more than 8,000 per

year including endangered species. The estimate annual death is about 4,700 warthogs, 1,500 hares, 300 baboons and scores of antelopes, cheetahs, wildcats, foxes and jackals (large cats are not at risk because of their jumping abilities). Personal communication with the Namibia Environment and Wildlife Society (2016) also revealed that snakes, aardvarks, warthogs, kudu, oryx and eland are amongst the victims of drowning in this canal. The Namibian Afrikaners online newspaper called "Republikein" also reveals that casualties include domestic animals (cow and goats). In addition, the newspaper mentions that the cost of supervising the canal and the effort required to remove trapped wildlife is significant. According to the Republikein, some small animals such as pangolin are known to dig and destroy canal embankment which causes water loses and seepage. According to the article, omission to close fences and gates by maintenance staff as also led to wildlife intrusion in fenced areas (the Republikein, 2016). The Grootfontein – Omatako Canal is still called the "Killer canal".

Figure 95: Wildlife casualties in Grootfontein – Omatako Canal (Source: the Republikein, 2016)

Discussion with Piet Heyns (personal communication, 2016) who was during planning, construction and management of the canal the Head of the Planning Division and later the Director of the Investigations and Research in the Department of Water Affairs in Namibia has confirmed that the number of casualties was and still is very high and removal of dead animals is very expensive and therefore often neglected. According to him, the largest group were/are snakes and antelopes. According to M. Heyns, many solutions were tested in order to reduce casualties: such as escape gentle slopes (escape structures) with "guides" in the canal to force the animal to use the escape structure. However, most animals when faced with "guides" were swimming on the opposite direction (and up and down the canal) and finally drowning in agony. In parks and reserve, an agonizing animal or an animal in distress is a disturbing experience for visitors and could really affect the image of MWR and LNP (tourists publishing a dying animal on social media will affect the image of parks). The following is a picture from the non-efficient escape structure with the "guide"

Figure 96: Inefficient escape structure (Source: Heyns, 2016)

M. Heyns mentioned that regular farm fences were inefficient to keep wildlife from entering due to the fact that many antelopes (oryx, kudu, eland) could jump over 1.6 m high fences. Today, this canal has not seen any efficient action to fight against drowning and the cost of maintenance is affected by this issue. M. Heyns also said that, based on his experience, regardless of the fence many small animals could pass under the fence or across and drown in the canal. According to him, the only way to reduce casualties in parks is to cover or bury the canal. He also mentioned that the structure should be strong enough to allow passage of intruding wildlife. With the presence of elephants in MWR, this issue is rather serious.

M. Heyns sent the consultant a picture of a wildlife pass that was installed in commercial game farms along the Grootfontein – Omatako Canal to reduce the number of drownings.

Figure 97: Overpass in Namibia (Source: Heyns, 2016)

Therefore this impact concerns not only protected areas and wildlife reserves, but also the whole length of the canal will be accessible to smaller wildlife as well as domestic animals.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 90: assessment of significance of impacts for drowning hazard for wildlife

	Drowning hazard for wildlife. Open canals represent a drowning hazard for wildlife
Value of the affected component	Highly valued
Intensity	High
Extent	Punctual
Duration	Permanent
Significance	Major
Occurrence probability	High probability

7.21. 4 Summary of impact significance assessment

Table 91: Summary of impact significance assessment

	Loss of Critical Habitat (thicket) in LNP: the project may result in impacts to the expanse of thicket in Old Lengwe, which is one of the reasons for designation of the park and is key habitat to an endemic population of Nyala	**Disturbances of wildlife and vegetation.** Forest clearing will permanently destroy valuable habitats and work will startle wildlife	**Habitat fragmentation.** Canals will permanently fragmentize habitats especially in parks	**Drowning hazard for wildlife.** An open canal will represent a drowning hazard for wildlife. There is also a risk that hippos and crocodiles enter the canal and cause wildlife – human conflicts
Value of the affected component	Highly valued			
Intensity	Medium	Medium	High	High
Extent	Punctual	Punctual	Punctual	Punctual
Duration	Permanent	Permanent	Permanent	Permanent

Significance	Major	Moderate	Major	Major
Occurrence probability	High probability	High probability	High probability	High probability

8.21.5 Mitigation measures

8.21.5.1 Loss of CRITICAL NATURAL HABITAT

Now that the detailed design work for Phase 1 canal has been completed (Phase 1 finishes at the border of Lengwe National Park), further optioneering of alignment through Lengwe can be undertaken with a view to minimizing the loss of thicket habitat. In order not to preclude any alignment options in Lengwe National Park, the end point for Phase 1 has been carefully selected.

A key aim of SVTP will be to assist Lengwe National Park address some of the issues that are affecting the wildlife use of the park, including availability of water, poaching, human encroachment, and lack of infrastructure. The measures to be taken forward will be aligned with the management objectives for the park (as described in Lengwe National Park – General Management Plan 2021- 2025 prepared as part of SVTP-I) and will be described along with the options considered and final route selection in a Biodiversity Management Plan for Lengwe National Park to be prepared in 2023.

The Biodiveristy Management Plan (BMP) will be prepared prior to preparing the tender for the Constractor for working through Lengwe National Park, and this BMP will nclude details of the mitigation and compensation measures to be provided. As a minimum, the measures will include:

- findings of an updated tree survey of the final alignment together with proposals for the sensitive removal of the trees, ensuring the valve of the timber is retained for management activities in the National Park
- a monitoring program for wildlife in the park
- provision of a minimum of 5 overpasses and one underpass suitable for wildlife to pass across the canal without entering the water. These may be combined with connections of roads, but shall be oversized and comprise shrub/savannah habitat as well as road
- use of armourflex, earth banks for open areas of the canal, with slack (less than 1:2.5) sides to minimise drowning and allow passage of wildlife
- provision of waterholes for wildlife
- habitat enhancement measures in parts of the park that are currently of sub-optimal value for wildlife
- fencing of the park and particularly the canal entrances to the park, to prevent access from outside of the park along the route of the canal, and to minimise animals from exiting the park
- construction of ranger camps
- provision of facilities (camps, routes, water, etc) for rangers and scouts to ensure adequate patrolling and security of the Park

8.21.5.2 Disturbances of wildlife and vegetation

Lengwe National Park and Majete Wildlife Reserve

The mitigation measures being delivered to minimise impacts to wildlife in Majete Wildlife Reserve are detailed in the Phase 1 ESMP. Learning from the experiences of Phase 1, the following measures will be adopted on SVTP Phase 2 at Lengwe National Park.

- The construction program through Lengwe National Park will be phased such that except for a haul road along the alignment of the canal, no open unfinished excavation of longer than 1km will be worked at any one time. Although several stretches may be worked at the same time, for example to enable the construction of overpasses and underpasses, there shall be a gap of 1km between the areas of construction activity where only haul operations and vehicle movements between working areas will be permitted.
- The boundary of each construction area will be marked by fencing such that it is clear where the boundaries of the working area are: no works shall occur outside of these boundaries and no materials will be stored or allowed to spill beyond these areas. No workers will be allowed to stray beyond these areas.
- Temporary fences will be established around excavations suitable to prevent incursion by animals and humans. Temporary fencing shall also be used around stores of materials (including any hazardous materials and wastes) to prevent access and minimise the chances of the wastes dispersing into the park. As agreed with DNPW and the Supervising Engineer, these fences will be wildlife approved and electrified.
- New or upgraded water points will help encourage animals away from the construction area and will therefore be provided as detailed in the BMP
- Regular sensitization induction training will be provided to all workers engaged in construction activities in the National Park
- No construction camps shall be allowed in Lenge National Park, and no waste materials including construction spoil shall be deposited within the park
- Construction vehicles shall access the construction areas only along the alignment of the canal, and not use any of the existing roads within the Park (except where these also follow the alignment of the canal). All vehicles entering the park will be cleaned of all mud and earth, to prevent accidental transport of invasive species of plant
- Speed limits shall be set at 15km/hour for all vehicles and trucks in LNP
- Workers shall be transported in buses from the entrance of the park to working areas. Welfare facilities shall be provided in association with the working areas. These shall comprise; rest areas; canteen/eating areas; hand washing facilities; latrines. Latrines shall not be pit latrines, but of the ‘portaloo’ type so that all materials are carrying in and taken out of the park, and nothing is left in the park.
- Workers will be provided with an induction that explains the rules of working within the park, and reminds workers of the need to respect working boundaries and wildlife within the park, as well as the health and safety requirements for undertaking their duties. No hunting of any sort will be permitted by any staff in the park, and intentionally causing harm/injury to any animal or polluting any part of the park, as well as damaging any vegetation outside of the working area will be reported to the relevant authorities and result in dismissal from the contractor’s workforce

- All workers will be provided with identification badges, which shall be shown to security prior to admission to the park. The identification badge shall indicate that the date on which the worker received the induction for working within the park. Any workers without a badge or who have not received the induction within the last 6 months will be forbidden to enter parks. Workers cannot spend the night in the park.
- Extra law enforcement personnel shall be provided to the satisfaction of DNPW (to increase patrol and law enforcement effort) during construction phase. Costs shall be covered by project financiers.
- No fires shall be permitted in the park
- Vegetation removal shall be limited to the permanent footprint of the canal, plus a 10m working width either site. Cleared vegetation shall be removed from the park, unless agreed otherwise with DNPW.
- Post construction soil rehabilitation, planting and seeding shall be done progressively, as each working area is completed. The restoration proposals will be agreed for each section with DNPW, as part of a restoration plan prepared and submitted for approval within 3 months fo the start of works in each section.

8.21.5.3 Habitat fragmentation

ECOLOGICAL CONTINUITY IN MWR

As shown on figure pp, approximately 1.25 km (50%) of the canal inside the reserve will be buried to allow free passage of animals over the top. It is expected for vegetation to regenerate over the top of the canal in the buried sections, allowing for some continuity of habitat types on both side of the canal.

In the sections with open canal, a wall topped with a fence (electyfied in key locations) is being constructed to prevent animals from falling into the canal.

ECOLOGICAL CONTINUITY IN LNP

During the detailed design of the canal through Lengwe National Park, the designers will work closely with the environmental specialists and DNPW to minimise impacts to ecological continuity in the Park. This includes provision for the passage of animals typically found in the park through, over or under the canal, as well as considering the alignment of the canal to minimise fragmentation of habitat types such as the thicket.

Underpasses will be provided where the canal is elevate, and may be designed in association with crossings of rivers. In these cases the crossings will be ‘over engineered’ to ensure that dry passage is provided except at times of flood. As a minimum the crossings will be designed to retain dry passage except during a 1:100 year flood. An underpass will only offer limited passage since many animal move in herds and the limited size of the box culverts may not allow herds to pass.

Overpasses shall have very mild slopes (1 Vertical / 8 Horizontal), and be wide enough for herds to cross (no less than 50 meters wide), The overpasses shall have walls at the edge and shall have walls and fences on either side to guide wildlife to the overpasses.

In LNP, where the canal will be open (see Natural Heritage section), it is suggested to install five wildlife overpass and one wildlife underpass. Wherever possible, overpasses shall be located in open areas to avoid them becoming a focus for poaching. Overpasses can be shared with vehicle bridges, although the road should be defined and vegetaion facilitied to establish alongside.

It is necessary to install bridges for vehicle at all locations where an existing path crosses the canal. Based on actual map of LNP, the canal will cross paths at 4 locations (see maps on impact in LNP), bridges shall be designed to allow wildlife passage (with very gentle slopes and fences on the side). There is no need to install specific pedestrian passes in LNP. Locations for the underpasses and overpasses to be confirmed during the detailed design are shown on Figure pp.

Compensation planting and habitat creation works in the park will be designed with the agreement of DNPW. Consideration will be given to the creation of a large wetland that will take water from the canal. The wetland could be around 30 meters in diameter and shall be lined with concrete to avoid seepage, with a depth of 0.5 m, it would require about 350 m^3 of water from the canal, filled every two days, this would be the equivalent of 1230 m^3 per week (or 0.002 m^3/s) which is negligible in regard to the volume of water in the canal. The wetland will allow the park to achieve an overall net gain from a conservation standpoint, and if installed on the western part of the canal may minimise the chances of villagers bringing their cattle inside the park to fetch for water.

BUFFER ZONES AROUND LNP AND ENCROACHMENT

A 100m buffer zone has been incorporated into the design between the park and the command areas. No land shall be irrigated in the buffer zone.

Since communities in Zones A and B will benefit from the SVTP, and since most illegal wood cutting activities and illegal grazing originate from these communities, part of their inclusion in the scheme shall be conditional on the acceptability of a “no illegal wood clearing rule” and a “no grazing rule” at each village level. Village headmen shall sign a contractual agreement or some form of engagement to respect this rule prior to their inclusion in the scheme. .

8.21.5.4 Drowning hazard for wildlife

- The design of the water intake at Kapichira reservoir shall ensure that no crocodiles and hippos can enter the canal. For that, the trash rack or screens at the intake shall be designed to prevent juvenile crocodiles (as well as adults) from entering, as well as water hyacinth, as far as possible. This may require grill spacing of 5 cm, unless other methods are incorporated to prevent the survival of juvenile crocodiles in the canal.
- The open areas of canal through Majete Wildlife Reserve will be surrounded by a wall and fence, with the fence electrified stretches where African Parks have identified the greatest risk of large animals trying to pass through.
- Despite the wall and fence providing a barrier to larger species, it may not provide hindrance to other species. Therefore the design has included escape ramps at regular locations, as shown on Figure vv.

- Animal escape ramps comprising roughed areas of slack slope (1:2.5) are provided every 250m along the canal, on alternate sides. In between these areas, escape ladders are provided, mainly for human escape.
-
  - Having a shallower and wider canal without fence rather than a narrow and deep canal to ensure that wildlife do not drown should form part of the design solution, especially through Lengwe National Park. Consideration will be given to how to minimise damage to the cana as this solution is progressed.l
  - If an earth canal is feasible in LNP, it may not lead to drowning as animal who enter the canal may exit it because of the better grip earth offers as shown in the following pictures, which also shows some damage to the canal walls starting to occur.
  -

Figure 98: : Earth offers better grip than concrete (Source : BRLi, 2017)

A solution against animal damaging the earth canal in LNP could be an earth canal lined with insitu- or prefabricated concrete mats, such as the flexible matrix of cellular concrete blocks provided by Armorflex ®. (see examples in figures dd, and cc. The mat offer good grip for animals to exit canals but nevertheless should be installed at a gentle slope of 1 Vertical / 3 Horizontal through the park. A comparative cost of the Armorflex technology against earth canal is provided in table dd.

Table 92: Options to avoid drowning of wildlife in LNP

Type of canal inside LNP	Earth only	Earth canal + Armorflex ®	Lined canal + fences on both sides	Lined canal + walls on both sides
Unit cost (USD per meter)	346	346 + 1000	439 + 22 (11x2)	439 + 800 (400x2)
Cost for 14 km (USD)	**4,850,400**	4,850,400 + 14,000,000 = **18,85,400**	6,147,600 + 308,000 = **6,455,600** (excluding the cost of fence maintenance)	6,147,600 + 11,200,000 = **17,347,600**

Based on: KRC, 2016 for the cost of Bangula canal (lined and earth canal), African Parks for cost of electric fences (22 USD per meter for fence on both side of the canal) and for cost of a wall (800 USD per meter for a wall on both side of the canal) and Technicrete, 2016 for the cost of Armorflex®

Figure 99: Prefabricated concrete mats (Armorflex ®)

Figure 100: Armorflex (Source: ISG Infrastructure Specialist Group, 2016)

WILDLIFE DROWNING OUTSIDE LNP AND MWR

In addition to the animal escape ramps comprising roughed areas of slack slope (1:2.5) provided every 250m along the canal, on alternate sides (and the escape ladders in between) cattle troughs as described in (see chapter 13) will be provided and these will reduce the likelihood of domestic animals and small wildlife from drowning in the canals as they would be able to reach water more easily in at the troughs.

8.22 WETLAND HABITATS AND WILDLIFE

7.22.1 Description of impacting activities

The impact matrix has identified the following activities and impacts.

Table 93: Impact on wetland

Theme	Baseline	Project (Phases I and II)
Sources of water	In the dry season, damp conditions are maintained thanks to several factors: • The marsh is a depression, water remain stagnant in many areas, • The Shire and its branches and accompanying alluvial water tables, • Seepages from the Thyolo escarpment on the west bank of the marsh	The Project will slightly reduce the volume of water flowing into the Shire River from Kapichira Reservoir
Critical period for wetland plants	The critical periods for wetlands plants are not the rainy season when most areas are damp in the marsh or submerged; the critical period is the dry season when water is irregularly distributed.	The project will not change much of the wetland hydrology during the rainy season, however, since irrigation requirements are less and therefore abstraction will be limited. The project will affect the critical period for wetland plants by reducing the Shire flow during the dry season, affecting more the edge of the marsh where conditions may no longer allow wetland plants to grow. The eastern edge is the area where water recedes earlier after the rainy season floods; it will be more severely affected. This area is also intensively cultivated (dimba agriculture). Dimba is also called recession agriculture, therefore, with reduced flow (and in the absence of controls), people would move further into the wetland to cultivate land at the peak of the dry

Theme	Baseline	Project (Phases I and II)
		season, further increasing pressure on wetland plant during a critical period.
Wetland zones	The baseline has described three zones in the marsh: • Area where dimba agriculture takes place. Dimba takes place in wetland that is the least damp during the dry season • Areas where the soil is permanently damp and where dimba agriculture is not taking place thanks to high water level • Areas of pools, where water submerges the ground.	□ Flow reduction will lead to □ changes in plant communities. The surface that will affected is however difficult to assess. Dimba agriculture and facultative wetland plants will take more space at the expense of obligate wetland plant species. Some areas where the soil was permanently damp inside the marsh may be encroached by people who lost their dimba field due to reduced wetness at the edge of the wetland and who will find new suitable conditions further inside the wetland. Baseline reports presented historical facts that linked increased dimba agriculture with flow reduction. This statement is also supported by the DRIFT report, which has identified the

Theme	Baseline	Project (Phases I and II)
		eastern, central and southern part of the marsh as potential new suitable area for dimba agriculture. Water level will be lower in pools during the dry season. This could affect fishing activities and rooted aquatic plants.

8.22.2 Changes in plant composition in Elephant Marsh

During operation of the scheme the reduction of flow due to abstraction of up to 50m^3/s (with a maximum net abstraction of about 32 m3/s) will reduce the size of some plant communities in the wetland due to less favour water regime. The impact is influenced by several factors:

- The higher demand for SVTP will be during the dry season when up to 50m^3/s will be directly withdrawn from the Shire River; the dry season is also when the marsh is under more stress due to shortage of water;
- The existing sugar estates--which have a fixed area of cultivable land--will reduce their pumping from the Shire River in direct proportion to the newly available, gravity-fed water they will be able to purchase from SVTP. This will locally moderate the impact, since the actual capacity of pumping stations is around 21 m^3/s and up to 18 m^3/s is pumped in the dry season;
- The Elephant Marsh includes many cultivated areas with flood-recession (dimba) agriculture in its drier portions; these may shift from wetlands to "drylands" as a result of reduced dry season Shire River flows. This transition is illustrated by satellite

imagery treated by infrared to highlight plant activity, since dimba agriculture shows less plant activity at the peak of the dry season than does natural wetland vegetation. The DRIFT report (Ecosystem Functional Model by Southern Waters in association with Streamflow Solutions, Anchor Environmental and MRAG for the SRBMP, 2016) states that the western part of the marsh is expected to react more strongly to flow changes in the Shire River than other areas of Elephant Marsh.

- The Application Efficiency for furrow irrigation is 64% (KRC, 2016), which means that about one third of the water at each furrow-irrigated plot is returned to the natural environment. In this figure, part of the water goes to the water table along drains (seepage), part of it evaporates and part of it returns to surface water at Elephant marsh (as the marsh is the final receptor of drainage). The percentage of each pathway is not easily assessable. Any return irrigation flows to the Elephant Marsh (via surface water or groundwater) are considered beneficial to the Marsh from a hydrological standpoint. However, SVTP impacts upon the Elephant Marsh (including a maximum seasonal reduction of about 10% in flows to the Marsh at Phase II development) have been calculated without taking irrigation return flows into account. This is because such return flows are likely to shrink over time, since farmers might well switch to more water-efficient irrigation techniques (sprinkler or drip irrigation).

As mentioned in the baseline report, a wetland is an area where hygrophilous plant species thrive. Hygrophilous plants are those that require a certain moisture level during a certain length of the year. For most wetland plants, there are thresholds under which they can no longer grow and give way to terrestrial plants. These thresholds are unique to each plant species, most of which have not been scientifically studied in this regard. However, the DRIFT report presents a few thresholds for key species such as Phragmites reed grass and Papyrus. Phragmites are internationally known as facultative wetland plants because they can withstand seasonally dry conditions, in contrast to Papyrus which are known to be obligate wetland plant species (which cannot withstand dryness).

Determining how changes in flow will affect the area of wetland is rather difficult without long-term follow up. However, several statements can be made to describe what will qualitatively change from baseline to Project.

The SRBMP Sub-study 4: Biodiversity of Elephant Marsh, Final version (Anchor Environmental Consulting Report, 2016) makes the following statements about the impacts of reduced Shire River flows (including those attributable to SVTP) on the Elephant Marsh:

> "Marsh vegetation will be impacted by reduced flow, as drying will reduce the ability of marsh plants to resprout and therefore to persist and will also make it easier to clear marsh areas for cultivation."
>
> "Reduced flow through the Elephant Marsh will reduce the extent and flooding of lake and permanently inundated habitats as well as lessen the extent (and possibly frequency) to which the flood plain is flooded. These changes will affect the biodiversity of the Elephant Marsh directly as flow, sediments, vegetation and marsh fauna are intricately linked. Reduced flow through the Elephant Marsh will also facilitate encroachment by people and increase the extent of cultivation and natural resource harvesting."

A modest reduction in the wetland area of Elephant Marsh could also change local sources of livelihood, with incremental increases in dimba cultivation and potential reductions in fishing. The recent report on Ecosystem Services of the Elephant Marsh (Anchor Environmental Consulting, 2016) estimates the total annual provisioning value of the Marsh at approximately US$5 million per annum. Most of this value is from fish and thatching grass.

CONCLUSION ON IMPACT ON ELEPHANT MARSH

In the light of this analysis on impacts, the Project will not lead to "significant conversion or degradation" of the Elephant Marsh. Water abstraction of about 10% of Shire River flow (full development of Phases I and II) at the peak of the dry season is not likely to result in the elimination of the Elephant Marsh, a severe diminution of its integrity, or a substantial reduction in its ability to maintain viable populations of its native species. However, some change is to be expected in the area covered by different wetland plant species.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 94: Assessment of impact significance for changes in plant composition in Elephant marsh

	Changes in plant composition in Elephant marsh. Flow reduction will reduce the size of Elephant marsh
Value of the affected component	Highly valued
Intensity	Medium
Extent	Local
Duration	Permanent
Significance	Moderate
Occurrence probability	High probability

8.22.3 Human Wildlife Conflicts (HWC)

With the Project's irrigated fields and somewhat reduced flows to the Elephant Marsh, human wildlife conflicts (HWC) would be expected to increase in the absence of special mitigation measures. The actual situation in the Project is already unique, as HWC in and around the Elephant Marsh have generally worsened over time. HWC are also expected to increase with the increase in irrigated agriculture especially irrigable areas in the vicinity of MWR, LNP and Mwabvi Wildlife Reserve. Absent adequate mitigation measures, SVTP would be expected to aggravate the following existing situations:

- Any reduction in the wetland area of the Elephant Marsh may shrink the available habitat and food resources for hippopotamus and crocodiles. The SRBMP Sub-study 4: Biodiversity of Elephant Marsh Final version (Anchor Environmental Consulting Report, 2016) states: "Crocodile-human interactions will increase if human numbers and encroachment into the remaining uncultivated regions of the Elephant Marsh persist. This will be exacerbated as fish stocks, the natural food of crocodiles, dwindle and crocodiles have to hunt for alternative prey";

- During the dry season, there will be increased availability of fresh forage for hippopotamus closer to the Elephant Marsh thanks to irrigation;
- The irrigation drainage canals into the Elephant Marsh are likely to provide aquatic pathways for crocodile movement (currently crocodiles occupy Illovo drains as observed during the ESIA study);
- A projected increase of dimba agriculture around the Elephant Marsh (if not adequately controlled through SVTP's Natural Resources Management Component) could increase human wildlife conflicts (particularly with hippopotamus);
- The development of irrigation blocks and increase the abundance of water close to MWR, LNP and Mwabvi will attract wildlife to green fields. This will generate human wildlife conflicts with game incursions into farms.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 95: Assessment of impact significance for wildlife-human conflict

	Wildlife-human conflict. There is a chance that hippos and crocodiles will enter the
	irrigation drains and cause wildlife – human conflicts (and some casualties). Irrigated fields may become attractive for wildlife as a food source.
Value of the affected component	Highly valued
Intensity	Medium
Extent	Local
Duration	Permanent
Significance	Moderate
Occurrence probability	Potential occurrence

8.22.4 Mitigation measures

8.22.4.1 Changes in plant composition in Elephant marsh

This impact is largely unavoidable since withdrawing water from the Shire River is the basis of the Project.

The water intake will be dimensioned to abstract a maximum of 50 m^3/s from the Shire River. However, since some of the canal water will simply substitute for irrigation water that is currently pumped from the river, the maximum net abstraction will be 32 m^3/s at full development (Phase II) and only 12 m^3/s for Phase I. Based on the World Bank's International Waterways Notification Letter, this translates to a net abstraction at full SVTP development of not more than about 10 percent of the Shire River's flow during September, the dry season month of peak irrigation water demand. For Phase I, this maximum seasonal reduction in flows to the marsh would be only about 3 percent.

The Project will mitigate these impacts and enhance the conservation of the Elephant Marsh through support for:

- hydrological and biological monitoring;
- designation of Elephant Marsh as a Community Conservation Wetland Area, and establishing programs with associated communities to adopt sustainable practices on Elephant Marsh

This improved protection and management of the Elephant Marsh begun during the Phase I Project and will continue and expand during Phase 2, including as part of the Natural Resources Management Components of the project. The monitoring will begin under Phase 2. It will facilitate adaptive management to mitigate impacts of reduced flows, such as through the establishment of different Wetland Area Use Zones that could limit further conversion of the drier wetland areas to flood-recession (dimba) agriculture.

8.22.4.2 Human-Wildlife Conflict (HWC)

Conflicts in Elephant Marsh between people, hippopotamus and crocodiles are currently the most common.

CROCODILES

Crocodiles are present in Illovo drainage, it is unlikely that, with SVTP, the situation will be different. Crocodiles can move on land and in the water therefore there is little direct actions that can be undertaken, the risk will never be eliminated. To reduce the risk it is recommended to implemented the following measures:

- Sensitize people not to use drains to bath or to bring cattle for water.
- Design drains with steep bank slopes to keep crocodiles from exiting them and attacking people.
- With the installation of cattle troughs along the canal, the access to the Shire for livestock would be less important
- Install a crocodile fence across every connecting drain with the Shire. Each crocodile fence shall be fixed to the drain bed and grounded using concrete and shall be high enough to stand out during a flood. Wire mesh shall remain sharp at the top of the fence. On ground, it shall be wide enough to discourage crocodiles from moving on land and circulate around the fence to reach the drain. Such fences would need to be maintained and debris removed on a regular basis to avoid having the fence destroyed, as drains will be maintained by farmers there is a risk that they will be neglected. In addition, any major floods in the Shire River would most likely destroy the fence. Regular replacements are to be foreseen. Chances to see crocodiles climbing fences are also to be expected. All these elements are serious limitations to the success of a crocodile fence. In addition, fences would restrict movement of other species from drains to the wetland.

HIPPOPOTAMUS

Hippopotamus will be attracted to forage in irrigated fields. Some measures can be proposed as part of the Community Conservation Area work to minimise the Human Wildlife Conflict when this arises:

- Sensitize people not to stay late in their field, as hippopotamus are known to enter fields at night;
- Adapt crop in the command area so that cotton (non-edible crop) is cultivated closer to the Shire and food crops further away;
- Install along irrigated fields thorny branches (acacia branches) to keep hippopotamus from entering. However, it has been reported that even barbed wire are not efficient against hippos. In fact, walls could be the only efficient measure (UNDP, 2016) given the size of the irrigation scheme, efficient actions are rather limited and death of hippopotamus due to conflicts are likely to take place.
- Install trenches around crop fields

ENVIRONMENTAL FLOW

As with other impacts, the environmental flow with adaptation from Kamuzu barrage has another reason to be implemented, it will safeguard crocodiles and hippopotamus habitat and food supply and will help to minimize conflicts with farmers.

BUFFALOS ENTERING FIELDS

LNP will have nieghbhouring irrigated fields, to avoid all encounter with buffalos, it will be important to fence the whole Old Lengwe section of the park (finalize the current fencing process).

8.23 AQUATIC HABITATS AND FISH

8.23.1 Description of impacting activities

The impact matrix has identified the following activities and impacts:

8.23.1.1 Disturbance to fish migration to spawning sites

During construction of the scheme, works at the crossing points of temporary rivers could lead to disturbances of fish migration. Permanent infrastructures and channelization of tributary rivers could disturb fish migration to spawning sites as well. During construction, the main risk comes from damage from crossings of rivers, and from accidental pollution to watercourses.

Crossings rivers in construction vehicles by fording or by installing culverts will result in damage to the bed and banks. Culverts may result in barriers to the migration of fish if they are poorly placed or undersized. Another impact comes from the operation of the scheme where natural rivers will be used as drainage canal collecting polluted water from

the scheme and being modified to convey drainage water. River channelization reduces suitable sites for spawning.

Figure 101: Inadequate culverts in an earth dike across a seasonal river (Source: BRLi, 2015

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 96Assessment of impact significance for disturbance to fish migration to spawning sites

	Disturbance to fish migration to spawning sites. Works and infrastructures in temporary rivers could lead to fish migration disturbances
Value of the affected component	Highly valued
Intensity	Medium
Extent	Punctual
Duration	Permanent
Significance	Moderate
Occurrence probability	Potential occurrence

8.23.1.2 Risk of Tiger fish invasion in the upper Shire

The Lower Shire River is an independent ecoregion from the Middle Shire and Upper Shire in terms of aquatic fauna. The Lower Shire River belongs to the Lower Zambezi fish fauna and, since Kapichira falls constitute a barrier to upstream movement, all the totally aquatic 'Lower Zambezi' species of the Lower Shire River are absent upstream from Kapichira falls (Tweddle et al., 1979).

Lake Malawi (Upper Shire) fish fauna is mainly endemic (several species of endemic cichlids) and fish are adapted to lacustrine conditions (low flow conditions).

The separation in fish fauna between the Lower and Upper Shire has always existed. However, there is a risk that SVTP will provide a route for the migration of tiger fish to other stretches of the Shire, with adverse consequences for the important acquatic life present.

Figure 102: The tiger fish (Source: Angle Zambia, 2016)

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 97 Assessment of impact significance for risk of Tiger fish invasion in the upper Shire

	Risk of Tiger fish invasion in the upper Shire. The water intake could lead to Tiger fish invasion of Middle and Upper Shire and Lake Malawi
Value of the affected component	Highly valued
Intensity	High
Extent	Regional
Duration	Permanent
Significance	Major
Occurrence probability	Potential occurrence

8.23.1.3 Reduction of suitable habitat for fish in the Elephant marsh

During operation, reduction of flow will lead to reduction of habitat suitability in the marsh. With flow reduction, especially at Phase II, many areas will be less submerged, leading to reduction of suitable fish habitats. In addition, slower water may lead to more silt being deposited in the marsh, which will further degrade the habitat. The correlation between flow and fish catch was proven to be highly significant, whenever there was a flow reduction, the number of fish declined (Tweddle et al., 1994).

The DRIFT report (Ecosystem Functional Model by Southern Waters in association with Streamflow Solutions, Anchor Environmental and MRAG for the SRBMP, 2016) does

not foresee a reduction of open water surface (but depth) in the marsh (where most fishery takes place) however it foresees a reduction in rooted vegetation where spawning takes place.

Lastly, the increase drainage of pollutants (fertilizers and pesticides) will impact aquatic habitats.

ASSESSMENT OF IMPACT SIGNIFICANCE

Table 98: Assessment of Impact Significance for reduction of suitable habitat for fish in the Elephant marsh

	Reduction of suitable habitat for fish in the Elephant marsh. Reduction of flow will lead to reduction of habitat suitability in the marsh
Value of the affected component	Highly valued
Intensity	Low
Extent	Local
Duration	Permanent
Significance	Moderate
Occurrence probability	High probability

8.23.2 Mitigation measures

8.23.2.1 Disturbance to fish migration to spawning sites

In order to reduce impact on fishes during construction, the detailed design for Phase 1 and the emerging design for SVTP should incorporate the following:

- Where the canal crosses rivers, the crossings will be in oversized culvert (1:100 year flood level), to maintain continuity of passage for aquatic life during flash floods.
- For SVTP-II, during construction, the contractor will be required to construct 'Irish drains', where the banks and bottom of the river are protected by a concrete pad on which vehicles drive. Temporary crossings in culvert will only be permitted with the approval of the Supervising Engineer, and only be permitted between March and November, to avoid creating barriers during flash floods
- All work in temporary rivers shall be prohibited from November to March and shall be concentrated between July and October to minize impacts on migrating fishes.

Figure 103: : Poor design of the culvert (Source : Bibliothèque nationale du Québec, 1997)

8.23.2.2 Risk of Tiger fish invasion in the upper Shire

"If there is one thing the history of evolution has taught us it's that life will not be contained. Life breaks free, it expands to new territories and crashes through barriers, painfully, maybe even dangerously…" Professor Ian Malcom, quote from the movie Jurassic Park (1993).

A fish barrier is currently being construted as part of SVTP-I to ensure that tiger fish can not pass through. The fish barrier is xxm high, and to ensure its safety, it is being constructed within the Majete Wildlife Reserve. A cross section of the fish barrier being constructed is provided in figure 93 below.

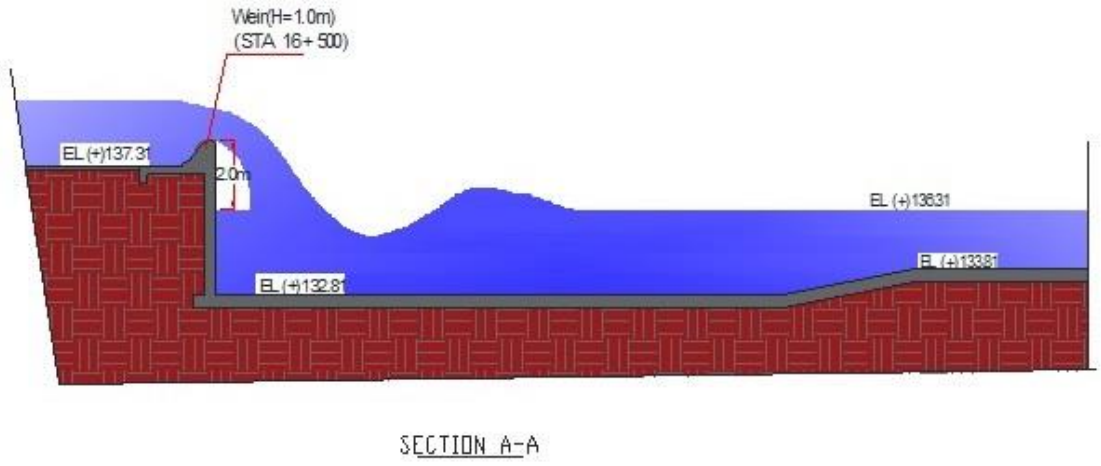

Figure 104: Cross section of fish barrier being constructed as part of SVTP-I

8.23.2.3 Reduction of suitable habitat for fish in the Elephant marsh

In order to mitigate the impact on Elephant marsh not much could be done in terms of civil engineer infrastructures. Installing weirs or dikes to maintain a level of water at some key locations is not recommended as important floods would destroy them. In the SRBMP study "Climate resilient livelihoods and sustainable natural resources management in the Elephant Marshes, Malawi" details are set out of thef institutional measures to implement to ensure adequate natural resources management which will help to improve biodiversity in the marsh as well. These have been progressed as part of SVTP-I with the establishment of the first CCA in the marsh, and the construction of fish ponds, and will be continued as part of Component 4 (Natural Reserve Management) measures of SVTP-II

Kamuzu barrage could assist in providing an environmental flow to assist Elephant Marsh.

Lessons Learnt in Phase I Mitigation Measures

Several lessons were learnt in the course of implementing Phase I activities which could be very useful in the implementation of Phase II activities. The following are the most notable one:

Payment of Compensations is an On-going Exercise.

It was generally thought that after paying compensations to the group of PAPs who had been identified during the RAP exercise that would be the end of the activity. On the contrary, the experience during the implementation of SVTP 1 has shown that payment of compensations should be regarded as an on-going exercise considering that some grievances that occur do require payment of compensations and therefore there cannot be a cut-off date for compensations. The project just has to be prepared to pay compensations throughout the construction period.

Livelihood Restoration Activities must be demand driven.

During the implementation of SVTP I, vulnerable PAPs were provided with farm inputs, maize seed and fertiliser as a way or restoring their livelihoods following their replacement. It was, however, noted that the inputs did not meet the needs of the PAPs. Firstly, the PAPs expressed concern that maize is not really their staple food. They would have appreciated much if they had received sorghum or millet seed, which is their main staple food. A big lesson was learnt; livelihood restoration activities need to be demand driven based on a proper assessment. As such, different people would demand interventions according to their various economic activities.

PMT must always be vigilant against threat of GBV cases

The main lesson learnt during the SVTP I is the unpredictability nature of the occurrence of GBV incidents. GBV incidents can occur when they are least expected and therefore the Project must have all the necessary mitigation measures and support systems must be in place and ready at all times.

The GBV Service provider is an important player

The sensitivity and unpredictability of GBV issues requires alertness on the ground. There is need for constant sensitisation and reinforcement of mitigation measures. PMT cannot always be on the ground to do this. The arrangement in SVTP I where a GBV Service Provider was engaged to manage GBV mitigation measures has proved to be very vital in the fight against this vice in project implementation and SVTP II would do well to adopt this as it ensures.

GRM Structures Are Crucial in Resolving issues

SVTP I has relied much on the various GRM committees to resolve all grievances form the communities. The fact that community leaders have been involved in grievance resolution has been crucial as the leaders have used their knowledge of the people and the history of their respective areas to resolve the issues. SVTP II has adopted the system used under SVTP I and the mechanism has been strengthened by including AFDB OS1 provisions and IFC Guidelines.

The Power of Collaboration with Stakeholders

Safeguards activities have benefited much from collaboration with other stakeholders, particularly relevant Government departments. This lesson would also be helpful in the implementation of SVTP II.

CHAPTER 9. GREEN HOUSE GAS ACCOUNTING

The World Bank Environment Strategy (2012) adopted a corporate mandate to account for the Greenhouse Gas (GHG) emissions for investment lending and ESS3 of the WB ESF requires an estimated of the gross GHG emissions. The quantification of GHG emissions is an important step in managing and ultimately reducing emissions as it provides an understanding of the GHG mitigation potential of the Shire Valley Transformation Program (SVTP) and can support sectoral strategies toward low-carbon development. This analysis looks at both phases (1 and 2) of the SVTP.

GHG accounting methodology. The World Bank has adopted EX-ACT, developed by the FAO[12] to estimate the impact of agricultural investment lending on the GHG emission and carbon sequestration in the program area. EX-ACT allows the assessment of a program's net carbon balance. The carbon balance is defined as the net balance across all GHGs expressed in CO2 equivalents (CO2e) that will be emitted or sequestered due to Program implementation (With Project (WP)), as compared to a business-as-usual scenario (Without Project (WOP)). EX-ACT is a land-based accounting system (or herd-based), estimating CO2e stock changes (i.e. emissions or sinks of CO2) expressed in equivalent tons of CO2 per hectare/animal and year. The tool was designed using mostly data from the Intergovernmental Panel on Climate Change (IPPCC) Guidelines for National Greenhouse Gas Inventories (NGGI-IPCC, 2006), which furnishes EX-ACT with recognized default values for emission factors and carbon values in soils and biomass (the so-called "Tier 1 level" of precision).

Assumptions in the EX-ACT model. The SVTP proposes several activities and outputs that were captured with the GHG accounting tool EX-ACT. The assumptions for this analysis were informed by discussions during Program preparation and appraisal stages and are aligned to the assumptions of the Results Framework and Economic and Financial Analysis (EFA) of the Program.

The SVTP is situated in the southern part of Malawi. The climate and moisture regime for Malawi is tropical dry. The dominant soil type is Sandy. The Program implementation duration is 12 years (SVTP-1 6 years, SVTP-2 6 years) and the capitalization period assumed to be 13 years. Dynamics of implementation are assumed to be linear over the project period. Default Tier 1 coefficients are used. The SVTP aims to enhance agriculture and livestock productivity through investments in improved agriculture and livestock practices. It is assumed that the benefits would come from improvements of productivity, as well as crop diversification and a shift from low value to high value crops (sugar cane, cereals, vegetables and fruits, for domestic and export markets), and not from the expansion of the cultivated area. The SVTP will support the adoption of improved water management and improved technologies such as improved seeds, crop husbandry practices, fertilization, and horticulture technologies.

The GHG calculation is based on the following elements, which are derived from the Results Framework and EFA: (a) incremental crop production from productivity increases in the targeted value chains, with a shift from traditional cultivation to improved agronomic

[12] http://www.fao.org/tc/exact/ex-act-home/en/.

practices; (b) additional fuel consumption due to marketing and transport of the additional production; (c) increased use of fertilizer and agro-chemicals. The assumptions for the GHG calculation are summarized in the table below.

Table 99: Data inputs to EX-ACT in the Without and With Program Scenario

Activities	Without Program Scenario	With Program Scenario
Crop production	Traditional maize 29,700 ha Sugarcane 13,300 ha (pumping)	Sugarcane 13,300 ha (gravitation) Sugarcane new 1,700 ha
		Cycle 1 (total 28,000 ha): Fruit trees (banana, citrus, mango) 3,361 ha Maize 1,400 ha Cotton 7,746 ha Pulses 15,493 ha
		Cycle 2 (total 28,000 ha):: Fruit trees (banana, citrus, mango) 3,361ha Pulses: 12,317 ha Maize 11,622 ha Vegetables: 700 ha
Animal production	Traditional cattle	Specialized livestock production (5,100 heads)
Energy use	Shift from pumping to gravitation	Reduction of 1,000 MT of diesel
Consumption of fertilizer and agro-chemicals (insecticides, herbicides)		Additional use (MT/annum): Ammonium nitrate: 850 MT Potassium chloride: 136 MT Single superphosphate: 340 MT NPK 23:21:0: 9451 MT CAN: 4558 MT DAP: 775 MT Ammonium sulfate: 775 MT

Results show that the SVTP can constitute a sizeable net carbon sink of -278,099 tCO2 eq over 20 years, thus −13,905 tCO2 eq annually, due to the introduction of improved crop management practices and technologies. The cropping activities constitute an absolute carbon sink with a carbon balance of -1,040,743 tCO2 eq in the with-project scenario.

However, the increased use of fertilizer and insecticides/herbicides, partially compensated by a reduced use of energy, would lead to an overall increase of 730,224 tCO_2 eq.

The monetary value of the GHG balance has been estimated and taken into account as economic benefit of the project in the Economic and Financial Analysis. The Guidance Note on Shadow Price of Carbon in Economic Analysis (September 2017) recommends

"projects' economic analysis use a low and high estimate of the carbon price. The economic analysis[13] uses a low and high estimate of the carbon price starting at US$38 and 77, respectively, in 2018 and increasing to US$65 and 131 by 2042. Carbon market prices are the market value of CO_2e emission reductions or sequestration (offsets) that are registered and sold through various market structures.

[13] World Bank. Shadow price of carbon in economic analysis, Guidance note. November 12, 2017. However, the price will vary according to global demand and no specific price will/can be guaranteed by the project. The market shall be further explored as the need arises.

CHAPTER 10. CUMULATIVE IMPACT ASSESSMENT

10.1 INTRODUCTION

The World Bank Environmental and Social Framework (ESF) requires the assesment of cumulative impacts in addition to direct and indirect environmental and social risk and impacts. Specifically, ESS1 Assessment and Management of Environmental and Social Risks and Impacts requires that a project environmental and social assesment "will assess, in an integrated way, all relevant direct, indirect and cumulative environmental and social risks and impacts throughout the project life cycle, including those specifically identified in ESSs2–10."

According to ESF, cumulative impact is defined as "The cumulative impact of the project is the incremental impact of the project when added to impacts from other relevant past, present and reasonably foreseeable developments as well as unplanned but predictable activities enabled by the project that may occur later or at a different location. Cumulative impacts can result from individually minor but collectively significant activities taking place over a period of time."

The 2017 SVTP-I project ESIA included some considerations for cumulative impacts assessment. The 2017 ESIA describes the overall SVTP program concept and in some cases baseline-level environmental and social baseline conditions. More distinctively, it presents the impact assessment part similar to a CIA. A project ESIA can be characterized as project- or activities-centered, while a CIA is VEC-centered. VEC stands for "valued environmental and social components", an environmental and social receptor of impacts or effects coming from human activities or natural forces. In a typical project ESIA, the assessment starts with a description and analysis of project activities, then cause-and-effect pathways, the type and scale of impacts on a receptor or VEC. Meanwhile, a mitigation hierarch of avoidance, minimize, mitigate and offset compensation is applied.

In a CIA, though the assessment also starts with activities, the focus shifts to VECs subsequently. The area considered is the area in which the VECs occur, which is where other stresses (developments, human activities not subject to ESIA, and natural environmental and external social drivers) may also affect them. Once the other impacts have been identified, the cumulative impacts are assessed as the resulting change in the condition of the VECs.

The 2017 ESIA's chapters on impact assessment is receptor- or VEC- centered, as can be seen in preceding chapters. However, though the overall SVTP program activities have been considered and have not altered significantly since 2017, more detail is now known, and baseline conditions may have altered. In addition, the consideration of other "relevant past, present and reasonably foreseeable developments" needs to be reviewed to ensure it remains pertinent. In view of the evolving context in the Shire Valley over the last years, incorporating uptodate information into the CIA is important. Finally, it is practical to distinguish the management responsibility for cumulative impacts from project impacts, considering the cumulative changes to a VEC is caused by multiple activities executed by multistakeholders. To this end, a modern CIA, be it part of an ESIA like this report or a standalone report, is presented separately from project level impact assessment. Therefore, in updating the 2017 ESIA to this 2022 ESIA, a separate chapter on CIA is added.

10.2 METHODOLOGY AND PROCESS

Cumulative impact assessment is a multistakeholder and iterative process. Over the last three decades, internatonally recogonized good practices have been developed to provide guidance on the methodology and process that a CIA could follow. These include the guidances provided in the Considering Cumulative Effects published by the U.S. Council on Environmental Quality in 1997, the Cumulative Effects Assessment Practitioners' Guide of Canadian Environmental Assessment Agency in 1999.

More recently, the World Bank Group's International Finance Corporation (IFC) published the Good Practice Handbook for Cumulative Impac Assessment and Management, which was developed with the intention of being applied in the context of developing economie and to comply with IFC's environmental and social policy and Performance Standards. Given the similarities between IFC's Performance Standards and the Environmental and Social Standards of the Workd Bank, the IFC's Good Practice Handbook fit well the objective and context of the project's cumulative impact assesment.

The process presented in the IFC's handbook includes six steps:

1. Step 1: Scoping Phase I – VECs, Spatial and Temporal Boundaries
2. Step 2: Scoping Phase II – Other Activities and Environmental Drivers
3. Step 3: Establish Information on Baseline Status of VECs
4. Step 4: Assess Cumulative Impacts on VECs
5. Step 5: Assess Significance of Predicted Cumulative Impacts
6. Step 6: Management of Cumulative Impacts – Design and Implementation

The six-step approach is illustrate in Figure 94. The process however is iterative: scoping (Steps 1 and 2), VEC baseline determination (Step 3), assessment of the contribution of the development under evaluation to the predicted cumulative impacts (Step 4), evaluation of the significance of predicted cumulative impacts to the viability or sustainability of the affected VECs (Step 5), and design and implementation of mitigation measures to manage the development's contribution to the cumulative impacts and risks (Step 6).

It should be noted that the process for cumulative impact assesment needs to be flexible. In this updated CIA for SVTP, as needed, other recognized good practices or technical terms are introduced to fit the project's context.

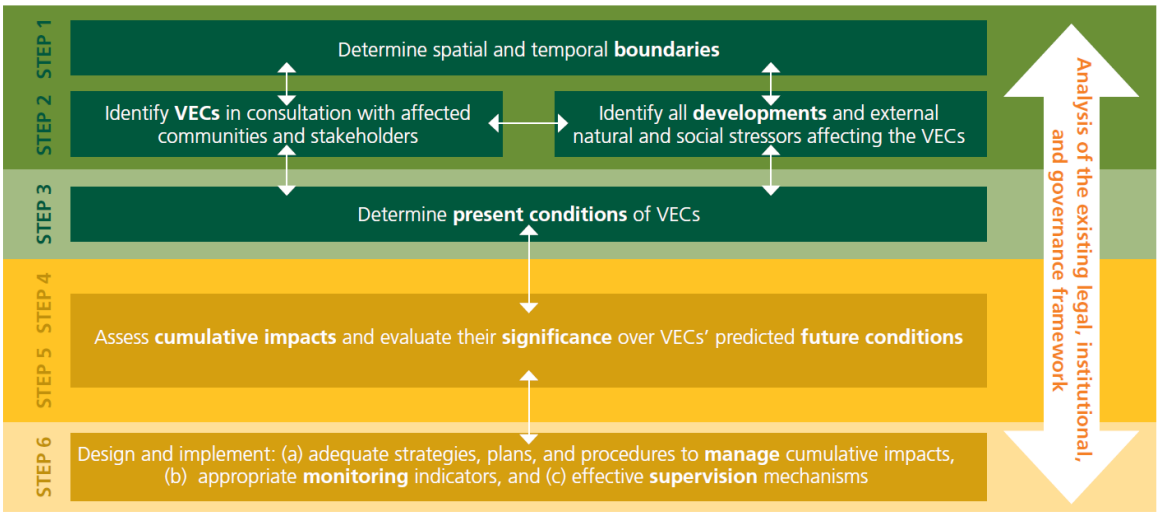

Figure 105: : Six-Step Approach for CIA (Source: IFC Good Practice Handbook for Cumulative Impac Assessment and Management)

10.3 IDENTIFICATION OF VECs

Identification of the VECs and determination of spatial and temporal boundaries stand for the fist step of cumulative impact assessment. Based on the preceding project level environmental and social impact assessment, several key VECs can be identified, including River Shire, Elephant Marsh Ramsar Site, Lengwe National Park and Majete Game Reserve. Transformation of the valley by the project will result in impacts to these key VECs not only from direct landtake (as the irrigation canal is built and the command areas are established during the three phases of the program), but also indirectly from water abstraction and an increase in agricultural chemicals and other wastes that may pollute the watershed. However, if these VECs are subject to changes as a result of other projects occurring at the same time as SVTP, the combination or cumulative effects may be more profound.

Other VECs are identified through well-known cumulative issues in the Shire Valley, consutlations with stakeholders and review of relevant regional, cumulative and project impact assessment. Carring capacity is a significant cumulative issue for example.

10.4 DETERMINATION OF SPATIAL AND TEMPORAL BOUNDARIES

The establishement of the spatial boundaries for cumulative impact assessment begins with examining the whole Shire Valley.

The spatial boundary of the CIA is currently set at the Lower Shire catchment which extends from the Kapichira Hydroelectric Power Station reservoir (downstream the confluence with the Mkurumazdi River) to the end of Elephant Marsh (downstream the confluence with the Ruo River) considering the main VECs identified for cumulative impact assesment. Necessary extension of the boundary is made by including key activities that may impact the VECs in a significant manner.

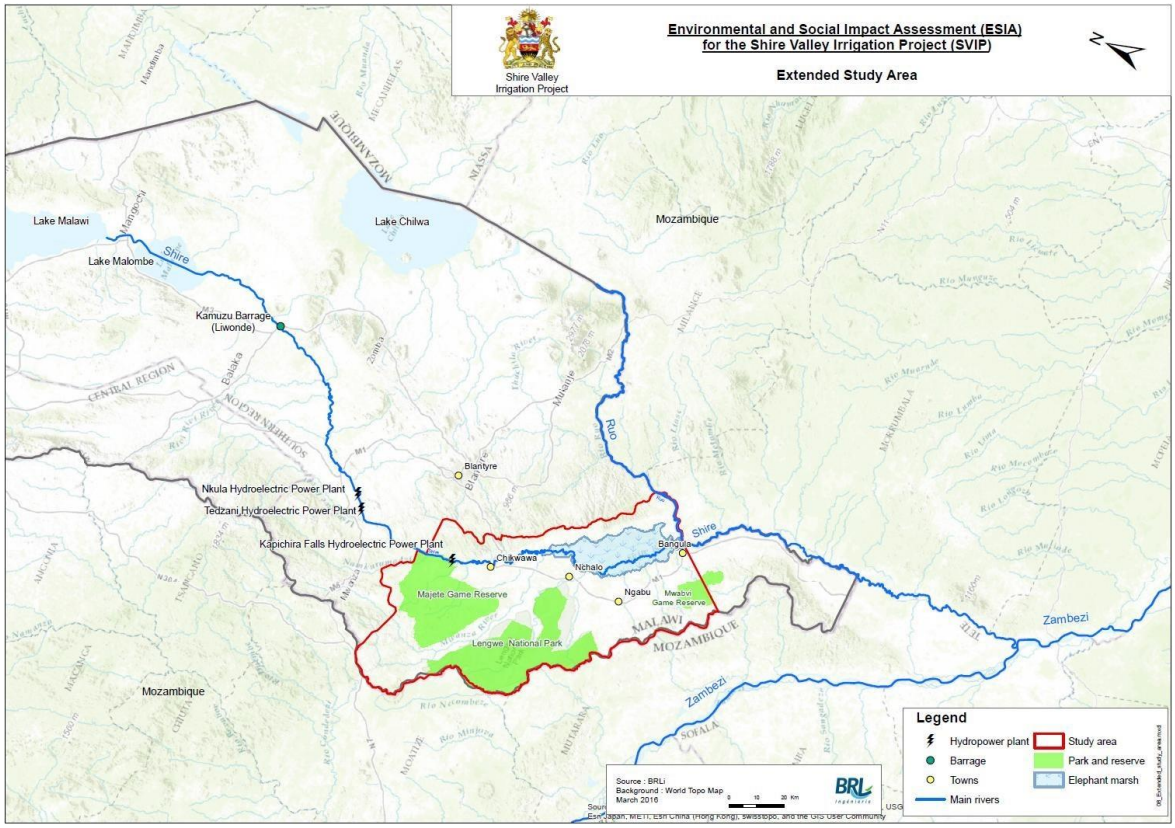

Figure 106: : Extended Study Area

The temporal boundary for the cumulative impact assessment is determined based on the lifecycle of the SVTP. As described in Chapter 4. The first phase under the program has initiated the process of transformation of the Shire Valley and paved the way for agricultural commercialization and improved natural resource management at the landscape level. The objectives for the second and third phases are to increase agricultural productivity in targeted smallholder-owned commercial farm enterprises; support value chain and value addition; extend area supported with irrigation and farm development; and continue and expand efforts to address land degradation and sustainable management of forests, wetlands and protected areas.

10.5 OTHER ACTIVITIES AND ENVIRONMENTAL DRIVERS

To assess cumulative impacts meaningfully, identification of past, existing, or planned activities is an critical step. Those activities are identified through desk review and consultation with stakeholders.

A number of meetings were held with stakeholders in the Shire Valley with a view to examine projects that have been implemented between 2017 and 2021 and any future projects that have a consumptive effect on the Shire River and consequently may affect the Elephant Marsh. The information is required to understand the communlative impact that may occur and their implications for the Shire river and Elephant marsh.

a) Malawi Watershed Services Improvement Project (MWSIP)

With a focus on the upper and middle reaches of Shire Valley (and other catchments in Malawi), the project will identify and implement measures to introduce more sustainable methods of landscape management practices, with the aim of protecting and enhancing watershed services. When fully implemented, the project will improve the quality and reliability of the watershed services upstream of SVTP. Sub-project improvements are currently in the planning stages, but will be designed to slow the discharge of runoff water into the Shire during rainfall fall events, reducing erosion and reducing the sediment loading.

Through MWASIP, 7 large scale and small scale irrigation schemes capable of irrigation 690 Ha of land will be developed alongside upgradinging of gravity fed water supply schemes. Building on experiences of previous failures of such schemes, the project will support catchment management activities in the middle Shire Catchment Area to reduce siltation and enhance water retention.

The actual water abstraction figures for these interventions will become known during studies and detailed designs of the schemes towards late 2022 to early 2023. The map below shows catchment areas targetted by MWASIP.

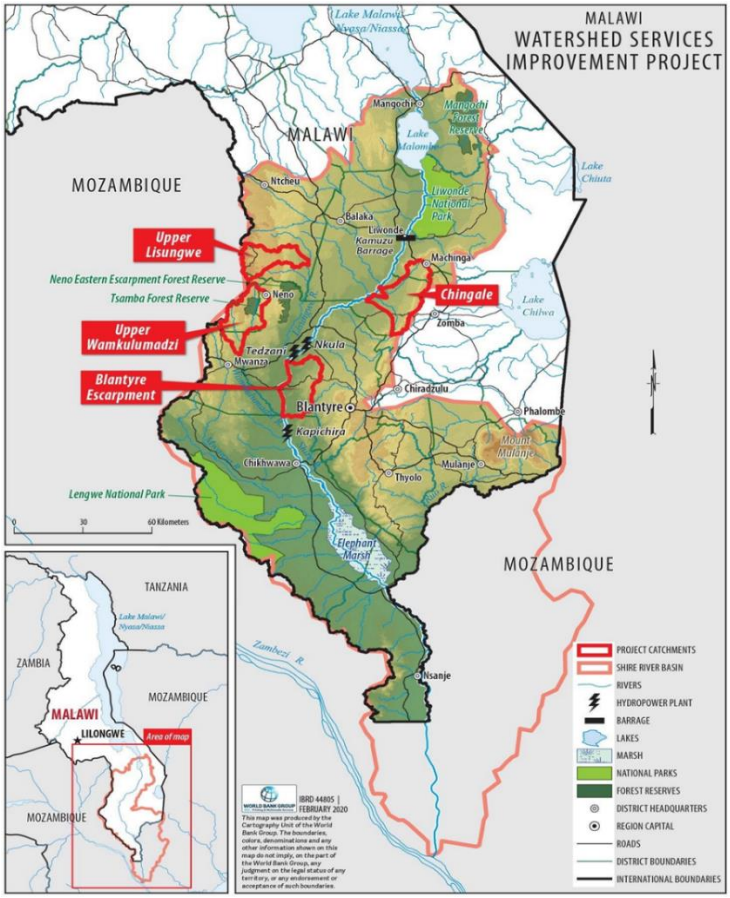

Figure 107: Targetted Watersheds Under MWASIP

b) Mpatamanga Hydropower scheme

Approximately 12km upstream of SVTP and to the north of Majete Game Reserve is the proposed location for the Mpatamanga Hydropower Scheme, which is expected to be composed of two dams, a HPP dam and a flow regulation dam. The scheme is likely to be developed with private sector involvement, including in terms of detailed design development, is currently in the planning phase. The project has completed an Environmental Flow assessment, and is reviewing and updating this as part of a rapid Cumulative Impact Assessment. A full Cumulative Impact Assessment will be required for the project in due course, and a key consideration of this will be the implication for the supply of water to SVTP as well as impacts downstream, for example on Elephant Marsh.

Mpatamanaga hydropower project will not remove water from the River Shire, but may have a regulating effect on the hydrological regime, similar to the effect of the other other hydropower projects along the upper reaches of the Shire River, and this may affect sediment transportation patterns along the river. As with the other hydroelectric power plants in the upper and middle reaches of the River Shire, the water reaching Mpatamanaga will be larely controlled by the Kamuzu barrage. The justification for building the Kamuzu Barrage as a control gate at Liwonde was to mitigate the possibilities of failure to maintain the design flow of 170 m^3/sec for hydropower in the middle reach of the Shire River. The barrage is designed to reduce the risk to an acceptable level, by retaining water when the Lake level is relatively high and by releasing it at times when the flow would otherwise have been too low.

Figure 108: Location of Mpatamanga in the Lower Shire Valley

The hydropower project estimates 121 households from three small villages (Chaswanthaka and Chikira villages in Blantyre District and Kambalame in Neno District) and a school (of about 800 students) and about 43-50 households along the main transmission line and access roads, will be affected by the construction works. The project will also impact local livelihoods and generate increased social risks related to construction-induced immigration. Local communities will also be exposed to the risk of flooding, accidental drowning, and exposure to vector-borne disease during operation.

A detailed analysis and evaluation of the impacts of Mpatamanga Hydroelectric Power Project will become clear as detailed designs get completed.

C) Shire Biodiversity and Environmental Support Trust (BEST)

Shire BEST has been established by the Millenium Challenge Corporation (MCC) – Malawi Compact to provide an emphasis on sustainable energy development. The purpose is to promote sustainability of project initiatives started by projects focusing on the Shire River Basin. To date the trust, in collaboboration with EGENCO, have embarked on catchment restoration and another with Illovo on flood management, soil stabilization and promotion of bamboo cultivation. These projects will not abstract from the River Shire and are designed to improve water retention and natural resources within the Shire catchment area.

As such they are unlikely to result in any detrimental impacts that would need to be considered alongside SVTP-II.

d) Prescane

Prescane, a local company (Press Holdings) to the Lower Shire River Valley, is a producer of high grade ethanol that is used for blending with petrol. As part of its expansion drive, the company is developing an irrigation scheme that will abstract 2,5 M3 per second of water from the Shire River upstream of the Elephant Marsh. Presscane also has a long-term plan to connect with the SVTP irrigation network, and therefore there will be no additional abstraction to consider in addition to that of SVTP.

Prescane will be developing a 2,215 hactre Kama-Kasinthula Scheme, starting with 1,069 hactres in 2022. The design abstraction rate is 2.5 M3 / second and the intake will be at the Kamuzu Bridge upstream of the Elephant Marsh. This scheme is currently in planning, and has not yet begun. The additional abstraction could have a small additional detrimental effect on Elephant Marsh, if it comes to fruitition.

e) SVADD - Divisional Irrigation Office

New development was considered with respect water abstraction from the Shire river, namely, the establishment of a small but new Chaimbatuka Irrigation Scheme. The schemes has an abstraction of 3 litres per second of water for 10 hactares and is solar powered. This is unlikely to have a significant impact on the hydrology of Elephant Marsh, even in combination with SVTP-II.

f) Water Resources Authority (WRA)

The Water Resources Authority are responsible for licencing abstractions from the Shire River. Discussions with the WRA are ongoing, that maintain a register that contains details of the abstraction permits issued since 2017. This information will assist in understanding the cumulative impacts of SVTP-II on the current baseline conditions.

No new licences have been issued for the abstraction of water from the River Shire since 2017.

g) Shire River Basin Management Program (SRBMP)

SRBMP was financed by the World Bank to support basin planning of the Shire River, including to develop the framework, institutional capacity, and water resources information systems. Component B Catchment Management supported catchment planning, monitoring and learning, rehabilitation targeted catchments, and alternative rural livelihoods and ecological management. Component C Water related infrastructure supported Kamuzu Barrage, flood management, and new water investment. Most activities of the SRBMP related to catchment management and rehabilitation, as well as the upgrading and future operation of the Kamuzu Barrage that influences the Shire River's flow, well upstream of the SVTP.

The SRBMP produced a series of study reports that are related to water resource management, Elephant Marsh adaptive management and climate resilident livelihoods. Refer to Chapter 3, Table 1 of this report for details.

10.6 BASELINES OF IDENTIFIED VECs

For cumulative impact assessment, baselines or existing conditions focus on the most important VECs hence are not as detailed as those for ESIA. This section describes the baseline conditions of identified VECs as described above.

River hydrology described in Chapter 6 of this report covers the whole Shire River and applies to the cumulative impact assessment. In relation to the several identified VECs, river hydrology, specifically hydraulic regime and process of Shire River, is fundamental to the assimilation and carrying capacity of the river and downstream ecosystems. Thus it is repeated in below with necessary modifications.

10.6.1 River Hydrology

The flow in the Shire River is highly regulated by the water level in Lake Malawi, in conjunction with the lake's natural outflow controls (a sand bar at 471.5 m above sea level , across the mouth of the Shire), and by the artificial influence of the Kamuzu Barrage at Liwonde (ATKINS, 2011). The justification for building the Kamuzu Barrage as a control gate at Liwonde was to mitigate the possibilities of failure to maintain the design flow of 170 m^3/sec for hydropower in the middle reach of the Shire River. The barrage is designed to reduce the risk to an acceptable level, by retaining water when the Lake level is relatively high and by releasing it at times when the flow would otherwise have been too low (Kumambala, 2009).

There are two major water abstraction points that also influence the flow in the Shire River at Kapichira (NORPLAN, 2013):

- Irrigation scheme of Mtengula: 5 m^3/s for peak water demand.
- Drinking water supply for Blantyre Water Board: 2 m^3/s maximum including possible extension.

The Shire River runoff at Kapichira is therefore highly influenced by the flow regulation of the Lake Malawi and Kamuzu Barrage and water abstractions for irrigation of Mtengula and drinking water supply for Blantyre (ATKINS, 2011) and (SMEC, 2014).

There are several hydropower stations and dams on the Shire River between the Lake Malawi and the Kapichira Falls: the Nkula, Tedzani and Kapichira hydropower stations. Their operation patterns also influence the runoff at Kapichira.

To take into account this upstream influence and to be consistent with the FS, the following flow estimates have been considered for the water resources assessment:

- NORPLAN (2013) and NIRAS/DHI (2017) for the upstream part (flow at Kapichira);
- from SMEC (2014) for the downstream part (runoff for Mwanza River, right-bank and left-bank tributaries); and from

- BRLi (2016) for the Ruo River[14].

The upstream part of the basin at Kapichira Dam controls approximately 80% of the average annual flow of the whole basin at Chiromo Bridge. The intermediary part of the basin from Kapichira to Chiromo (including Mwanza but not Ruo) only contributes for about 5%. The remaining 15% are driven by the Ruo River.

During the dry season, 95% of the total flow at Chiromo are controlled by the upstream basin at Kapichira. The contribution of the intermediary basin is close to nil and the inflow of the Ruo River brings about 5%.

During the wet season, about 75% of the total flow at Chiromo are controlled by the upstream basin at Kapichira. The contribution of the intermediary basin counts for about 5% to 10% and the inflow of the Ruo River rises up to 20% and to 25% of the peak flow.

Thus, on the one hand, the Elephant Marsh hydrological behaviour during the dry season is almost entirely driven by the upstream basin of the Shire River at Kapichira and consequently the main leverage for action to satisfy the minimum environmental flow for Elephant Marsh is the Kamuzu Barrage.

On the other hand, during the wet season, the Elephant Marsh inundation is mainly due to the Shire River but also to the Ruo River that brings more than the quarter of the inflow in the wetlands.

10.6.2 Elephant Marsh

Refer to Section 9.4 for the existing conditions of the Elephant Marsh.

10.6.3 Lengwe National Park

Refer to Section 9.2 for the existing conditions of the Lengwe National Park

10.6.4 Majete Wildlife Reserve

Refer to Section 9.1 for the existing conditions of the Majete Wildlife Reserve

10.7 ASSESS CUMULATIVE IMPACTS ON VECs

This section is based on what was included in Section 11.3.

10.7.1 River Hydrology and Elephant Marsh

With respect to the river hydrology and Elephant Marsh, the water abstraction for SVTP on the hydrological functioning of the River and Elephant Marsh is examined. In undertaking this assessment, the Illovo and Mtengula irrigation schemes (5 m^3/s for peak water demand), the Blantyre Water Board abstraction (2 m^3/s maximum), and a program of measures described and assessed as part of the Shire River Basin Management Program (SRBMP) were taken into account. The study concluded a Moderate residual impact for the cumulative abstraction of water on Shire River and Elephant Marsh, on the assumption that the Illovo irrigation scheme pumping stations would be shut and that no further provision is made for

[14] A GR2M hydrological model was implemented (Mouehli, 2003). The calibration was made with the historical time series discharge for the Ruo River at Sinoya South (4721 km^2). The statistic calculations were made for the reference period from 1979-2009 as in (JICA, 2014) and (SMEC, 2014).

an environmental flow from Kamuzu Barrage. Kamuzu Barrage is reported to be highly influential on flow regulation in the River Shire.

The Shire River runoff at Kapichira is therefore highly influenced by the flow regulation of the Lake Malawi and Kamuzu Barrage. The Elephant Marsh hydrological behaviour during the dry season is almost entirely driven by the upstream basin of the Shire River at Kapichira and consequently the main leverage for action to satisfy the minimum environmental flow for Elephant Marsh is the Kamuzu Barrage. On the other hand, during the wet season, the Elephant Marsh inundation is mainly due to the Shire River but also to the Ruo River that brings more than the quarter of the inflow in the wetlands. SVTP does not impact the flow regime in the Ruo River.

As described, the intake that is constructed as part of SVTP Phase 1 will extract 50m3/s from Kapichira reservoir, which is the maximum amount of water that is needed to irrigate the 43,370ha of SVTP. The maximum net abstraction will be 32m3/s, considering the move of Illovo from direct river pumping to using water from the SVTP scheme. The net abstraction is equivalent of 10% of the low flow (dry season month of peak irrigation demand), and therefore 90% of the current water will still flow along the River Shire and to Elephant Marsh.

The operator of the canal and canal infrastructure is responsible to ensuring that no unauthorized abstractions occur from the canal network, and for ensuring that the water needed to meet the demand in the farms is abstracted from Kapichira reservoir. The SOCFEs will be established with consultant support and in order to be as financially viable as possible will make use of efficient water (and resource) use processes that are designed to meet exactly the needs of the crops. This will reduce wasteage as well as farm run-off, further ensuring the maximum designed water extraction will not be exceeded. Due to the flat nature of the irrigated land, SVTP is not predicted to be a major source of sediments washed into the River Shire and Elephant Marsh.

However, there will be increases in the use of pesticides, herbicides, fertilizers and other farm chemicals during farm operations as part of the SVTP scheme. Over time, there may be an accumulation of these within the River Shire and particularly within Elephant Marsh. A monitoring program has been integrated into SVTP project to enable early identification of any changes that may result in the flora or fauna of elephant marsh as part of SVTP and to allow for adaptive management practices (such as substitution of chemicals or altered use arrangements) to be introduced into operations.

10.7.2 *Majete Reserve and Lengwe National Park*

No other developments have been identified that will directly affect Majete or Lengwe negatively at the location of the SVTP works. Illegal logging, encroachment of cattle grazing and poaching impacts have been recorded in past from Majete Game reserve and are known to occur from time to time in Legnwe National Park, although strengthened management practices and community engagement in Majete Game Reserve has reduced the number of events dramatically, according to African Parks. As part of SVTP-II, measures will be taken to assist Lengwe National Park achieve its management objectives, including through investments in fencing, ranger services, human-wildlife conflict management, and enhancement of facilities to promote conservation and increase tourism.

As part of SVTP-I, studies on potential wildlife corridors to enhance the natural movement of animals between Majete Game Reserve (which needs to reduce numbers of some key

species, including elephant) and Lengwe National Park (which is currently devoid of many species) were undertaken. If these studies identify a feasible option for linking the parks, the opportunity may be persued subject to full and complete consultation with local communities. The linking of these parks may result in significant benefits to both parks and animal numbers in the long term.

10.8 MANAGEMENT OF CUMULATIVE IMPACTS

The hydrological model developed for Shire River to investigate the potential impacts and cumulative impacts of the abstraction of water SVTP program considered carefully the projects that were known about or planned. During the update of the SVTP, no further significant abstractions have been identified, and although the planning of Mpatamanga Hydropower Project has advanced, it has not yet reached the position where clear information about its implications for the VECs are known. Therefore the findings of the cumulative assessment presented in the ESIA are still considered pertinent for the current assessment.

No other planned projects have been identified that could significantly alter the water quality or quantity reaching Elephant Marsh, and the mitigation measures described in the ESIA, for example through the flora and fauna monitoring and as necessary adaptive management of chemicals and pesitices used on the farms to minimise impacts.

Recongising the importance of the River Shire Basin to the success of the projects, many of the other projects in the Shire Valley that are being undertaken contemporaneously with SVTP include natural resource or catchment improvement measures. SVTP is no exception and following the work to identify management interventions in Elephant Marsh and Lengwe National Park (as well as Mwabvi Wildife Reserve and Matandwe Forest Reserve) during SVTP-I, management interventions are planned to continue during subsequent phases of SVTP to deliver on the improvements.

The activities planned under Component 4 of SVTP-2, in particular those linked to the Elephant Marsh, will be screened relative to the CIA for the entire basin. If the screening shows that there may be a negative impacts as a result of the planned activities for SVTP-2 component 4 works, these activities will be kept pending until the basin-wide CIA has been completed.

CHAPTER 11. IMPACT ASSESSMENT CONCLUSION

This Impact assessment report is based on several bibliographical researches and consultations with various stakeholders as well as external experts on wildlife behavior. The ESIA has highlighted several significant impacts, all of which can however be mitigated to acceptable levels as long as adequate budget is dedicated to mitigation measures.

TENDER PROCESS FOR A CONSTRUCTION CONTRACTOR

The selection of a construction contractor and the inclusion of appropriate mitigation measures in call for tender and contract is a crucial step in ensuring delivery of the mitigation measures. Contractors must be clear as to the obligations they are to meet, and be provided with sufficient information to guide understanding of what they should do to meet these obligations.

For SVTP-I the bidding process was used to carefully select two contractors, one with experience of working in sensitive areas to be responsible for the works that affect Majete Wildlife Reserve. A similar approach will be taken in SVTP-II to ensure that the contractor engaged to construct within Lengwe National Park can demonstrate suitable experience of working in protected areas.

WORK IN Majete Wildlife Reserve

The mitigation measures being delivered as part of SVTP-I in Majete Wildlife Reserve are as described in this ESIA and set out in the Phase 1 ESMP. The works are progressing in accordance with program, and are being closely monitored by African Parks.

Alignment and TYPE OF CANAL INLENGWE NATIONAL PARK

The detailed design of the canal through Lengwe is yet to be undertaken. During the detailed design process, an alignment will be selected that avoids or minimizes impacts to the thicket, and careful consideration will be given to locating the wildlife overpasses and underpass. In addition, the design of the canal cross section, as well as the surfacing of the canal will be considered to minimise fragmentation effects.

Watering points shall be provided in Lengwe National Park, and compensatory planting and habitat creation measures will also be undertaken, to include a wetland area. In designing the works, DNPW will be consulted.

A Biodiveristy Management Plan will be prepared to describe the mitigation proposals to be put in place in Lengwe National Park.

ELEPHANT MARSH

Although not directly affected by works, the abstraction of water for SVTP may result in some localized changes to the extent of marsh vegetation in Elephant Marsh. Hydrological and botanical monitoring will be designed and implemented as part of SVTP, and the information used will assist with the implementation of Community Conservation Area initiatives to be undertaken on Elephant Marsh as part of the Natural Resource Management Works of SVTP..

11.1 RESIDUAL IMPACTS

This section presents residual impacts, if mitigations are implemented impacts can reach an acceptable level.

Table 100: Residual impacts

Impacts	Significance	Residual impact	Explanations
Impacts from water work. During construction, some actions and infrastructures will modify geomorphology of rivers	Negligible	Negligible	Impacts will be reduced with mitigation but not suppressed
Siltation of Elephant marsh. During operation of the scheme, erosion and sedimentation pattern will be modified	Minor	Minor	Reduction of flow cannot be mitigated, the impact will remain
Water abstraction. Up to 50m^3/s will be extracted from the Shire system	Major (and cumulative)	Moderate	Reduction of the impact can be slightly achieved if pumping stations of Illovo remain shut down and if drainage is efficient. However, they are no provision for an environmental flow from Kamuzu barrage
Hydraulic transparency. When crossing the canal tributary rivers can flood upstream village if culverts are not properly sized	Minor	Negligible	If infrastructures (box culvert, etc.) are properly dimensioned, the impact should be negligible
Impacts from water works. Construction activities will bring silt and other pollutants to rivers	Negligible	Negligible	Impact will be reduced with mitigation but not eliminated
Water quality impairment. Drainage in watercourses will impair water quality	Moderate	Moderate	Impact will remain the same as pesticides and fertilizer will inevitably be used
Impacts from earthwork and land leveling. Construction of the canal system will lead to important earth movement	Moderate	Minor	If mitigations are implemented the impact can be reduced

Impacts	Significance	Residual impact	Explanations
Changes in soil properties and rising water table. Several changes in soil properties could take place in the command area	Minor	Negligible	Proper soil management will reduce the impact
Village reorganization and resettlement. Major changes are foreseen in terms of land occupation	Major	Minor	The RAP report will address impacts from village reorganization
Workers influx. Land will be necessary and there is a risk that infrastructures do not respect quality standards. Influx could be associated with social impacts	Moderate	Minor	If mitigations are implemented, including the strict application of the Code of conduct, the impact can be reduced
Rapid social changes. There is a risk that people do not	Minor	Minor	Impact will be reduced with mitigation but not eliminated.
change their lifestyle and develop skills			The current CCPLTRPF assignment aims to collecting people grievances and communicate about the Project. The Communication strategy report provides a tool to ensure social acceptability of the Project.
Hinterland effect. Increase in human activity and local economy may lead to additional pressure on resources (wood for charcoal, fish, etc.) and land	Moderate	Moderate	Mitigations for this impact are difficult to address in an ESIA
Permanent loss of buildings and other assets. Canals could necessitate to pass through several buildings and assets	Minor	Minor	Impact will be reduced with mitigation but not eliminated, however, the RAP will compensate according to the World Bank requirements
Disruption of access. Canals may sever footpaths and cattle paths	Moderate	Minor	If all measures to ensure continuity of access are

Impacts	Significance	Residual impact	Explanations
			fulfilled, the impacts will be mitigated
Inadequate maintenance of canals and infrastructures. There is a risk of canals and water intake siltation and invasion of plants in canal and drainage channel	Moderate	Minor	If all measures to ensure proper maintenance of canals and infrastructures are implemented by the scheme operator, the impact will be mitigated
Disturbance to existing agriculture. New lands may not be ready for cropping immediately because of timing, lack of water, or the need for land preparation including levelling, boundaries and drains	Minor	Minor	Impact will be reduced with mitigation but not eliminated, the risk still needs to be adressed
Job opportunities. Work will require unskilled and skilled labour for construction	Minor (positive)	Moderate (positive)	If the employment recruitment policy is implemented, the positive impact can be enhanced
Potential delays in irrigated agriculture development. Any delays in the project completion or skills acquisition could delay the benefits	Minor	Minor	The impact will be reduced with mitigations but not eliminated
Over supply of crops. Increase in production could lower prices and affect rain fed producers	Major	Minor	If this issue is addressed in future studies (agriculture development, agribusiness development), this risk will be significantly reduced
Benefits of irrigated agriculture. The project overall goal is to benefits local communities	Major (positive)	Major (positive)	This major positive impact will be enhanced thanks to training of farmers, creation of water user associations, etc.
Reduction of fisheries. Fishery could be impacted by SVTP	Minor	Minor	Reduction in fishery (if it occurs) will hardly be mitigable. The SRBMP will develop more good management measures for fisheries

Impacts	Significance	Residual impact	Explanations
Impacts on livestock rearing. The project will require adaptation of livestock rearing activities	Moderate	Minor	If appropriate mitigations to ensure that livestock owners have access to grazing areas, the impact will be mitigated.
Construction risk and nuisances. The public and workers are at risk from important works along canals	Minor	Minor	Impact will be reduced with mitigation but not eliminated as they will always remain a level of nuisance (noise, dust) and risks of collision
Bilharzias. An increase of bilharzia in the command area is expected	Moderate	Minor	Impact will be reduced with mitigation such as mass treatment but will not be eliminated
Drownings. The presence of main canals may lead to drownings	Major	Moderate	Reduction of the drowning risk can be achieved with sensitization and safety ladders, but never eliminated
Increase workload for women. The Project may become a burden to the workload of women but on the other hand time spent to get water should decrease with **Improved access to water**	Minor (positive)	Minor (positive)	Gender and Youth Strategy Study (COWI, 2016) has developed a series of measures to mitigate these impacts.
Risk of unfair distribution of benefits. Access to financial services is a strong barrier to women and youth empowerment	Moderate	Minor	
Impacts on vulnerable people. The Project benefits may not reach vulnerable people	Moderate	Minor	
Loss of physical cultural heritage. During construction, excavation of the canal will affect some known and unknown cultural heritage sites.	Minor	Minor	Reduction of the impact can be achieved, however, they will always remain a certain level of impacts as excavation may unveil (or destroy) unknown cultural heritage material

Impacts	Significance	Residual impact	Explanations
Loss of Critical Habitat (thicket in Lengwe) and decision on the type of canal and its alignment. Decisions regarding the canal layout during the design stage will have long term impacts on Lengwe National Park and **Majete Wildlife Reserve**	Major	Minor	The canal alignment and design has been optimized in MWR and is currently underconstruction. The detailed design for the canal in Lengwe National Park is yet to be undertaken but measures to minimise habitat loss and fragmentation are expected to be possible.
Tender process and selection of a construction contractor. The tender process for the selection of the Project construction contractor represent a high risk for parks as it is a crucial step in the development of binding environmental measures	Major	Moderate	A high quality construction contractor has been selected and is working through Majete Wildlife Reserve. A similar approach shall be taken for the works through Lengwe National Park.
Impact on tourism. Construction activities in MWR and LNP and close to Ng'ona lodge will have deleterious impacts on tourism	Moderate (MWR) / Minor (LNP and Ng'ona lodge)	Minor	Construction within Majete has coincided with the outbreak of the COVID pandemic. As a result of travel restrictions, less international travel from outside of Africa. This has obscured the true impact of the works on tourism in Majete. Nonetheless, the mitigation measures to minimise disturbance have been undertaken. Mitigation measures for Lengwe will ensure the works have minor effect on tourism.
Impact on Majete buildings, roads and infrastructures. Infrastructures will be disturbed by construction of the Feeder canal	Moderate	Minor	Controls during works as described in the ESMP have been implemented to minise disturbance to the park

Impacts	Significance	Residual impact	Explanations
Impact on Kapichira falls attractiveness. The viability of the falls as a sight to see for tourists may be compromised on long term with reduced flows	Moderate	Moderate	As explained in the report, no realistic mitigation can be implemented
Impact on Lengwe roads and infrastructures. The fence and park roads will be impacted	Moderate	Minor positive	If appropriate infrastructures are implemented as part of the detailed design, they could become an opportunity for LNP
Loss of ownership of park management on the western side of Lengwe. Construction and operation of the Bangula canal will split the park in two, this could be interpreted as a message of weak ownership	Moderate	Minor	If appropriate compensations such as a new ranger scout are funded, the impact will be mitigated
The presence of a canal inside parks will be long-term agent of changes. The presence of canals and other infrastructures inside parks will require additional efforts and inputs from park management in order to maintain parks' integrity	Moderate	Minor	If responsibilities are clearly stated in agreements, the impact will be reduced
Rapid change in land cover. The command area will lead to significant changes in land cover	Moderate	Minor	If set aside lands are implemented at Design, the impact will be reduced
Disturbances of wildlife and vegetation. Forest clearing will permanently destroy valuable habitats and work will startle wildlife	Moderate	Minor	With compensation measures (planting of trees) and mitigation during work are implemented, the impact will be reduced
Habitat fragmentation. Canals	Major	Minor	With a buried canal in MWR

Impacts	Significance	Residual impact	Explanations
will permanently fragmentize habitats especially in parks			and wildlife overpasses in LNP, the impact will be reduced
Drowning hazard for wildlife. An open canals represent a drowning hazard for wildlife	Major	Moderate	If the appropriate measure is taken against animal intrusion in the canal the impact will be reduced for large animals, however small animals will always be at risk of drowning.
Changes in plant composition in Elephant marsh. Flow reduction will reduce the size of Elephant marsh	Moderate	Moderate	The impact is not mitigable, as they are no provision for an environmental flow from Kamuzu barrage
Wildlife-human conflict. There is a probability that hippos and crocodiles enter the drains and cause wildlife – human conflicts (and casualties). Irrigated field will become very attractive for wildlife.	Moderate	Moderate	The risk is hardly mitigable, however it mainly concerns Phase II as Phase I is far from Elephant marsh
Disturbance to fish migration to spawning sites. Works and infrastructures in temporary rivers could lead to fish migration disturbances	Moderate	Minor	If work is done outside the spawning season and crossings and culverts properly sized, the impact will be reduced
Risk of Tiger fish invasion in the upper Shire. The water intake could lead to Tiger fish invasion of Middle and Upper Shire and Lake Malawi	Major	Nil	The fish barrier being constructed at Majete Wildlife Reserve will prevent the passage of Tiger Fish to the upper reaches of the Shire River
Reduction of suitable habitat for fish in the Elephant marsh. Reduction of flow will lead to reduction of habitat suitability in the marsh	Moderate	Moderate	The risk is hardly mitigable. However, SRBMP may propose measures to mitigate impact

MONITORING INDICATORS

The success of the implementation of this ESIA and and the plan in Annex 1 below will depend on the extent to which indicators in Table 96 below are addressed

Table 101: Summary of Monitoring Indicators

Required Measure	Responsible Actor	Description of monitoring	Monitoring actors
Inclusion of Environmental and Social (E&S) requirements into the Bidding Documents for the Contractor	PMT Procurement, Environment and Social specialists are responsible for ensuring measures set out in Chapter 5 into the Bidding Document and subsequent Contract for the construction contractors.	Self check, internal reviews and sign-off by Project Coordinator of the draft Bidding Documents.	PC, PMT relevant Specialists
Implementation of E&S Requirements set out in the Construction Contract	**Construction contractor** is fully responsible to budget for and implement the measures in their contract **Supervising Engineer** Responsible for day to day monitoring of compliance with requirements	**Self-Monitoring by Contractor** Environmental, Social and Health and Safety Specialists monitor own performance against CESMP and OHSM etc **Supervising Engineer** Will undertake document reviews and site inspections to confirm works are proceeding in accordance with requirements **PMT** Environment and social specialists to monitor performance of Supervising Engineer in holding the Contractor to account for delivering the requirements of the contract, including through undertaking reviews of the contractor performance. **Governmental monitoring** Governmental monitoring	Environmental, Social and Health and Safety Specialists from Contractor and Supervising Engineer PMT Environment and Social Specialists Government Inspectors from EAD, Ministry of Labour (MoL)

Required Measure	Responsible Actor	Description of monitoring	Monitoring actors
		of compliance with national regulation regarding health and safety, workers condition and environmental protection	
Inclusion of E&S requirements into the Supervising Engineers Terms of Reference	PMT Procurement, Environment and Social specialists are responsible for ensuring measures set out in Chapter 5 are incorporated into the Supervising Engineers Terms of Reference	Self check, internal reviews and sign-off by Project Coordinator of the Terms of Reference.	PC, PMT relevant Specialists
Implementation of the Terms of Reference of the Supervising Engineer	**Supervising Engineer** is responsible for complying with their Terms of Reference **PMT** Responsible for monitoring the performance of the Supervising Engineer	Supervising Engineer's reports will be checked by PMT Specialists to ensure that they include details of the measures that the Supervising Engineer has done to ensure Contract is implementing the Contract PMT will undertake site inspections of the works to satisfy themselves that the workers are being undertaken in accordance with the contract	Environment, Social and Health and Safety specialists from Supervising Engineer PMT relevant Specialists
Inclusion of E&S requirements into the Bidding Documents for the bulk water Operator	PMT Procurement, Environment and Social specialists are responsible for ensuring measures set out in Chapter 5 are incorporated into the bidding documents for the operator	Self check, internal reviews and sign-off by Project Coordinator of the bidding document.	PC, PMT relevant Specialists
Implementation of the E&S Requirements during operation of the canal and	**PMT** Responsible for monitoring the performance of the	PMT Specialists to undertake inspections and documentation reviews as necessary to ensure that the	PC, Environment, Social and Health and Safety

Required Measure	Responsible Actor	Description of monitoring	Monitoring actors
associated infrastructure	Operator against the requirements of the contract	operator is complying with the requirements of the contract	specialists from PMT
Inclusion of E&S requirements into the Designer's Terms of Reference	PMT Procurement, Design Manager, Environment and Social specialists are responsible for ensuring measures set out in Chapter 6 are incorporated into the Designers Terms of Reference	Self check, internal reviews and sign-off by Project Coordinator of the Terms of Reference.	PC, PMT relevant Specialists
Implementation of requirements set out in the Designers Terms of Reference	The Designer's team will implement Environmental Design Management Procedures to ensure that all issues are adequately incorporated into the design. PMT specialists will confirm requirements have been met	**Self-Monitoring by Designer** Environmental, Social and Health and Safety Specialists will follow the EDM Procedures to ensure the timely incorporation of issues **PMT** Will review designs and the solutions to confirm all issues have been incorporated	Environmental, Social and Health and Safety Specialists from Designer PMT Specialists
Compensating for impacts to Lengwe National Park – Monitoring Chapter 7	The Compensation measures described in the ESMP will be delivered to DNPW, commensurately with the delivery of the relevant services, and on presentation of compliant invoices	**PMT** PMT will agree the timescales for the delivery of the compensation payments with DNPW, taking into account the program of services to be provided by DNPW. Where necessary this will need to reflect the construction program	PMT Environment Specialist DNPW
Establishing and operation of Command Areas to ensure design	PMT will ensure relevant TORs (SOCFE Development	Self check, internal reviews and sign-off by Project Coordinator of the Terms of Reference.	PC, PMT relevant Specialists

Required Measure	Responsible Actor	Description of monitoring	Monitoring actors
requirements from Chapter 6 are incorporated in farm set up and operation, including: No impacts to natural habitat Archaeology is rescued PMP requirements are delivered Farm H&S plan is prepared and implemented Energy and resource (water) use efficiency is considered	Service Provider; Investment Assessment Panel; Farm Managers) contain relevant provisions	PMT will submit to World Bank for their review and no-objection the TORs. PMT to monitor the work of the specialists and ensure requirements of the TOR are being delivered.	
Screening of projects under Natural Resources Management Component, including fish ponds	PMT Natural Resource Management Coordinator will be responsible to organizing the screening of all projects	**PMT:** PMT Environment and Social Specialists will check and review the screening forms prior to submission to PMT PC. PMT PC will sign off on the screening.	PMT specialists PC
Waste Management Planning – preparation and implementation of TORs	PMT will prepare TORs for the Waste Management Planning study PMT to appoint appropriately skilled specialist to implement the TOR and to prepare the study outputs.	Self check, internal reviews and sign-off by Project Coordinator of the Terms of Reference, of the proposed specialists CV, and of the study outputs. PMT will submit to World Bank for their review and no-objection to the TOR, to the proposed specialist, and to the outputs of the study	PC, PMT relevant Specialists
HS Training – Farm and water related health issues, including Schistosomiasis and communicable diseases	MoH specialists will undertake research, identification and sensitization campaigns	**PMT:** PMT Environment and Social Specialists will monitor the delivery of services and of educational campaigns	PMT Specialists

Required Measure	Responsible Actor	Description of monitoring	Monitoring actors
HS Training of community and workers – Safety on construction sites, near canals and on farm safety	OHS specialists will prepare and deliver training and awareness raising campaigns, according to the TOR prepared by PMT	**PMT:** Having prepared TORs for the trainings and awareness raising, PMT Environment and Social Specialists will monitor the roll out of the programs	OHS Specialists, PMT Specialists
Engaging with Law Enforcement	PMT will request regular attendance of law enforcement	**PMT:** PMT Social Specialist will monitoring the presence of Law Enforcement at GBV trainings	PMT Social Specialist
Project GRM	PMT Social Specialist will be responsible for the publication and smooth running of the project GRM	**PMT:** Self check by PMT Social Specialist Monthly reports to PC	PC, PMT Social Specialist
Archaeology and Cultural Heritage rescue in advance of construction	PMT will engage DoA to undertake rescue of artefacts from high priority sites prior to construction	**PMT:** Environment Specialist will ensure the TOR for the advanced rescue operations accord with the ESMP. Environment Specialist will monitor the delivery of the service	DoA, PMT
Action Plan for Gender and Youth	PMT Social Specialist will coordinate and promote these activities amongst the actors	**PMT:** Will set up regular meetings with actors and prepare reports of the activities undertaken.	PMT, Consultants, District Councils, MoAIWD, National Youth Council, farmer organisations, various other departments and institutions

11.Environmental and Social Management and Monitoring Plan

1.1 Environmental and Social Management Plan

The main purpose of Environmental and Social Management Plan (ESMP) is developing procedure that details measures to be taken during the implementation and operation of a project that reduce, eliminate or offset adverse environmental and social impacts and actions needed to implement these measures. ESMP is used to ensure that negative environmental impacts identified are mitigated during project implementation and operation phases. This requires identification of suitable administrative arrangements and responsible parties to undertake the ESMP and a mitigation plan setting out what mitigation is required and monitoring plan (see section 11.2) to assess the adverse impacts during implementation and the efficacy of the mitigation measures and budget estimate for implementing the ESMP.

The environmental and social management plan (ESMP) is also a statement of how and who will carry the implementation of proposed mitigation measures. Environmental and social management plans to be adopted the proposed project during different phases of proposed project are summarized in Table 5 below.

The environmental and social management plans of the proposed project indicates that most of the responsibilities lies with the client however contractors will be required to prepare and submit a construction environmental and social management plans .

The construction contractors will prepare and submit the following Construction Environmental and Social Management Plans (C-ESMP) and these plans should be part of bidding and contract documents. The C-ESMPs shall include the following specific Site Environmental Management Plans but not limited to:

- Occupational Health and Safety Management Plan
- Community Health, Safety and Security Management Plan
- Air Quality Management Plan
- Noise and Vibration Management Plans
- Traffic Management Plans
- Construction Camp Management Plan
- Water Management Plan
- Wastewater and Sewerage Management Plan
- Human Resources Management Plan
- Landscaping and Re-vegetation Plan
- Demobilization Plan
- Quarries, Borrow and Spoil Disposal Sites Restoration Plan et

1.2 Environmental and Social Monitoring Plan

Environmental and social monitoring is required during pre-construction, construction and operation phase of the proposed project .Environmental and social monitoring plan plays an important role in achieving environmental study objectives, realization of proposed mitigation measures and ensure project sustainability.

Monitoring involves the continuous or periodic review of project activities to determine actual implementation and effectiveness of recommended mitigation measures. Consequently, trends in environmental degradation or improvement can be established. Its

purpose is to establish benchmarks so that the nature and magnitude of anticipated environmental and social impacts can be continually assessed. The objectives of environmental and social monitoring for the proposed project are:

- To check on whether the proposed mitigation measures have actually been implemented
- To provide actual nature and extent of key impacts and the effectiveness of mitigation and benefit enhancement measures, and modify existing or create new mitigation measures to ensure actual impacts and risks are properly mitigated
- To help decision making in environmental, health and safety, and social management monitoring, including resolution of non-compliances, unplanned events, and building upon lessons learned to have more effective and efficient environmental and social management
- To create institutional coordination mechanism between the proponent, relevant district and sector office and the other partners involved in the environment monitoring activities. The environmental and social monitoring plan for the proposed project .

The Environmental and Social Management and Monitoring Plan of the SVTP2 is summarized in Annex 1.

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ANNEXES

ANNEX 1: ENVIRONMENTAL MANAGEMENT AND SOCIAL MONITORING PLAN

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
1	**Impacts in Lengwe National Park**								
1.1	Loss of revenue from tourism	Compensate DNPW for loss of income	DNPW at Lengwe National Park	Accounts records	Quarterly	Amount of revenue generated from torurism for LNP and Nyala Lodge	DNPW, Nyala Lodge	SVTP	7,000
1.2	Drowning hazard for wildlife	Ensure side slope is no more than 1:1.25; Install eco-bridges, anti-drowning structures and escape routes	Entire alignment of canal in the parkl;	Design of canal	Throughout the project construction period	Design and design review reports	Contractor	SE, SVTP	Included in SE and contruction contract
1.3	Loss of Critical Habitat and fragmentation of park	Change alignment so as to avoid critical habitat	New alignment of canal	Design report	Design and construction period	New design of canal alignmrnt that avoids the critical habitat	Design engineer, SVTP	SE, SVTP, DNPW	Included in construction and SE contracts
1.4	Loss of fauna species due to poor disposal of waste in Lengwe National Park	Develop and implement a waste management plan for the contractor	Construction sites along the alignment in LNP	Site visits	Throughout construction and operation periods	Mortality rates of fauna during construction and operation	Contractor, OM&M Operator	DNPW, SE	Included in OM&M and contractruction contract

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
1.5	Disturbance of fauna due to noise and vibration	Develop a Memorandum of Understanding between Contractor, DNPW, SE and SVTP to guide construction works in LNP; Restrict construction in LNP to day time only; Ensure that rock blasting is conducted at times agreed with DNPW	Construction site	Site visits	Throughout construction period;	Memorundum of Understanding in place; Number of non compliance reports	Contractor	DNPW, SE and SVTP	Included in construction and SE contracts
1.6	Loss of flora species due to construction activities in Lengwe National Park	Restrict vegetation clearing to RoW of the canal; Prohibit establishment of campsites in the park	Canal alignment in the park	Site monitoring visits; monthly site meeting visits	Throughout construction	Number of cases of non compliance reported;	Contractor	DNPW, SE, SVTP	Included in BMP
1.7	Wildlife poaching and trafficking by workers, job seekers and local communities	Enhance enforcement and monitoring capacity of DNPW;	New ranger camps;	Human resources records at DNPW	Throughout construction period	Number of new ranger camps established; Number of new vehicles	DNPW, SVTP	SVTP, DNPW	2,861,400.00

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
		Establish extra ranger camps for DNPW in LNP; Develop wildlife rescue protocal; Provide transport support to DNPW; Capacity building of DNPW officers in impact assessments, biodiversity monitoring, wildlife evacuation and reporting protocal				procured for DNPW; Biodiversity Monitoring Expert hired; New monitoring equipment procured; Number of new rangers posted to LNP. Number of DNPW counterparts to the Monitoring Expert			
1.8	Fragmentation of wildlife habitat in Lengwe National Park forming a barrier for the movement of species	Construct eco-briges for passage of wildlife and DNPW rangers; Construct under passes in the park	Canal alignment with eco-bridges; Canal alignment with under pass	Routine SVTP monitoring; Monthly site meetings; Supervision Engineer's reports	Monthly	Number of eco-bridges constructed; Number of underpasses constructed	Contractor	DNPW, SE, SVTP	Included in constraction and SE contracts

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
1.9	Risks to disruption of wildlife migratory routes due to habitat clearing, construction and canal activities	Install fauna species crossings from one side to another side wherever possible; Do not disturb/disrupt any wildlife migratory routes that are outside the right of way of the canal alignment ;	Construction site	Site visits; Biodiversity monitoring	Throughout construction period	Number of crossing points installed; Number of wildlife migratory routes impacted and species affected	Contractor,	Supervising Engineer, DNPW, SVTP	
1.10	Introduction of exotic and invasive species into Lengwe National Park through inflow of water into the canal and water holes	Develop Early detection and rapid response procedures to control IAS; Train Park staff on identification of IAS and management of IAS; Construction of sieving elements of water before entering the national park and removal and destruction of seeds	Construction sites	Site visits, monitoring reports	Monthly and Quarterly	Early detection and rapid response procedures developed; Number of DNPW staff trained; Number of sieving elements installed	DNPW, Contractor	DNPW	46,000

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
		trapped on the sieve (grit)							
1.11	Fluctuation of water levels in Elephant Marsh due to diversion of water to irrigated sites by the primary and secondary canals	Maintain optimal environmental flows of not less tgan 17 M^3 / second at Kapichira to sustain water levels in the Marsh	Kapichira Reservoir	Water flow meter at Kapichira	Daily	Number of days with less than 17 M^3/second of water flow at Kapichira	EGENCO and SVTP	NWRA	Within routine monitoring budget
1.12	Pollution from agro chemicals including pesticides causing pollution of aquatic species and eutrophication	Monitor implementation of pesticides management plan for irrigation land; Assess baseline water quality levels and undertake routine monitoring of water quality Enhance the institutional capacity for the management of obsolete pesticides and herbicides; Institute set aside	Elephant Marsh and Irrigation blocks	Pesticide load in water and soil	Annually	Annual water and soil quality surveys	SVTP, SOCFEs,	SVTP, SOCFEs, PCB, EAD, MEPA, NWRA	80,000.00

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
		areas to reduce areas that are in contact with pesticides closer to the Marsh; Buffer zone of an unirrigated land for attenuation before entry of effluent into the elephant Marsh							
1.14	Salinisation and Alkalinisation ,waterlogging	Ensure optimal water application in irrigation blocks; Promote integrated soil management techniques	Elephant Marsh and irrigation blocks	Water and soil quality monitoring	Annually	Level of salinity, alkalinity / acidity in water and soils	SOCFEs	NWRA, EAD, MEPA	Included in SOCFE development budgets
1.15	Worsened vulnerability of elephant Marsh to climate change through droughts and floods	Enhance adaptation activities in communities; Enhance alternative livelihood activities for communities dependent on elephant Marsh; Institute a human wildlife conflict management plan	Elephant Marsh and area with 100 m radius of the Marsh	Land use changes	Annually	Change in land use change and encroahment (Ha) in and around the marsh; Number of alternative livelihoods adopted;	Community Conservation Committees (CCC), Elephant Marsh Committees, District	Council, DPNW	80,000.00

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
						Human Wildlife Conflict (HWC) Management plan developed and implemented			
1.16	Increase in wildlife illegalities	Development and implementation of restoration plan Borehole for watering the nursery; Nursery structure and fencing Tubes and seed Provision of water holes in western side of LNP Support during clearance, cutting of wood and acquisition of chain saws	Lengwe National Park	Site visits, M&E reports	Monthly	Restoration plan for in Lengwe developed; Number of water holes sunk; Number of water troughs established. Area (Ha) replanted	SVTP, DNPW	SVTP	1,089,400.00

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
1.17	Inadequate Monitoring Capacity in DNPW	Support conduct of aerial survey; Provide monitoring collars to DNPW; Acquire radio and radio transmitting equipment; Development and implementation of monitoring protocal for protected species; Replication of biodiversity surveys Hire a fulltime Biodiversity Expert;	DNPW Headquarters and Lengwe	Site visits, M&E reports, Training reports	Quarterly	Number of equipment secured; Amount of money used to enhance security in Lengwe; Number of biodiversity surveys conducted; Existence of monitoring protocal;	SVTP, DNPW	SVTP	845,000.00
2	**Community Health and Safety**								
2.1	Increase in cases of schistosomiasis	Sensitization and health education by the health sector Sensitization for the use of latrines for defecation	Health facilities in the districts	Laboratory analysis	continuous	Number of cases of schistosomiasis recorded;	Chikwawa and Nsanje district councils	DHOs office	368,880.00

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
		Treatment of patients by oral praziquantel: Microscopic diagnosis to confirm the cause of the symptoms for urinal and intestinal schistosomiasis shall be strongly reinforced from current situation. Sensitization at school and village level (it shall focus on other topics of this Action Plan as well):				Number of sensitization meetings conducted; Number of patients treated; Number of microscopes procured.			
2.2	Disruption of access to local communities	Construct bridges and crossings where canal crosses access routes	Canal alignment	Site visits	Monthly	Number of bridges constructed; Number os crossings constructed	Contructor	SE, SVTP	Included in construction contract
2.3	Drowning of humans / children in canals	Raise awareness among communities of risks of canal water;	Canal alignment	Site visits	Monthly	Number of awareness campaigns conducted;	Contractor	SE, SVTP	Included in construction contract

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
		Construct anti-drowning structures in the canal				Njumber of anti-drowning structures installed			
2.4	Drowning of domestic animals in the canal	Construct animal escape routes; Erect grits for animal rescure; fence canal alignment to restrict access by animals and human beings	Cnala alignment	Site visits	Monthly	Number of escape routes constructed; Length (Km) of fence erected	Contractor	SE, SVTP	Included in construction contract
2.5	Drownings and agriculture safety	Prepare and deliver community awareness sessions over a 5 year period; Develop materials and sensitise local communities over a 5 year period	Along the main canal, in-field canals	M&E reports; Police and hospital reports	Continuous	Number of cases of drowning recorded; Number of awareness meeting recorded	SVTP, Ministry of Health, Ministry of labour	SVTP	250,000
2.6	Sexual Exploitation Abuse and Harassment (SEAH)and	Preparing and delivering community, district and school awareness sessions over a 5 year;	Chikwawa and Nsanje	M&E reports	Quarterly	Number of capacity building sessions conducted by category;	Ministry of labour, SOCFEs,	SVTP	250,000

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
	Gender Based Violence (GBV)	Support to GBV champions for 5 years				Number of GBV champions supported			
		Prepare and deliver community awareness sessions ; Deliver awareness including prevention materials over a 5 year period	One stop centres	SEAH and GBV reports	contoniuos	Number of awareness meetings conducted; Number of SEAH and GBV reports received	GBV Service provider, Police, GRCs	SVTP	150,000
2.7	Increase in incidences of communicable diseases	Sensitise communities over a 5 year period; Orient construction workers on communicable diseases over a 5 year period	Health centres	STI surveillance and detection reports	Continuous	Number of cases of communicable diseses; Number of awareness meetings conducted; Number of orientation sessions conducted	DEHOs	SVTP	100,000

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
2.8	Labour influx	Encourage contractor to hire local labour	Constractor's campsite and construction sites	Employment records	Construction	Number of employed engaged by gender, origin	SE, Contractor	SE, SVTP	
2.9	COVID-19	Promote hiring of local labour force where possible; Promote early detection at contractor's clinic and district hospital; Make PPE including masks mandatory	Constractor's campsite and construction sites; Health centres	Laboratory analysis	Continuous	Number of cases of COVID-19 reported	SE, Contractors and District Health centres	SVTP	100,000
3	**Cultural Heritage**								
3.1	Preservation of cultural heritage	Promote archaeological rescue during excavations; Contractor training and awareness program; Initialise one to two months	Construction site	Specialized chance find methodology	Continuous	Number od cases of archeological findings recorded	Department of Culture and Monuments	SVTP	100,000

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
		archaeological monitoring of land transformation activities during construction; Salvage excavations in case of discoveries; and Facilitate the development of the Cultural Heritage Management Plan including Chance Finds Procedure							
4	Loss of use of land and property	Ensure that PAPs are gender, age and poverty defined; Ensure that women, youths and poor are also provided with land in the schemes; Ensure that women and youths and poor who lose land are	Construction site; DCs offices and PMT offices	PAP validadtion	continuous	Number of RAPs formulated; Existence of reviewed GRM that is aligned to World Bank and AFDB	SVTP, Ministry of Lands	SVTP	5,219,078.16

No.	Impacts	Mitigation measures	Monitoring site	Monitoring method	Time/Frequency of Implementation	Monitoring indicators	Implementing Body	Monitoring Body	Cost (US$)
		appropriately compensated Develop RAP to address involuntary resettlement impacts Implementation of the RAPs; Create a Grievance Redress Mechanism with multiple channels				safeguard policies Number of PAPs identified by gender;			
5	Noise and vibration								
6	Improper Waste Disposal								
7	Impact on air quality/Air pollution								
8	Occupational health and safety risks								
9	Community health and safety risks								

Annex 2: Consultations Outcomes

	Date	**10 March, 2023**
1	**Project Steering Committee Composition** • Chair: Chair: PS, Ministry of Agriculture • Co-Chair: Ministry of Finance, Economic Planning and Development for Planning • Secretary: Project Coordinator • Members: Ministry of Natural Resources, Energy and Environment, Ministry of Lands, Housing and Urban Development, Ministry of Local Government, Ministry of Tourism, Malawi Trade Centre, DNRDM, and PPP Commission **Attendance for March 10, 2023 Project Steering Committee** • Mr. S. Maweru, Principal Secretary, Ministry of Agriculture **(Chair)** • Ms Tiyamike. Kanthambi, Assistant Director, Ministry of Finance & Economic Affairs (Co-Chair) • Eng. G. Mamba, Director of Irrigation Services, Department of Irrigation • Dr Yanira Mtupanyama Principal Secretary, Ministry of Natural Resources and Climate Change • Ms C. Chiumia, Director of Rural Development, Ministry of Local Government • Mr. P. Kabambe, Chief Executive Officer, Public Private Partnership Commission • Mr. F. Zhuwao, Principal Secretary (MSME), Ministry of Trade and Industry	**Issues Discussed** **1. Issue 1:** The Committee **enquired** on the status of Illovo engagement in the Programme *Response:* PMT **reported** that Illovo will participate in the Programme following regular engagement with the Ministry. The Company has been involved in the review of the designs for Main Canal 3 in line with needs expressed **2. Issue 2:** The Committee **enquired** on ways the Project will engage to ensure that designs for construction are resilient to natural disasters *Response:* PMT **confirmed** that the designs will take into account effects of natural shocks including floods and earthquakes 3. **Issue 3:** The Committee **wanted to know** the financial implications of the damages caused to the intake following Cyclone Ana *Response:* The PMT **reported** that the cost will increase as the intake has to be redesigned to include the new fuse plug. The cost will also include construction of the new intake and there will be need for a cost extension 4. **Issue 4** The committee inquired on the progress made in optimizing the canal alignment in Lengwe National Park

	• Mr. J. Nyirongo, Chief Executive Officer, Farmers Union of Malawi • Ms Elles Kwanjana, Head of Administration, NASFAM • Dr P. Kumambala, Deputy College Director, Lilongwe University of Agriculture and Natural • Eng. C. Jana, Regional Irrigation Water Development Officer, Ministry of Water & Sanitation • Mr. O. Mvula, Chief Irrigation Officer, Shire Valley Irrigation Services Office, • Eng. B. Sumani, Chief Irrigation Officer, Blantyre Irrigation Services Division • Ms. Patricia Dzikolidaya Chief Economist, Ministry of Energy • Eng. A. Kacheyo Programme Manager, Southern Region Water Board • Mr. B. Namarika Manager, (Planning & Research), Malawi Investment and Trade Centre • Mr. A. Musa, Chief Legal Counsel, Ministry of Justice • Mr. C. Mwalabu, Chief Irrigation Officer, Department of Irrigation	*Response:* The PMT indicated that the issue of canal alignment in Lengwe National Park would be revisited so as to arrive at an option that minimizes impact on the critical habitat (thicket), the design and supervision engineer would work on this. 5. **Issue 5** The Committee enquired how **chance finds** are being managed following excavations *Response:* PMT **reported** that contractors are advised to comply with the chance find procedures stipulated in the ESMP as agreed with the Department of Museums and Art. Samples salvaged taken to the Department of Museums and Arts laboratory in Nguludi for analysis and preservation. Where the canal is passing through a site, redesigning is considered
2	**Project Technical Committee Meeting of 24 February, 2023** **Objectives of the Meeting** • inter-sectoral coordination and facilitation • annual programming of activities • approval of work plan and budget • monitoring implementation and results (including audits) • policy guidance • recommending corrective actions when necessary	

	Membership • Co-Chairs: MoAIWD Director of Irrigation Services & MoFEPD Director of Planning • Secretary: Project Coordinator Members: • Director-level representatives of MoLHUD, Members DWR, DoI, DNPW, DoE, EAD, DoS, DNRDM; • Representatives of ESCOM; MITC; SRBA/NWRA; Civil Society Organizations; private sector/agri-business; academia and invitees	
	1. Mr G. Mwepa, Director of Irrigation Services, Department of Irrigation **(Chairperson).** 2. Mr. R. Zimba, Principal Debt and Aid Officer, Ministry of Finance and Economic Affairs 3. Mrs. T Kanthambi, Chief Debt and Aid Officer, Ministry of Finance and Economic Affairs 4. Mr. J. Lungu, Chief Physical Planning Officer, Ministry of Lands 5. Mrs T. Munthali, Director of Planning and Development, Chikwawa District Council 6. Mr. W. Nkombezi, Director of Small and Medium Enterprise and Cooperatives, Ministry of Trade and Industry. 7. Fr M. Semba, Director, CCJP 8. Dr T. Sanjika, Researcher, LUANAR 9. Mr. G. Chiwayula, Principal Energy Officer, Ministry of Energy. 10. Ms C. Chisanu, Regional Commissioner of Lands, Ministry of Lands 11. Mr. G. Ngwira, Principal Economist, Department of Irrigation 12. Ms A. Lapken, Gender and Development Officer, Ministry of Gender and Child Development 13. Mr. F. Mastala, Chief Agricultural Officer, Chikwawa District Council 14. Mr. E. Chirambo, Principal Trade Officer, Ministry of Trade and Industry 15. Mr. H. Mandele, Deputy Director of Cooperatives, 16. Mr. A. Phiri, District Commissioner, Chikwawa District Council	**Issue 1:** The project seems to be underspending in phase one. Will PMT be able to utilize phase 2 finds Response: This, seemingly, underspending is due to the outstanding procurement of supervision engineeres for Lengwe section of MC2, contractors for secondary pipelines for Phase 1, MC3, secondary pipelines for Phase 2 and Bangula line (MC2), There are resources locked up in on farm investments under Component 3. **Issue 2:** Ensure that compensations are paid on time to avoid work stopages as was the case at some point in phase 1 Response: PMT noted this and has since made provisions for phase 2 under IDA funds as opposed to GoM Part II funding **Issue 3** Ensure that all stakeholders are well informed about Phase 2 of the project to avoid situations where stakeholders are resistant to project work

	17. Mr. M. Mbano, Land Surveyor/ Geographical Input System Specialist, Land and Implementation Unit. 18. Mr. W. Sataya, Deputy Director, Department of Irrigation` 19. Ms E. Kazira, Director for Crops Development, Ministry of Agriculture 20. Mr. J. Chulu, Director for Animal Health and Livestock Development, Ministry of Agriculture 21. Dr Modesta Kanjaye, Director of Water Resources, Ministry of Water and Sanitation. 22. Mr. B.K Kumchedwa, Director for Parks and Wildlife, Department of National Park and Wildlife 23. Mr. I. Fandika, Chief Agricultural Research Scientist, Department of Agricultural Research 24. Mr. F. Chitayo, Gender and Development Officer, Ministry of Gender and Child Development 25. Mr. A. Kacheyo, Projects Manager, Southern Region Water Board 26. Mr. F. Sakala, Deputy Director of Rural Development, Ministry of Local Government 27. Mr. M. Kalungulu, Principal Economist, Economic Planning and Development 28. Mr. G. Kupunda, Deputy Director, Department of Land Resources and Conservation 29. Mr. E.Chimwaza, Project Officer, CISANET 30. Mr. S. Tsokonombwe, Economist, Ministry of Agriculture 31. Mr. P. Chimbamba, Assistant Budget Director, Ministry of Finance and Economic Affairs 32. Mr. C. Mwalabu, Chief Irrigation Officer, Department of Irrigation 33. Mr. P. Soko, Director, Department of Agricultural Extension Services	Response All stakeholders will be notified accordingly and their views will be taken on board. PMT plans to meet all the stakeholders during formulation and disclosre exercises

	34. Mr. F. Chitengo, Gender and Development Officer, Ministry of Gender and Child Development 35. Mr. F. Nkhoma, Regional Surveyor General, Department of Surveys 36. Mr. O. Mbalame, Deputy Surveyor General, Department of Surveys 37. Mr. D. Ghambi, Director for Agriculture Extension and Natural Resources, Chikwawa District Council 38. Mr. F. Matola, Senior State Advocate, Ministry of Justice. 39. Mrs M. Tembo, Head of Member Service and Outreach, Farmers Union of Malawi. 40. Mr. C. Amoni, Principal Agriculture Communication Officer, Department of Agricultural Extension Services 41. Mr. N. Mwaisunga , Environmental Officer, Environmental Affairs Department 42. Dr P. Kariba, Deputy Director, Department of Museums and Monuments 43. Mr. C. Phangaphanga, Director, Ministry of Trade and Industry 44. Ms R. Chikakuda Head of Policy and Communication, NASFAM 45. Mr. H.K. Nyangulu, Labour Commissioner, Ministry of Labour 46. Mr. O. Mvula, Chief Irrigation Officer, Shire Valley Irrigation Services Division 47.	
3	**SVTP and Department of National Parks and Wildlife** **01 March, 2022**	
	1. B. Kumchedwa, Director of National Parks **2.** A. Chunga, Senior Parks and Wildlife Officer – Wildlife Management Unit **3.** A . Kataya, Principal Wildlife Officer (Planning) **4.** Dr. Gibson Mphepo, Protected Area Management Specialist, SVTP	**Issue 1** Biodiversity Monitoring requires an expert and the process should run for the duration of the project Response: Mitigation measures provide for hiring of a Biodiversity Monitoring Expert for 24 months. The expert will

	5. Daulos Mauambeta, Natural Resources Management Coordinator (NRMC), SVTP 6. Christopher Mwambene, Environmental Safeguards Specialist, SVTP 7. William Mgoola, Deputy Director, DNPW 8. D. Kalima,Deputy Director, Wildlife Management, DNPW 9. Mary Chilimampunga, Deputy Director, DNPW 10. W. Fixon, Park Manager, Lengwe National Park **11.** W. Kawaye, Divisional Manager, Shire Valley	have a counterpart to understudy him / her from DNPW **Issue 2** Canal alignment recommended in the technical feasibility study (TFS) will have serious negative impacts on the thicket which is the critical habitat for Nyala Response: The canal should run in the western section of the park sparing the thicket. Supporting studies should be undertaken including biodiversity studies.
		
		Issue 3: There is risk of animals drowning in the canal

		Response: The design of the canal will include anti-drowning structure, escape stairs and side slop that enables to climb out of the canal. **Issue 4** There will be habitat fragmentation and restricted access by animals to Old Lengwe Response: Eco-bridges will be provided to enable animal mobility between the eastern and western sides of the park. An underpass will also be provided.

	Date	**22 November, 2022**
	Stakeholders	**Nsanje Full Council**
	Place	**Nsanje District Council Chamber**
	Participants	District Commissioner Senior Chief Tengani Senior Chief Chimombo Member of Parliament, Nsanje Central Senior Irrigation Engineer Director of Planning and Development District Land Officer District Land Surveyor District Community Development Officer District Environmental Officer District Fisheries Officer District Economist Chief Administrative Officer Principal Public Works Officer

		Estates Management Officer District Information Officer District Social Welfare Officer District Gender Officer Ward Councilors
	Consultation objectives	1. To sensitise the Council on SVTP 2 2. Solicit their views and advice on the project implementation
		
No	**Summary of Discussion**	
	Observation	**Response**
1	That the 6Km phase II extension to Nsanje is inadequate to leverage the programme goal communities in Nsanje and that extending the canal to Mchengamalembo would at least be effective	There is need for joint advocacy for canal extension to Mchengamalembo. The Programme Manager for ADD committed to take it up and we also committed to request our hnourable members to jointly take the matter to Parliament for consideration.
2	Conservation of endangered species of vegetation and preservation of graveyards	The programme will strive to preserve critical environmental resources and socially important places like graveyards by by-passing them
3	Delayed and fraud lidden compensations	That the Council will lead the assessment and that everything is done on a transparent and

		accountable manner with payments made through bank accounts for beneficiaries
4	Security of animals and people in canals	The programme will provide spaces and ropes to be used by people and animals if they accidentally fall into the canal. Where the canal passes through a settlement, the canal will be fenced
5	Preventing the canal from posing a risk of floods to surrounding communities	There is need for comprehensive Environmental and Social Impact Assessment with comprehensive Environmental Social Management Plans in place to mitigate the attribution of the canal to flooding by communities
6	Water for livestock	The programme will provide some water points for livestock
7	Communication between communities separated by the canal	The programme will provide crossover points for both people and animals

1.	**Date**	**24 November, 2022**
	Stakeholders	Chikwawa Full Council District Commissioner Director of Planning and Development Senior Irrigation Officer District Social Welfare Officer District Gender Officer District Social Welfare Officer District Information Officer District Land Officer Land Registrar Ward Councillors Paramount Chief Lundu Traditional Authority Kasisi Senior Chief Chapananga Traditional Authority Katunga Member of Parliament for Chikwawa

Place	Chikwawa District Council
Participants	District Commissioner Director of Planning and Development Senior Irrigation Officer Director of Agriculture Director of Public Works District Gender Officer District Social Welfare Officer Chief District Agronomist District Land Officer Land Registrar
Consultation objectives	• Sensitise the Council on SVTP 2 • Document issues, concerns and expectations related to the proposed irrigation canal; and b) the compensation and resettlement process; • Discuss impacts of the project; and • Document recommendations related to the project.

Summary of discussion

The project, location and RAP development process:

- The Social Safeguards Specialist together with other PMT members outlined the project design and informed the participants that the transition into phase 2 of the project was under way
- Areas for irrigation have already been identified. A RAP Consultant was identified would soon be conducting household surveys in order to profile areas which will be affected in the SVTP 2 (an asset inventory and census to establish Project Affected Persons (PAPs) and property for the preparation of a Resettlement Action Plan.

Issues, concerns and expectations related to the project and the compensation and resettlement process:

- The officers from the lands office acknowledged that they have attended various meetings at the District Council on the project.
- They have seen the project site and were involved in the preparation of the Environmental and Social Impact Assessment report and the preparation of the Resettlement Policy Framework for the project and have attended project review meetings in Phase 1.
- They indicated that the irrigation project is a welcome development as it will reduce hunger. However, there is a need to sensitise the affected people on the importance of the project despite the fact that they have heard about it from the areas affected in phase 1.
- They expressed concern that the project has taken long to implement and hoped that phase 2 will be implemented much faster than the first phase.
- There is need for proper documentation of the Project Affected Persons, affected property and compensation to avoid overwhelming the GRCs with issues to be sorted out.
- They are concerned that most of the local people are not aware of the land rights due to low literacy levels. Additionally, the local leaders do not relay information on new land laws after attending related meetings and trainings. This is because they perceive the new land laws as taking powers away from them.
- The Lands Office does not have adequate resources including officers, office space and transport to fully get involved in the RAP process; keep records and monitor the implementation of the compensation and to handle grievances and therefore they will need assistance from the project.

Discussion of impacts of the project:

- The main impact of the project is taking away land from the people. Nonetheless the project is designed to avoid some of the fields and the people to be affected will be compensated accordingly.
- The impact could be mitigated by:
  - Including the people whose land is taken among the beneficially of the project;
  - Training the project affected persons on appropriate use of compensations;
  - Village heads in collaboration with the office of the DC should assist the PAPs in identification of replacement land;

Recommendations:

- Consider enhancing the capacity of the District Lands Office in administration of land, thorough provision of necessary resources including human resource.
- The RAP development and resettlement and compensation process should be implemented through local government structures.
- The grievance redress mechanism should include the Lands Clerk (responsible for registering all lands) at district level, the Lands Officer at district level, the land board act and the Regional Commissioner of Lands as is the case in phase 1.

2.	**Date**	27 November, 2022
	Place	Chikwawa District Council Office – Social Welfare Office
	Participants	District Social Welfare Officer Assistant District Social Welfare Officer Social Safeguards Specialist (SVTP) District Irrigation Officer
	Consultation objectives	• Presentation of Phase 2 of the project, location and RAP development process; • Document issues, concerns and expectations related to the project; • Document the existing social condition of the project area; • Document recommendations in the implementation of phase 2 of the project.

Summary of discussion

Presentation of Phase 2 of the project and RAP development process:

- Phase 2 of the project will construct an irrigation canal from the edge of Lengwe National Park all the way to Bangula in the area of Traditional Authority Mbenje.
- The project will take land from the local people; hence the need for resettlement and compensation. The consultant is therefore conducting sensitisations, stakeholder consultations, household survey, census and asset inventory for project affected persons in order to prepare a Resettlement Action Plan.

Reaction on the project:

- The project was discussed at full council meeting where they were present.
- The project is relevant as the project area is affected by water shortages during the dry season, while during the rainy season the areas are affected by floods and there is a lot of sand, making rain fed agriculture a challenge. At the same time the areas are very fertile; hence water availability during dry season would increase agriculture production. The commercialisation part of the project is important as it will provide markets for the produce, a missing link to current agriculture in the area.
- The project will reduce cost for pumping water as water will flow using gravity force.
- In some areas there are agriculture cooperatives which would make it easy for people to understand, considering that SVTP 2 will also use the cooperative strategy.

	Issues, concerns and expectations related to the project and the compensation and resettlement process: • Looking at the recent annual water flows of Shire River, water may be a challenge. The project should consider constructing a dam. • There is need for extensive sensitizations so that people fully understand the project, to avoid unnecessary delays due misunderstandings. Lessons from phase 1 should be used to improve the sensitisation • There is also concern for corruption in terms of the use of the irrigation scheme. How will it be used? How will the users be identified? (This was explained and concerns were addressed) • A lot of people will come to the area, which is also a source of concern. • Child labour and environmental management issues should be checked. • Livestock production is expected to be affected as the project will take away land which is also used for grazing livestock. • Chiefs and people are likely to be moved which is also a concern. Existing social condition of the project area • The HIV/AIDS situation for the project area is not bad. However, during construction there may be increased sexual relationships due to influx of people, presence of construction workers and increased circulation of cash. • School dropout rates are high in east bank. Due to high agricultural activities in the area and the related economic activities, school is not valued. This is also anticipated in the west bank, where the project will be implemented the project should, therefore, put mitigation measures • Also, there are cases of child labour, whereby children assist parents in the gardens instead of going to school. Where they do no assist the parents, there is little care of the children, which also affects education. • Women are vulnerable in terms of land ownership because of culture – land belongs to men. As such after working together with men (or alone) in the gardens, the women have little say in terms of how to sell the crops and how to use the money. The women do not benefit much. • Interventions on the social problems are being implemented through Community Based Organisations and Non-Governmental Organisations. The interventions, among others, include child protection programmes, orphan care programmes caring for elderly and persons with disabilities, HIV/AIDS awareness and sensitisations. The district social welfare office provides policy direction. Recommendations on the project • Conduct adequate sensitization on the project and social impacts. • Child protection committees should be formed as part of the project to protect children from child labour and sexual exploitation among others. • Awareness campaigns should be done to ensure that the project is accepted in the phase 2 area and infrastructure is not vandalised. • The project should be implemented as planned and designed up to completion and should not be abandoned before completion. • An ESIA should be done for the project.	
3.	**Date**	27 November, 2022
	Place	Chikwawa District Education Office (Representing Schools in Chikwawa)
	Participants	District Commissioner Director of Planning and Development District Education Manager Primary Education Advisor
	Consultation objectives	• Presentation of phase 2 of the project, location and RAP development process; • Document issues, concerns and expectations related to the project; • Document the existing social condition of the project area with regard to education;

	Summary of discussion Presentation of the project and RAP development process: • Phase 2 of the project will construct an irrigation canal from the edge of Lengwe National Park all the way to Bangula in the area of Traditional Authority Mbenje. • The project will take land away from the local people; hence the need for resettlement and compensation. The consultant is therefore conducting sensitisations, stakeholder consultations, household survey, census and asset inventory for project affected persons in order to prepare a Resettlement Action Plan. • The District Education Manager was present at the Full Council Meeting where Phase 2 of the Project was presented and discussed. Issues, concerns and expectations related to the project; • The project is good as it will reduce hunger as crops will be grown throughout the year and not in a specific season. • In turn, economic levels of the people will improve through sales of crops. This is also expected to result in good health of the people. Status of education in relation to agriculture and conditions of schools: • In winter, parents move to the banks to grow crops, taking with them children. This results in absenteeism, low performance and high repetitions in class, which in turn results in the said dropping out of school. The children accompany the parents because of the need for man power. The parents value the present economic situation more than the future of the children. • Some of the schools with high absenteeism are Mwanza, Hereu, Mchalo CCAP, Namicewu, Jombo, Malipppo and Linga Primary Schools. The schools are along the Shire River. • There are a number of projects being implemented to reduce absenteeism (e.g. by the World Without Hunger). The projects use awareness and sensitizations; however, there is inadequate monitoring and follow up. • Teenage pregnancy dropout rates are high because of the following: – Poverty levels such that girls find sugar daddies e.g. men working at Nchalo Estates and Industries such as Cane Growers. – Lack of interest from the Parents – Lack of role models. Recommendations on the project • The project has more advantages than disadvantages; hence, it should be implemented. • Include follow up and monitoring in the interventions. • The lessons learnt from SVTP 1 will be utilised in Phase 2 to ensure that education is not affected and that the canal acts as a motivation to both parents and pupils	
4.	**Date**	28 November, 2022
	Place	Chikwawa District Health Office (Representing all Health facilities in Chikwawa)
	Participants	District Health Director Director of Planning and Development Senior Irrigation Officer Social Safeguards Officer Clinical Officer

		Chief Nursing Officer.
	Consultation objectives	• Presentation of phase 2 of the project, location and RAP development process; • Document issues, concerns and expectations related to the project; • Document the existing health condition of the project area; • Document recommendations related to the project.
	Summary of discussion Presentation of phase 2 of the project and RAP development process: • Phase 2 of the project will construct an irrigation canal from the edge of Lengwe National Park all the way to Bangula in the area of Traditional Authority Mbenje . • The project will take land away from the local people, hence the need for compensations. The consultant is therefore conducting studies to prepare a Resettlement Action Plan. Reaction on the project: • The DHO is aware of the project through participating in the studies conducted by a Consultant who prepared the Environmental and Social Impact Assessment report and Resettlement Policy Framework in phase 1. However, she was not aware of any meetings being conducted recently about the project. • The project is welcome as it will increase agricultural productivity. However, the shifting of people can result in health problems such as stress, HIV/AIDS, reduction in sanitation conditions etc. There is need for provision of psychosocial support. • The abundance of stagnant water could result in increased incidences of water related diseases like Malaria and Diarrhoea. • Health posts may have to be relocated if there will be shifting of people as they are established basing on populations. • The project will reduce malnutrition cases through increased availability of food and improved income as farming will be taken as a business. The health situation of the project area: • The main diseases in the project area are Malaria, followed by diarrhoea. Acute respiratory and skin conditions are also prevalent in the project area. • HIV/AIDS prevalence rate for the district is 8.4 percent. • Chikwawa District Hospital does not have the capacity to address health challenges. The hospital was opened in 1944 and has a capacity of 300 beds. Its infrastructure is old and inadequate; additionally, there are inadequate health personnel including nurses and doctors. • Sanitation related diseases are high in the district as only Chapananga area has achieved open defecation free (ODF) status. Recommendations on the project • During construction, there will be risk of increased spread of HIV/AIDS because of the presences of migrant workers and the need for money among the local women. Hence, the project should include community sensitization. • The project should include sanitation interventions to reduce sanitation related diseases.	
	Date	28 November 2022
	Place	CCJP Office, Chikwawa District
	Participants	Lewis Msiyadungu (CCJP Coordinator); Father Allan Semba, Project Director, Social Safeguards Specialist (SVPT)
	Consultation objectives	• Present of the project, location and RAP development process; • Document issues, concerns and expectations related to the project;

		• Document the existing social condition of the project area; • Document recommendations related to the project.

Summary of discussion

Presentation of phase 2 of the project, the project affected area and RAP development process:

- Phase 2 of the project will construct an irrigation canal from the edge of Lengwe National Park all the way to Bangula in the area of Traditional Authority Mbenje
- The project will take land away from the local people; hence the need for compensations. The consultant is therefore conducting studies to prepare a Resettlement Action Plan. The coordinator for CCJP in the district was aware of the project, having attended several meetings on it.

Perception about the project:

- The approach taken by the project in the design phase, specifically conducting a lot of consultations is good.
- The consultations should however be thorough and should involve the local people (the project affected persons).
- The project should consider issues of sustainability – will there be user fees? There is need for training workshops to ensure that the people accept this.
- Negatives: land issues are sensitive and should be handled carefully.
- The project is well known to the people outside Chikwawa such that there are reports that people outside the project area are buying land in the irrigation corridor. There is need to sensitise the local people to not sell land so that they can benefit from the project.

Land related problems in the project area and how to handle them:

- Most of the local people do not know or understand the new land laws. This is because they were accompanied by controversies. More importantly sensitizations on the new land laws has not reached the local people as the chiefs who attend the meetings on the laws do not explain the laws to their subjects as they fear of reduced authority over land.
- Women are vulnerable as they do not have rights over land due to the Sena cultural influence. In many cases women grow crops, men sell the produce as the women do not have information on markets and also because of the culture.
- Families are losing land because of the inheritance act whereby men would marry into a family, control the land and inherit the land when the wife dies.
- There is polygamy in the area (locally called chipali) which does not favour the women. Instead of the men providing for the women, the women work on the land and the men just come to sell the produce and control the use of the money.

What should be done to ensure that the mentioned land related problems are reduced during project implementation?

- Sensitization is key to avoiding the problems in the short term. In the long-term education is key.
- Sensitization and education should be centred on reducing early marriages (most of the girls in the villages marry at the age of 14, 15 and 16 but lie that they are 18 years old).
- Sensitization and education should also include issues of rights over land, human rights in general and marketing of agricultural produce. The women should be equipped with knowledge to protect their land and access to markets.
- Grievance redress mechanism on land conflicts should use a mediatory approach as the judicial system brings in more conflicts. This is because the court judgement usually involves fines or arresting the wrong. Unfortunately, land conflicts are usually among family members. The people do not see eye to eye where they have to pay fines – there is no forgiving each other. Court cases bring more enormity.

Activities of CCJP in the district which are relevant for the project:

- Apart from being a GBV Service provider for the project, CCJP is implementing a primary justice project whereby if a subject feels that chiefs have not given a fair judgment, they report to the NGO and it follows up and provides advice on the appropriate course of action.
- The organisation is also involved in sensitisation of the masses on land issues including the new land laws. However, it lacks resources. In the district. It has a lean secretariat; 20 community-based educators for 20 Roman Catholic Churches in the district. Each church also has 20 animators who would act as focal person in the communities when there are problems.

5.	**Date**	16-23 December, 2022
	Places	**Kozere, Masache, Mphambe, Balala, Mchacha, Chapomoka, Nkhwangwa, Mpheza, Jassi, Mafale, Khongo, Msomo, Paiya, Khungubwe, Mwanjobvu, Malemia and Ngowe**
	Participants	Refer to the annex….
	Consultation objectives	• To sensitise the communities on SVTP 2 and how they will be affected and the mitigation measures put in place. • To discuss and receive people's views on the project • To learn from the commuities how best the project can be implemented to minimize or avoid negative impacts on people's life and environment. • To explain how the RAP process will be implemented and how they will be involved.

ISSUES AND COMMENTS

ISSUE/QUESTION	RESPONSE
If a PAP is a minor, is he/she eligible to receive compensation?	According to Malawi Laws, a minor is not eligible to receive compensation, however a relative/representative from his family can receive on his/her behalf.
How long will take for the PAPs to get paid after assessment	PAPs to receive their compensation soon after disclosure and agreement on compensation amount for the particular affected asset
What happens when a PAP dies before getting his/her compensation?	Next of kin will receive the compensation
What happens when a canal passes through the graveyard/play ground or church?	For the church or playground, compensation is paid in kind while on graveyard, the department of antiquities is consulted for guidance.
Between a PAP and the project who will determine amount of compensation to be paid?	The project will involve experts to determine the amount of compensation
What will start first between payment of compensation to PAPs and construction works	In normal case, compensation comes first before construction
Is the project going to protect the communities from land grabbers during the assessment	Chiefs and Customary Land Committees will help and protect the communities
Who will receive compensation on public land	No compensation is given out on public land.
What will happen if one doesn't want to let his land for the canal development?	Local leaders will negotiate with her/him to consider his or her decision
Are Chiefs entitled to compensation as custodians of land?	No one is entitled to compensation unless affected
What are the assets worth compensation?	Land, trees, dwelling houses and other personal structures

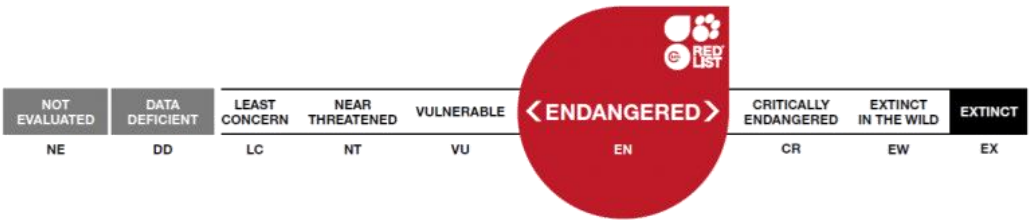
6	**Date**	16 December, 2022
	Place	**Nsanje District Council Staff**
	Participants	District Commissioner, Director of Planning and Development, Senior Irrigation Officer, District Land Officer, District Economist, District Gender Officer, District Fisheries Officer, District Social Welfare Officer.
	Consultation objectives	• To sensitise the communities on SVTP 2 and how they will be affected and the mitigation measures put in place. • To discuss and receive people's views on the project • To learn from the communities how best the project can be implemented to minimize or avoid negative impacts on people's life and environment. • To explain how the RAP process will be implemented and how they will be involved.

ISSUES AND COMMENTS

ISSUE/QUESTION	**RESPONSE**
Can PMT consider to extend the canal up to the end of the boarder with Mozambique?	According to the current design, this can not be possible as it would require inclusion of motorized pumps to move water from Mbenje to the rest of the district. This is not in the plan.
Will the canal not bring flooding risk to the area?	That is not expected, the canal is well desined and water flow shall be controlled.
Why is the canal targeting only one TA in the area?	That's as far as the gravitational force can push the water from the intake.
What happens when a canal passes through the graveyard/play ground or church? People are worried.	For the church or playground, compensation is paid in kind while on graveyard, the department of antiquities is consulted for guidance.
When shall compensation be paid to affected people?	When all the valuation processes have been finalized, agreed upon and even approved. Compensations shall be paid before commencement of civil works.
What will start first between payment of compensation to PAPs and construction works	In normal case, compensation comes first before construction
Who will receive compensation on public land	No compensation is given out on public land.
What will happen if one doesn't want to let his land for the canal development?	Local leaders will negotiate with her/him to consider his or her decision
Are Chiefs entitled to compensation as custodians of land?	No one is entitled to compensation unless affected

Annex 3: Mammals of Lengwe National Park

Legend (Source: https://www.iucn.org/resources/conservation-tools/iucn-red-list-threatened-species)



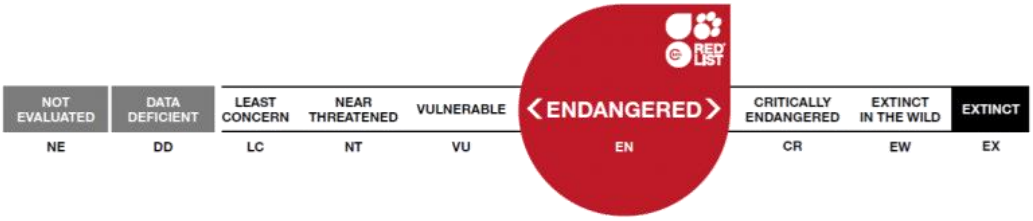
No	SCIENTIFIC NAME	ENGLISH NAME	VERNACULAR NAME	IUCN Red Datalist
1	Suncus lixus	The greater dwarf shrew		LC
2	S. varilla	The lesser dwarf shrew		NE
3	Erinaceus albiventris	Hedgehog		LC
4	Petrodomus tetradactylus	Four-toed elephant-shrew		NE
5	Elephantulus	Snouted elephant shrews		LC
6	E. fuscus,	Short-snouted elephant shrew		DD
7	E. myurus	The rock elephant shrew		LC
8	Epomophorus wahlbergi	Wahlberg's epaulettedfruit bats	Mleme	LC
9	E. crypturus	Peters' epauletted fruit bats	Mleme	DD
10	Epomops dobsonii	Dobson's fruit bat	Mleme	LC
11	Rousettus aegyptiacus	Egytptian fruit bat	Mleme	LC
12	Tadarida midas	Midas Freetailed bat	Mleme	DD
13	T. condylura	Angola freetailed bat	Mleme	DD
14	T. aegyptiaca	Egyptian freetailed bat	Mleme	LC
15	T. pumila	Little freetailed bat	Mleme	NE
16	Vespertilio spp	Vesper bats	Mleme	NE
17	Miniopterus fraterculus	Lesser long-fingered bat	Mleme	LC
18	M. shreibersii.	Schreibers' long-fingered bat	Mleme	NE
19	Myotis welwitschii	Welwitsch's hairy bat	Mleme	LC
20	M. bocagei	Rufous hairy bat	Mleme	NE

No	SCIENTIFIC NAME	ENGLISH NAME	VERNACULAR NAME	IUCN Red Datalist
21	P. ruepellii	Rüppell's bat	Mleme	NE
22	Pipistrellus kuhli	Kuhl's bat	Mleme	LC
23	P. nanus	The banana bat	Mleme	LC
24	Chalinolobis variegatus	Butterfly bat	Mleme	NE
25	E. rendall	Rendall's -tailed serotine bat	Mleme	NE
26	E. hottentotus	Long-tailed serotine bat	Mleme	LC
27	E. melckorum	Melck's serotine bat	Mleme	NE
28	E. capensis	Cape serotine bat	Mleme	LC
29	S. dinganii	The yellow house bat	Mleme	LC
30	S. viridis	Lesser yellow house bat	Mleme	LC
31	Nycticeius schliefdenii	Schlieffen's bat	Mleme	NE
32	Scotoecus albofuscus	Thomas's house bat	Mleme	DD
33	S. hindei	House bat	Mleme	NE
34	K. argentata	Damara woolly bat	Mleme	LC
35	Nycteris hispida	Hairy slit-faced bat	Mleme	LC
36	N. macrotis	Greater slit-faced bat	Mleme	LC
37	N. thebaica	Common slit-faced bat	Mleme	LC
38	R. hildebrandti	Hildebrant's		NE
39	R . fumigatus	Rüppell's		NE
40	R. clivosus	Geoffroy's		NE
41	R. darling	Darling's		NE
42	R. landeri	Lander's		NE
43	R. blasii	Peak-saddle		LC
44	R. simulator	Bushveld		NE
45	R. capensi	Cape horseshoe bat		NE
46	H. commersoni	Commerson's		NE
47	H. caffer	Sundevall's leaf-nosed bat	Muleme	NE
48	Galago crassicaudatus	Brown greater galago	Changa	NE
49	Papio ursinus	Chacma baboon		LC
50	Papio cynocephalus	Yellow baboon	Nyani	LC
51	ercopithecus pygerythrus	Vervet monkey	Pusi	NE
52	Cercopithecus albogularis	Samango or Blue monkey	Ntchima	LC
53	Manis temminckii	Pangolin	Ngaka	VU
54	Lepus saxatilis	Scrub hare	Kalulu	LC
55	Pronolagus rupestris	Smith's red rock		LC
56	Heliophobius argentocinereus	Silvery molerat		NE

No	SCIENTIFIC NAME	ENGLISH NAME	VERNACULAR NAME	IUCN Red Datalist
57	Cryptomus hottentotus	Common molerat		NE
58	Hystrix africaeaustralis	Cape Porcupine	Nungu	LC
59	Pedetes capensis	Spring hares	Kalulu	LC
60	Graphiurus murinus	Woodland dormouse		LC
61	Heliosciurus rufobrachium	Sun squirrel		LC
62	Paraxerus palliatus	Red squirrel		LC
63	Paraxerus cepapi	Tree squirrel		LC
64	Thryonomys swinderianus	Greater canerat	Ntchezi wamkulu	LC
65	Thryonomys gregorianus	Lesser canerat	Ntchezi wangóno	LC
66	Otomys angoniensis	Angoni vlei rat		LC
67	Pelomys fallax	Groove-toothed mouse		LC
68	Acomys spinosissimus	Spiny mouse		LC
69	emniscomys spp	Single-striped mouse		NE
70	Rhabdomys pumilio	Striped mouse		LC
71	Dasymys incomtus	Water rat		LC
72	Thamnomys dolichurus	Woodland mouse		NE
73	Thamnomys cometes	Mozambique woodland mouse		NE
74	Mus minutoides	Pygmy mouse		LC
75	Mus triton	Grey-bellied pygmy mouse		LC
76	Praomys natalensis	The multimammate mouse		NE
77	hallomys paedulcus	Tree mouse		NE
78	Aethomys namaquensis	Rock mouse		LC
79	A. chrysophilus	Red veld rat		LC
80	Tatera leucogaster	Bushveld gerbil		LC
81	Cricetomys gambianus	Giant rat		LC
82	Dendromus melanotis	Grey climbing mouse		LC
83	D. mesomelas	Brants' climbing mouse		LC
84	D. mystacalis	Chestnut climbing mouse		LC
85	D. nyikae	Nyika climbing mouse		LC
86	Steatomys pratensis	Fat mice		LC
87	Crocuta crocuta	Spotted hyaena	Fisi	LC
88	Felis lybic	African wild cat	Vumbwe	NE
89	Felis serval	Serval Cat	Nuzi	NE
90	Canis adustu	Side-striped jackal	Nkhandwe	LC
91	Mellivora capensis	Honey badger	Chiuli	LC

No	SCIENTIFIC NAME	ENGLISH NAME	VERNACULAR NAME	IUCN Red Datalist
92	Poecilogale albinucha	Striped weasel		LC
93	Ictonyx striatus	Striped polecat		LC
94	Nandinia binotata	Tree civet	Fungwe	LC
95	Civettictis civetta	African civet	Fungwe	LC
96	Genetta genetta	Common genet	Mwili	LC
97	Paracynictis selousi	Selous' mongoose	Nsulu/Nyenga	LC
98	Bdeogale crassicauda	Bushy-tailed mongoose	Nsulu/Nyenga	LC
99	Herpestes ichneumann	Large grey mongoose	Nsulu/Nyenga	NE
100	Galerella sanguinea	Slender mongoose	Nsulu/Nyenga	NE
101	Rhynchogale melleri	Meller's mongoose	Nsulu/Nyenga	LC
102	Ichneumia albicauda	White-tailed mongoose	Nsulu/Nyenga	LC
103	Mungos mungo	Banded mongoose	Nsulu/Nyenga	LC
104	Helogale parvula	Dwarf mongoose	Nsulu/Nyenga	LC
105	Orycteropus afer	Ardvark (antbear)	Nkumba-nkumba	LC
106	Heterohyrax brucei	Yellow-spotted rock dassie		LC
107	Dendrohyrax arboreus	Tree dassie		LC
108	Potamochoerus porcus	Bushpig	Nguluwe	LC
109	Phacohoerus aethiopicus	Warthog	Njili/Kaphulika	NE
110	Sylvicapra grimmia	Grey (Common) duiker	Gwape	LC
111	Oreotragus oreotragus	Klipspringer	Chinkhoma	LC
112	Ourebia ourebi	Oribi	Chowe	LC
113	Raphicerus sharpei	Sharpe's grysbok	Tungwa	LC
114	Neotragus moschatus	Suni	Kadumba	LC
115	Aepyceros melampus	Impala	Nswala	LC
116	Syncerus caffer	Buffalo	Njati	NT
117	Tragelaphus strepsiceros	Kudu	Ngoma	LC
118	Tragelaphus angasii	Nyala	Boo	LC
119	Tragelaphus scriptus	Bushbuck	Mbawala	LC

Annex 4: Birds of Lengwe National Park



No.	ENGLISH NAME	SCIENTIFIC NAME	REMARKS	IUCN Red Datalist
1	Abdim's Stork	Ciconia abdimii	Resident, Rare	LC
2	African Barred Owlet	*Glaucidium capense*	Resident, Rare	LC
3	African Black Swift	Apus barbatus	Resident, Rare	LC
4	African Broadbill	Smithornis capensis	Resident, Rare	LC
5	African Crake	Crecopsis egregia	Resident, Rare	LC
6	African Crowned Eagle	Stephanoaetus coronatus	Resident, Common	NT
7	African Cuckoo	Cuculus gularis	Resident, Rare	LC
8	African Cuckoo-Hawk	Aviceda cuculoides	Resident, Rare	LC
9	African Firefinch	Lagonosticta rubricata	Resident, Rare	LC
10	African fish Eaglee	Haliaeetus vocifer	Resident, Rare	LC
11	African Golden Oriole	Oriolus auratus	Resident, Common	LC
12	African Goshawk	Accipiter tachiro	Resident, Common	LC
13	African Grey Hornbill	Lophoceros nasutus	Resident, Common	LC
14	African Hawk Eagle	Aquila spilogaster	Resident, Rare	LC
15	African Hoopoe	Upupa africana	Resident, Common	NE
16	African Jacana	Actophilornis africanus	Resident, Rare	LC
17	African Marsh Harrier	Circus ranivorus		LC
18	African Mourning Dove	Streptopelia decipiens	Resident, Common	LC
19	African Moustached Warbler	Melocichla mentalis	Resident, Rare	LC
20	African Openbill Stork	Anastomus lamelligerus	Resident, Common	LC
21	African Palm Swift	Cypsiurus parvus	Resident, Common	LC
22	African Paradise Flycatcher	Terpsiphone viridis		LC

No.	ENGLISH NAME	SCIENTIFIC NAME	REMARKS	IUCN Red Datalist
23	African Penduline-Tit	Anthoscopus caroli	Resident, Common	LC
24	African Pied Wagtail	Motacilla aguimp	Resident, Common	LC
25	African Pipit	Anthus cinnamomeus		LC
26	African Pygmy Kingfisher	Ispidina picta	African Migrant, Rare	LC
27	African Reed Warbler	Acrocephalus baeticatus	African Migrant	NE
28	African Rock Martin	Hirundo fuligula	Resident, Rare	NE
29	African Scops Owl	Otus senegalensis	Resident, Rare	NE
30	African-barred owlet	Glaucidium capense	Resident, Rare	LC
31	Amethyst Sunbird	Chalcomitra amethystina	Resident, Rare	LC
32	Arnot's Chat	Myrmecocichla arnoti	Resident, Common	NE
33	Arrow-marked Babbler	Turdoides jardineii	Resident, Rare	LC
34	Ashy Flycatcher	Muscicapa caerulescens	Resident, Common	LC
35	Ayres's Hawk Eagle	Hieraaetus ayresii	Resident, Rare	LC
36	Barn Owl	Tyto alba	Resident, Common	LC
37	Barn Swallow	Hirundo rustica	Migrant, Common	LC
38	Barred Long-tailed Cuckoo	Cercococcyx montanus	African Migrant, Rare	LC
39	Basra Reed Warbler	Acrocephalus griseldis	Migrant, Rare	EN
40	Bateleur	Terathopius ecaudatus	Resident, Com	EN
41	Bat-like Spinetail	Neafrapus boehmi	Resident, Rare	LC
42	Bearded Scrub-robin	Cercotrichas quadrivirgata		LC
43	Bearded Woodpecker	Thripias namaquus	Resident, Common	LC
44	Bennett's Woodpecker	Campethera bennettii	Resident, Rare	LC
45	Black (Yellow-billed) Kite	Milvus migrans	African Migrant	LC
46	Black Cuckoo	Cuculus clamosus	African Migrant, Common	LC
47	Black Cuckoo Shrike	Campephaga flava	Resident, Common	LC
48	Black Goshawk	Accipiter melanoleucus	Resident, Rare	LC
49	Black Saw-wing	Psalidoprocne pristoptera	African Migrant, Common	LC
50	Black Stork	Ciconia nigra	Resident, Rare	LC
51	Black-and-white Flycatcher	Bias musicus	Resident, Rare	LC

No.	**ENGLISH NAME**	**SCIENTIFIC NAME**	**REMARKS**	**IUCN Red Datalist**
52	Black-backed puffback	Dryoscopus cubla	Resident, Common	LC
53	Black-bellied Bustard	*Eupodotis melanogaster*	Resident, Rare	LC
54	Black-breasted Snake Eagle	*Circaetus gallicus pectoralis*	Resident, Rare	LC
55	Black-collared Barbet	Lybius torquatus	Resident, Common	LC
56	Black-crowned Night Heron	Nycticorax nycticorax	Resident, Rare	LC
57	Black-crowned Tchagra	Tchagra senegalus	Resident, Common	LC
58	Black-headed Heron	Ardea melanocephala	Resident, Rare	LC
59	Black-rumped Buttonquail	Turnix nanus	African Migrant, Rare	LC
60	Black-shouldered Kite	Elanus axillaris	Resident, Rare	LC
61	Black-throated Wattle-eye	Platysteira peltata	Resident, Common	LC
62	Black-winged Red Bishop	Euplectes hordeaceus	Resident, Common	LC
63	Black-winged Stilt	Himantopus himantopus	Resident, Rare	LC
64	Bleating camaroptera	Camaroptera brachyura	Resident, Common	LC
65	Blue Quail	Excalfactoria adansonii	African Migrant	NE
66	Blue-cheeked Bee-eater	Merops persicus	Parlearctic Migrant, Common	LC
67	Blue-mantled Flycatcher	Trochocercus cyanomelas	Resident, Common	LC
68	Blue-spotted Dove	Turtur afer	Resident, Rare	LC
69	Böhm's Bee-eater	Merops boehmi	Resident, Common	LC
70	Booted Eagle	Hieraaetus pennatus	Parlearctic Migrant, Rare	LC
71	Broad-billed Roller	Eurystomus glaucurus	African Migrant, Common	LC
72	Broad-tailed paradise whydah	Vidua obtusa	Resident, Rare	LC
73	Bronze Mannikin	Lonchura cucullata	Resident, Rare	LC
74	Bronze-winged Courser	Rhinoptilus chalcopterus	Resident, Common	LC
75	Brown-backed Honeyguide	Prodotiscus regulus	Resident, Rare	LC
76	Brown-crowned tchagra	Tchagra australis	Resident, Common	LC
77	Brown-headed Parrot	Poicephalus cryptoxanthus	Resident, Rare	LC
78	Brown-hooded Kingfisher	Halcyon albiventris	Resident, Common	LC

No.	ENGLISH NAME	SCIENTIFIC NAME	REMARKS	IUCN Red Datalist
79	Brown-necked (Cape) Parrot	P. fuscicollis fuscicollis	Resident, Rare	NE
80	Brubru	Nilaus afer	Resident, Common	LC
81	Bully Canary	Crithagra sulphurata	Resident, Rare	LC
82	Burchell's Coucal	Centropus burchellii	Resident, Common	NE
83	Burnt-necked Eremomela	Eremomela usticollis	Resident, Common	LC
84	Bushveld Pipitica	Anthus caffer	Resident, Common	LC
85	Cabanis bunting	Emberiza cabanis	Resident, Rare	LC
86	Cape bunting	Emberiza capensis	Resident, Rare	LC
87	Cape Turtle Dove	Streptopelia capicola	Resident, Common	LC
88	Cardinal Woodpecker	Dendropicos fuscescens	Resident, Common	LC
89	Cattle Egret	Bubulcus ibis	Resident, Rare	LC
90	Chestnut-backed Finch Lark	Eremopterix leucotis	Resident, Common	LC
91	Chinspot Batis	Batis molitor	Resident, Common	LC
92	Cinnamon-breasted Rock Bunting	Emberiza tahapisi	African Migrant, Common	LC
93	Collared Palm Thrush	Cichladusa arquata	Resident, Common	LC
94	Collared Sunbird	Hedydipna collaris	Resident, Common	LC
95	Common Bulbul	Pycnonotus barbatus	Resident, Common	LC
96	Common Buzzard	Buteo buteo	Parlearctic Migrant, Common	LC
97	Common Cuckoo	Cuculus canorus	Parlearctic Migrant, Common	LC
98	Common Moorhen	Gallinula chloropus	Resident, Rare	LC
99	Common Sandpiper	Actitis hypoleucos	Parleactic Migrant, Rare	LC
100	Common Scimitarbill	Rhinopomastus cyanomelas	Resident, Rare	LC
101	Common Swift	Apus apus	Parlearctic Migrant, Common	LC
102	Common Waxbill	Estrilda astrild	Resident, Common	LC
103	Coppery Sunbird	Nectarinia cuprea	Resident, Common	LC
104	Crested Barbet	Trachyphonus vaillantii	Resident, Common	LC
105	Crested Francolin	Dendroperdix sephaena	Resident, Common	LC
106	Crested Guineafowl	Guttera pucherani	Resident, Common	LC
107	Croaking Cisticola	Cisticola natalensis	Resident, Rare	LC
108	Crowned Hornbill	Lophoceros alboterminatus	Resident, Common	LC
109	Cut-throat Finch	Amadina fasciata	Resident, Rare	LC

No.	**ENGLISH NAME**	**SCIENTIFIC NAME**	**REMARKS**	**IUCN Red Datalist**
110	Dabchick	Tachybaptus ruficollis	Resident, Rare	LC
111	Dark-backed Weaver	Ploceus bicolor	Resident, Common	LC
112	Dark-caped Bulbul	Pycnonotus capensis	Resident, Common	LC
113	Dickinson's Kestrel	Falco dickinsoni	Resident, Rare	LC
114	Diederick Cuckoo	Chrysococcyx caprius	African Migrant, Common	LC
115	Dusky Flycatcher	Muscicapa adusta	Resident, Rare	LC
116	Dwarf Bittern	Ixobrychus sturmii	African Migrant, Rare	LC
117	Eastern Bearded Scrub Robin	Erythropygia quadrivirgata	Resident, Rare	LC
118	Eastern Black-headed Oriole	Oriolus larvatus	Resident, Common	LC
119	Eastern Nicator	Nicator gularis	Resident, Common	LC
120	Eastern Red-footed Falcon	Falco amurensis	Parlearctic Migrant, Common, NTH*	LC
121	Egyptian Goose	Alopochen aegyptiaca	Resident, Rare	LC
122	Emerald Cuckoo	Chrysococcyx cupreus	African Migrant, Common	LC
123	Emerald-spotted Dove	Turtur chalcospilos	Resident, Common	LC
124	European Bee-eater	Merops apiaster	Parleactic Migrant, Common	LC
125	European Golden Oriole	Oriolus oriolus	Parleactic Migrant, Rare	LC
126	European Hobby	Falco subbuteo	Parleactic Migrant, Common	LC
127	European Marsh Warbler	Acrocephalus palustris	Parleactic Migrant, Common	LC
128	European Nightjar	Caprimulgus europaeus	Parleactic Migrant, Rare	LC
129	European Roller	Coracias garrulus	Migrant, Common, NTH*	LC
130	European Sand Martin	Riparia riparia	Parleactic Migrant, Rare	LC
131	Familiar Chat	Cercomela familiaris	Resident, Rare	LC
132	Fan-tailed Widowbird	*Euplectes axillaris*		LC
133	Fiery-necked Nightjar	Caprimulgus pectoralis	Resident, Common	LC
134	Flappet Lark	Mirafra rufocinnamomea	Resident, Common	LC
135	Fork-tailed Drongo	Dicrurus adsimilis	Resident, Common	LC
136	Freckled Rock Nightjar	Caprimulgus tristigma	Resident, Rare	LC

No.	ENGLISH NAME	SCIENTIFIC NAME	REMARKS	IUCN Red Datalist
137	Gabar Goshawk	Micronisus gabar	Resident, Rare	LC
138	Gaboon Nightjar	Caprimulgus fossii	Resident, Common	LC
139	Garden Warbler	Sylvia borin	Parleactic Migrant, Rare	LC
140	Giant Eagle Owl	Bubo lacteus	Resident, Common	LC
141	Giant Kingfisher	Megaceryle maxima	Resident, Rare	LC
142	Glossy Ibis	Plegadis falcinellus	Resident, Rare	LC
143	Golden-rumped Tinkerbird	Pogoniulus bilineatus	Resident, Common	LC
144	Golden-tailed Woodpecker	Campethera abingoni	Resident, Rare	LC
145	Goliath Heron	Ardea goliath	Resident, Rare	LC
146	Great Reed Warbler	Acrocephalus arundinaceus	Migrant, Rare	LC
147	Great Spotted Cuckoo	Clamator glandarius	African Migrant, Rare	LC
148	Great Spotted Eagle	Clanga clanga	Parleactic Migrant, Rare, VUL*	VU
149	Great White Egreat	Ardea alba	Resident, Rare	LC
150	Great White Pelican	Pelecanus onocrotalus	Resident, Rare	LC
151	Greater Black-backed Cisticola	Cisticola galactotes	Resident, Common	LC
152	Greater Blue-eared Starling	Lamprotornis chalybaeus	Resident, Common	LC
153	Greater Honeyguide	Indicator indicator	Resident, Common	LC
154	Greater-painted Snipe	Rostratula benghalensis	Resident, Rare	LC
155	Green Coucal	Ceuthmochares aereus	Resident, Common	LC
156	Green Indigo bird	Vidua codringtoni	Resident, Rare	LC
157	Green Pigeon	Treron australis	Resident, Rare	LC
158	Green Sandpiper	Tringa ochropus	Parleactic Migrant, Common	LC
159	Green Shank	Tringa nebularia	Parlearctic Migrant, Rare	LC
160	Green Twinspot	Mandingoa nitidula	Resident, Rare	LC
161	Green Wood Hoopoe	Phoeniculus purpureus	Resdent, Common	LC
162	Green-backed Camaroptera	Camaroptera brachyura	Resdent, Common	LC
163	Green-backed Heron	Butorides striatus	Resident, Rare	NE
164	Green-capped Eremomela	Eremomela scotops	Resdent, Common	LC
165	Green-winged Pytilia	Pytilia melba	Resdent, Common	LC

No.	ENGLISH NAME	SCIENTIFIC NAME	REMARKS	IUCN Red Datalist
166	Grey Go-away Bird	Crinifer concolor		NE
167	Grey Heron	Ardea cinerea	Resident, Rare	LC
168	Grey Hornbill	*Tockus nasutus*	Resdent, Common	LC
169	Grey Lourie	Corythaixoides concolor	Resident, Common	LC
170	Grey Penduline Tit	Anthoscopus caroli	Resident, Common	LC
171	Grey Sunbird	Cyanomitra verreauxii	Resident, Common	LC
172	Grey-backed Camaroptera	Camaroptera brevicaudata	Resident, Common	NE
173	Grey-headed Bush Shrike	Malaconotus blanchoti	Resident, Common	LC
174	Grey-headed Sparrow	Passer griseus	Resident, Common	LC
175	Grey-headed Kingfisher	Halcyon leucocephala	African Migrant, Rare	LC
176	Grey-rumped Swallow	Pseudhirundo griseopyga		LC
177	Gymnogene	Polyboroides typus	Resident, Common	LC
178	Hadeda Ibis	Bostrychia hagedash	Resident, Common	LC
179	Half-collared Kingfisher	Alcedo semitorquata	Resident, Common	LC
180	Harlequin Quail	Coturnix delegorguei	Resident, Common	LC
181	Harmekop Scopus	Scopus umbretta	Resident, Common	LC
182	Helmeted Guineafowl	Numida meleagris	Resident, Rare	LC
183	Heuglin’s Robin	Cossypha heuglini	Resident, Common	LC
184	Hildebrandt’s Francolin	Pternistis hildebrandti	Parleactic Migrant, Rare	LC
185	Holub's Golden Weaver	Ploceus xanthops	Resident, Rare	LC
186	Honey Buzzard	Pernis apivorus	Migrant, Rare	LC
187	Hooded Vulture	Necrosyrtes monachus	Resident, Rare	LC
188	Horus Swift	Apus horus	Parleactic Migrant	LC
189	House Martin	Delichon urbicum	Parlearctic Migrant, Rare	LC
190	Icterine Warbler	Hippolais icterina	Parleactic Migrant, Rare	LC
191	Jacobin Cuckoo	Clamator jacobinus	Resident, Common	LC
192	Jameson’s Firefinch	Lagonosticta rhodopareia	Resident, Common	LC
193	Klaas’s Cuckoo	Chrysococcyx klaas	Resident, Common	LC
194	Knob-billed Duck	Sarkidiornis melanotos	Resident, Rare	LC
195	Kurrichane Buttonquail	Turnix sylvaticus	Resident, Common	LC

No.	**ENGLISH NAME**	**SCIENTIFIC NAME**	**REMARKS**	**IUCN Red Datalist**
196	Kurrichane Thrush	Turdus libonyana	Resident, Rare	LC
197	Lanner Falcon	Falco biarmicus	Resident, Rare	LC
198	**Lappet-faced Vulture**	**Torgos tracheliotos**	**Resident, Rare**	**EN**
199	Large-striped Pipit	Anthus lineiventris	Resident, Rare	LC
200	Laughing Dove	Spilopelia senegalensis	Resident, Common	LC
201	Lazy Cisticola	Cisticola aberrans		LC
202	Lead-coloured Flycatcher	Myioparus plumbeus	Resident, Rare	LC
203	Lemon-breasted Canary	Crithagra citrinipectus	Resident, Common	LC
204	Lesser Black-winged Plover	Vanellus lugubris	Resident, Common	LC
205	Lesser Blue-eared Starling	Lamprotornis chloropterus	Resident, Common	LC
206	Lesser cuckoo	Cuculus poliocephalus	Migrant, Rare	LC
207	Lesser Honeyguide	Indicator minor	Parlearctic Migrant, Rare	LC
208	Lesser Masked Weaver	Ploceus intermedius	Resident, Common	LC
209	Lesser Spotted Eagle	Clanga pomarina	Parleactic Migrant, Rare	LC
210	Lesser Swamp Warbler	Acrocephalus gracilirostris	Resident, Rare	LC
211	Levaillant's cisticola	Cisticola tinniens	Resident, Common	LC
212	Lilac-breasted Roller	Coracias caudatus	Resident, Common	LC
213	Little Bee-eater	Merops pusillus	Resident, Rare	LC
214	Little Egret	Egretta garzetta	Resident, Rare	LC
215	Little Sparrow Hawk	Accipiter minullus	Resident, Rare	LC
216	Little Spotted Woodpecker	Campethera cailliautii	Resident, Common	LC
217	Livingstone's Flycatcher	Erythrocercus livingstonei	Resident, Common	LC
218	Lizard Buzzard	Kaupifalco monogrammicus	Resident, Common	LC
219	Long-billed Crombec	Sylvietta rufescens	Resident, Rare	LC
220	Long-crested Eagle	Lophaetus occipitalis	Resident, Rare	LC
221	Long-tailed (Mountain) Wagtail	Motacilla clara	Resident, Rare	LC
222	Long-tailed Paradise Whydah	Vidua paradisaea	Resident, Common	LC
223	Madagascar Bee-eater	Merops superciliosus	Resident, Common	LC
224	Malachite Kingfisher	Corythornis cristatus	Resident, Rare	LC

No.	ENGLISH NAME	SCIENTIFIC NAME	REMARKS	IUCN Red Datalist
225	Marabou Stork	Leptoptilos crumenifer	Resident, Common	LC
226	Marsh Sandpiper	Tringa stagnatilis	Parleactic Migrant, Rare	LC
227	Martial Eagle	Polemaetus bellicosus	Resident, Rare, END*	LC
228	Mascarene Martin	Phedina borbonica	Resident, Common	LC
229	Miombo Barred Warbler	Calamonastes undosus	Migrant, Rare	LC
230	Miombo Blue-eared Starling	Lamprotornis elisabeth		LC
231	Montagu's Harrier	Circus pygargus	Parleactic Migrant, Rare	LC
232	Mosque Swallow	Cecropis senegalensis	Resident, Rare	LC
233	Mottled Spinetail	Telacanthura ussheri	Resident, Rare	LC
234	Mourning Dove	Zenaida macroura	Resident, Common	LC
235	Namaqua Dove	Oena capensis	Resident, Common	LC
236	Narina Trogon	Apaloderma narina	Resident, Common	LC
237	Neddicky	Cisticola fulvicapilla	Resident, Common	LC
238	Olive Tree Warbler	Hippolais olivetorum	Resident, Rare	LC
239	Orange-breasted Bush Shrike	Chlorophoneus sulfureopectus	Resident, Rare	LC
240	Orange-winged Pytilia	Pytilia afra	Resident, Rare	LC
241	Ovambo Sparrowhawk	Accipiter ovampensis	Resident, Rare	LC
242	Pale-billed Hornbill	Lophoceros pallidirostris	Resident, Common	LC
243	Pale-chanting goshawk	Melierax canorus	Resident	LC
244	Pallid Flycatcher	Melaenornis pallidus	Resident, Common	NE
245	Paradise Flycatcher	Terpsiphone	African Migrant, Common	LC
246	Parasitic Weaver	Anomalospiza imberbis	Resident, Common	LC
247	Pearl-spotted Owlet	Glaucidium perlatum	Resident, Rare	LC
248	Pel's Fishing Owl	Scotopelia peli	Resident, Common	LC
249	Pennant-winged Nightjar	Caprimulgus vexillarius	Resident, Common	LC
250	Pied Crow	Corvus albus	Resident, Rare	LC
251	Pied Kingfisher	Ceryle rudis	Resident, Rare	LC
252	Pink-backed Pelican	Pelecanus rufescens	Resident, Rare	LC
253	Pin-tailed whydah	Vidua macroura	Resident, Rare	LC

No.	ENGLISH NAME	SCIENTIFIC NAME	REMARKS	IUCN Red Datalist
254	Purple Heron	Ardea purpurea	Resident, Rare	LC
255	Purple Indigobird	Vidua purpurascens	Resident, Rare	LC
256	Purple Roller	Eurystomus azureus	African Migrant	NT
257	Purple-banded Sunbird	Cinnyris bifasciatus	Resident, Common	LC
258	Purple-crested Turaco	Gallirex porphyreolophus	Resident, Common	LC
259	Racket-tailed Roller	Coracias spatulatus	Resident, Common	LC
260	Rattling Cisticola	Cisticola chiniana	Resident, Common	LC
261	Red-backed Mannikin	Spermestes nigriceps	Parleactic Migrant, Common	NE
262	Red-backed Shrike	Lanius collurio	Parleactic Migrant, Common	LC
263	Red-belled Helmet Shrike	Prionops caniceps		LC
264	Red-billed Firefinch	Lagonosticta senegala	Resident, Rare	LC
265	Red-billed Oxpecker	Buphagus erythrorhynchus	Resident, Common	NE
266	Red-billed Quelea	Quelea quelea	Resident, Common	LC
267	Red-capped Robin Chat	Cossypha natalensis	Resident, Common	LC
268	Red-chested Cuckoo	Cuculus solitarius	Resident, Rare	LC
269	Red-collared Wydah	Euplectes ardens	Resident, Common	LC
270	Red-eyed Dove	Streptopelia semitorquata	Resident, Common	LC
271	Red-faced Cisticola	Cisticola erythrops	Resident, Common	LC
272	Red-faced Crombec	Sylvietta whytii		LC
273	Red-faced Mousebird	Urocolius indicus	Resident, Common	LC
274	Red-headed Quelea	Quelea erythrops	African Migrant, Common	LC
275	Red-headed Weaver	Anaplectes rubriceps	Resident, Rare	LC
276	Red-necked Falcon	Falco chicquera	Resident, Common	NT
277	Red-necked Francolin	Pternistis afer	Resident, Common	LC
278	Red-throated Twinspot	Hypargos niveoguttatus	Resident, Common	LC
279	Red-winged Starling	Onychognathus morio	Resident, Rare	LC
280	Reed Cormorant	Microcarbo africanus	Resident, Common	LC
281	Retz's Red-billed Helmet Shrike	Prionops retzii	Resident, Common	LC
282	Richard's Pipit	Anthus richardi	Resident, Rare	LC
283	River Warbler	Locustella fluviatilis	Resident, Rare	LC
284	Rudd's Apalis	Apalis ruddi	Resident, Rare	LC

No.	**ENGLISH NAME**	**SCIENTIFIC NAME**	**REMARKS**	**IUCN Red Datalist**
285	Saddle-billed stork	Ephippiorhynchus senegalensis	Resident, Rare	LC
286	Scaly-throated Honeyguide	Indicator variegatus	Resident, Common	LC
287	Scarlet-chested Sunbird	Chalcomitra senegalensis	Resident, Common	LC
288	**Secretary Bird**	**Sagittarius serpentarius**	**Rare**	**EN**
289	Shelley's Francolin	Scleroptila shelleyi	Resident, Rare	LC
290	Shikra	Accipiter badius	Resident, Common	LC
291	Short-winged Cisticola	Cisticola brachypterus	Resident, Common	LC
292	Sombre Bulbul	Andropadus importunus	Resident, Common	LC
293	Sourthen MaskedWeaver	Ploceus velatus	Resident, Rare	LC
294	Southern Black Flycatcher	Melaenornis pammelaina	Resident, Common	LC
295	Southern Black Tit	Melaniparus niger	Resident, Rare	LC
296	Southern Blue Waxbill	Uraeginthus angolensis	Resident, Common	LC
297	Southern Brown-throated Weaver	Ploceus xanthopterus	Resident, Common	LC
298	Southern Carmine Bee-eater	merops nubicoides	Resident, Common	LC
299	Southern Grey-headed Sparrow	Passer diffusus	Resident, Common	LC
300	Southern Ground Hornbill	Bucorvus leadbeateri	Resident, Common	VU
301	Southern Hyliota	Hyliota australis	Resident, Common	LC
302	Southern Red Bishop	Euplectes orix	Resident, Rare	LC
303	southern Red-billed Hornbill	Tockus rufirostris	Resident, Common	NE
304	Southern Yellow-billed Hornbill	Tockus leucomelas	Resident, Common	LC
305	Southern-banded Snake Eagle	Circaetus fasciolatus	Resident, Common	NT
306	Speckled Mousebird	Colius striatus	Resident, Common	LC
307	Spectacled Weaver	Ploceus ocularis	Resident, Rare	LC
308	Spotted Dikkop	Burhinus capensis	Resident, Common	LC
309	Spotted Eagle Owl	Bubo africanus	Resident, Common	LC
310	Spotted Flycatcher	Muscicapa striata	Parleactic Migrant, Common	LC
311	Spur-winged goose	Plectropterus gambensis	Resident, Common	LC
312	Squaco Heron	Ardeola ralloides	Resident, Rare	LC

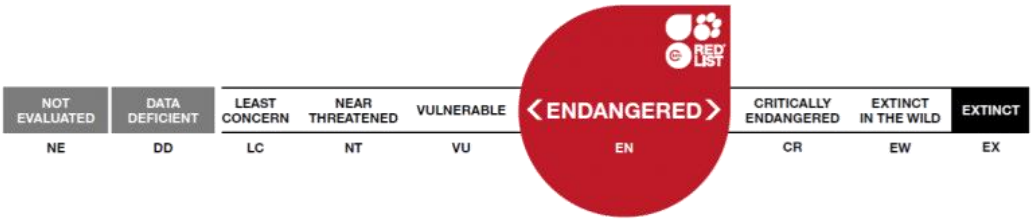
No.	**ENGLISH NAME**	**SCIENTIFIC NAME**	**REMARKS**	**IUCN Red Datalist**
313	Square-tailed Drongo	Dicrurus ludwigii	Resident, Common	LC
314	Starred Robin	Erithacus rubecula	Parleactic Migrant	LC
315	**Steppe Eagle**	**Aquila nipalensis**	**Parleactic Migrant**	**EN**
316	Striped Cuckoo	Tapera naevia	Resident, Common	LC
317	Striped Kingfisher	Halcyon chelicuti	Resident, Common	LC
318	Swallow-tailed Bee-eater	Merops hirundineus	Resident, Rare	LC
319	Tambourine Dove	Turtur tympanistria	Resident, Rare	LC
320	Tawny Eagle	Aquila rapax	Resident, Common	VU
321	Tawny-flanked Prinia	Prinia subflava	Resident, Common	LC
322	Temminck's Courser	Cursorius temminckii	African Migrant, Rare	LC
323	Thick-billed Cuckoo	Pachycoccyx audeberti	Resident, Common	LC
324	Thick-billed Weaver	Amblyospiza albifrons	Resident, Rare	LC
325	Three-banded Plover	Charadrius tricollaris	Parleactic Migrant, Common	LC
326	Thrush-Nightingale	Luscinia luscinia	Resident, Common	LC
327	Tropical Boubou	Laniarius major	Resident, Common	NE
328	Trumpeter Hornbill	Bycanistes bucinator	Resident, Rare	LC
329	Variable Indigo bird	Vidua funereal	Resident, Rare	NE
330	Variable Sunbird	Cinnyris venustus	Resident, Rare	LC
331	Verreaux's eagle-owl	*Bubo lacteus*	Resident, Common	LC
332	Village Indigo bird	Vidua chalybeata	Resident, Rare	LC
333	Village Weaver	Ploceus cucullatus	Resident, Rare	LC
334	Vincent Bunting	Emberiza vincenti	Resident	NE
335	Violet-backed Starling	Cinnyricinclus leucogaster	Resident	LC
336	Violet-backed Sunbird	Anthreptes orientalis	Resident	LC
337	Wahlberg's Eagle	Hieraaetus wahlbergi	African Migrant, Rare	LC
338	Wattled Starling	Creatophora cinerea	African Migrant, Rare	LC
339	Western Banded Snake Eagle	Circaetus cinereus	Resident, Common	LC
340	Western Banded Snake Eagle	Circaetus cinerascens	Resident, Common	LC
341	Western Red-footed Falcon	Falco vespertinus	Resident, Common	NT
342	White Stork	Ciconia ciconia	Parleactic Migrant, Common	LC
343	White-backed Vulture	Gyps africanus	Resident, Common,	CR
344	White-bellied Sunbird	Cinnyris talatala	Resident, Common	LC

No.	**ENGLISH NAME**	**SCIENTIFIC NAME**	**REMARKS**	**IUCN Red Datalist**
345	White-breasted Cuckoo-shrike	Ceblepyris pectoralis	Resident, Common	LC
346	White-browed Scrub Robin	Cercotrichas leucophrys	Resident, Common	LC
347	White-browed Sparrow-weaver	Plocepasser mahali	Resident, Common	LC
348	White-crested Helmet Shrike	Prionops plumatus	Resident, Common	LC
349	White-faced Duck	Dendrocygna viduata	Resident, Rare	LC
350	White-faced Owl	Otus leucotis	Resident	NE
351	**White-headed Vulture**	**Trigonoceps occipitalis**	**Resident, Common**	**CR**
352	White-throated Swallow	Hirundo albigularis	African Migrant, Rare	LC
353	White-winged Whydah	Euplectes albonotatus	Parlearctic Migrant, Common	LC
354	Willow Warbler	Phylloscopus trochilus	Resident, Common	LC
355	Wood Owl	Strix woodfordii	Parlearctic Migrant, Rare	LC
356	Wood Sandpiper	Batis fratrum	Resident, Rare	LC
357	Woodwards' Batis	Batis Batis fratrum	Resident, Rare	NE
358	Woolly-necked Stork	Ciconia episcopus	Resident, Rare, VUL*	NT
359	Yellow Bishop	Euplectes afer	Migrant, Rare	LC
360	Yellow Wagtail	Motacilla flava	Resident, Rare	LC
361	Yellow White-eye	Zosterops senegalensis	Resident, Common	LC
362	Yellow-bellied Eremomela	Chlorocichla flaviventris	Resident, Common	NE
363	Yellow-bellied Greenbul	Nectarinia venusta	Resident, Rare	LC
364	Yellow-bellied Sunbird	Neodrepanis hypoxantha	Resident, Rare	VU
365	Yellow-billed Bulbul	Alophoixus phaeocephalus		LC
366	Yellow-billed Egret	Ardeaaynch brachyrh	Resident, Rare	NE
367	Yellow-billed Kite	Milvus aegyptius		LC
368	Yellow-billed Oxpecker	Buphagus africanus	Resident, Common	LC
369	Yellow-billed Stork	Mycteria ibis	Resident, Common	LC
370	Yellow-breasted Apalis	Apalis flavida	Resident, Common	LC
371	Yellow-fronted Canary	Serinus mozambicus	Resident, Common	LC
372	Yellow-fronted Tinkerbird	Pogoniulus chrysoconus	Resident, Common	LC

No.	**ENGLISH NAME**	**SCIENTIFIC NAME**	**REMARKS**	**IUCN Red Datalist**
373	Yellow-throated Bush Sparrow	Gymnoris superciliaris	Resident, Common	LC
374	Yellow-throated Petronia	Pytilia hypogrammica	Resident, Common	LC

Annex 5: Plants of Lengwe National Park

Legend



No	Scientific Name	English Name	IUCN Data Redlist
1	*Azolla nilotica*	Free-floating aquatic ferns	LC
2	*Marsilea sp.*	Creeping ferns	NE
3	*Peperomia pellucida*	Wild pepper	NE
4	*[Milicia {= Chlorophora} excelsa]*		NT
5	*Maclura {= Cardiogyne} africana*	African osage orange	LC
6	*Ficus bussei {= zambesiaca}*	Zambezi fig	LC
7	*Ficus capreifolia*	Riverine sandpaper fig	LC
8	*Ficus ingens*	Red-leaved rock fig	LC
9	*Ficus sur {= capensis}*	Cape fig	LC
10	*Ficus sycomorus*	Sycamore fig	LC
11	*[F. abutilifolia {= soldanella}, F. craterostoma, F. sansibarica, F. sonderi, F. verruculosa]*		LC
12	*Boehmeria platyphylla*		NE
13	*Laportes penducularis*		NE
14	*Plicosepalus kalachariensis {= Loranthus curvifolia}*		NE
15	*Loranthus spp*		NE
16	*Thesium scandens*		NE
17	*Opilia campestris {= celtidifolia }*		NE
18	*Jasminium fluminense*		NE
19	*Olax dissitiflora*	Small-fruited olax	LC
20	*Ximenia americana*	Small sourplum	LC
21	*Ximenia caffra*	Large sourplum	LC
22	*Aristolochia albida {= petersiana}*		NE
23	*Achyranthes aspera*		NE
24	*Amaranthus sp.*		NE
25	*Celosia triguna*		NE
26	*Psilotrichulm sp.*		NE
27	*Pupalia sp.*		NE
28	*Boerhavia diffusa*		NE

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29	*Boerhavia erecta*		NE
30	*Commicarpus sp*		NE
31	*Corbichonia sp.*	Vygies (small annuals)	NE
32	*Mollugo sp*		NE
33	*Portulaca sp.*		NE
34	*Talinum sp.*		NE
35	*Nymphaea nouchali {= caerulea}*	Water lily (mauve flowers)	LC
36	*Nymphaea lotus*	Water lily (white flowers)	LC
37	*Cissampelos mucronata*	Blue lotus	LC
38	*Cocculus hirsutus*		NE
39	*Tiliacora funifera*		NE
40	*Tinospora caffra*		NE
41	*Tinospora tenera*		NE
42	*Cleistochlamys kirkii*	Purple cluster pear	LC
43	*Friesodielsia obovata*	Northern dwaba-berry	LC
44	*Monanthotaxis obovate*		NE
45	*Hexalobus monopetalus*		LC
46	*Xylopia parviflora*	Bitterwood	LC
47	*Artabotrys brachypetalus*	Purple hook-berry	LC
48	*Artabotrys monteiroae*	Red hook-berry	LC
49	*Annona senegalensis*		LC
50	*Monodora junodii*		LC
51	*Monodora grandidieri*	Green-apple	LC
52	*Monodora stenopetala*	Oval green-apple	VU
53	*Gyrocarpus americanus*		LC
54	*Argemone mexicana*	(Naturalised)	NE
55	*Cladostemon kirkii*	Three-finger bush	LC
56	*Capparis erythrocarpos*	Caper-bush	NE
57	*Capparis tomentosa*	Woolly caper-bush	NE
58	*C. sepiaria*		LC
59	*Boscia salicifolia*	Willow-leaved shepherd's tree	LC
60	*B. angustifolia, B. mossambicensis*		NE
61	*Cadaba kirkii*	Large-flowered worm-bush	LC
62	*C. termitaria*		NE
63	*Maerua angolensis*	Bead-bean	LC
64	*Maerua decumbens {= edulis, = Courbonia glauca}*		NE
65	*Maerua juncea*		LC
66	*Maerua parvifolia*		LC
67	*[M. kirkii, M. triphylla]*		LC
68	*Thilachium africanum*	Cucumber bush	LC

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69	*Kalanchoe sp. Kalanchoe*		LC, VU
70	*Pittosporum viridiflorum*		LC
71	*Trichocladus ellipticus*		LC
72	*Parinari curatellifolia*		LC
73	*Rourea {= Byrsocarpus} orientalis*	Short-pod	LC
74	*Mimosa mossambicensis*		LC
75	*Albizia amara*	Bitter albizia	LC
76	*Albizia anthelmintica*	Worm-cure albizia	LC
77	*Albizia glaberrima*	Low Veld albizia	LC
78	*Albizia harveyi*	Sickle-leaved albizia	LC
79	*Albizia versicolor*	Poison-pod albizia	LC
80	*[A. antunesiana, A. tanganyicensis, A. zimmermannii]*		LC
81	*Acacia adenocalyx*	Small-leaved acacia	LC
82	*Acacia ataxacantha*	Flame acacia	LC
83	*Acacia galpinii*	Monkey-thorn	LC
84	*Acacia goetzei*	Purple-pod acacia	LC
85	*Acacia grandicornuta*	Horned thorn	LC
86	*Acacia hockii*		NE
87	*Acacia nigrescens*	Knob-thorn tree	NE
88	*Acacia nilotica*	Scented thorn	LC
89	*Acacia polyacantha*	White-thorn	NE
90	*Acacia robusta*	Splendid acacia	LC
91	*Acacia schweinfurthii*	River climbing acacia	LC
92	*Acacia sieberiana*	Paperbark	LC
93	*Acacia tortilis*	Umbrella thorn	LC
94	*Acacia welwitschii*	Delagoa thorn	LC
95	*Acacia xanthophloea*	Fever tree	LC
96	*A. erubescens*		LC
97	*A. Senegal*		NE
98	*A. amathethophylla {= macrothyrsa}*		NE
99	*A. karroo*		LC
100	*A. gerrardii*		
101	*Faidherbia albida*	Winterthorn	LC
102	*Dichrostachys cinerea*	Sickle-bush	LC
103	*Amblygonocarpus andongensis*		LC
104	*Newtonia hildebrandtii*	Lebombo wattle	LC
105	*Xylia torreana*		LC
106	*Elephantorrhiza spp*	The sumach bean genus	LC
107	*Entada spp*	The splinter bean genus	LC
108	*Burkea Africana*	Red syringa	NE

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109	*Guibortia conjugata*		NE
110	*Colophospermum mopane*	Mopane (Tsanya)	LC
111	*Brachystegia boehmii**	Prince-of-Wales' feather	LC
112	*Brachystegia glaucescens*	Mountain acacia	NE
113	*[B. allenii*		LC
114	*B. utilis]*		LC
115	*B. spiciformis*		LC
116	*B. microphylla*		NE
117	*B. manga*		LC
118	*Tamarindus indica*	Tamarind (Bwemba)	LC
lc	*Afzelia quanzensis*	Pod mahogany	LC
120	*Julbernardia globiflora*	Munhondo	LC
121	*[J. paniculata]*		LC
122	*Bauhinia tomentosa*	Yellow-tree bauhinia	LC
123	*[B. petersiana]*		LC
124	*Piliostigma {= Bauhinia} thonningi*	Monkey bread tree	NE
125	*Cassia abbreviata Long-tail cassia*		LC
126	*Senna {= Cassia} petersiana*	Eared cassia	LC
127	*Senna {= Cassia} singueana*	Winter cassia	LC
128	*[Peltophorum africanum]*	African Wattle	LC
129	*Chamaecrista absus*	(Forb)	LC
130	*Cordyla africana*	Wild mango	LC
131	*[Swartzia madagascariensis]*		LC
132	*Xanthocercis zambesiaca*	Nyala tree	LC
133	*[Pericopsis angolensis]*		LC
134	*Bolusanthus speciosus*	Tree wistaria	LC
135	*[Baphia spp]*	The camwood genus	NT
136	*Crotalaria sp.*	The rattle-pod genus	NT
137	*Indigofera sp.*	The indigo genus	LC
137	*Tephrosia virgata*		LC
139	*[Mundulea sericea]*		LC
140	*[Millettia spp]*	The panga panga genus	DD
140	*Sesbania bispinosa*	River bean	LC
142	*Sesbania rogersii*		NE
143	*{Sesbania tetraptera*		NE
144	*Ormocarpum kirkii*	Small caterpillar pod	LC
145	*[O. trichocarpum]*		LC
147	*Aeschynomene indica*	False-teeth tree	LC
148	*Dalbergia arbutifolia*	Climbing river dalbergia	LC

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149	*Dalbergia boehmii*	Large-leaf dalbergia	LC
150	*Dalbergia fischeri*	Fischer's dalbergia	LC
151	*Dalbergia lacteal*		NE
152	*Dalbergia melanoxylon*	African blackwood	NT
153	*[D. nitidula]*		LC
154	*Dalbergiella nyasae*	Mane-pod	NE
155	*Pterocarpus angolensis*	Mukwa, Bloodwood	LC
156	*Pterocarpus lucens subsp. antunesii*	Thorny teak, Small-leafed bloodwood	LC
157	*Pterocarpus lucens*	Large-leafed bloodwood	LC
158	*Pterocarpus rotundifolus*	Round-leafed bloodwood	NE
159	*Philenoptera {= Lonchocarpus} bussei*	Narrow lance-pod	NE
160	*Philenoptera violacea {= Lonchocarpus capassa}*	Rain tree	LC
161	*Xeroderris stuhlmannii*	Wing pod	NE
162	*Erythrina livingstoniana*	Aloe erythrina	NE
163	*E. abyssinica*		LC
164	*E. latissimi*		NE
165	*E. lysistemon*		LC
166	*Rhynchosia sublobata*	Shaggy-bush	NE
167	*Abrus sp*		NE
168	*Lablab niger*	Climbing bean	NE
169	*Dolichos sp*		NE
170	*Mucuna sp. Buffalo bean*		NE
171	*Vigna sp. Cow pea*		NE
172	*Hugonia orientatis {= africana}*		NE
173	*Balanites maughamii*	Y-thorned torchwood	LC
174	*[Fagara spp]*	The knobwood genus	NE
175	*[Fagaropsis angolensis]*		NE
176	*[Oricia bachmannii]*		LC
177	*Vepris zambesiaca*	Rare woodland vepris	LC
178	*Teclea nobilis*	Small-fruited teclea	LC
179	*[T. myrei]*		NE
180	*[Clausena anisata]*		LC
181	*Citropsis daweana*	Wild citrus	LC
182	*[Harrisonia abyssinica]*		LC
183	*Kirkia acuminata*	White syringa	LC
184	*Commiphora africana*	Poison-grub commiphora	LC
185	*Commiphora mossambicensis*	Pepper-leafed commiphera	NE
186	*C. caerulea*		LC
187	*C. edulis*		LC

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188	*C. marlothii*		LC
189	*C. viminea (= merkeri)*		LC
190	*C. mollis*		LC
191	*C. pyracanthoides*	Cork Tree	LC
192	*C. zanzibarica*		LC
193	*[Khaya anthotheca {= nyasica}]*	Mahogany	VU
194	*[Entandrophragma caudatum]*		LC
195	*Turraea nilotica*	Small mahogany	LC
196	*[T. floribunda]*		LC
197	*[Ekebergia capensis]*		LC
198	*Trichilia capitata*	Small Trichilia	LC
199	*Trichilia emetica*	Natal mahogany	LC
200	*[T. dregeana]*		LC
201	*Securidaca longipedunculata*	Violet tree	NE
202	*Tapura fischeri*	Leaf-berry tree	LC
203	*Pseudolachnostylis maprouneifolia*	Kudu-berry	LC
204	*Flueggea virosa*	White-berry bush	LC
205	*Phyllanthus pinnatus {= kirkianus}*	Woody cushion	NE
206	*Phyllanthus ovalifolius {= guineensis}*	Small-fruited phyllanthus	LC
207	*[P. inflatus, P. reticulatus]*		LC
208	*Drypetes gerrardii*	Hairy drypetes	LC
209	*Drypetes mossambicensis*	Lowveld drypetes	NE
210	*[D. natalensis]*		LC
211	*[Hymenocardia acida, H. ulmoides]*		LC
212	*Antidesma membranaceum*	Pink tassel berry	LC
213	*Antidesma venosum*	Tassel berry	LC
214	*[Antidesma vogelianum]*		NE
215	*[Uapaca genus]*	The mahobohobo genus	NE
216	*[Cleistanthus genus]*	The umzithi genus	NE
217	*Bridelia carthatica*	Knobby bridelia	NE
218	*Bridelia mollis*	Velvet bridelia	LC
219	*[B. micrantha]*		LC
220	*Croton megalobotrys*	Fever-berry croton	LC
221	*Croton megalocarpus*		LC
222	*Croton pseudopulchellus*		NE
223	*C. menyhartii*		NE
	C. sylvaticus		LC
224	*Erythrococca sp.*	Red-berry	NE
225	*E. menyharthii*		LC
	E. polyandra		NE

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	E. trichogyne		LC
226	*Mallotus oppositifolius*		LC
227	*Alchornea laxiflora*	Lowveld bead-string	LC
228	*Neoboutonia melleri*		LC
229	*Acalypha chirindica*	False-nettle	LC
230	*Schinziophyton (Ricinodendron) rautanenii*		LC
231	*Excoecaria bussei*	Pawnbroker tree	NE
232	*[Maprounea africana]*		NE
233	*Euphorbia cooperi*	Lesser candelabra tree	LC
234	*Euphorbia lividiflora*	Red-flowered euphorbia	LC
235	*Euphorbia matebelensis*	Three-forked euphorbia	NE
236	*E. halipedicola*		NE
	E. ingens		LC
	E. tirucalli		LC
237	*Margaritaria discoidea {= Phyllanthus discoideus}*	Pheasant-berry	LC
238	*Sclerocarya birrea subsp. caffra*	Marula	NE
239	*Lannea discolor*	Live-long	LC
240	*Lannea edulis*	Tsambatsi	NE
241	*Lannea mossambicensis*		NE
242	*Lannea schweinfurthii {stuhlmanii}*	False marula	NT
243	*Ozoroa insignis subsp. reticulata*	African resin tree	LC
244	*Rhus spp*	The rhus genus	NE
245	*Gymnosporia {= Maytenus} senegalensis*	Confetti tree	LC
246	*[G. putterlickioides]*		NE
247	*[Maytenus undata]*		LC
248	*[Pterocelastrus echinatus]*		LC
249	*[Pleurostylia spp]*	The coffee-pear genus	LC
250	*Hippocratea indica*	Paddle-pod	NE
251	*[H. buchananii, H. parvifolia]*		NE
252	*Allophylus chaunostachys*	Forest dotted allophylus	LC
253	*[A. africanus]*		LC
254	*Deinbollia nyikensis*		LC
255	*Deinbollia xanthocarpa*	Soap-berry	NE
256	*[Glenniea africana]*		NE
257	*Lecaniodiscus fraxinifolius*	River lytchi	NE
258	*Haplocoelum foliolosum*	Northern galla plum	LC
259	*[Pappea capensis]*		LC
260	*[Aporrhiza nitida]*		NE
261	*[Blighia unijugata]*		LC
262	*[Dodonaea angustifolia {= viscosa}]*		NE

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263	*Zanha africana*	Velvet-fruited zanha	NE
264	*[Z. golungensis]*		LC
265	*Ziziphus mauritiania*	Masau - introduced	NE
266	*Ziziphus mucronata*	Buffalo-thorn	LC
267	*Ziziphus pubescens*	Small jujube	NE
268	*[Z. abyssinica]*		LC
269	*Berchemia discolor*	Bird plum	LC
270	*[Rhamnus prinoides]*		LC
271	*Rhoicissus revoilii*	Grape genus	LC
	R. tridentata		LC
272	*Cyphostemma subciliatum Cobas*		NE
273	*Cyphostemma sp. Cobas*		NE
274	*Cayratia gracilis*		NE
275	*Cissus integrifolia*		NE
276	*Cissus quadrangularis*	Quadrangular cissus	NE
277	*Cissus rotundifolia*	Round-leafed cissus	NE
278	*Corchorus sp*		LC
279	*Grewia bicolor*	False brandybush	NE
280	*Grewia flavescens*	Donkeyberry	LC
281	*Grewia forbesii*		NE
282	*Grewia lepidopetala*	Green-haired cross-berry	NE
283	*Grewia pachycalyx*	Large-flowered white cross-berry	NE
284	*Grewia stolzii*	Green-petalled cross-berry	NE
285	*Grewia sulcata*	Stellar cross-berry	NE
286	*[G. inaequilatera, G. micrantha, G. microcarpa, G. praecox,]*		NE
	G. subspathulata	False Grey Raisin	LC
287	*Triumfetta sp*		DD
288	*Abutilon sp.*	Abutilon (herbaceous)	DD
289	*Hibiscus vitifolius*	Hibiscus (tough herbaceous plants)	NE
290	*Hibiscus vulgaris*	Hibiscus (tough herbaceous plants)	NE
291	*Azanza garckeana*	Snot-apple	NE
292	*Kosteletskya adoensis*		NE
293	*Adansonia digitata*	Baobab	NE
294	*Dombeya kirkii*	River wild pear	NE
295	*D. burgessiae*		LC
	D. rotundifolia		LC
296	*[Triplochiton zambesiacus]*		LC
297	*Sterculia africana†*	Tick tree, African star-chestnut	LC
298	*Sterculia appendiculata†*	Tall star-chestnut	NE

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299	*Sterculia quinqueloba*	Large-leafed star-chestnut	NE
300	*Cola sp*.*	Coshwood	DD
301	*C. mossambicensis]*		NT
302	*Waltheria indica*		NE
303	*Ochna leptoclada*		NE
304	*O. gambleoides*		LC
	O. holstii		LC
	O. polyneura		NE
	O. rovumensis		LC
	O. schweinfurthiana		LC
305	*Brackenridgea zanguebarica*		NE
306	*Psorospermum febrifugum*		LC
307	*Garcinia livingstonei*	African mangosteen	NE
308	*[G. huillensis]*		NE
309	*[Monotes engleri]*		LC
310	*Oncoba spinosa*	Fried egg flower, Snuff-box tree	LC
311	*Xylotheca tettensis*	Northern African Dog-rose	LC
312	*[Scolopia stolzii]*	The thorn-pear genus	NE
	, S. zeyheri	thorn-pear	LC
313	*Flacourtia indica*	Flacourtia	LC
314	*Dovyalis sp. Kei-apple*		LC
315	*[D. caffra]*		LC
316	*Tricliceras sp. {= Wormskioldia}*	Pimpernel	DD
317	*Adenia gummifera*		NE
318	*Ammannia sp.*		LC
319	*Combretum apiculatum*	Red bushwillow	LC
320	*Combretum collinum*	Variable bushwillow	LC
321	*Combretum adenagonium {= fragrans, = ghasalense} Four-leafed combretum*		*NE*
322	*Combretum hereroense*	Russet bushwillow	LC
323	*Combretum imberbe*	Leadwood	LC
324	*Combretum molle*	Velvet bushwillow	LC
325	*Combretum mossambicense*	Shaving-brush combretum	LC
326	*Combretum microphyllum*	Burning bush combretum, flame combretum	NE
327	*Combretum zeyheri*	Large-fruited bushwillow	LC
328	*Combretum sp.*		
329	*C. celastroides*		LC

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	C. holstii		NE
	C. padoides		NE
	C. pisoniflorum		NE
	C. psidioides		LC
330	*Pteleopsis myrtifolia*	Stinkbush willow	NE
331	*Terminalia sericea*	Silver terminalia	LC
332	*Terminalia stenostachya*	Rosette-leaved terminalia	NE
333	*T. gazensis, T. prunioides, T. trichopoda*		LC
334	*Syzygium spp*	The waterberry genus	DD
335	*Heteropyxis dehniae {= natalensis}]*	Lavender tree	LC
336	*Schefflera umbellifera*	False Cabbage Tree	LC
337	*Cussonia spp*		DD
338	*Heteromorpha arborescens*	The cabbage tree genus	LC
339	*Steganotaenia araliacea*	Carrot tree, popgun tree	LC
340	*Myrsine africana*		NE
341	*Rapanea melanophloeos*		NE
342	*Plumbago zeylanica*		NE
343	*Englerophytum {= Bequaertiodendron} magalismontanum]*		LC
344	*Mimusops sp*		DD
345	*[M. obtusifolia {= fructicosa},]*		NE
	M. zeyheri	*The milkwood genus*	LC
346	*Manilkara mochisia*	Lowveld milkberry	LC
347	*Euclea sp.*	Euclea, Guarri	LC
348	*E. crispa, E. natalensis,*		LC
	E. schimperi		NE
349	*Diospyros kirkii*	Pink jackal-berry	LC
350	*Diospyros mespiliformis*	Rhodesian ebony	LC
351	*Diospyros quiloensis*	Crocodile-bark jackal-berry	LC
352	*Diospyros senensis*	Peeling-bark diospyros	LC
353	*Diospyros squarrosa*	Rigid star-berry	LC
354	*[D. lycioides, D. natalensis, D. loureiriana {= usambarensis}]*		LC
355	*Schrebera trichoclada*	Wooden-pear	LC
356	*[Schrebera alata]*		LC
357	*[Olea capensis]*		LC
358	*Azima tetracantha*	Bee-sting bush, Needle bush	LC
359	*Salvadora persica*	Mustard tree	LC
360	*Strychnos decussata*	Cape teak	LC
361	*Strychnos innocua*	Dull-leafed monkey orange	LC
362	*Strychnos madagascariensis*	Shiny-leafed monkey orange	LC

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363	*Strychnos potatorum*	Grape strychnos, Black bitterberry	NE
364	*Strychnos spinosa*	Spiny monkey orange, Green monkey orange	LC
365	*S. cocculoides, S. henningsii, S. pungens*		LC
366	*Nuxia oppositifolia*	Water elder	LC
367	*Buddleja salviifolia*	Butterfly bush	LC
368	*Acokanthera oppositifolia*		LC
369	*Carissa spp*	The carissa genus	LC
370	*Holarrhena pubescens*	Jasmine tree	LC
371	*Diplorhynchus condylocarpon*	Wild rubber, Horn-pod tree	LC
372	*Tabernaemontana elegans*	Toad tree	LC
373	*Rauvolfia caffra*		LC
374	*Adenium obesum*		LC
375	*Strophanthus courmontii*	Poison rope	LC
376	*Strophanthus kombe*		NE
377	*Strophanthus nicholsonii*		NE
378	*Wrightia natalensis*		NE
379	*Ancylobotrys petersiana*	Liana	NE
380	*Landolphia kirkii*	Liana	NE
381	*Calotropis procera*		NE
382	*Marsdenia {= Dregea} macrantha*		NE
383	*Marsdenia {= Gymnaema} sylvestris*		NE
384	*Pentarrhinum insipidum*		NE
385	*Pergularia daemia {= barbata}*		NE
386	*Sarcostemma viminale*		NE
387	*Cryptolepis apiculata*		NE
388	*Cryptolepis obtusa*		NE
389	*Cryptolepis ovata*		NE
390	*Tacazzea apiculata*		NE
391	*Secamone parvifolia*		NE
392	*Evolvulus nummularius*		NE
393	*Ipomoea aquatica*		LC
394	*Ipomoea {= Turbina} stenosiphon*	Morning glory	NE
395	*Ipomea sp.*		DD
396	*Jacquemontia tamnifolia*		NE
397	*Convolvus sagittatus*		NE
398	*Cordia goetzei*	Blue-bark cordia	NE
399	*[C. abyssinica, C. pilosissima,]*		NE
	C. sinensis		LC
400	*Ehretia amoena*	Stamperwood, Sandpaper bush	LC
401	*Heliotropium sp.*		DD

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402	*Trichodesma zeylanicum*	Bells of St. Mary (Herbaceous)	NE
403	*Lippia javanica*		NE
404	*Vitex payos*	Chocolate berry	LC
405	*[V. doniana, V. madiensis, V. mombassae]*		LC
406	*Clerodendrum ternatum*		NE
407	*Clerodendrum wildii*		NE
408	*Clerodendrum sp.*	Tinderwood, Cat's whiskers	DD
409	*C. glabrum*		LC
	C. myricoides		EN
410	*Hoslundia opposita*	(Shrub)	NE
411	*Karomia {= Holmskioldia} spinescens*	Wild Chinese hats	NE
412	*{Holmskioldia tettensis*		LC
413	*[Iboza riperia]*	Ginger bush	NE
414	*Leucas glabrata*		NE
415	*Ocimum sp.*		DD
416	*Orthosiphon australis*		NE
417	*Premna senensis*	Skunk bush	LC
418	*Solanum incanum {= panduriforme}*	Poison apple, Bitter apple	LC
419	*[S. aculeastrum, S. giganteum]*		LC
420	*[Halleria lucida]*	Tree fuchsia	LC
421	*Cycnium adonense*	The ink plant (Herbaceous)	NE
422	*Lindernia {= Ilysanthes} parvifolia*		NE
423	*[Tecomaria capensis]*		LC
424	*Markhamia obtusifolia*	Golden bean tree	LC
425	*Markhamia zanzibarica*	Zanzibar bean tree	LC
426	*M. acuminata*		LC
427	*Stereospermum kunthianum*	Pink jacaranda	LC
428	*Kigelia africana*	Sausage tree	LC
429	*Ceratotheca sesamoides*	Wild foxglove	NE
430	*Utricularia sp.*		DD
431	*Anisotes spp.*		DD
432	*Asystasia gangetica*		NE
433	*Barleria spinulosa*		NE
434	*Blepharis maderaspatensis*		NE
435	*Crabbea velutina*		NE
436	*Crossandra puberula*		NE
437	*Duosperma quadrangulare*		NE
438	*Ecbolium sp*		DD
439	*Elytraria acaulis*		NE
440	*Hygrophila pilosa*		NE
441	*Hypoestes verticillaris*		NE

No	Scientific Name	English Name	IUCN Data Redlist
442	*Isoglossa floribunda*		NE
443	*Justicia betonica*		NE
444	*Justicia flava*		NE
445	*Justicia striata*		NE
446	*Justicia whytei*		NE
447	*Megalochlamys strobilifera*		NE
448	*Monechma debile*		NE
449	*Phaulopsis imbricata*		LC
450	*Ruellia patula*		LC
451	*Hymenodictyon floribundum*	Firebush	LC
452	*[H. parvifolium]*		LC
453	*Crossopteryx febrifuga*	Crystal-bark	LC
454	*[Breonadia salicina {= microcephala}]*		LC
455	*[Tarenna neurophylla]*		NE
456	*Cantunaregam spinosa {= Xeromphis obovata}*	Thorny bone-apple	NE
457	*[Aïdia micrantha]*		NE
458	*Gardenia sp.*	Gardenia	DD
459	*[G. imperialis, G. ternifolia {= jovis-tonantis*		LC
	G. resiniflua		NE
460	*[Rothmannia spp]*	The rothmannia genus	DD
461	*[Feretia aeruginescens]*		NE
462	*Tricalysia junodii var. kirkii {= T. allenii)*	Smooth bark tricalysia	NE
463	*Tricalysia sp.*		DD
464	*[T. capensis]*		LC
465	*[Sericanthe {= Neorosea}andongensis, S. jasminiflora]*		NE
466	*Heinsia crinita*	Small false gardenia	LC
467	*[Polysphaeria lanceolata]*		NE
468	*Vangueria sp. Wild medlar*		DD
469	*[V. apiculata, V. infausta]*		LC
470	*Tapiphyllum velutinum*	Velvet leaf	LC
471	*[Vangueriopsis lanciflora]*		NE
472	*Canthium angustifolium*	Turkey berry or rock alder	NE
473	*Canthium grandifolium*	Turkey berry or rock alder	NE
474	*[C. frangula]*		NE
475	*Psydrax livida {= Canthium huillense} Bushveld canthium*		LC
476	*P. martinii,*		NE
	P. parviflora {= Canthium vulgare}		LC

No	Scientific Name	English Name	IUCN Data Redlist
477	*[Tarchonanthus camphoratus]*		LC
478	*[Chrysanthemoides monilifera]*		LC
479	*Bidens pilosa*	Blackjack (Chisoso/Kazota)	NE
480	*Blumea aurita*		NE
481	*Gnaphalium indicum*		NE
482	*Nidorella microcephala*		NE
483	*Pterocaulon decurrens*		NE
484	*Sphaeranthus angolensis*		NE
485	*Limnophyton sp*	Water plantain	LC
486	*Lagarosiphon sp*		DD
487	*Ottelia exserta*		LC
488	*Acroceras macrum*		NE
489	*Alloteropsis semialata*		NE
490	*Andropogon gayanus*	Blue grass	NE
491	*Andropogon schirensis*	Stab grass	NE
492	*[A. appendiculatus, A. chinensis, A. eucomus, A. huillensis]*		NE
493	*Aristida adscensionis*	Annual three-awn	NE
494	*A. congesta, A. junciformis, A. rhiniochloa, A. scabrivalvis*		NE
495	*Bewsia biflora*		NE
496	*Bothriochloa bladhii, B. insculpta, B. radicans*		NE
497	*Brachiaria deflexa*	False signal grass	NE
498	*Brachiara sp*	Signal grass	DD
499	*B. brizantha, , B. nogropedata, B. serrata*		NE
	B. eruciformis		LC
500	*Cenchrus ciliaris*	Buffalo grass	LC
501	*Chloris virgata*	Feather-top chloris	NE
502	*C. gayana, C. pycnothrix, C. roxburghiana*		NE
503	*Chrysopogon serrulatus*		NE
504	*Cymbopogon excavatus*	Broad-leaved turpentine grass	NE
505	*[C. plurinodis*		NE
506	*Ctenium concinnum*	Sickle grass	NE
507	*Cynodon dactylon*	Couch grass	NE
508	*Dactyloctenium aegyptium*	Common crowfoot	NE
509	*Dactyloctenium sp.*	Crowfoot	NE
510	*D. giganteum*		NE
511	*Dichanthium annulatum*		NE

No	Scientific Name	English Name	IUCN Data Redlist
512	*Digitaria milanjiana*	Milanje finger grass	NE
513	*[D. diagonalis, D. longiflora, D longifloras, D. ternata,]*		NE
	D. velutina		LC
514	*Diheteropogon amplectens*	Broad-leaved bluestem	NE
515	*Dinebra retroflexa*		NE
516	*Echinochloa pyramidalis*	Antelope grass	LC
517	*Echinochloa spp.*	Water grass	LC
518	*E. colona, E. holubi*		LC
519	*Elionurus muticus*		NE
520	*Eleusine coracana*	Wild African Finger millet	LC
521	*Enneapogon cenchroides, E. scoparius*		NE
522	*Enteropogon macrostachyus*	Mopane grass	NE
523	*Eragrostis sp.*	Love grass	DD
524	*E. aspera, E. capensis, E. cilianensis, E. ciliaris, E. curvula, E.cylindriflora {= rigidior},*		NE
525	*E.heteromera, E. inamoena, E. lehmanniana, E. nindensis, E. racemosa, E. rotifer, E. superba,*		NE
526	*E. trichopora, E. viscosa*		NE
527	*Eriochloa meyeriana*		LC
528	*Eustachys paspaloides*		NE
529	*Hemarthria altissima*		LC
530	*Heteropogon contortus*	Spear grass	NE
531	*Hyparrhenia filipendula*	Fine thatching grass	NE
532	*Hyparrhenia sp.*		DD
533	*H. hirta*		NE
534	*Hyperthelia dissoluta*		NE
535	*Imperata cylindrica*		LC
536	*Ischaemum afrum*	Turf grass	NE
537	*Ischaemum sp.*		DD
538	*I. fasciculatum*		NE
539	*Leersia hexandra*		LC
540	*Leptocarydion vulpiastrum*		NE
541	*Leptochloa uniflora*		NE
542	*L. {= Diplachne} fusca*		LC
543	*Lepturus radicans*		NE
544	*Loudetia simplex*	Common russet grass	NE
545	*Melinis repens*		NE
546	*[Microchloa caffra]*		NE

No	Scientific Name	English Name	IUCN Data Redlist
547	*Miscanthus junceus*		NE
548	*Monocymbium ceresiiforme*		NE
549	*Oplismenus burmannii*	Basket grass	NE
550	*Oryza punctata**	Wild rice	LC
551	*Panicum maximum*	Guinea grass	NE
552	*P. coloratum*		LC
	P. deustum		NE
	P. ecklonii		NE
	P. repens		LC
	P. schinzii		NE
553	*Paspalum distichum, P. scrobiculatum*		LC
	P. urvillei		NE
554	*Pennisetum purpureum*	Elephant grass	LC
555	*Perotis patens*		NE
556	*Pogonarthria squarrosa*		NE
557	*Phragmites mauritianus*	Mauritian common reed	LC
558	*P. australis*		LC
559	*Rottboellia cochinchensis {= exaltata}*	*Guineafowl grass*	NE
560	*Sacciolepis sp.*		DD
561	*Schmidtia pappophoroides*	Sand quick	NE
562	*Shizachyrium sanguineum*		NE
563	*Sehima sp.*		NE
564	*Setaria palustris*		NE
565	*Setaria (Cymbosetaria) sagittifolia*	Arrow grass	
566	*Setaria sp*		DD
567	*S. sphacelata*		LC
	S. pumila		NE
	S. incrassata		NE
	S. lindenbergiana		NE
	S. megaphylla		NE

No	Scientific Name	English Name	IUCN Data Redlist
	S. verticillata		NE
568	*Schmidtia pappophoroides*		NE
569	*Sorghastrum bipinnetum ?*		NE
570	*S. halepense, S. versicolor*		NE
	Sorghum bicolor		LC
571	*Sporobolus sp*		DD
572	*S. africanus, S. festivus, S. fimbriatus, S. panicoides, S. pyramidalis,*		NE
	S. stapfianus		LC
573	*Stereochlaena cameronii*		NE
574	*Themeda triandra*		NE
575	*Trachypogon spicatus*		NE
576	*Tragus berteronianus*	Carrot seed grass	NE
577	*Tricholaena monachne*		NE
578	*Trichoneura grandiglumis*		NE
579	*Tristachya leucothrix*		NE
580	*Urelytrum agropyroides*		NE
581	*Urochloa mosambicensis*	Bushveld signal grass	NE
582	*[U. panicoides, U. oligotricha]*		NE
583	*Coleochloa setifera*		NE
584	*Cyperus alternifolia*		NE
585	*Cyperus sp.*		NE
586	*Fimbristylis hispidula*		DD
587	*Kyllinga cartilaginea*		NE
588	*Mariscus sp.*		LC
589	*Scirpus sp.*		DD
590	*Phoenix reclinata*		LC
591	*Hyphaene petersiana {= crinata}*	Ilala palm	LC
592	*Borassus aethiopum*	Borassus palm	LC
593	*Raphia farinifera*		LC
594	*Pistia stratiotes*	Water Lettuce	LC
595	*Amorphophallus sp*		DD
596	*Stylochiton natalensis*		NE
597	*Lemna minor*	Common Duck Weed	LC
598	*Wolffia sp.*		LC
599	*Aneilema sp.*		DD
600	*Commelina africana*	Commelina	LC
601	*Commelina benghalensis*	Commelina	LC
602	*Chlorophytum sp.*	(Tall herbaceous flowers)	DD

No	Scientific Name	English Name	IUCN Data Redlist
603	*Asparagus africanus*	Wild asparagus	LC
604	*Gloriosa suberba*	Flame-lily	LC
605	*Dipcadi longifolium*	(Bulbous plant)	NE
606	*Ledebouria {= Scilla} sp.*		DD
607	*Urginea zambesiaca*		NE
608	*Crinum sp.*	Crinum lily	LC
609	*Sansevieria longifolia*	Sansevieria	LC
610	*Dioscorea sp.*		DD
611	*Siphonochilus kirkii {= Kaempferia sp. listed in Kwabazi et al (2000)}*		NE
612	*Microcoelia exilis*	(Epiphyte)	NE
613	*Microcoelia sp.*	(Epiphyte)	DD

Annex 6: Bird Species Spotted Along the Canal Alignment in Lengwe National Park

No.	Common name	Scientific name	Malawi gazetted	IUCN	CITES
1	Burchel's Coucal	*Centropus superciliosus*	Yes	LC	Not listed
2	Black Sunbird	*Chalcomitra amethystina*	Yes	LC	Not listed
3	Yellow-bellied Bulbul	*Chlorocichla flaviventris*	Yes	LC	Not listed
4	Claas's Cuckoo	*Chrysococcyx klaas*	Yes	LC	Not listed
5	Amethyst Starling	*Cinnyricinclus leucogaster*	Yes	LC	Not listed
6	Black-breasted Snake Eagle	*Circaetus pectoralis*	Yes	LC	Not listed
7	Short-winged Cisticola	*Cisticola brachypterus*	Yes	LC	Not listed
8	Rattling Cisticola	*Cisticola chiniana*	Yes	LC	Not listed
9	Red-faced Cisticola	*Cisticola erYthrops*	Yes	LC	Not listed
10	Cardinal Woodpecker	*Dendropicos fuscescens*	Yes	LC	Not listed
11	Southern Puff back	*Dryoscopus cubla*	Yes	LC	Not listed
12	Common Waxbill	*Estrilda astrild*	Yes	LC	Not listed
13	Yellow-Rumped Bishop	*Euplectes capensis*	Yes	LC	Not listed
14	Red-necked Francolin	*Francolinus afer*	Yes	LC	Not listed
15	Brown-hooded Kingfisher	*Halcyon albiventris*	Yes	LC	Not listed
16	Blue billed firefinch	*Lagonosticta rubricata*	Yes	LC	Not listed
17	Tropical Boubou	*Laniarius aethiopicus*	Yes	LC	Not listed
18	Black-collared Barbet	*Lybius torquatus*	Yes	LC	Not listed
19	Yellow-throated Longclaw	*Macronyx croceus*	Yes	LC	Not listed
20	Eurasian Bee Eater	*Merops apiaster*	Yes	LC	Not listed
21	Southern Carmine Bee Eater	*Merops nubicoides*	Yes	LC	Not listed
22	Little Bee Eater	*Merops pusillus*	Yes	LC	Not listed
23	Yellow-bellied Sunbird	*Nectarinia venusta*	Yes	LC	Not listed

No.	Common name	Scientific name	Malawi gazetted	IUCN	CITES
24	Helmeted Guinea Fowl	*Numida meleagris*	Yes	LC	Not listed
25	White-browed Sparrow weaver	*Plocepasser mahali*	Yes	LC	Not listed
26	Yellow-fronted Tinkerbird	*Pogoniulus chrysoconus*	Yes	LC	Not listed
27	Martial Eagle	*Polemaetus bellicosus*	Yes	EN	Not listed
28	Tawny-flanked Prinia	*Prinia subflava*	Yes	LC	Not listed
29	Black-eyed Bulbul	*Pycnonotus barbatus*	Yes	LC	Not listed
30	Yellow-fronted Canary	*Serinus mozambicus*	Yes	LC	Not listed
31	Cape Turtle Dove	*Streptopelia capicola*	Yes	LC	Not listed
32	Red-eyed Dove	*Streptopelia semitorquata*	Yes	LC	Not listed
33	Red-capped Crombec	*Sylvietta ruficapilla*	Yes	LC	Not listed
34	Brown-headed Tchagra	*Tchagra australis*	Yes	LC	Not listed
35	African Paradise Flycatcher	*Terpsiphone viridis*	Yes	LC	Not listed
36	African Grey Hornibill	*Tockus nasutus*	Yes	LC	Not listed
37	Blue Spotted Wood Dove	*Turtur afer*	Yes	LC	Not listed
38	Blue Waxbill	*Uraeginthus angolensis*	Yes	LC	Not listed
39	Red-faced Mousebird	*Urocolius indicus*	Yes	LC	Not listed
40	Village indigobird	*Vidua chalybeata*	Yes	LC	Not listed
41	Long-tailed Paradise Widow	*Vidua paradisaea*	Yes	LC	Not listed

Annex 7: Plant Species in Elephant Marsh

No	Species Name	Family	Conservation Status		Invasiveness	
			Global	National	Global	National
1	*Ageratum conyzoides L.*	Asteraceae	NE	NE	invasive	invasive
2	*Amaranthus hybridus L.*	Amaranthaceae	LC	NE	invasive	not invasive
3	*Blumea brevipes* (Oliv. & Hiern) Willd	Asteraceae	NE	NE	not invasive	not invasive
4	*Bolboschoenus maritimus* (L.) Palla	Cyperaceae	LC	NE	invasive	not invasive
5	*Brachiaria brizantha (Hochst. ex A. Rich.) Stapf*	Poaceae	NE	NE	Not invasive	not invasive
6	*Ceropegia meyeri*-johannis Engl.	Apocynaceae	NE	NE	not invasive	not invasive
7	*Ceropegia papillata* N.E.Br.	Apocynaceae	NE	NE	not invasive	not invasive
8	*Cissampelos mucronata* A.Rich.	Menispermaceae	NE	NE	not invasive	not invasive
9	*Cissus integrifolia* (Baker) Planch.	Vitaceae	NE	NE	Not invasive	not invasive
10	*Cissus quadrangularis* L	Vitaceae	NE	NE	invasive	not invasive
11	*Cocculus hirsutus* (L.) Diels	Menispermaceae	NE	NE	not invasive	not invasive
12	*Convolvulus sagittatus* Thunb Var. sagittatus.	Convolvulaceae	NE	NE	not invasive	not invasive
13	*Crotalaria globifera* E.Mey.	Fabaceae	NE	NE	not invasive	not invasive
14	*Cynodon dactylon* Pers	Poaceae	NE	NE	Invasive	not invasive
15	*Cyperus alternifolius* L.	*Cyperaceae*	LC	NE	invasive	not invasive
16	*Cyperus articulatus* L.	Cyperaceae	NE	NE	not invasive	not invasive
17	*Cyperus aterrimus* Hochst. ex Steud	Cyperaceae	LC	NE	not invasive	not invasive
18	Cyperus denudatus L.F.	Cyperaceae	LC	NE	invasive	not invasive
19	*Cyperus derreilema* Steud.	Cyperaceae	LC	NE	not invasive	not invasive
20	*Cyperus distans* L.f.	Cyperaceae	LC	NE	invasive	not invasive
21	*Cyperus esculentus* L.	Cyperaceae	NE	NE	not invasive	not invasive
22	*Cyperus flavescens* L.	Cyperaceae	LC	NE	invasive	not invasive
23	*Cyperus papyrus* L.	Cyperaceae	LC	NE	invasive	not invasive
24	*Cyperus rotundus* L.	Cyperaceae	NE	NE	not invasive	not invasive
25	*Cyperus squarrosus* L.	Cyperaceae	LC	NE	invasive	not invasive
26	*Eichhornia crassipes* (Mart.) Solms	Pontederiaceae	NE	NE	invasive	not invasive
27	*Eragrostis namaguensis (*Thunb.) trin	Poaceae	NE	NE	not invasive	not invasive
28	*Eragrostis aethiopica* Chiov.	Poaceae	LC	NE	not invasive	not invasive
29	*Eragrostis ciliaris* (L.) R.Br.	Poaceae	NE	NE	invasive	not invasive
30	*Euphorbia heteropodum* Pax	Euphorbiaceae	NE	NE	not invasive	not invasive
31	*Euphorbia hirta* L.	Euphorbiaceae	NE	NE	Invasive	not invasive

No	Species Name	Family	Conservation Status		Invasiveness	
			Global	National	Global	National
32	*Festuca abyssinica* A.Rich.	Poaceae	NE	NE	not invasive	not invasive
33	*Fimbristylis bisumbellata* (Forssk) Bubani	Cyperaceae	LC	NE	invasive	not invasive
34	*Glinus lotoides* L.	Molluginaceae	LC	NE	invasive	not invasive
35	*Heliotropium indicum* L	Heliotropiaceae	NE	NE	invassive	not invasive
36	*Hibiscus diversifolius* Jacq.	Malvaceae	NE	NE	invasive	not invasive
37	*Indigofera arrecta* - Hochst. ex A.Rich.	Fabaceae	NE	NE	invasive	not invasive
38	*Jasminum fluminense* Vell.	Oleaceae	NE	NE	Invasive	not invasive
39	*Leersia hexandra* Sw.	Poaceae	LC	NE	invasive	not invasive
40	*Ludwigia erecta* (L.) Hara	Onagraceae	NE	NE	invasive	not invasive
41	*Ludwigia stolonifera (Guill. &Perr) Raven.*	Onagraceae	LC	NE	not invasive	not invasive
42	*Mimosa pudica L.*	*Fabeceae*	LC	NE	invasive	invasive
43	*Monechma debile* (Forssk.) Nees	Sterculiaceae	NE	NE	not invasive	not invasive
44	*Mucuna pruriens* (L.) DC	Fabaceae	NE	NE	invasive	not invasive
45	*Neojeffreya decurrens* (L.) Cabrera	Asteraceae	NE	NE	invasive	not invasive
46	*Ocimum americanum* L.	Lamiaceae	NE	NE	Invasive	not invasive
47	*Oxygonum sinuatum* (Hochst. & Steud. ex Meisn.) Dammer	Polygonaceae	NE	NE	invasive	not invasive
48	*Paederia bojeriana* (A. Rich. ex DC.) Drake	Rubiaceae	NE	NE	not invasive	not invasive
49	*Pistia stratiotes* L	Araceae	LC	NE	invasive	not invasive
50	*Prosopis juliflora* (Sw.) DC.	Fabeceae	NE	NE	invasive	invasive
51	*Ricinus communis* L.	Euphorbiaceae	NE	NE	Invasive	invasive
52	*Rumex abyssinicus* Jacq.	Polygonaceae	NE	NE	Invasive	not invasive
53	*Rumex abyssinicus* Jacq.	Polygonaceae	NE	NE	invasive	not invasive
54	*Rumex bequaertii* De Wild.	Polygonaceae	NE	NE	not invasive	not invasive
55	*Sesbania sesban* (L.) Merr.	Fabaceae	LC	NE	invasive	not invasive
56	*Spermacoce dibrachiata* Oliv.	Rubiaceae	NE	NE	not invasive	not invasive
57	*Spermacoce princeae* (K. Schum.) Verdc.	Rubiaceae	NE	NE	not invasive	not invasive
58	*Sterculia appendiculata* K.Schum.	Malvaceae	NE	NE	not invasive	not invasive
59	Vossia cuspidata(Roxb.) Griff	Poaceae	LC	NE	Invasive	not invasive
60	*Xanthium strumarium* L.	Asteraceae	NE	NE	invasive	invasive

Appendix 8: Grievance Redress Forms

Grievance mechanism collection form

Project District & Canal (Secondary or main Canal)			
Main Canal (Y/N)		Secondary Canal (No)	
No	Date		
	Grievance No.		
1	GRM level (select as appropriate)	1. Community Grievance Redress Committee 2. Area Grievance Redress Committee 3. District Grievance Redress Committee 4. National Grievance Redress Committee	
2	Name of the GRC (Name as appropriate)		
3	Person Recording Grievance/Feedback		
3.1	Name of Person		
3.2	Position in GRC		
3.3	Phone Number		
4	Person reporting grievance/feedback		
4.1	Name of Person		
4.2	Aggrieved or Representative?		
4.3	Role in the project Activities		
4.4	Phone Number		
5.	Description of Concern, Incident or Grievance	What is your concern/grievance/what happened? Where did it happen? Who did it happen to? What is the result of the problem?	

6	Initial Assessment of the Case	1. Accepted and to be handled by GRC 2. Referred to police/Court, others 3. Rejected, lacks credibility/substance

Grievance Redress form (Report Form)

Reference No:	
Name of GRC	
TA	
District	
Main Canal (Y/N)	
If Secondary Canal (No)	
Full Name	
Description of Concern, Incident or Grievance:	
Description of Actions Taken to Resolve the Grievance	
Date of Submission of Grievance	
Date of Communication of Solution to Grievance	
Has the grievance been resolved (Yes/No)	
Name of a person Handling the grievance	
Date:	
Signature	

Grievance Mechanism log (General Record Form)

Ref No.	How Was grievance submitted	Date of Submission of Grievance	Name and Contact Information	Description of Grievance	Actions Taken to Resolve the Grievance	Date Comm of So

Appendix 9: Plant species recorded in the Lengwe Irrigation Canal corridor and their conservation status (LC-Least Concern; NE-Not Evaluated; VU-Vunerable, NT-Near Threatened)

No.	Num. Name Mean	Family	Frequency of occurrence	Life form		
					Global	National
1	*Senegalia ataxacantha (DC.) Kyal. & Boatwr.*	Fabaceae	1	Shrubby climber	LC	NE
2	*Senegalia nigrescens (Oliv.) P.J.H. Hurter*	Fabaceae	8	Tree	NE	NE
3	*Vachellia nilotica (L.) P.J.H.Hurter & Mabb*	Fabaceae	2	Tree	LC	NE
4	*Acalypha chirindica S. Moore*	Euphorbiaceae	1	Shrub	NE	NE
5	*Acalypha ornata Hochst. ex A. Rich.*	Euphorbiaceae	1	Shrub	NE	NE
6	*Afzelia quanzensis Welw.*	Fabaceae	1	Tree	LC	VU
7	*Ampelocissus africana (Lour.) Merr.*	Vitaceae	1	Climber	LC	NE
8	*Asparagus africanus Lam.*	Asparagaceae	3	Herb	NE	NE
9	*Borassus aethiopum Mart.*	Palmae	1	Tree	LC	NE
10	*Boscia salicifolia Oliv.*	Capparaceae	1	Tree	LC	NE
11	*Cadaba kirkii Oliv.*	Capparaceae	4	Shrub	NE	NE
12	*Canthium glaucum Hiern*	Rubiaceae	2	Shrub	LC	NE

13	*Capparis tomentosa Lam.*	Capparaceae	4	Shrub	NE	NE
14	*Chlorophytum cameronii (Baker) Kativu*	Anthericaceae	1	Herb	LC	NE
15	*Cissus cornifolia (Baker) Planch.*	Vitaceae	1	Climber/Creeper	NE	NE
16	*Cissus rubiginosa (Welw. ex Baker) Planch.*	Vitaceae	1	Climber/Creeper	NE	NE
17	*Cleistochlamys kirkii (Benth.) Oliv.*	Annonaceae	3	Tree	LC	NE
18	Coccinia mildbraedii *Gilg ex Harms*	Cucurbitaceae	1	Climber/Creeper	NE	NE
19	*Coffea mufindiensis Hutch. ex Bridson*	Rubiaceae	1	Tree/Shrub	LC	NE
20	*Colophospermum mopane (J.Kirk ex Benth.) J.Léonard*	Fabaceae	2	Tree	LC	NE
21	*Combretum adenogonium Steud. ex A. Rich.*	Combretaceae	1	Tree	LC	NE
22	*Combretum imberbe Wawra*	Combretaceae	4	Tree	LC	NE
23	*Combretum microphyllum Klotzsch*	Combretaceae	7	Climber	NE	NE
24	*Combretum mossambicense (Klotzsch) Engl.*	Combretaceae	3	Climber	LC	NE
25	*Combretum psidioides Welw.*	Combretaceae	1	Tree	LC	NE
26	*Commelina benghalensis L.*	Commelinaceae	4	Herb	LC	NE
27	*Commelina diffusa Burm.f.*	Commelinaceae	1	Herb	LC	NE
28	*Commelina venglialensis*	Commelinaceae	1	Herb	NE	NE

29	*Commiphora edulis (Klotzsch) Engl.*	Burseraceae	2	Tree	LC	NE
30	*Commiphora marlothii Engl.*	Burseraceae	1	Tree	LC	NE
31	*Convolvulus sagittatus agg.*	Convolvulaceae	1	Climber/Creeper	NE	NE
32	*Cordyla africana Lour.*	Fabaceae	1	Tree	LC	NE
33	*Crossandra fruticulosa Lindau*	Acanthaceae	1	Herb	NE	NE
34	*Crotalaria cleomifolia Welw. ex Baker*	Fabaceae	1	Herb	NE	NE
35	*Cucumis hirsutus Sond.*	Cucurbitaceae	1	Climber/Creeper	NE	NE
36	*Dalbergia melanoxylon Guill. & Perr.*	Fabaceae	2	Tree	NT	VU
37	*Dalbegiella nyasae*	Fabaceae	1	Tree	NE	NE
38	*Dichrostachys cinerea Wight et Arn.*	Fabaceae	3	Tree	LC	NE
39	*Diospyros natalensis (Harv.) Brenan*	Ebenaceae	4	Tree	LC	NE
40	*Diospyros zombensis (B.L. Burtt) F. White*	Ebenaceae	6	Tree	LC	NE
41	*Dolichos kilimandscharicus Harms ex Taub.*	Fabaceae	1	Herb	NE	NE
42	*Echinochloa colona (L.) Link*	Poaceae	1	Herb	NE	NE
43	*Echinochloa crus-galli (L.) P.Beauv.*	Poaceae	1	Herb	NE	NE
44	*Euclea crispa (Thunb.) Gürke*	Ebenaceae	1	Tree	LC	NE
45	*Euclea natalensis A.DC.*	Ebenaceae	1	Tree	LC	NE
46	*Gloriosa superba L.*	Colchicaceae	1	Herb	LC	NE

47	*Gonatopus boivinii (Decne.) Engl.*	Araceae	1	Herb	NE	NE
48	*Grewia bicolor Juss.*	Tiliaceae	5	Tree/Shrub	NE	NE
49	*Grewia forbesii Harv. ex Mast.*	Tiliaceae	11	Tree	NE	NE
50	*Grewia microthyrsa K.Schum. ex Burret*	Tiliaceae	1	Tree	NE	NE
51	*Grewia mollis Juss.*	Tiliaceae	1	Tree	LC	NE
52	*Grewia villosa Willd.*	Tiliaceae	3	Tree	LC	NE
53	*Hewittia malabarica (L.) Suresh*	Convolvulaceae	3	Herb	NE	NE
54	*Hibiscus diversifolius Jacq.*	Malvaceae	1	Herb	NE	NE
55	*Hibiscus physaloides Guill. & Perr.*	Malvaceae	1	Herb	NE	NE
56	*Hippocratea goetzei Loes.*	Celastraceae	1	Climber	NE	NE
57	*Hugonia orientalis Engl.*	Linaceae	1	Tree	LC	NE
58	*Ipomoea cairica (L.) Sweet*	Convolvulaceae	1	Climber/Creeper	LC	NE
59	*Ipomoea crassipes Hook.*	Convolvulaceae	1	Climber/Creeper	NE	NE
60	*Ipomoea pes-caprae (L.) R.Br.*	Convolvulaceae	1	Climber/Creeper	LC	NE
61	*Ipomoea sinensis (Desr.) Choisy*	Convolvulaceae	1	Climber/Creeper	NE	NE
62	*Jasminum fluminense Vell.*	Oleaceae	2	Shrub	NE	NE
63	*Siphonochilus kirkii (Hook. f.) B.L. Burtt*	Zingiberaceae	2	Herb	NE	NE

64	*Lannea schweinfurthii var. stuhlmannii (Engl.) Kokwaro*	Anacardiaceae	1	Tree	NE	NE
65	*Ledebouria apertiflora (Baker) Jessop*	Hyacinthaceae	2	Herb	NE	NE
66	*Lepidotrichilia volkensii (Gürke) Leroy*	Meliaceae	4	Tree	NE	NE
67	*Leucas martinicensis R. Br.*	Lamiaceae	1	Herb	NE	NE
68	*Lippia javanica (Burm.f.) Spreng*	Verbenaceae	2	Herb/ Shrub	NE	NE
69	*Luffa aegyptiaca Mill.*	Cucurbitaceae	1	Climber/Creeper	NE	NE
70	*Maerua angolensis DC.*	Capparaceae	1	Tree	LC	NE
71	Maerua kirkii *F. White*	Capparaceae	1	Tree	NE	NE
72	*Markhamia zanzibarica (Bojer ex DC.) K.Schum*	Bignoniaceae	1	Tree	LC	NE
73	*Mellera submutica C.B. Clarke*	Acanthaceae	1	Herb	NE	NE
74	*Merremia tridentata (L.) Hallier f.*	Convolvulaceae	1	Climber	NE	NE
75	*Momordica foetida Schumach.*	Cucurbitaceae	3	Climber	NE	NE
76	*Ocimum americanum L.*	Lamiaceae	2	Herb	NE	NE
77	*Panicum monticola Hook. f.*	Poaceae	4	Herb	NE	NE
78	*Panicum simplex Rottler ex Trin.*	Poaceae	9	Herb	NE	NE
79	*Pavonia urens Cav.*	Malvaceae	2	Herb	NE	NE
80	*Phyllanthus ovalifolius Forssk.*	Euphorbiaceae	0	Shrub	LC	NE
81	*Searsia longipes (Engl.) Moffett*	Anacardiaceae	2	Tree	LC	NE

82	*Ruellia cordata Thunb.*	Acanthaceae	2	Herb	NE	NE
83	*Ruspolia hypocrateriformis (Vahl) Milne-Redh.*	Acanthaceae	4	Herb	NE	NE
84	*Salvadora persica L*	Salvadoraceae	2	Shrub	LC	NE
85	*Sclerocarya birrea (A. Rich.) Hochst*	Anacardiaceae	4	Tree	NE	NE
86	*Sesbania sesban (L.) Merr.*	Fabaceae	3	Shrub	LC	NE
87	*Setaria sphacelata (Schumach.) Stapf & C.E. Hubb.*	Poaceae	4	Herb	LC	NE
88	*Solanum incanum L.*	Solanaceae	3	Herb	LC	NE
89	*Solanum panduriforme E.Mey.*	Solanaceae	6	Herb	NE	NE
90	*Sporobolus pyramidalis Beauv.*	Poaceae	1	Herb	NE	NE
91	*Sterculia appendiculata K. Schum.*	Sterculiaceae	1	Tree	NE	NE
92	*Strombosia scheffleri Engl.*	Olacaceae	1	Tree	LC	NE
93	*Strychnos potatorum L.f.*	Logoniaceae	2	Tree	NE	NE
94	*Synsepalum brevipes (Baker) T.D.Penn*	Sapotaceae	1	Tree	LC	NE
95	*Teclea gerrardii I.Verd.*	Rutaceae	1	Tree	LC	NE
96	*Urochloa mosambicensis (Hack.) Dandy*	Poaceae	9	Herb	NE	NE
97	*Vepris lanceolata (Lam.) G.Don*	Rutaceae	1	Shrub	NE	NE
98	*Vernonia adoensis Sch. Bip. ex Walp.*	Asteraceae	8	Herb	NE	NE
99	*Vigna unguiculata (L.) Walp.*	Fabaceae	1	Climber	Cultivated	
100	*Xanthocercis zambesiaca (Baker) Dumaz-le-Grand*	Fabaceae	1	Tree	LC	NE

101	*Xeroderris stuhlmannii (Taub.) Mendonça & E.P. Sousa*	Fabaceae	1	Tree/Shrub	NE	NE
102	*Ximenia americana L.*	Olacaceae	4	Tree/Shrub	LC	NE
103	*Ximenia caffra Sond.*	Olacaceae	3	Tree/Shrub	LC	NE
104	*Zanha golungensis Hiern*	Sapindaceae	2	Tree	LC	NE
105	*Ziziphus abyssinica Hochst. ex A. Rich*	Rhamnaceae	3	Tree	LC	NE
106	*Ziziphus mucronata Willd.*	Rhamnaceae	5	Tree	LC	NE

Annex 10: Options Report For The Canal Route Of Mc2 In The Lengwe Park Area

31st May 2022

Prepared by the Design Team of Consultant (KRC JV)

PART 1: THREE OPTIONS OF CANAL ALIGNMENT

1. Introduction

Lengwe National Park is home to a variety of flora and fauna, which are protected and maintained in their natural state under special management. However, as the canal constructed as part of the SVTP passed through this area, it was placed under a situation that affected the ecosystem in the park in various ways due to the canal installation. Accordingly, it is necessary to select a route that is financially reasonable while minimizing the impact on the environment. For this, the most appropriate option was selected by evaluating three options from various aspects.

2. Three Options of Canal Route

1) Alignment 1: Original Route (Open Lined Canal)

- This canal route is a route installed in the Phase II area extending from the end point of the MC2 route set in the Phase I area. This route is a route constructed by connecting points in Lengwe Park where the amount of excavation is minimized.

- Minimization of excavation amount is an essential element to reduce construction cost and minimize environmental impacts.
- However, this route passes through the western end of the thicket area located north of Lengwe Park. The thicket area has an area of about 3,475 ha, and the area of the western section separated by the canal is about 200 ha.

2) Alignment 2: New Route No.1

a) Option 1: Open Lined Canal

- This route is set to pass through points that minimize the amount of excavation under the condition that the canal does not pass through the thicket area.

- However, since this canal route passes through points higher than the original route, the excavation cross-section becomes very large, and the amount of excavation of the ground is greatly increased.

- If the excavation cross section is enlarged, not only will the construction cost increase, but also the safety of animals in the park will be adversely affected.

b) Option 2: Concrete Box Conduit

- This option installs canal on the same route as option 1. However, one difference is that it is installed as a concrete box conduit rather than an open canal.

- When the conduit is installed, the ground is restored to its original state, so there is no problem in the movement of animals.

- However, the total construction cost increases significantly due to the conduit construction cost.

3) Alignment 3: New Route No.2

- This canal route goes along the existing road located in the west of the Thicket area.

- This route is far from the thicket area, and since it uses the existing road in some part, it has the advantage of minimizing environmental impacts.

- However, since this route deviates greatly from the original route, the canal length is longer by 5.9km compared to the original route. In addition, excavation of 30m depth or more is required because it has to pass through the high ground level zone.

- This is a very unfavorable condition in reality, and even if it is constructed, it will bring a big change in the topography. As a result, it will have a very

adverse effect on the environment. For this reason, this route is difficult to adopt.

Figure 1: Original Route and New Route 1 in the Lengwe Park Area

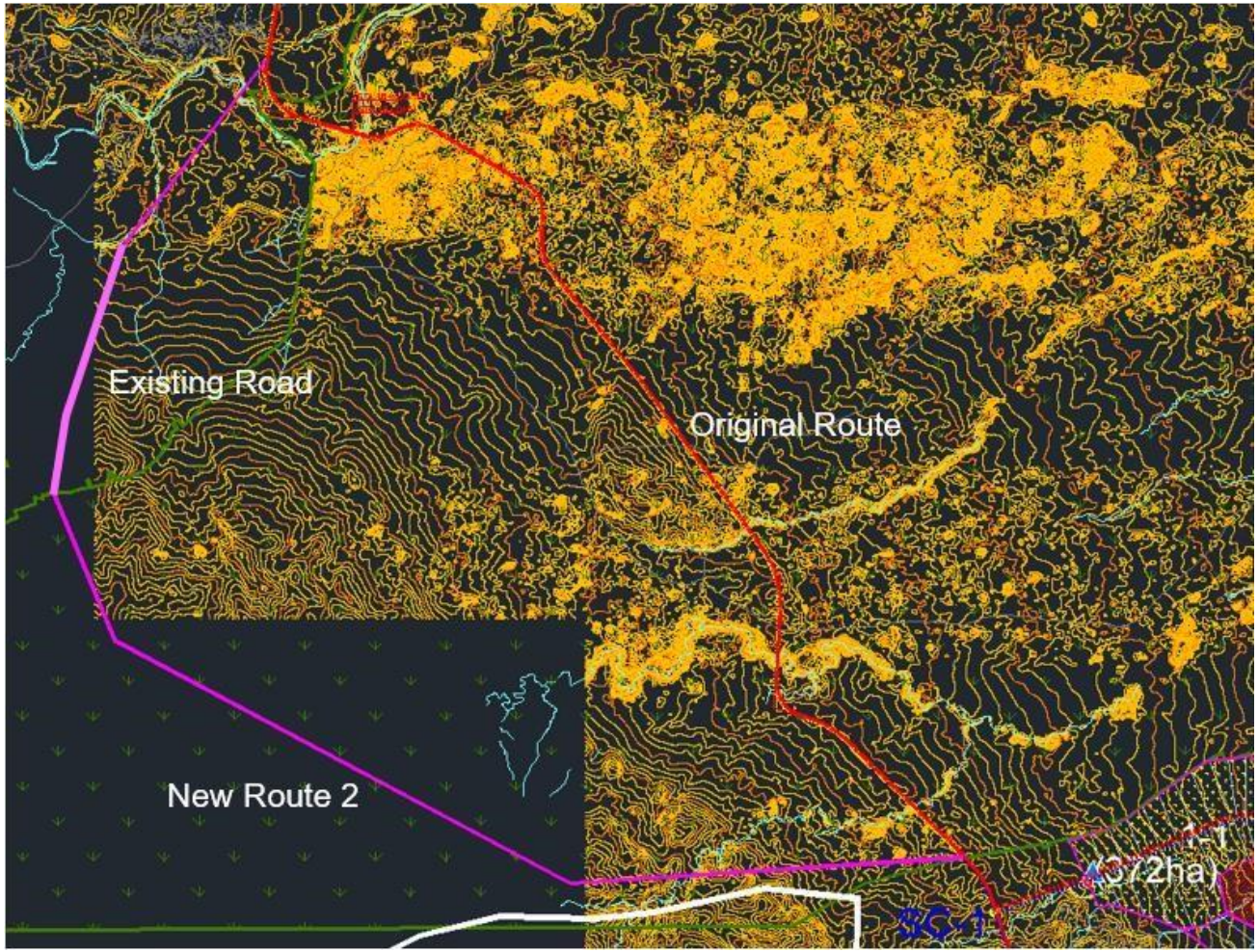


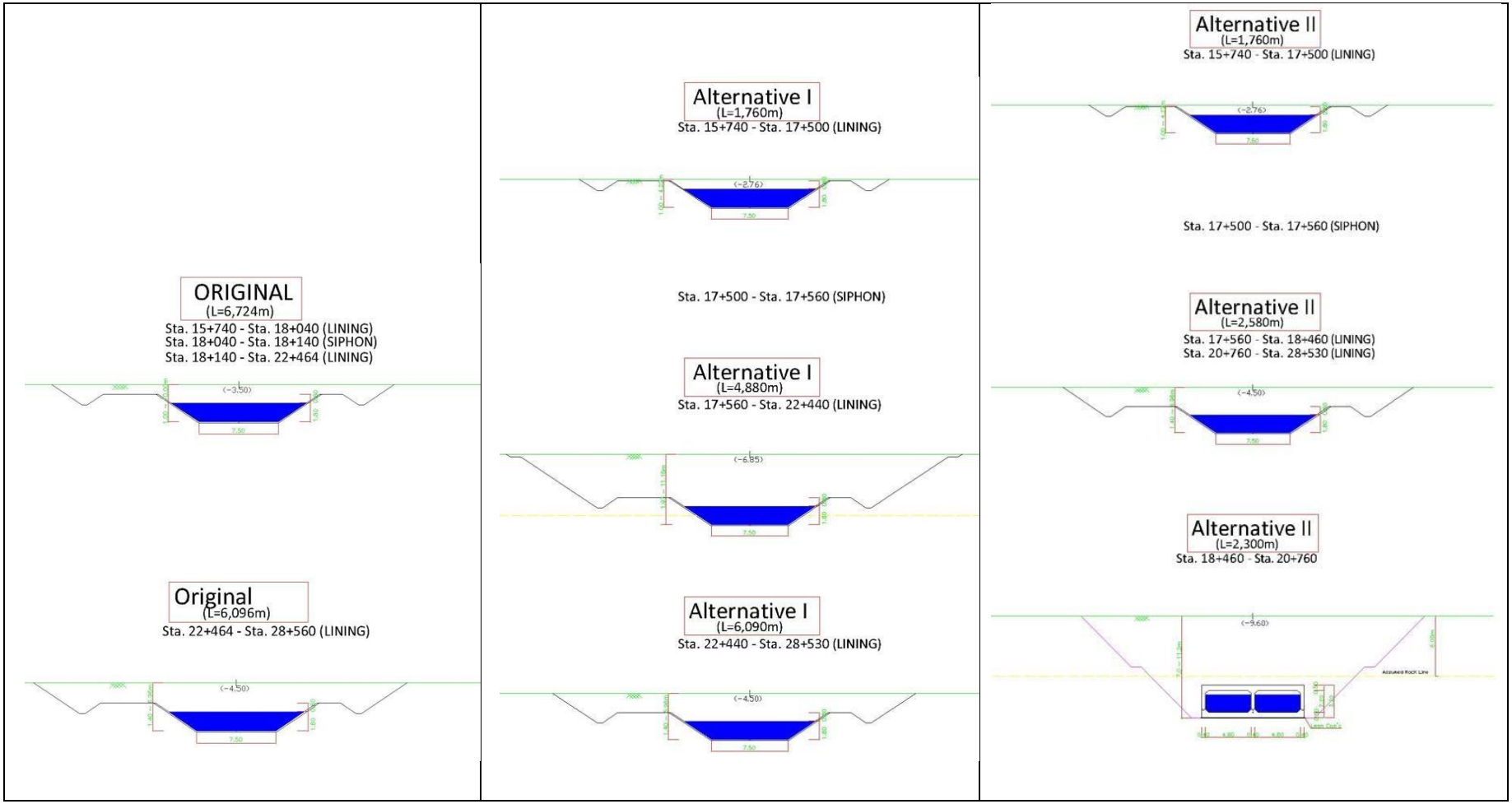
Figure 2: Original Route and New Route 2 in the Lengwe Park Area

3. Important Construction Items

	Unit	Alignment 1 (Original Route – Open Lined Canal)	Alignment 2		Alignment 3 (New Route 2 – Open Lined Canal)
			Option 1 (New Route 1 – Open Lined Canal)	Option 2 (New Route 1 – Open Canal + Conduit)	
Length outside National Park	m	1,300	2,460	2,460	5,980
Length inside National Park	m	11,520	10,330	10,330	10,800
Length of open canal in National Park	m	11,020	9,830	6,230	10,300
Length of covered canal in National Park	m	500	500	4,100	500
Area of Natural Habitat lost permanently	m2	280,500	456,900	408,100	972,000
Area of Natural Habitat lost temporarily	m2	85,000	127,900	127,900	167,800
Area of Critical Habitat permanent lost	m2	142,560	-	-	-
Area of Critical Habitat temporarily lost	m2	43,200	-	-	-

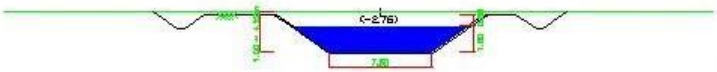
Area of compensation planting	m2	423,060	456,900	408,100	972,000
Gradient of side slopes achieved (minimum 1:2.5)		Not Acceptable	Not Acceptable	Not Acceptable	Not Acceptable
Volume of spoil to be removed	m3	1,063,416	1,680,337	1,011,292	23,120,161
Approximate cost (Lengwe Section 14km)	USD	10,456,509	12,292,489	24,762,679	130,686,882

4. Canal Sections for Four Options



Alternative III
(L=1,380m)

Sta. 15-740 Sta. 17-120 (LINING)

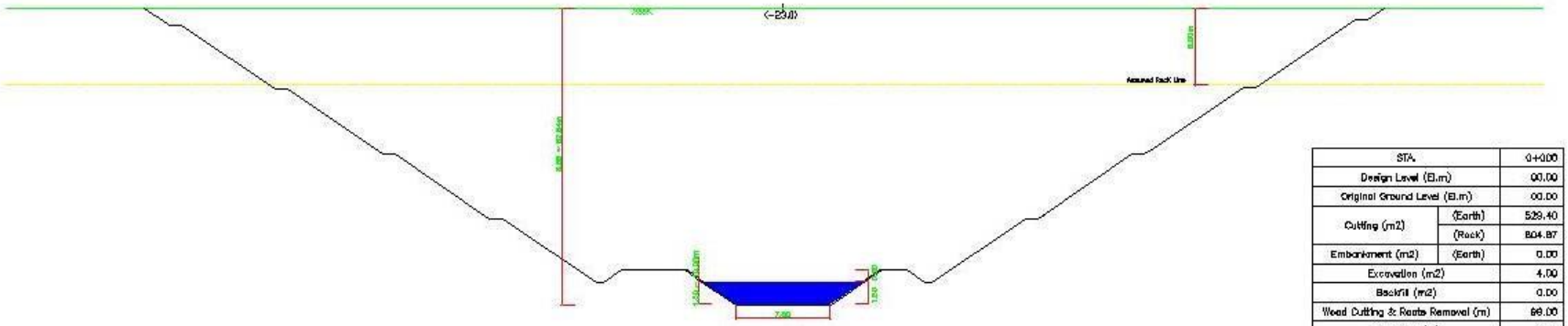


STA.		0+000
Design Level (El.m)		00.00
Original Ground Level (El.m)		00.00
Cutting (m2)	(Earth)	34.40
	(Rock)	0.00
Embankment (m2)	(Earth)	0.00
Excavation (m2)		4.00
Backfill (m2)		0.00
Wood Cutting & Roots Removal (m)		30.00
Lined Sod (m)		0.00
Side Slope Forming (m)	(E)	0.00
	(C)	8.00
Lining(m)	Machine	18.78
	Lining	0.00

Sta. 17-120 Sta. 17-220 (SIPHON)

Alternative III
(L=15,300m)

Sta. 17-220 Sta. 32-520 (LINING)



STA.		0+000
Design Level (El.m)		00.00
Original Ground Level (El.m)		00.00
Cutting (m2)	(Earth)	529.40
	(Rock)	804.87
Embankment (m2)	(Earth)	0.00
Excavation (m2)		4.00
Backfill (m2)		0.00
Wood Cutting & Roots Removal (m)		60.00
Lined Sod (m)		68.4
Side Slope Forming (m)	(E)	0.00
	(C)	72.0
Lining(m)	Machine	18.78
	Lining	0.00

5. Pros and Cons of Four Options

Considering Points	Alignment 1 (Original Route – Open Lined Canal)	Alignment 2		Alignment 3 (New Route 2 – Open Lined Canal)
		Option 1 (New Route 1 – Open Lined Canal)	Option 2 (New Route 1 – Open Canal + Conduit)	
Whether to pass through the thicket area	- Pass through the thicket area - Unfavorable for preservation of vegetation in thicket area	- Does not pass through the thicket area - Favorable for preservation of vegetation in thicket area	- Does not pass through the thicket area - Favorable for preservation of vegetation in thicket area	- Does not pass through the thicket area - Favorable for preservation of vegetation in thicket area
Impact of ground excavation (Landscape, disposal of excavated soil, animal safety, etc.)	- Minimize volume and depth of ground excavation - Minimize damage to the landscape - Disposal is not difficult due to the small amount of excavated soil. - Since the canal depth is small, it is advantageous for animal safety.	- Ground excavation volume and depth are greatly increased - The landscape is severely damaged - Disposal is difficult due to the large amount of excavated soil. - Unfavorable to animal safety as the canal depth is large.	- Since most of the excavation section is restored to the original topography, the environmental damage caused by excavation is minimal.	- Since this route passes high area, lots of excavation is needed. (Max. Depth: 50m; Max. Width: 90m) - This causes another environmental problem.

Installation of Animal Passages	- Length of conduit section for Animal Passages installation: 34 m x 2ea - Construction cost of conduit: 403,821$ (Favorable)	- Length of conduit section for Animal Passages installation: 42 m x 2ea - Construction cost of conduit: 498,665$ (Unfavorable)	- No need to install additional conduit for Animal Passages as the conduit is installed in 46% of the new route section.	- Unreasonable to install conduit section
Construction Cost	- The smallest	- The medium	- The larger	- The Largest

5. Conclusion

1) **All 3 options have their pros and cons.**
2) **Alignment 2 is advantageous from the aspect of preserving the thicket area.**
3) **From the aspect of impact of ground excavation, Option 2 of Alignment 2 minimizes the impact on the environment, and Option 1 of Alignment 2 gives the greatest impact.**
4) **Since the thicket area shall be recovered after the box conduit was installed, installation of Animal Passages is unnecessary in Option 2 of Alignment 2.**
5) **The total cost of construction is minimum in case of Alignment 1, followed by Option 1 and Option 2 of Alignment 2, and maximum in case of Alignment 3.**
6) **Alignment 3 has a very large adverse effect on the environment because too much excavation is required, so that it is difficult to apply.**

7) **If only environmental aspects are considered, Option 2 of Alignment 2 is the most advantageous. However, since its construction cost is very high compared to other two options, it is difficult to apply it in practice. Option 2 of Alignment 2 is advantageous from the aspect of preservation of the thicket area, but it has no other advantages. In particular, compared to the Alignment 1, its construction cost is very large. Considering these points, the Alignment 1 is considered to be the most appropriate canal route.**

PART 2: OTHER ENVIRONMENTAL ISSUES

1. Cross Sectional Slope

Request of Environment Expert	**Application in the Design**
The cross section (minimum 1:2.5, preferably flatter)	The Cross Sectional Slope will be designed as 1:1.5, and the reasons for this are as follows: - Since the water depth in the canal is designed based on 1.8m, it is very dangerous for animals to enter the canal. Therefore, in principle animals should not be designed to enter the canal. Animals will be moved through Eco passages, and all other canal sections will be fenced off. Therefore, it is not necessary to relieve the canal sectional slope. - If the canal sectional slope is alleviated, the occupied area of the canal will be further expanded, creating more unfavorable conditions for the environment in the park. In addition, if the canal width is enlarged, the floor friction force is increased and the water head is reduced, which causes an obstacle to the downstream water supply.

2. Canal Paving Material

Request of Environment Expert	Application in the Design
Install the armorflex on the floor.	The canal floor will be constructed with a concrete lining, for the following reasons: - As described above, it is not necessary to install an armourflex at the canal floor as it is assumed that the animals do not enter the canal. In addition, if armorflex is installed on the bottom of the canal, floor friction is increased and the head of water is reduced, which interferes with the downstream water supply.

3. Eco Passages

Request of Environment Expert	Application in the Design
5 over passes (50m wide) and one under pass	5 over passes (50m wide) will be installed, but not under pass. The reasons for this are as follows: - Since the Lengwe Park area has a higher surface elevation than the canal, the canal passing through this area must be installed by excavating the existing ground. Under these conditions, the under pass cannot be installed.

4. Compensation Planting

Request of Environment Expert	Application in the Design
84 ha of woodland restoration and 60 ha of thicket plating	Planting will be carried out with a width of 20m around both sides of the canal in the area except for the thicket section.

ANNEX 11: MINUTES OF MITIGATION WORKSHOPS

Annex 11.1: Minutes of Nsanje Workshop

Questions raised during the workshop	Answers from the Consultant
What will happen if there is a need to cut valuable or protected trees?	At this stage, the ESIA could not identify individual protected trees, the Department of forestry will be involved whenever there is a risk of destruction of protected trees (whenever the canal passes across forested areas). This is added in the ESIA/ESMP in addition to the need to protect woodlands as set aside lands
Will canal be accessible for canoe?	No, canal access will be strictly forbidden for canoe
Water level in the Shire is already going down, is the Project feasible?	Indeed, however the ESIA role is not to assess the feasibility of the Project but to assess impacts. The FS has assessed the feasibility of the Project.
Who will maintain the canals?	The primary canal and branch canals will be under the management of an operator. People will have to maintain their plots, tertiary canals and drains
Could the canal overflow and flood villages?	No, water in the canal is controlled by gates at the water intake
Could the canal be fenced to keep children from drowning?	No, fencing will not withstand (stolen, vandalized, etc.), in addition the length of the canal (160 km) would make this very expensive. However, the ESIA/ESMP recommends regular sensitization in school about the risks for children associated with the canal
Will the water be safe to drink?	No, the objective of the scheme is irrigation. Some pipes may be built to provide with drinking water.
There is concerns over the spread of HIV	Ok, the ESIA/ESMP has highlighted this in the Code of conduct
How to ensure that local people will be hired in the construction process?	An Affirmative Action Recruitment Policy will have to be implemented so that contractor hire local people to work
How will the water fees be collected?	Answer by provided by Boniface Nthakomwa (SVTP) : same as PATHA out grower model (participants related to this example)
Can the canal be buried?	No, in Nsanje it will be open and lined (burying a canal is too expensive)

Questions raised during the workshop	Answers from the Consultant
Will there be any school impacted?	Normally not, however if the canal cannot avoid infrastructures, they will be rebuild to good standards (according to the OP 4.12 from the World Bank)
What about transboundary impact?	Shire River is part of the Zambezi commission, they have been contacted (riparian notification)

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Annex 11.2: Minutes of Chikwawa Workshop

Question raised during the workshop	Answer from the Consultant
Shire water level is low (same level than in 1997), the barrage is managed by the National Water Authority	Ok, this is taken into account
To compensate for lower water level in the Elephant marsh is it possible to build a pipe to bring water to dimba agriculture?	Dimba agriculture cover a vast area, a pipeline would not solve the issue and would cost a lot
If Kamuzu barrage releases more to compensate for impacts of SVTP it will impact Liwonde National Park (inundations)	Ok, this will be taken into account in the ESIA.
Comment on the PowerPoint : WESM has highlighted that Impact on Majete Wildlife Reserve are not acceptable as African Parks has invested millions in a prime touristic area that is now under threat from construction work and the presence of a canal, in order for the World Bank to comply with their policies, it has to give impacts and mitigation a serious consideration.	Impacts and mitigation on MWR are presented in depth in the ESIA
Comment on the PowerPoint : a participant has highlighted the risk from the Tiger fish	Impact from the Tiger fish is dealt with in the ESIA
Comment on the PowerPoint: How to propose more measures to ensure that a good construction contractor is selected?	The best way to ensure that is to verify the contractor reputation
Comment on the PowerPoint : WESM has highlighted that Elephant poaching was major during work close to Liwonde National Park in 2003, bringing a contractor inside a park is a risk	Ok
The water intake shall have a trash rack with appropriate size to keep juvenile crocodiles from entering	This concern is dealt with in the ESIA/ESMP
Comment from WESM: are local people fully aware of the fact that there will be a water fee?	Yes it was presented as part of the Consultation work from COWI
How will the project mitigate risk during construction of the canal (risk of animal falling in the trench)?	In MWR the work area will be fenced (as described in the ESMP)
Slow moving animal (snakes) shall be protected from persecution from workers	A measure has been added in the ESIA/ESMP

Question raised during the workshop	Answer from the Consultant
Who will have the authority to stop work in cases on non-compliances?	Details are added in the ESIA/ESMP

ANNEX 12: GREENHOUSE GAS ACCOUNTING ANALYSIS

COUNTRY : Malawi

Shire Valley Transformation Program – phase 2 (P179575)

1. **Motivation.** The World Bank Environment Strategy (2012) adopted a corporate mandate to account for the Greenhouse Gas (GHG) emissions for investment lending. The quantification of GHG emissions is an important step in managing and ultimately reducing emissions as it provides an understanding of the GHG mitigation potential of the Shire Valley Transformation Program (SVTP) and can support sectoral strategies toward low-carbon development. This analysis looks at both phases (1 and 2) of the SVTP.
2. **GHG accounting methodology.** The environmental externalities of the Program were estimated using the EX-ACT tool, based on an excel-sheet, developed by FAO[1] to provide estimations of the impact of AFOLU (Agriculture, Forestry and Other Land Use) Programs and policies on the carbon balance. The World Bank has adopted EX-ACT, to estimate the impact of agricultural investment lending on the GHG emission and carbon sequestration in the program area. The carbon balance is defined as the net balance across all GHGs expressed in CO_2 equivalents (CO_2e) that will be emitted or sequestered due to Program implementation (with-program: WP), as compared to a business-as-usual scenario (without program: WOP). EX-ACT is a land-based accounting system, estimating CO_2e stock changes (i.e. emissions or sinks of CO_2) expressed in equivalent tons of CO_2 per hectare and year. The tool was designed using mostly data from the Intergovernmental Panel on Climate Change (IPPCC) Guidelines for National Greenhouse Gas Inventories (NGGI-IPCC, 2006), which furnishes EX-ACT with recognized default values for emission factors and carbon values in soils and biomass (the so-called "Tier 1 level" of precision).
3. The GHG accounting calculations are based on characteristics in the climatic conditions and the land use and crop management practices for with-program and without-program situations (as defined in the financial models of the Economic and Financial Analysis.
4. **Assumptions in the EX-ACT model**. The SVTP proposes a broad range of investments and activities that were captured with the GHG accounting tool EX-ACT. The assumptions for this analysis were informed by discussions during Program preparation and are aligned to the assumptions of the Results Framework and Economic and Financial Analysis (EFA) of the Program.
5. The SVTP-2 is situated in the Lower Shire Valley of southern Malawi. The climate and moisture regime for Malawi is tropical dry. The Program implementation duration is 12 years (SVTP-1 for 6 years, SVTP-2 for 6 years) and the capitalization period assumed to be 13 years. Dynamics of implementation are assumed to be linear over the project period. The SVTP aims to enhance agriculture and livestock productivity through investments in improved agriculture and livestock practices in an intervention area of approximately 43,000 ha. The benefits of SVTP would come from improvements of productivity, as well as crop diversification and a shift from low value to high value crops (sugar cane, maize, legumes (pigeon pea, dry beans), cotton, vegetables and fruits (bananas, mangoes,

citrus), for domestic and export markets), and not or to a very minor degree from the expansion of the cultivated area. In addition, the Program would support investments in livestock intensification and aquaculture. The SVTP will support the adoption of improved water management and improved production technologies such as improved seeds, crop husbandry practices, fertilization, and horticulture technologies.

6. The GHG calculation in EX-ACT is based on the following elements, which are derived from the Results Framework and EFA: (a) incremental crop production from productivity increases in the targeted value chains, with a shift from traditional cultivation to improved agronomic practices; (b) additional fuel consumption due to marketing and transport of the additional production; (c) increased use of fertilizer and agro-chemicals. The assumptions for the GHG calculation are summarized in the table below.

Table 10.1. Data inputs to EX-ACT in the Without and With Program Scenario

Activities	Without Program Scenario	With Program Scenario
Crop production	Sugarcane 13,300 ha (pumping of water from the Shire River with electric pumps)	Sugarcane 13,300 ha (gravitation-led irrigation) Sugarcane new 1,700 ha (gravitation-led irrigation
	Traditional maize: 29,700 ha produced using traditional production technologies (1 cropping season)	**Two cropping seasons:** **Cycle 1 (total 28,000 ha)**: Fruit trees (banana, citrus, mango) 3,361 ha Maize 1,400 ha Cotton 7,746 ha Pulses 15,493 ha
		Cycle 2 (total 28,000 ha):: Fruit trees (banana, citrus, mango) 3,361ha Pulses: 12,317 ha Maize 11,622 ha Vegetables: 700 ha
Animal production	Traditional cattle rearing by targeted households in the intervention area	Intensive livestock production by members of the SOCFE. Livestock intensification has a negative impact on GHG.

Energy use	Sugarcane companies are currently using electric or thermic energy	Reduction of 1,000 MT of diesel due to the use of gravitation for irrigation of sugarcane
Consumption of fertilizer and agro-chemicals (insecticides, herbicides)	Traditional farmers is the intervention area are using low or no fertilizers and agro-chemicals in the rain-fed production systems	Additional use (MT/annum) of fertilizers has been calculated for 43,000 ha on the basis of the crop-budgets.: Ammonium nitrate: 850 MT Potassium chloride: 136 MT Single superphosphate: 340 MT NPK 23:21:0: 9451 MT CAN: 4558 MT DAP: 775 MT Ammonium sulfate: 775 MT

7. **Results** show that the SVTP can constitute a sizeable net carbon sink of -278,099 tCO2 eq over 20 years, thus −13,905 tCO2 eq annually, due to the introduction of improved crop management practices and technologies. The cropping activities constitute an absolute carbon sink with a carbon balance of -1,040,743 tCO2 eq in the with-project scenario. The increased use of fertilizer and insecticides/herbicides, partially compensated by a reduced use of energy, would lead to an increase of 730,224 tCO_2 eq.
8. The monetary value of the GHG balance has been estimated and taken into account as economic benefit of the project in the Economic and Financial Analysis. The Guidance Note on Shadow Price of Carbon in Economic Analysis (September 2017) recommends "projects' economic analysis use a low and high estimate of the carbon price. The economic analysis[2] uses a low and high estimate of the carbon price starting at US$38 and 77, respectively, in 2018 and increasing to US$65 and 131 by 2042. Carbon market prices are the market value of CO_2e emission reductions or sequestration (offsets) that are registered and sold through various market structures.

[1] http://www.fao.org/tc/exact/ex-act-home/en/.

[2] World Bank. Shadow price of carbon in economic analysis, Guidance note. November 12, 2017

Annex 12: Workers Code Of Conduct

Code of Conduct for the Contractor and Contractors Personnel

SHIRE VALLEY TRANSFORMATION PROGRAMME

DATE

CONTRACTOR'S CODE OF CONDUCT

We/I…….**,** have signed a contract with **THE MALAWI GOVERNMENT** for the **CONSTRUCTION OF AN IRRIGATION CANAL** in **CHIKWAWA** District under the **SHIRE VALLEY TRANSFORMATION PROGRAMME**. We/I commit to implement measures to address environmental and social risks related to the Works, including the risks of gender-based violence, sexual exploitation, sexual abuse, and sexual harassment.

This Code of Conduct is part of our measures to deal with environmental and social risks related to the works. It applies to all staff, laborers and other employees at the Works Site or other places where the works are being carried out. It also applies to the personnel of each subcontractor and any other personnel assisting us in the execution of the works. All such persons are referred to as "**Contractor's Personnel"** and are subject to this Code of Conduct.

This Code of Conduct identifies the behavior that we require from all Contractor's Personnel.

Our workplace is an environment where unsafe, offensive, abusive, or violent behavior will not be tolerated and where all persons should feel comfortable raising issues or concerns without fear of retaliation.

REQUIRED CONDUCT

Contractor's Personnel shall:

1. Carry out his/her duties competently and diligently;

2. Comply with this Code of Conduct and all applicable laws, regulations and other requirements, including requirements to protect the health, safety and well-being of other Contractor's Personnel and any other person;

3. Maintain a safe working environment including by:

   a. ensuring that workplaces, machinery, equipment and processes under each person's control are safe and without risk to health;
   b. wearing required personal protective equipment;
   c. using appropriate measures relating to chemical, physical and biological substances and agents; and following applicable emergency operating procedures;

4. Report work situations that he/she believes are not safe or healthy and remove himself/herself from a work situation which he/she reasonably believes presents an imminent and serious danger to his/her life or health;

5. Treat other people with respect, and not discriminate against specific groups such as women, people with disabilities, migrant workers or children;

6. Not engage in Sexual Harassment, which means unwelcome sexual advances, requests for sexual favors, and other verbal or physical conduct of a sexual nature with other Contractor's or Employer's Personnel;

7. Not engage in Sexual Exploitation, which means any actual or attempted abuse of position of vulnerability, differential power or trust, for sexual purposes, including, but not limited to, profiting monetarily, socially or politically from the sexual exploitation of another;

8. Not engage in Sexual Abuse, which means the actual or threatened physical intrusion of a sexual nature, whether by force or under unequal or coercive conditions;

9. Not engage in any form of sexual activity with individuals under the age of 18, excepting case of pre-existing marriage;

10. Complete relevant training courses that will be provided related to the environmental and social aspects of the Contract, including on health and safety matters, and Sexual Exploitation and Abuse (SEA), and Sexual Harassment (SH);

11. Not use illegal substances;

12. Not use physical violence;

13. Properly use company property and protect it. Not steal, waste or be careless with company property;

14. Respect speed limit, all traffic signs and regulations inside and outside the construction area;

15. Follow rules laid out by Majete Wild Reserve while within their premises;

16. Report violations of this Code of Conduct; and

17. Not retaliate against any person who reports violations of this Code of Conduct, whether to us or the Employer, or who makes use of the grievance mechanism for Contractor's Personnel or the project's Grievance Redress Mechanism.

RAISING CONCERNS

If any person observes behavior that he/she believes may represent a violation of this Code of Conduct, or that otherwise concerns him/her, he/she should raise the issue promptly.

This can be done in either of the following ways:

1. Contact management through HR and Social and Safeguards Officers.

2. Contact PMT through the Social Safeguards Specialist or GBV/SEA Service Provider in writing at these phone numbers…….

3. Put the grievance in a grievance box provided at strategic location in the project area.

4. Contact any member of the Grievance Redress Committees set for the community and for workers.

The person's identity will be kept confidential, unless reporting of allegations is mandated by the country law. Anonymous complaints or allegations may also be submitted and will be given all due and appropriate consideration. We take seriously all reports of possible misconduct and will investigate and take appropriate action. We will provide referrals to service providers that may help support the person who experienced the alleged incident, as appropriate.

The complete GBV Plan and Grievance Redress Mechanism Plan can be consulted at the HR and Social Safeguards offices.

There will be no retaliation against any person who raises a concern in good faith about any behavior prohibited by this Code of Conduct. Such retaliation would be a violation of this Code of Conduct.

CONSEQUENCES OF VIOLATING THE CODE OF CONDUCT

Any violation of this Code of Conduct by Contractor's Personnel may result in serious consequences, up to and including termination and possible referral to legal authorities.

This document is solely held by *(name of contractor),* it shall not be used, reproduced, altered or conveyed to third parties, partially or fully, without explicit authorization. Electronically issued document after approval of the original.

FOR CONTRACTOR'S PERSONNEL:

I have received a copy of this Code of Conduct written in a language that I comprehend. I understand that if I have any questions about this Code of Conduct, I can contact .....[*enter name of Contractor's contact person with relevant experience*] requesting an explanation.

Name of Contractor's Personnel:

.....

Signature:

.....

Date: (day month year):

.....

Countersignature of authorized representative of the Contractor:

Signature:

.....

Date: (day month year):

.....

ATTACHMENT 11.1: Behaviors constituting Sexual Exploitation and Abuse (SEA) and behaviors constituting Sexual Harassment (SH)

The following non-exhaustive list is intended to illustrate types of prohibited behaviors:

(1) **Examples of sexual exploitation and abuse** include, but are not limited to:

• A Contractor's Personnel tells a member of the community that he/she can get them jobs related to the work site (e.g. cooking and cleaning) in exchange for sex.

• A Contractor's Personnel rapes, or otherwise sexually assaults a member of the community.

• A Contractor's Personnel denies a person access to the Site unless he/she performs asexual favor.

• A Contractor's Personnel tells a person applying for employment under the Contract that he/she will only hire him/her if he/she has sex with him/her.

(2) **Examples of sexual harassment in a work context**

• Contractor's Personnel comment on the appearance of another Contractor's Personnel (either positive or negative) and sexual desirability.

• When a Contractor's Personnel complains about comments made by another Contractor's Personnel on his/her appearance, the other Contractor's Personnel comment that he/she is "asking for it" because of how he/she dresses.

• Unwelcome touching of a Contractor's or Employer's Personnel by another Contractor's Personnel.

• A Contractor's Personnel tells another Contractor's Personnel that he/she will get him/her a salary raise, or promotion if he/she sends him/her naked photographs of himself/herself.