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**Biodiversity Management Plan for Lengwe National Park And The Elephant Marsh**

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## **EXECUTIVE SUMMARY**

### **Introduction**

Ministry of Agriculture, through the Department of Irrigation, is implementing the Shire Valley Transformation Programme (SVTP). The programme development objective for the Shire Valley Transformation Programme (SVTP) 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.

The Shire Valley faces a complex of development challenges including deforestation, , pollution, unsustainable farming practices, unsustainable and use of natural resources. The scale and complexity of these development challenges can only be effectively addressed through an integrated multi-sector approach. SVTP will address these challenges through four coordinated pillars as follows: (i) providing reliable, professionally managed, and sustainably financed irrigation service to a number of irrigators in a phased construction of an irrigation and drainage scheme; (ii) supporting farmer organizations within a comprehensive land use plan, and supporting land tenure strengthening and voluntary consolidation; (iii) establishing and investing in smallholder-owned commercial farm enterprises transitioning into commercial agriculture from subsistence farming and integrating them into commercial value chains; and (iv) natural resources management in and around 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.

### **Lengwe National Park**

Lengwe was gazetted in 1928 as a Game Reserve and was extended in 1970. The 1928 gazettement resulted into creation of the **Old Lengwe** and the extension area is commonly known as **New Lengwe**. In 1975, Lengwe was declared a National Park by the National Park Establishment Amendment Order 26 August 1975, under the National Parks Act (Cap. 66:07), and published in Government Notice No.149 of 1975. Figure 2 below shows Old and New Lengwe

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 originating from South Africa and extending to Zimbabwe and Mozambique before finally reaching southern Malawi

(Clarke, 1983). It is believed that nyala prefers thicket vegetation part of which will be destroyed by the canal.

## **Elephant Marsh**

The Elephant Marsh lies within the floodplain of the Lower Shire River in southern Malawi between the towns of Chikwawa and Chiromo in southern Malawi (Figure 3) between S14°25'–17°50' and E35°15'–35°15', shared by the two administrative districts of Chikwawa and Nsanje. In the northwest, the Marsh is typically a seasonal wetland; centrally, it is semi-permanent marshland, and; in the south, it is characterized by semi-permanent marsh and shallow lakes. It covers an average area ranging from 500 km<sup>2</sup> in the dry season to 2 700 km<sup>2</sup> in the wet season. Its core area is a mosaic of rooted swamp vegetation (sudd), floating vegetation and open water with grassy margins. This is surrounded by seasonally-inundated grassy floodplains, which are in turn (originally) bordered by woodland.

## **Objectives of the BMP**

The Biodiversity Management Plan for Lengwe National Park and the Elephant Marsh was formulated to achieve the following:

- To develop an in-depth knowledge of the species available in Lengwe National Park, especially the area affected by the proposed canal development, so as to develop their conservation status and come up with management and mitigation measures in the ESMP;
- Examine the best option in terms of the development of the canal through the critical habitat in Lengwe National Park taking into consideration the national laws, African Development Bank's OS3 of the Integrated Safeguard Systems, World Bank's ESS 6 of the Environmental and Social Framework and IFC's Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Natural Resources.

## **Policy and Legal Framework**

The development of the BMP was informed by both national and international policy and legal frameworks that have a bearing on the project.

The following national policies were examined and applied to the plan: National Environmental Policy (2004), National Climate Change Management Policy (2016), National Fisheries and Aquaculture Policy (2016), National Wildlife Policy (2018), National Biodiversity Strategy and Action Plan II (2015 – 2025), Guidelines for Environmental Impact Assessment in Malawi (1997),

The following national laws have been applied: The Constitution of the Republic of Malawi (1995), Environment Management Act (2017), National Forestry (Amendment) Act (2020), Fisheries Conservation and Management Act (1997), National Parks and Wildlife (Amendment) Act (2017), National Parks and Wildlife (Protection, Endangered and Listed Species) (Declaration) Order (2017),

SVTP applied the following safeguard policies for the financing partners: African Development Bank's OS3 of the Integrated Safeguard Systems, World Bank's ESS 6 of the Environmental and Social Framework and IFC's Performance Standard 6 – Biodiversity Conservation and Sustainable Management of Natural Resources.

## **Institutional Arrangements**

A number of institutions, governmental and non-governmental, will provide input into designing, consultations, implementation and monitoring of biodiversity during construction and operation of the project. The successful implementation of the ESIA will be dependent on the effective coordination between the various sectors and stakeholders. The most relevant institutions in relation to the project will include the following:

### **National Institutions**

The Malawi Environmental Protection Authority (MEPA) will be important for administering the ESIA process including reviewing, conducting public consultations on the findings, licensing the Project developer and monitoring implementation of the ESMP's once approved.

The Department of National Parks and Wildlife (DPNW) will be responsible for providing practical guidance on the conservation and management of flora and fauna species in Lengwe National Park and Elephant Marsh including ecosystem management approach. The Department will also be responsible for enforcing the National Wildlife Act, dealing with illegal incidences, managing the control of invasive alien species, implementation of mitigation actions that are identified in the ESMP.

The Department of Forestry has the structures and means to strengthen capacity of the communities in tree nursery establishment and management. For the Elephant Marsh, the Department will encourage and promote planting of indigenous and fruit tree seedlings on farms, including agro-forestry trees to offset the number of trees to be cut down. Institutions that the project will utilize through the Department of Forestry include the Local Forest Management Board, Village Forest Area Committees, Village Natural Resources Management Committees (VNRMC) and the local leaders.

Ministry of Agriculture : Some of the areas around the Elephant Marsh will be subjected to irrigation farming that may potentially pollute the marsh through chemical fertilizers and herbicides as already pointed out. Ministry of Agriculture will advise on sustainable farming practices that are less harmful to the marsh.

Chikwawa and Nsanje District Councils will be important for implementation of mitigation measures in Elephant Marsh. Structures through which development projects are implemented at the district council include the District Executive Committee (DEC), District Environmental Sub-Committee (DESC), Area Development Committees (ADCs)/ Community Development Committee (CDC) and the Village Development committee (VDC):

In all these committees, there key representatives (technical officers) from the Department of Environmental Affairs, Department of National Parks and Wildlife (sometimes depending on the district), Department of Fisheries, and the Department of Forestry who contribute positively towards the any deliberations and make any decision on behalf of their respective departments for the benefit of the nation.

The World Bank and the African Development Bank: As SVTP is co-financed by a number of institutions, the development partners have a pivotal role to play including the provision of

financing for the project. The banks will be involved in project monitoring and supervision by staging relevant technical missions as agreed with the Government of Malawi. The Banks' safeguards personnel will work with the counterparts in SVTP to ensure recommendations agreed in this report, ESIA and ESMP are implemented. The two teams will ensure that the two banks' safeguard policies are adhered to.

## Methodology

Two principal approaches were employed, namely desk review and field assessments.

- **Literature review:** This was geared at assessing the baseline biodiversity in Lengwe and Elephant Marsh. Terms of Reference were developed jointly between SVTP and the African Development Bank. between SVTP and Environmental Affairs Department (EAD). The team proposed names to form a task team which included the Natural Resources Coordinator of SVTP, the Fisheries and Wetlands Expert of SVTP, the Protected Area Management Specialist of SVTP and Lengwe National Park Research team in addition to the ESIA Specialist and the Biodiversity Team from EAD. Literature review relied, in addition to other sources, on the following documents:

- Climate Resilient Livelihoods and Sustainable Natural Resource Management in the Elephant Marsh developed during the Shire River Basin Management Program which has four sub-study reports namely:
  - (i) Sub-Study 1: Livelihood Report
  - (ii) Sub-study 2: Hydromorphology of Elephant Marsh Report
  - (iii) Sub-study 3: Ecosystem services of the Elephant Marsh
  - (iv) Sub-study 4: Biodiversity of the Elephant Marsh
- Unpublished reports from Lengwe National Park on large mammals, birds, vegetation and illegal incidences;
- Unpublished reports from the Elephants Marsh on birds, crocodiles, hippopotamus and illegal activities;
- The 2021-2025 Lengwe National Park General Management Plan;
- Precision-a Consulting Firm conducting Aerial surveys in Elephant Marsh and Lengwe National Park.

- **Field Assessments :** For Lengwe National Park, literature review results showed that the data collected and analysed were for the whole park. However, the proposed canal will only affect a small section of the park (11 km long and 45 metres wide). In this regard, there was need for canal specific biodiversity information focussing on vegetation, small mammals and birds.

Regarding the Elephant Marsh, on the other hand, most of the data were outdated. For this reason, there was need to conduct field assessments covering mammals (small and large), birds, amphibians, reptiles, and fish species.

## Results.

Overall, the surveys came up with a number of observations as follows:

### a) Lengwe National Park

The conservation status of animal species in Lengwe was examined based on IUCN conservation status and Malawi's Categorisation process.



(i) **Mammals**

According to the IUCN conservation status for most of these mammals (91%) is 'Least Concern' whereas at national level, 7 species are categorised as Endangered, 3 are protected and 1 is listed and protected.

Most of the mammals are found in the eastern side of the park due to water availability and security.

(ii) **Birds**

Lengwe National Park is one of the important bird areas in Malawi with number MW021 on Bird Life International. According to Dowsett (2000).

In 2015, the list of bird species was put at 368 by the Wildlife and Environmental Society of Malawi (WESM). In 2020, WESM continued with bird surveys and 79 species were recorded in Old Lengwe that included the rarely seen Crested Guinea fowl *Guttera pucherani*, Swallow-tailed Bee-eater *Merops hirundineus*, Cinnamon-breasted Bunting *Emberiza tahapisi*. In New Lengwe, 778 birds were sighted comprising of 153 species. The surveys identified some rare species which included Rudd's Apalis *ruddi*, common in Mozambique but rarely seen in Southern Malawi and was thought to be extinct in Lengwe. Vincent Bunting *Emberiza vincenti* was also recorded for the first time near the Mozambique boundary. The new list consists of 374 species of birds.

The majority of recorded bird species fall under the least concern on IUCN Red List Category while about 19 species are under vulnerable, near threatened, endangered and critically endangered (IUCN 3.1). The populations for these species which are mostly birds of prey (eagles and falcons) and scavengers (vultures) have been declining due to variety of threats including poisoning, persecution and ecosystem alterations.

The critically endangered species found in Lengwe include Basra Reed Warbler *Acrocephalus griseldis* and Hooded Vulture *Necrosyrtes monachus* while the vulnerable species include Woolly-necked Stork *Ciconia episcopus*, Lanner Falcon *Falco biarmicus* and Southern Ground Hornbill *Bucorvus leadbeateri*.

(iii) **Reptiles and Amphibians**

There are no records available at this stage. The National Museums of Malawi also does not have specimens from Lengwe NP. A full Herpetological survey of Lengwe NP is therefore required.

(iv) **Butterflies**

Between November and January and March-April (2015-2016) observations by J. Bayliss on butterflies was carried out in all areas visited with selective collection of specimens for correct identification (247 specimens of 93 species, with an additional 11 species based on sight records).

One butterfly hitherto unrecorded from Malawi was collected in Lengwe, *Acraea atergatis* (Acraeidae), a dry country species known further west in south-central Africa. Other interesting records include *Euxanthe wakefieldi* (Nymphalidae) in Lengwe and the neighbouring Nyala Park at Sucoma. This Eastern biome lowland

forest-associated species was previously known in Malawi only from the Malawi Hills and the Nkhata Bay lakeshore, though there is apparently an unpublished record of a vagrant from Blantyre. Also unexpected were the Eastern biome *Hypolimnas deceptor* from Lengwe and Mwabvi, and *Neptidopsis ophione* from Lengwe (both Nymphalidae). These are also unrecorded from southern Malawi. Among the Lycaenidae, *Pentila tropicalis* is an Eastern forest associated species (known hitherto from Malawi only in the Malawi Hills), while a number of species are newly reported from the Lower Shire Valley, including such scarce butterflies as *Baliochila hildegarda* and *Lachnocnema durbani*.

The combined list of 104 species is far from complete and an additional survey of the butterflies of Lengwe NP is recommended.

#### (v) **Vegetation**

The 2021-2025 Lengwe National Park General Management Plan provides detailed information regarding vegetation type including plant species found in each of the vegetation type. The common vegetation types highlighted include mopane woodland, thicket/savannah, mixed woodland, and Riparian. A vegetation survey conducted in new Lengwe from 26<sup>th</sup> Nov to 8<sup>th</sup> December 2022, identified one hundred and three (103) species of which 4 were endangered, 8 vulnerable and 22 were identified as least abundant, *Combretum zeyheri* was the only abundant species identified. Three species in Lengwe have been categories as Vulnerable, which include; *Pterocarpus angolensis*, *Dalbergia melanoxylon* and *Azelia quanzensis*.

#### **b) Elephant Marsh**

Elephant Marsh probably remains the most important and largest wetland in Malawi which harbors large mammals. For instance, outside protected areas, it is only Elephant Marsh that harbors Hippopotamus.

Hippopotamus, listed as Vulnerable under IUCN remains present at the Elephant Marsh, outside of the protected areas. The hippopotamus population is estimated to be less than 100, far fewer than the more than 1 000 individuals that are expected to have occurred under more natural conditions [Government of Malawi (GoM, 2016)].

#### **Reptiles**

There are 58 species of reptiles in the Elephant Marsh (about 45% of the reptiles recorded for Malawi). This is composed of 19 lizards, of which skinks (7 species) are the most diverse; 32 snakes, with colubrid (10) being the most diverse family, and with nine venomous species of which five have caused fatalities; a single crocodylian, and six chelonians of which side-necked *Pelomedusid terrapins* (3) are the most diverse.

#### **Crocodiles**

The Research and Development Unit at Lengwe National Park has been monitoring the Nile Crocodile (*Crocodylus niloticus*) for three consecutive years (2020 – 2022). Elephant Marsh

had a very high population of crocodiles in the 1980s. However anthropogenic activities such as habitat destruction and farming have reduced the numbers to as low as not more than 200. The conservation status of the Nile Crocodile under IUCN is of Least Concern or Low Risk.

## **Birds**

The Marsh is rich in abundance and diversity of water birds. This has enabled it to meet three criteria of the Ramsar Convention on Wetlands as follows:

- Criterion 3. Elephant Marsh has biological diversity
- Criterion 5. It supports over 20,000 water birds
- Criterion 6. It has 1% or more of a delineated population of water birds

Since the Marsh meets these criteria, it is designated a Ramsar Site, that is a wetland of international importance.

A total of 199 bird species were recorded in the Elephant Marsh area, of which 68 species were waterbirds. A total of 20 238 birds were estimated to occur in the marsh. The most abundant species were Openbilled Stork and White-faced Tree Duck, African Jacana, Common squacco heron and cattle egret (GoM, 2016). An estimated 26 waterbird species have been found breeding in the area; among them are the threatened Madagascar Squacco Heron (*Ardeola idae*), Wattled Crane (*Grus carunculatus*) and Grey Crowned Crane (*Balearica regulorum*).

However, the recent (2022) bird count conducted by Lengwe National Park Research Unit showed that there are 42 species of birds, out of these 31 are common residence and Palearctic and 4 are Intra- African migrant.

## **Fish**

There is a total of 52 fish species from 17 families were observed or strongly expected to be resident in the Elephant Marsh (See Annex 8). This list combines species recorded during the survey in November 2015 and species expected to be present but not seen, based on previous surveys by Tweddle & Willoughby (1979). Among the the species expected but not seen, the common mountain catfish *Amphilius uranoscopus*, was a notable absentee. According to Tweddle and Willoughby this species used to be to be widespread in the east bank streams and in the Wankurumadzi Stream in Majete Wildlife Reserve during the late 1970s. The report further indicates one new species not previously reported by Tweddle and Willoughby. This species is the non-native mosquito fish *Gambusia affinis*, native to Gulf of Mexico drainages in North America.

While other species are abundant, others are less common and these include *Synodontis zambensi* (Nkhonokono/squeaker), *Momyrus spp* (Mphuta and Mkupe), and *Marcusenius macrolepidotus* (Nyesi/elephant fish). Fish species on IUCN Red List include *Labeo altivelis*, *Labeomesops*, *Protopterus annectens* and *Marcusenius macrolepidotus*.

## **Invertebrates**

There are important aquatic invertebrates including the newly identified sub-species of the butterfly *Colotis amata* that breeds exclusively on the lake edge surrounded by the evergreen shrub *Salvadora persica*.

On the basis of the biodiversity sub-study, it appears that the central sub-area of the Elephant Marsh, which is less accessible, is currently the least impacted, while the Northern and Western sub-areas, where there is extensive agricultural development and roads, have seen a higher degree of modification and losses of natural habitats and biota as a result.

## **Vegetation**

The information on the Flora of Elephant Marsh is based on the GoM (2016) report which compiled a list of wetland plant species in the elephant Marsh from the scientific literature on wetlands of the Zambezi river basin. In 2015 a field survey as part of the same report was also conducted to collect data on cultivated and non-cultivated land, marshes, lakes, river channels, roads and main town of elephant Marsh. This data was used to develop a plant species list and used to describe dominant vegetation communities and ecological condition of the vegetation in Elephant Marsh.

The marsh has six wetland habitats each of which is associated with a particular species of fauna. For example, the 'lake' habitat contain submerged and floating-leaved aquatic plants; the marshes contain megagraminoids.

## **Exotic species**

The most commonly-encountered exotic aquatic species, according to GoM (2016), was water lettuce *Pistia stratiotes*, while water hyacinth *Eichhornia crassipes*, red water fern *Azolla filiculoides* and Kariba weed *Salvinia molesta* were encountered much less frequently. These four species were found in the lake habitats, which were dominated by indigenous white lotus and hornwort. Non-aquatic pest species encountered, again infrequently, where the giant sensitive tree *Mimosa pigra* and honey mesquite *Prosopis glandulosa*. The rest of the exotic species encountered were disturbance adapted perennials, annuals, or forbs, commonly encountered where humans inhabit and cultivate crops, and many of them are planted aside the crops for a variety of medicinal and herbal uses.

Some species like *Borassus aethiopicum* (borassus palm or *muvo*) which were not listed as endangered in the IUCN at the time of the study, were found to be listed as endangered in an FAO2F report on plant genetic resources (GoM, 1996). This species is used for the construction of mokoros (GoM, 2016). In this study *Borassus aethiopicum* was found on the seasonal floodplain adjacent to Bangula Lagoon (SF2) and also on a cultivated river bank of the Shire River, recruiting palm saplings were also found on the cultivated fields.

## **Anticipated Impacts**

The project is expected both beneficial and negative environmental and social impacts, as follows:

1. Lengwe National Park

The impacts that the canal construction would have in Lengwe National Park are: drowning of animals, restricted access between eastern and western sides of the park, and physical destruction.

2. Elephant Marsh:

Impacts on the Elephant Marsh include introduction of exotic plants, increase in waste generation carried by water from upland and decrease in water levels in the Elephant Marsh, increase in levels in herbicides and pesticides, and conflicts in water uses due to conflicting water demands. The Pesticides Management Plan (PMP) for SVTP 1 and 2 details the type of pesticides / insecticides/herbicides, their impact on fauna and flora species, and proposed mitigation measures.

## Mitigation Measures

Mitigation measures for Lengwe National Park have been put in place that include:

- compensatory planting measures to compensate for any residual significant, adverse impacts
- Avoid construction activities at night to avoid disturbance to nocturnal fauna from increased noise and vibration.
- Undertake pre-clearance checks of trees to support roosting of fauna species
- Night working and the use of artificial lighting shall not be permitted to avoid adverse impacts to priority nocturnal fauna
- Project vehicles shall not be used at night within the project area to avoid adverse impacts to priority nocturnal fauna
- Avoid accidental machinery and vehicle collisions with wildlife: Vehicle operation shall be restricted to daylight hours to minimize the risk of vehicle collisions with wild life
- Avoid spills of hydrocarbon, oil, chemicals and other hazardous materials
- Avoid introduction of invasive species and pests
- Promote integrated pest management (IPM)
- Ensure environmental flow of 17 M<sup>3</sup> / second is adhered to.

## Recommendations

1. For Elephant Marsh, field assessments were only done for fish and, as such, only generalized impacts could be determined. There is need for more field assessments on birds, hippopotamus, crocodiles and flora. The additional assessments will be conducted by the Biodiversity Monitoring Expert that DNPW will, hire. with support from SVTP; and
2. Results of the assessment presented in this report are based on rainy season field work. There might be seasonal variations in abundance, distribution, species richness and threats. Consequently, dry season assessments should be done along the proposed canal using the same methods employed as presented in this report.
3. Biodiversity Monitoring during after construction works  
This report has revealed that canal construction will have negative impacts on biodiversity, directly and indirectly. There will be need for continuous monitoring of biodiversity status through out construction phase and even after. For effective monitoring and evaluation, there is need for:

- i. Training and capacity building of DNPW staff on impact assessments, monitoring, evaluation and reporting.
- ii. Recruitment of a Biodiversity Monitoring Expert to provide technical assistance to DNPW on assessments, monitoring, evaluation and reporting.
- iii. Develop and implement a restoration plan for negative impacts on biodiversity identified in this report
- iv. Revise the ESIA report in light of the new information generated from field assessments;
- v. Train SOCFE members on herbicide and pesticide handling, management and disposal of obsolete stockpiles

## **STAKEHOLDER CONSULTATIONS AND DISCLOSURE**

Stakeholder consultations have been held frequently during the preparation of the BMP ranging from the national level to community levels. Key consultations included formulation missions with AFDB and the World Bank, DNPW, MEPA, EAD, Fisheries Department and the communities. These consultations led to re-alignment of canal in Lengwe National Park, greater understanding of species in Lengwe and the Elephant Marsh including conservation status, livelihoods dependence on Lengwe and Elephant Marsh.

## **List of Acronyms and Abbreviations**

ADC	Area Development Committee
AEC	Area Executive Committee
CBD	Convention on Biological Diversity
CCA	Community Conservation Area
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
DDP	District Development Plan
DEC	District Executive Committee
DNPW	Department of National Parks and Wildlife
EGENCO	Electricity Generation Company
ESCP	Environmental and Social Commitment Plan
ESF	Environmental and Social Framework
ESIA	Environmental and Social Impact Assessment
ESS	Environmental and Social Standards
IUCN	International Union for Conservation of Nature
MEPA	Malawi Environment Protection Agency
NAPA	National Adaptation Programmes of Action
NBSAP	National Biodiversity Strategy and Action Plan
NCCMP	National Climate Change and Management Policy
NGO	Non-Governmental Organization
PDO	Programme Development Objective
SEP	Stakeholder Engagement Plan
SVTP	Shire Valley Transformation Programme
VDC	Village Development Committee
VNRMC	Village Natural Resources Management Committee
WESM	Wildlife and Environmental Society of Malawi

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# 1. CHAPTER 1: GENERAL INTRODUCTION, BACKGROUND AND RATIONALE

This chapter provides a general introduction of the Shire Valley transformation Programme (SVTP) and background information. The general introduction highlights SVTP in terms of its objectives, phases, components and key tasks. The background focusses on Environmental and Social Impact Assessments done before production of this report. It gives rationale for literature review done to produce this report.

## 1.1 General Introduction

Ministry of Agriculture, through the Department of Irrigation, is implementing the Shire Valley Transformation Programme (SVTP). The programme development objective for the Shire Valley Transformation Programme (SVTP) 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.

The Shire Valley faces a complex of development challenges including deforestation, , pollution, unsustainable farming practices, unsustainable and use of natural resources. The scale and complexity of these development challenges can only be effectively addressed through an integrated multi-sector approach. SVTP will address these challenges through four coordinated pillars as follows: (i) providing reliable, professionally managed, and sustainably financed irrigation service to a number of irrigators in a phased construction of an irrigation and drainage scheme; (ii) supporting farmer organizations within a comprehensive land use plan, and supporting land tenure strengthening and voluntary consolidation; (iii) establishing and investing in smallholder-owned commercial farm enterprises transitioning into commercial agriculture from subsistence farming and integrating them into commercial value chains; and (iv) natural resources management in and around 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.

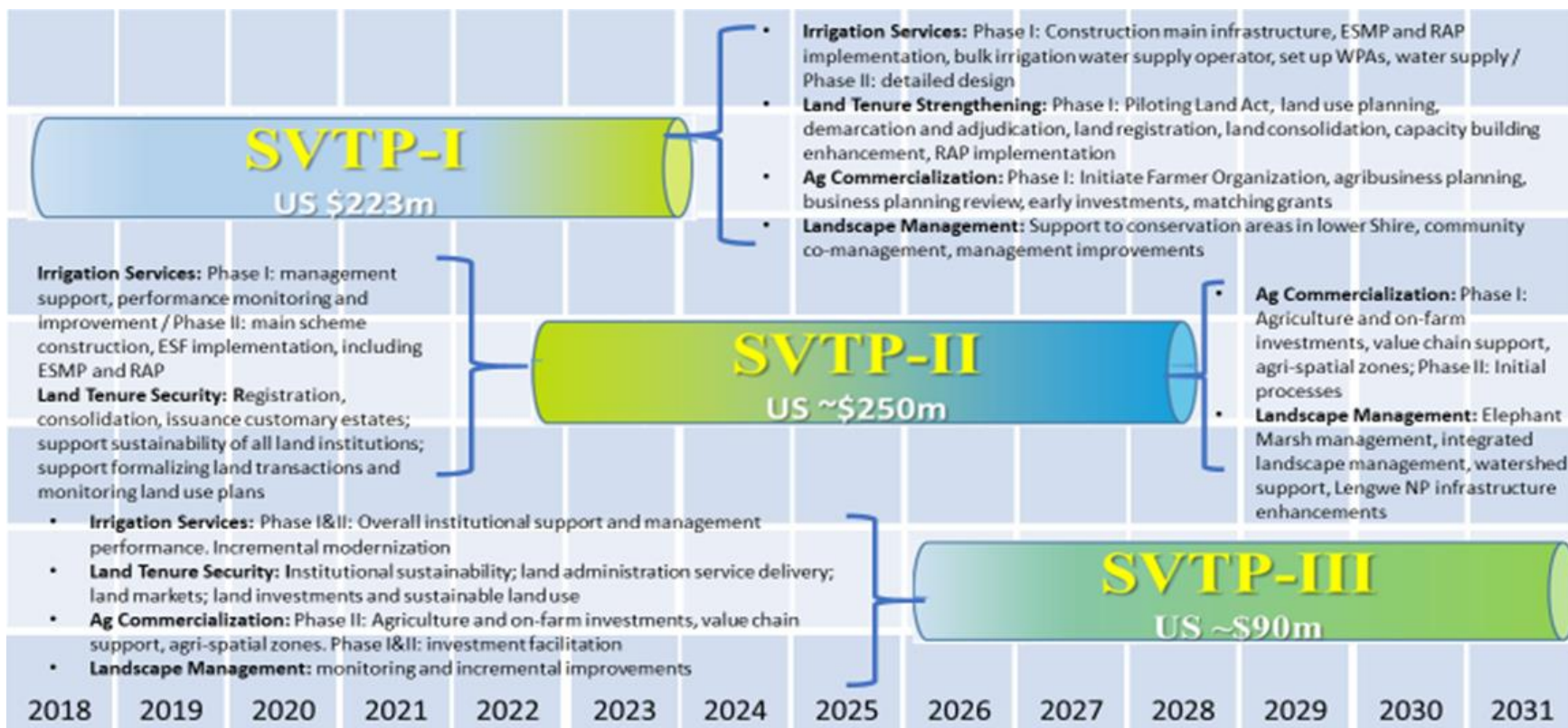


Figure 1: SVTP Phases and how they overlap

As figure 1 indicates, 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 originating from South Africa and extending to Zimbabwe and Mozambique before finally reaching southern Malawi (Clarke, 1983). It is believed that nyala prefers thicket vegetation part of which will be destroyed by the canal.

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.

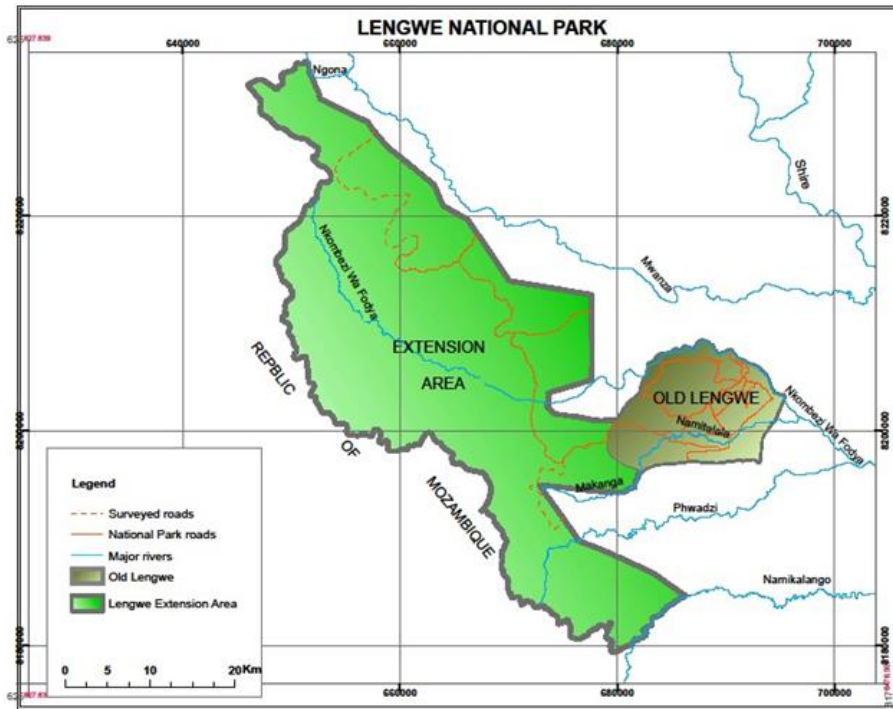
The first 10.5 km of the main canal to be constructed under SVTP-2 will be through Lengwe National Park, which is a protected area. Construction works within this area will therefore require a contractor with experience in developing infrastructure within protected areas.

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.

This report is about Lengwe National Park and the Elephant Marsh which are described below.

### **1.1.1 Lengwe National Park**

Lengwe was gazetted in 1928 as a Game Reserve and was extended in 1970. The 1928 gazettelement resulted into creation of the **Old Lengwe** and the extension area is commonly known as **New Lengwe**. In 1975, Lengwe was declared a National Park by the National Park Establishment Amendment Order 26 August 1975, under the National Parks Act (Cap. 66:07), and published in Government Notice No.149 of 1975. Figure 2 below shows Old and New Lengwe.

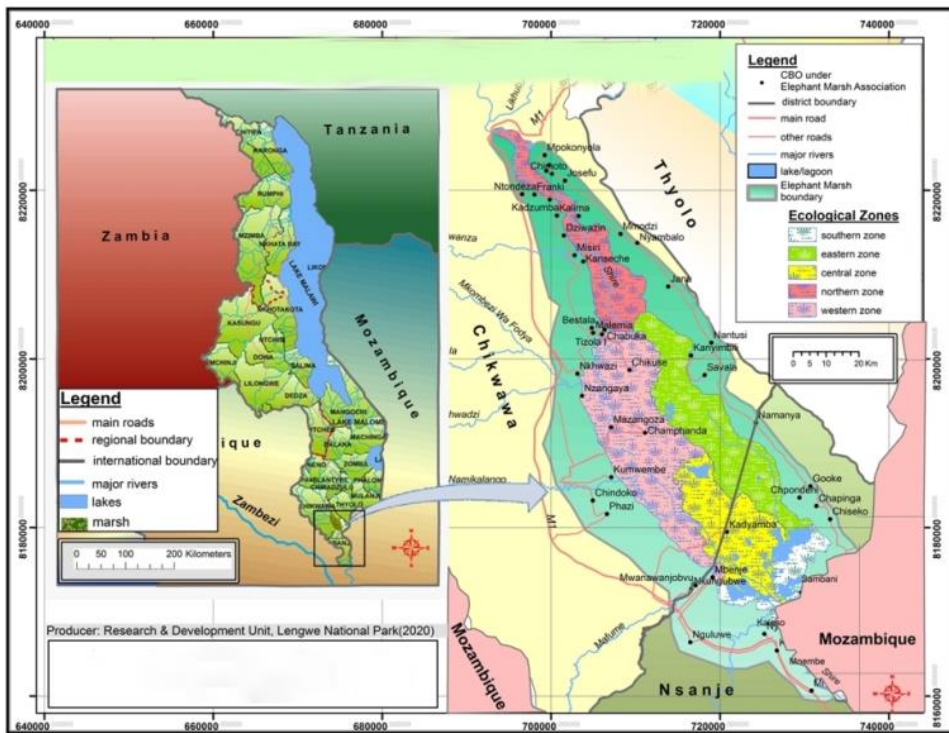


**Figure 2:** Map of Lengwe National Park showing Old Lengwe and New Lengwe (Extension Area).

### 1.1.2 Elephant Marsh

The Elephant Marsh lies within the floodplain of the Lower Shire River in southern Malawi between the towns of Chikwawa and Chiromo in southern Malawi (Figure 3) between  $S14^{\circ}25' - 17^{\circ}50'$  and  $E35^{\circ}15' - 35^{\circ}15'$ , shared by the two administrative districts of Chikwawa and Nsanje. In the northwest, the Marsh is typically a seasonal wetland; centrally, it is semi-permanent marshland, and; in the south, it is characterized by semi-permanent marsh and shallow lakes. It covers an average area ranging from  $500 \text{ km}^2$  in the dry season to  $2\,700 \text{ km}^2$  in the wet season. Its core area is a mosaic of rooted swamp vegetation (sudd), floating vegetation and open water with grassy margins. This is surrounded by seasonally-inundated grassy floodplains, which are in turn (originally) bordered by woodland.





**Figure 3:** Location of the Elephant Marsh

Elephant Marsh contains large areas of functional marshes and floodplain habitats to support significant biodiversity and ecosystem services though the resource density has been eroded due to over utilization. Currently, the most naturally-functioning and least disturbed open waters and marsh area, are found in the Centre and Southern portions of the Elephant Marsh, largely due to their being permanently inundated and difficult to access.

The Elephant Marsh is dominated by marsh and floodplain habitat and as such the vegetation comprises graminoids (grasses, sedges, rushes and reeds). A large proportion of the floodplains and some of the marsh periphery are cultivated, which means that the dominant undisturbed habitat is marsh. The numerous lakes (referred to as lagoons by the locals), which may only be connected to the river channels in the wet season, are dominated by floating and submerged aquatic plants and sustain large populations of water fowl and fish. Most river banks have been cleared for cultivation and so there are virtually no trees and shrubs present in the riparian area. Islands of elevated land, other than river banks, are small in extent and mainly peripheral. Sandbanks occur in the Shire River channel and generally are poorly vegetated, as are the strongly flowing river channels.

The wetland is a source of livelihood to over a million people who are dependent upon the wetland's natural resources for their food, water, construction materials and cultural identity. The total annual value of the marsh was estimated between 5 and 12 million US dollars per year (GoM, 2016). The marsh is threatened by human population growth, upstream developments leading to flow modifications, increased human encroachment, overfishing and invasive alien species among others.

The total annual provisioning value was at approximately US\$5 million (GoM, 2016) assuming that the lower end estimate of fisheries values is sustainable. Most of this value stems from the fisheries and the provision of thatching grass. The total tourism/recreation value was in the

order of US\$17 500 per annum which would have been higher if the hunting safari was still operating. the potential values in terms of tourism/recreation will be much higher once the process of creating the marsh as CCA and development of ecotourism completed under SVTP1 and 2 complete, however the sustainability of those operations had not been demonstrated.

Attributing an annual value to the regulating services offered by the Elephant Marsh has proven to be difficult given the uncertainties and lack of data in modelling. Flood retention values could only be estimated for certain return flood periods, while these values themselves are quite high, floods do not occur every year and the estimated annual value of US\$3.3 million was seen to be more realistic. Estimated values for sediment retention were very high (US\$252 million per year), however, they completely contingent on a plan to develop the Shire Zambezi Waterway Project. Carbon storage values were estimated to be low based on the social cost to Malawi (US\$3596) however may have a higher global social cost (US\$20 million). The GoM (2016)Report recommended that further work is required to properly estimate the value of regulating services provided by the Elephant Marsh.

A survey on Traditional Knowledge Holders carried out by the NEA (2022) revealed that Elephant Marsh has a well-defined community that possesses a close and profound relation with the equally well-defined marsh. Communities own clearly defined areas for cultivation along the Marsh which have been passed on in families from generation to generation over the years. These clearly defined boundaries generally increase the security and opportunities for the long-term well-being of local communities. The local communities around elephant Marsh have played a big role in the preservation of most of the existing biodiversity of Elephant Marsh for their own benefit as well as that of society at large.

Local communities in Elephant Marsh have accumulated knowledge on how to adapt to floods and droughts through sustainable use of biodiversity and ecosystem services. In Elephant Marsh, local women have traditionally grown crops along the Marsh and have been caretakers, offering rites and spiritual practices when in need. Women have also played a role as carriers and stewards of water, which is linked to their important role as life givers. They have an important mission given to them by mother nature to preserve the resources for present and future generations. Not only do the women ensure availability of quality water for domestic use, but also are essential in making it available for spiritual ceremonies like offering at Mbona in Khulubvi. This is why, the creation of the Marsh as CCA will allow community legitimacy to their areas as the process allows communities to register their land parcels and get ownership/title deed to the land while following internationally recognized (Convention on Biological Diversity, IUCN) conservation methods for indigenous and local communities.

## **1.2 Background**

Construction of the canal and the subsequent planned agricultural activities are anticipated to have both negative and positive impacts on the environment and people around Lengwe National Park and Elephant Marsh. The negative impacts include habitat destruction (e.g. through pollution), increased poaching incidences, water abstraction for the Elephant Marsh. The positive impacts include improved food and income security of the target communities.

In view of these perceived impacts, an Environmental and Social Impact Assessment (ESIA) was conducted and disclosed in August 2019 for the entire command area of SVTP subject to

updates that would arise based on emerging technical, environmental and social information. Based on this ESIA, an ESMP for SVTP-1 was developed.

Between November, 2021 and May, 2022 the Government of Malawi undertook to update the program ESIA and develop an ESMP for SVTP-2 including the Elephant Marsh. In both documents, an undertaking to update the documents based on new information prevails. The following documents were also developed and are being disclosed on the websites of SVTP and World Bank:

- a. Environmental and Social Commitment Plan (ESCP); and
- b. Stakeholder Engagement Plan (SEP)

Both the ESIA and ESMP recognize the need to revisit the canal alignment to ensure that natural and critical habitat (Figure 4) for nyala (*Tragelaphus angasii*) is not affected by the canal construction works.

Several impacts and mitigation measures, including alternatives, were suggested and included in the ESMP. The following are examples of impacts included in the ESIA report.

- Biodiversity loss that may arise from clearing of vegetation and increase in poaching;
- Drowning of wildlife in canal
- Restriction on wildlife migration

Regarding alternatives to canal alignment, four options were examined in terms of technical, financial, legal and environmental acceptability. New Route 1 (Figure 4) was recommended for detailed design as part of the scope of works for the Supervision Engineer. The route is of comparable length with the original route that was cutting through the thicket.



**Figure 4:** Map showing Original Route and Option adopted (New Route 1)



In October, 2022, the AFDB, being a co-financier of the SVTP engaged the Government of Malawi through a Project Formulation Mission by, among others, reviewing the adequacy of the ESIA and ESMP. The following were the agreed action between the GoM and AFDB:

- 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 (*Tragelaps angasii*); and
- 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 change in canal alignment to avert the impact on the thicket was effected and 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.

### **1.3 Rationale for literature review**

The impacts and mitigation measures proposed in the ESIA introduced in section 1.2 above are too broad for decision making. For example, under the impact 'biodiversity loss that may arise from clearing of vegetation and increase in poaching' the word 'biodiversity' is too broad. Likewise, the word 'wildlife' under the impact 'Drowning of Wildlife' is also broad. There was need to be specific, however, such specificity required data to be obtained through various means including literature review and actual surveys.

Against the above background, a literature review was conducted for Lengwe National Park and the Elephant Marsh. The objectives of this review were as follows:

- a. Improve presentation of impacts and mitigation measures of the canal construction and agriculture activities for Lengwe National Park;
- b. Identify impacts of the canal construction and agriculture activities on biodiversity and livelihoods for the Elephant Marsh
- c. Identify biodiversity gaps that may require field work to generate more biodiversity data.
- d. Identify critically endangered, endangered or restricted range species.

## **2. CHAPTER 2: POLICY AND LEGISLATIVE FRAMEWORK**

This chapter provides the relevant African Development Bank and World Bank policies that are triggered by the project. In addition, it also highlights relevant national policies and legislative frameworks that are applicable for the project.

### **2.1 World Bank and African Development Bank Requirements Applicable to the Canal Construction in Lengwe National Park (LNP)**

The construction of a canal through the LNP based on the Technical Feasibility Study (TFS) impacts on the thicket that is claimed 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 Environmental and Social Standards 6 (ESS6) of the Environmental and Social Framework (ESF) of the World Bank and OS3 of the Integrated Safeguard Systems of the African Development Bank.

The requirements of the two standards from the two banks are similar with minor differences as summarized in

**Table 1** below:

**Table 1:** Comparison of World Bank ESS 6 and AFDB OP 3

World Bank ESS 6	AFDB OS 3	Comment
<p><b>In Case of Critical Habitat:</b></p> <ul style="list-style-type: none"> <li>i. No other viable alternatives within the region exist for development of the project in habitats of lesser biodiversity value</li> <li>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</li> <li>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</li> <li>v. The project is not anticipated to lead to a net reduction in the population of any Critically Endangered, Endangered or</li> </ul>	<p><b>In Case of Critical Habitat:</b></p> <ul style="list-style-type: none"> <li>i. The mitigation hierarchy has been implemented;</li> <li>ii. The project provides clear benefits and positive outcome for biodiversity and ecosystem services;</li> <li>iii. The project-related activities will not have adverse effects (direct, indirect, or cumulative) on the criteria for which the critical habitat was designated;</li> <li>iv. The project will not have any negative effects on critically endangered or endangered species;</li> <li>v. The project will achieve the previous two points without offsets or a “net gain” analysis; and</li> <li>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.</li> </ul>	<p>Overall, the two standards from the two banks are similar, for instance:</p> <ul style="list-style-type: none"> <li>i. Points iii and vi for ESS 6 auger well with point iii from OS 3;</li> <li>ii. Point vii from ESS 6 and vi from OS 3 are similar; and</li> <li>iii. Points v from ESS 6 and iv from OS 3 are similar.</li> </ul>

<p>restricted-range species, over a reasonable timeframe</p> <p>v. The project will not involve significant conversion or degradation of critical habitats</p> <p>vi. The project's mitigation strategy will be designed to achieve net gains of those biodiversity values for which the critical habitat was designated</p> <p>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.</p>		
<p><b>Legally protected and internationally recognized areas of high biodiversity value</b></p> <p>i. Demonstrate that the proposed development in such areas is legally permitted;</p> <p>ii. Act in a manner consistent with any government recognized management plans for such areas;</p>	<p><b>Legally protected areas and internationally recognised areas</b></p> <p>i. The borrower or client complies with national and local regulations for appropriate environmental management, and consults with relevant stakeholders during the preparation of</p>	<p>i. Point iii of ESS 6 is similar to point i of OS 3;</p> <p>ii. Point ii of ESS 6 is similar to point ii of OS 3; and</p> <p>iii. Point iv of ESS 6 agrees with points iii and iv of OS 3</p>

<p>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</p> <p>iv. Implement additional programs, as appropriate, to promote and enhance the conservation aims and effective management of the area.</p>	<p>management and mitigation measures.</p> <p>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, protected area, or wildlife agency.</p> <p>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</p> <p>iv. The borrower or client does not encourage the degazetting or downgrading of protected areas status</p>	
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In view of the requirements of the ESS 6 and OS 3, SVTP undertook to interrogate the options in Figure 4 and adopted the alignment in Alignment1, New Route 1. The Construction parameters stipulated in table below were the basis for the decision.

**Table 2:** Construction Parameters Considered in Choice of canal route

Parameter	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 <sup>2</sup>	280,500	456,900	408,100	972,000
Area of Natural Habitat lost temporarily	m <sup>2</sup>	85,000	127,900	127,900	167,800
Area of Critical Habitat permanent lost	m <sup>2</sup>	142,560	-	-	-
Area of Critical Habitat temporarily lost	m <sup>2</sup>	43,200	-	-	-
Area of compensation planting	m <sup>2</sup>	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 <sup>3</sup>	1,063,416	1,680,337	1,011,292	23,120,161
<b>Approximate cost</b>	<b>USD</b>	<b>10,456,509</b>	<b>12,292,489</b>	<b>24,762,679</b>	<b>130,686,882</b>

It will be appreciated that although New Route 1 costs more compared to the original route by US\$1,835,980.00, New Route 1 was adopted because it avoids loss of the critical habitat for Nyala in compliance with national and banks policies.

## **2.2 Relevant National Policies**

There are several policies relevant to environment and natural resources management. The developers should be sensitive about the requirements provided in these policies. The following are samples of such policies.

### **2.2.1 National Environmental Policy (2004)**

The National Environmental Policy of 2004 aims at narrowing the gap between degradation of the environment and depletion of natural resources on one hand and sustainable production and economic growth on the other.

The policy contains strategies on environmental planning and environmental impact assessment, audits and monitoring among others. On environmental planning, the objective is to ensure that national and district development plans integrate environmental concerns in order to improve environmental management and ensure sensitivity to local concerns and needs. On Environmental and Social Impact Assessment, the objective is to regularly review and administer the guidelines for ESIA, audits, monitoring and evaluation so that adverse environmental impacts can be eliminated or mitigated and environmental and social benefits enhanced.

The relevance of this policy to the proposed project is that during the construction, the activities of the project will among other things involve clearing of vegetation, natural habitats, which may potentially cause degradation and affect terrestrial, and aquatic biodiversity

### **2.2.2 National Climate Change Management Policy (2016)**

The National Climate Change Management Policy (NCCMP) aims at providing a mechanism for harmonizing and enhancing the planning, development, coordination, financing and monitoring of climate change initiatives and programmes in Malawi. The policy goal is to promote climate change adaptation, mitigation, technology transfer and capacity building for sustainable livelihoods through Green Economy measures for Malawi.

The policy commits to reduce vulnerabilities of climatic hazard that affects the wildlife sector such as drought and bushfires. Drought and bushfires affect animal production systems and migratory habits. It is indicated in the National Adaptation Programs of Action (NAPA), that the 1970/80 drought resulted in the deaths of Nyala in Lengwe National Park in Chikwawa and the migration of most wildlife animals from the game reserve.

The relevance of this policy to the proposed project is that clearing of vegetation for construction works will potentially reduce carbon sinks and increase levels of carbon dioxide into the atmosphere. Such an increase will exacerbate the effects of climate change on fauna, flora and people's livelihoods. In this respect, appropriate mitigation measures should be put in place to ensure the risks and impacts of the project are managed sustainably and in accordance with the principles, rules and guidelines set out in the Environmental and Social Management Plan (ESMP) developed for the project.

### **2.2.3 National Fisheries and Aquaculture Policy (2016)**

The National Fisheries and Aquaculture Policy is a guiding framework for addressing the challenges and emerging issues of the fisheries sector, and to provide linkages with the emerging cross-cutting policies, plans and activities of national and regional bodies where they



affect or interact with fisheries. The priorities of the policy include enhancing capture fisheries; aquaculture development; fish quality control and value addition; governance; social development and decent employment; research and information; and capacity development.

The relevance of this policy to the proposed project is that the Elephant Marsh which is an important source of fisheries, including for subsistence and economic livelihoods could be affected from any changes in water flows and potential pollution from farming activities that will be promoted through the project.

#### **2.2.4 National Wildlife Policy (2018)**

The National Wildlife Policy aims to provide guidance and direction to all stakeholders for the development and strengthening capacity in the wildlife sector so that there is meaningful contribution towards socio-economic development of the country. The policy focuses on conservation, management and restoration of Malawi's wildlife resources inside and outside protected areas; wildlife community extension and public environmental conservation education; wildlife research and monitoring; infrastructure development in protected areas and some cross cutting issues.

Since the canal will be directly constructed in the protected area, where wildlife is resident, this policy will need to be actively ensured. The clearing of vegetation, and natural habitats during the construction will cause loss of fauna and flora. There could be potential death of animals, impact on nesting and reproduction processes, fragmentation of the park and increase in incidences of illegal activities.

#### **2.2.5 National Biodiversity Strategy and Action Plan II (2015 – 2025)**

This National Biodiversity Strategy and Action Plan (NBSAP) II is a guiding framework document for planning and implementation of biodiversity activities in Malawi. The strategy aims at enhancing conservation and sustainable use of biodiversity for the environment and human well-being. The NBSAP has indicated habitat loss and fragmentation, over-exploitation, invasive alien species, climate change and pollution among the major threats to biodiversity in Malawi. The project in question could result in habitat loss and fragmentation, over-exploitation of biodiversity, introduction of Invasive Alien Species into the National Park or further spread in Elephant Marsh, Climate Change due to removal of forest cover and pollution from wastes and operation of irrigation into elephant Marsh. It is therefore important that the strategies that have been outlined in the NBSAP for mitigation of these threats should guide the mitigation of the negative impacts from the activities of the project. In this regard, the following targets of the NBSAP should be observed during implementation of this project:

- Target 6 which highlights the need to protect habitats and restore and rehabilitate degraded habitats as relevant.
- Target 7 which highlights the need to manage and sustainably manage aquatic biodiversity including the need to identify, rehabilitate and protect fish spawning and nursing areas, undertaking ex-situ conservation of threatened or endangered aquatic species, and implementing plans for management of endemic fish
- Target 8 which highlights the need to increase area under forest cover by 4%, manage sustainably area under forest cover to ensure conservation of biodiversity including the need to implement effective reforestation programmes that ensure the survival and diversity of planted trees, implement community based programmes on conservation and sustainable use of forest biodiversity and promote improved forest management.

- Target 9 which highlights the need to ensure that invasive alien species and their pathways are identified, prioritized for control and prevention from movement and spread.
- Target 10 which highlights the need to reduce pollution to minimize ecosystem degradation and biodiversity loss and includes actions for capacity building on monitoring of environmental pollution, implementation of the polluter pays principal and promotion of reduction, reuse and recycling principals among others.
- Target 11 which highlights the need to prevent extinction of known threatened species and improve and sustain their conservation status and includes the need for increasing connectivity between protected areas and wildlife home ranges, implementing strategies to manage threatened and endemic species, conducting robust species monitoring using methods that account for both common and threatened species , identifying and characterizing biodiversity hotspots and ensure that protected areas are able to seek funds for management
- Target 12 highlights the need to maintain and safeguard the genetic diversity of wild and domesticated plants. Considering that Lengwe National Park is a known home for the wild relatives of domesticated plants including rice, there is need to observe the actions in the NBSAP including collecting representatives of common flora and fauna currently not available in the Herbarium and Museums Natural History Collections, maintaining and promoting local land races, promoting cultivation of indigenous plant species and identification of areas that contain wild relatives for conservation.
- Target 15 highlights that the supply of important ecosystem services is safeguarded and restored taking into account gender roles and responsibilities of the youth, the poor and vulnerable. Considering that Elephant Marsh supplies important ecosystem services, the actions of the NBSAP including development of collaborative management programs for the terrestrial and aquatic ecosystem with participation of vulnerable groups including women should be taken into account.

### **2.2.6 Guidelines for Environmental Impact Assessment in Malawi (1997)**

Guidelines for Environmental Impact Assessment (EIA) aim to facilitate compliance with Malawi's EIA requirement by Government, project developers, donors and the general public. The guidelines help to integrate environmental and social concerns in national development and are applicable to all types of projects, in the public and private sectors, for which EIA studies may be or are required.

EIA guidance was published in the Gazette to provide guidance on what constitutes compliance with Malawi's Environment Act, which is considered pertinent to the 2017. Construction of the canal in Lengwe National Park qualifies for a mandatory ESIA and ESMP as it falls under projects for which ESIA is mandatory as listed below:

- A1.2 Irrigation schemes designed to serve more than 10 ha
- A3.2 Construction of new water pipelines or canals longer than 1 km, or expansion to existing water pipelines or canals by longer than 1 km, where the cross-sectional area is greater than 20 square meters and the volume of water to be carried will be greater than 50 cubic meters per second.
- A3.6 Construction or expansion of dams with a height of 4.5 m or higher

- A8.1 All mining of minerals, expansions to mines, mining exploration activity, minerals prospecting activity, quarries, gravel pits and removal of sand or gravel from shore lines, except for those activities which have received a project specific exemption under subsection 26 (3) of the Environment Management Act signed by the Director for Environmental Affairs and co-signed by the Director of Mines [in this case, 26 (3) states: A licensing authority shall not issue any license under any written law with respect to a project for which an environmental impact assessment is required under this Act unless the Director has certified in writing that the project has been approved by the Minister under this Act or that an environmental impact assessment is not required under this Act.]
- A11.2 Construction of dams or weirs with a height of greater than 2 meters, or which divert more than 20 cubic meters per second, or any bypass channels or channel realignments to remedy riverine erosion or flooding.
- A13.2 Projects, in proximity to, or which have the potential to affect national parks, game reserves and protected areas.

## **2.3 Relevant Legislation**

### **2.3.1 The Constitution of the Republic of Malawi (1995)**

Section 13 of The Constitution of the Republic of Malawi sets out a broad framework for sustainable environmental management at various levels in order to:

- Prevent the degradation of the environment;
- Provide a 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 the sustainable development of natural resources;
- Conserve and enhance the biological diversity of Malawi; and
- Enhance the quality of life in rural communities with the ultimate aim of attaining sustainable development.

The implication of this provision is that Government, its cooperating partners and the private sector have a responsibility of ensuring that projects are undertaken in an environmentally and socially responsible manner. This biodiversity consideration in ESIA will therefore be undertaken in line with the constitution.

### **2.3.2 Environment Management Act (2017)**

The Environment Management Act makes provision for the protection and management of the environment and the conservation and sustainable utilization of natural resources. Under Section 31, the Act states that *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 and (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.*

In addition, section 68 of the Act stipulates that The Authority shall, in consultation with relevant lead agencies,— (c) determine actual and potential threats to the biological diversity of Malawi and devise such measures as are necessary for preventing, removing or mitigating the effect of those threats; (d) devise measures for the better protection and conservation of rare and endemic species of wild fauna and flora; (e) develop national strategies, plans and programmes for the conservation of the biological diversity of Malawi; (f) require, in writing, any developer, including the Government, to integrate the conservation and sustainable utilization of the biological diversity of Malawi in any project the implementation of which has or is likely to have detrimental effects to the biological diversity of Malawi.

The Act therefore requires an ESIA to be prepared and submitted to the Malawi Environmental Protection Authority (MEPA) for approval prior to undertaking certain activities listed in the Gazette. The most recent Gazette publication is the ESIA Guidelines prepared by MEPA, that include details of those projects for which ESIA is Mandatory and those for which the ESIA may be required.

### **2.3.3 National Forestry (Amendment) Act (2020)**

The Forestry (Amendment) Act, 2020 provides for participatory forestry, forest management, forestry research, forestry education, and forestry industries. In line with the forestry Act, the mitigation activities of the project will have to strengthen capacity of Village Natural Resources Management Committees living around Lengwe and Elephant Marsh to enable them establish tree nurseries that will be planted to replace trees that may have been affected by project activities but also to enhance the biodiversity of outside of protected areas.

The project activities will be carried out in compliance with the requirements of the National Forestry (Amendment) Act to ensure it is implemented in a friendly and socially acceptable manner to enhance fauna and flora conservation and for the benefit of the present and future generations.

### **2.3.4 Fisheries Conservation and Management Act (1997)**

The Act provides for the regulation, conservation and management of the fisheries of Malawi and for matters related to fisheries. Section 43 (1) prohibits the discharge of any waste or natural water containing waste in water bodies which will affect fish and other aquatic life/biota. The Act further stipulates that no person shall disturb, injure, poison, kill or detrimentally affect any fish, fish spawning ground, including any aquatic plant life or food for fish in any river, stream, lake or other part of the fishing waters by casting, discharging, introducing or allowing to fall, flow or percolate into such waters any sawdust or sawmill refuse, oil, chlorinated hydrocarbon, biocide, pesticide, toxins or any other substance, heavy metal or other material or rubbish which could lie on the bed of such waters.

The implication of this project on the Act is that during the implementation phase of the project will involve use of chemical fertilizers and herbicides for production of crops which if not managed may also pollute the surface water bodies thereby affecting aquatic and semi-aquatic fauna such as macro-invertebrate species.

### **2.3.5 National Parks and Wildlife (Amendment) Act (2017)**

The National Parks and Wildlife (Amendment) Act was gazetted in 2017 and the purposes of the Act are to ensure the conservation of selected samples of wildlife communities in Malawi; the protection of rare, endangered and endemic species of wild plants and animals; the sustainable use of wildlife and minimization of conflict between human beings and animals; the control of dangerous vertebrate species; the control of import, export and re-export of

wildlife species and specimens; the implementation of relevant international treaties, agreements or any other arrangement to which Malawi or the Government is a party; the promotion of local community participation and private sector involvement in conservation and management of wildlife; and the protection and management of protected areas.

Part IV sections 23 to 24 of the Act, stipulates the need to conduct ESIA for any proposed development that is deemed to have adverse impacts on the wildlife species or community. In this respect, an ESIA study must be carried out in line with the Act and EMA of 2017 and a report must be developed on the same to enable the Minister responsible for wildlife and the Director of Malawi Environmental Protection Authority (MEPA) to approve it or reject it.

The implication of this project on this Act is that during the construction and operation phase, the activities can cause loss of both terrestrial and aquatic fauna species.

### **2.3.6 National Parks and Wildlife (Protection, Endangered and Listed Species) (Declaration) Order (2017)**

This order is an extended version of the National Parks and Wildlife (Amendment) Act of 2017. The Declaration Order contains a list of species of wild plants, fungi, and wild animals specified in the Schedule hereto are hereby declared to be protected, endangered and or listed species for the purposes of the Act.

Part I of the Declaration Order contains protected species of wild plants, fungi and animals. This protected species have all the taxonomic groups of wildlife plants and animals that are declared to be protected in the country. Part II of the Order contains species of wild plants and animals that are categorized as endangered in the International Union for Conservation of Nature (IUCN) Red List of Threatened Species, and those listed in Appendix II of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES), and Part III listed species of wild plants, fungi and animals that are categorized as Critically Endangered and those listed in Appendix I of CITES.

The relevance of this Order on the proposed project is that the lists will help the developer to double check and determine species of fauna species recorded from the field surveys that are protected, threatened and endemic in the project area and in areas of project influence so that sound and robust strategies and action plan as well as mitigation measures should be developed to protect them from becoming extinct through the adverse impacts of the project and exploitation for wildlife trade. Therefore, this study report is developed in line with this Declaration Order.

## **2.4 Institutional Arrangements**

A number of institutions, governmental and non-governmental, will provide input into designing, consultations, implementation and monitoring of biodiversity during construction and operation of the project. The successful implementation of the ESIA will be dependent on the effective coordination between the various sectors and stakeholders. The most relevant institutions in relation to the project will include the following:

### **2.4.1 National Institutions**

#### **2.4.1.1 Malawi Environmental Protection Authority**

The Malawi Environmental and Protection Authority will be important for administering the ESIA process including reviewing, conducting public consultations on the findings, licensing the Project developer and monitoring implementation of the ESMP's once approved.

#### **2.4.1.2 Department of National Parks and Wildlife**

DPNW will be responsible for providing practical guidance on the conservation and management of flora and fauna species in Lengwe National Park and Elephant Marsh including ecosystem management approach. The Department will also be responsible for enforcing the National Wildlife Act, dealing with illegal incidences, managing the control of invasive alien species, implementation of mitigation actions that are identified in the ESMP.

#### **2.4.1.3 2.13.1.3 The Department of Forestry**

The Department of Forestry has the structures and means to strengthen capacity of the communities in tree nursery establishment and management. For the Elephant Marsh, the Department will encourage and promote planting of indigenous and fruit tree seedlings on farms, including agro-forestry trees to offset the number of trees to be cut down. Institutions that the project will utilize through the Department of Forestry include the Local Forest Management Board, Village Forest Area Committees, Village Natural Resources Management Committees (VNRMC) and the local leaders.

#### **2.4.1.4 Ministry of Agriculture**

Some of the areas around the Elephant Marsh will be subjected to irrigation farming that may potentially pollute the marsh through chemical fertilizers and herbicides as already pointed out. Ministry of Agriculture will advise on sustainable farming practices that are less harmful to the marsh.

#### **2.4.1.5 Chikwawa and Nsanje Councils**

The two local structures will be important for implementation of mitigation measures in Elephant Marsh. Structures through which development projects are implemented at the district council include the District Executive Committee (DEC), Area Development Committees (ADCs)/ Community Development Committee (CDC) and the Village Development committee (VDC):

- **The District Executive Committee (DEC)** is the technical advisory body to the District Council. It is composed of government line ministries, statutory corporations and non-governmental organizations working in the district.
- **The Area Development Committees (ADC)** are made up of chairpersons or deputies of VDCs, ward councillors, religious bodies, youth, women, business representatives and the chairperson of the Area Executive Committee. They are responsible for mobilizing community resources and determining development interventions in the area. Area Executive Committees (AEC) are composed of extension workers of government and non-governmental organizations (NGOs) operating in the traditional areas. They act as the technical arm at the Traditional Area level and are responsible for advising the ADCs on all aspects of development.
- **The Village Development committee (VDCs)**, facilitated by the AECs, carry out the Village Action Planning activities as basis for the formulation of the District Development Plan (DDP) every 5 years. The VDCs are also involved in the mobilization of community resources for popular participation in self-help initiatives and supervision, monitoring and evaluation of projects.

In all these committees, there key representatives (technical officers) from the Department of Environmental Affairs, Department of National Parks and Wildlife (sometimes depending on the district), Department of Fisheries, and the Department of Forestry who contribute positively towards the any deliberations and make any decision on behalf of their respective departments for the benefit of the nation.

#### **2.4.1.6 The World Bank and the African Development Bank**

As SVTP is co-financed by a number of institutions, the development partners have a pivotal role to play including the provision of financing for the project. The banks will be involved in project monitoring and supervision by staging relevant technical missions as agreed with the Government of Malawi. The Banks' safeguards personnel will work with the counterparts in SVTP to ensure recommendations agreed in this report, ESIA and ESMP are implemented. The two teams will ensure that that thw two banks' safeguard policies are adhered to.

### **3. CHAPTER 3: METHODOLOGY FOR BIODIVERSITY ASSESSMENT**

The Convention on Biological Diversity defines biodiversity as the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part: this includes diversity within species, between species and of ecosystems. Biodiversity and its ecosystem services are fundamental for human survival and wellbeing. This chapter outlines and describes methods for literature review, field assessment and data analysis for key biodiversity components of fauna and flora for Lengwe National Parks and the Elephant Marsh.

#### **3.1 Literature review**

To assess the baseline biodiversity in Lengwe and Elephant Marsh, the first step was a planning meeting to develop Terms of Reference was conducted between SVTP ESIA specialist and the Biodiversity Team from Environmental Affairs Department. The meeting came up with the Terms of Reference to define the scope of work, the expertise needed, the timelines and determine how the work will be funded. The meeting also proposed names to form a task team which included the Natural Resources Coordinator of SVTP, the Fisheries and Wetlands Expert of SVTP, the Protected Area Management Specialist of SVTP and Lengwe National Park Research team in addition to the ESIA Specialist and the Biodiversity Team from EAD. The Task team held meetings in November 2022 and discussions geared towards introducing all team members with others and bringing uniformity of expectations and understanding amongst all. Preliminary field visits were later conducted by the Task team to appreciate the new location of the canal, discussed the project environmental prospects, pinpoint the information already available on presence and status of any endangered species in the area. The team also reviewed the three alternative sites for the canal and agreed that the option that avoids the thicket is the best option and further biodiversity studies should be conducted on the preferred option.

Literature review mainly relied on the following documents:

1. Climate Resilient Livelihoods and Sustainable Natural Resource Management in the Elephant Marsh which has four sub-study reports namely:
  - i. Sub-Study 1: Livelihood Report
  - ii. Sub-study 2: Hydromorphology of Elephant Marsh Report
  - iii. Sub-study 3: Ecosystem services of the Elephant Marsh
  - iv. Sub-study 4: Biodiversity of the Elephant Marsh
2. Unpublished reports from Lengwe National Park on large mammals, birds, vegetation and illegal incidences;
3. Unpublished reports from the Elephants Marsh on birds, crocodiles, hippopotamus and illegal activities;
4. The 2021-2025 Lengwe National Park General Management Plan;
5. Precision-a Consulting Firm conducting Aerial surveys in Elephant Marsh and Lengwe National Park.

#### **3.2 Field assessments**

For Lengwe National Park, literature review results showed that the data collected and analysed were for the whole park. However, the proposed canal will only affect a small section of the park (11 km long and 45 metres wide). In this regard, there was need for canal specific biodiversity information focussing on vegetation, small mammals and birds. For both the



Elephant Marsh most of the data were outdated. For this reason, there was need to conduct field assessments.

### 3.2.1 Lengwe National Park

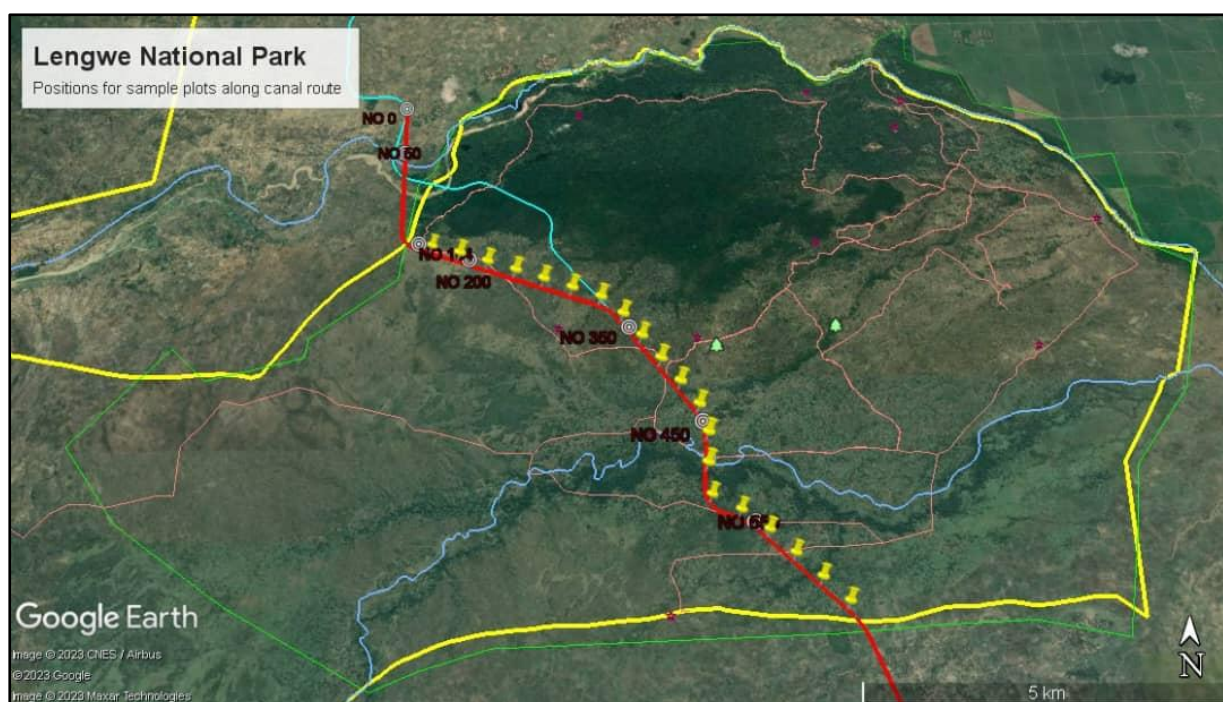
The following assessments were done along the proposed canal covering vegetation, small mammals, birds and reptiles

#### 3.2.1.1 Vegetation assessment

The assessment exercise targeted woody plants, herbs, shrubs, and, grasses along the area earmarked for the construction of an irrigation water canal.

##### 3.2.1.1.1 Determination of sample points

A systematic sampling design was employed with the first point starting within the 100m in Arc GIS and falling 100m from starting point. 20 sampling points were first distributed evenly along the proposed canal at an interval of 500m using ArcGIS 10.2 software. The predetermined sampling points and their waypoints from the attributes tables were uploaded into GPS units using the DNR Garmin package for easier tracking of points. For ease of navigation to sample plots and identify vegetation cover along the proposed canal, google earth satellite imagery along the entire perimeter of the canal was used. To enumerate vegetation data, Ten (10) odd number sample points (1,3,5,7, 9,11,13,15,17,19) of 1km apart were chosen due to the similarity of vegetation cover along the proposed canal corridor. Figure 5 below shows the targeted sample plots for Lengwe.



**Figure 5:**Map showing the targeted sample plots for the proposed Lengwe water irrigation canal

##### 3.2.1.1.2 Data collection

##### 3.2.1.1.3 Herbs and grasses

Rapid Botanical Surveys (RBS) were employed for herbs and grasses in 20m-by-20m sampling plots. All plant species found in the 400 m<sup>2</sup> quadrant including trees and herbs were identified and recorded including members of the family Poaceae and Cyperaceae (Hawthorne & Marshall, 2016). To quantify the abundance of herbaceous plant species belonging to family Poaceae and Cyperaceae, a nested vegetation sampling method was employed. This is when a

1m<sup>2</sup> quadrat is laid across a 100m<sup>2</sup> quadrat to ensure the efficiency of quantification (method adapted from Whittaker, 1975). Onsite determinations and documentation were done for all herbaceous and grass species found in each of the 1m<sup>2</sup> quadrats. Additional data collected includes; GPS coordinates for each sample point and the frequency of each species. All plant species that could not be identified in the field were collected and pressed for later identification and verification with assistance from resources such as field guides and botanical key specimens at the National Herbarium and Botanical Gardens (NHBG) in Zomba.

Furthermore, GPS readings were captured in areas that have been overexploited for charcoal and firewood. Key informants from the Department of parks and wildlife were also involved in the activity to assist in the navigation to the site and confirmation of illegal activities taking place in the project influence area. In addition to the usual plant inventory methodologies, Kobo toolbox (2014), a simple, robust, and powerful tool for data collection was used to collect additional data.

#### 3.2.1.1.4 Trees and shrubs along the canal corridor

Three (3) concentric subplots of radii, 2m, 5m, and 25m were established at each sample point as depicted in Table 1 and **Error! Reference source not found. 2**. Each of these subplots categorically represented a tree size stratum in relation to tree abundance in the stratum – thus the more trees of a certain stratum, the less the size of the subplot. All trees were tagged, and measured and species identified by experienced botanists and technicians in the field. Tree diameters were measured on all trees at the breast height (DBH) using a diameter tape or Caliper, while the total height of individual trees were measured by using a Haglöf Vertex5. The tree data variables with corresponding scientific names were recorded on a well-designed data collection form (Annex 6).

Vegetative as well flowers and fruits for samples that could not be identified onsite were collected and taken to the herbarium for identification. The trees measurements were meant to help to understand the structure of tree vegetation based on tree sizes (Height & DBH) and also to determine above-ground biomass (AGB) along the canal corridor. For ease of onsite identification and distinction amongst tree sizes, trees were categorized into three subgroups namely regeneration, saplings, and juvenile/adult trees. All trees with DBH (i.e., 1.3m above ground) of less/equal to 5cm were classified as regenerants and saplings while those 5cm while those above the cut off point of 5cm were classified as Juveniles/Adult trees. DBH and height were recorded in in the 25m sub-plot only because in all plots there trees were absent in subplots less than 5m. Table 1 shows variables recorded from sample plots.

**Table 3:** Variables Recorded From the Three Sub-plots

Sub-plot	Vegetation type assessed	Records collected
2m	Regenerants/herbs	<ul style="list-style-type: none"> <li>● Species</li> <li>● Regeneration count</li> <li>●Regeneration strata</li> </ul>
5m	Saplings	<ul style="list-style-type: none"> <li>●Trees number</li> <li>● Species</li> <li>● Height (m)</li> <li>● Dbh (cm)</li> </ul>

25m	Juveniles/Adult trees	<ul style="list-style-type: none"> <li>● Tree number</li> <li>● Species</li> <li>● Height</li> <li>● Dbh</li> <li>● Land use</li> </ul>
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### 3.2.1.1.5 Data Analysis

Data on plant species found was entered and analysed using Microsoft Excel (2016) V1.0 for Personal Computers. Parameters analysed were relative density and abundance. In addition, Statistical software PC-ORD v.6.08, 2011 was used to analyse species richness and biodiversity indices (McCune and Mefford 2016). Furthermore, the software (PC-ORD v.6.08, 2011) was also used to project plant families and lifeform data matrices on the detrended canonical correlation (DCA) biplot.

Researcher used their experience to provide scientific names to plant species observed. However, they had to validate these scientific names using online databases where used to verify plant names in order to follow the best practice in botanical nomenclature. Multiple botanical references exist online and in print to help researchers to check plant names. Since these reference sources vary in their purpose, scope and their degree of currency or maintenance. There was a need to use several databases to ensure that the name presented was current and valid bearing in mind that each reference has limitations: none is perfect. The main databases which were consulted for nomenclatural verifications are presented in Annex 1

### 3.2.1.1.6 Assessment of conservation status of species

To assess the conservation status of the recorded plant species, different reference documents including the IUCN red data list, the Global Biodiversity Information Facility (GBIF) and National Red Data lists were used to categorise species in their appropriate threat categories based on the predefined criterion of IUCN i.e., threatened, endangered, rare, or endemic (Golding et al. 2000). Similarly, the National and Global impact of Invasive and Alien Species was determined using existing literature.

### 3.2.1.2 Mammals, birds, reptiles and amphibians

#### 3.2.1.2.1 Sampling

Sampling was done at 100 metre intervals along the proposed canal. Species recordings were also done in-between observation points. At each sampling point, GPS coordinates were recorded.

#### 3.2.1.2.2 Data collection

##### 3.2.1.2.2.1 Mammals (small and large)

The following four specific methods were used to collect mammal data

- i. direct observation;
- ii. indirectly by recording animal signs such as vocalisations, scats, footprints, diggings, burrows, feeding signs and carcasses.
- iii. Active searching for specimens and signs

### **i. Birds**

Systematic and semi-systematic survey methods were used in sampling the diversity of birds in the area. Key methods used in bird identification were:

- i. use of a pair of binoculars in observing birds; and
- ii. bird vocals heard at the observation points and in between points.

### **ii. Amphibians and Reptiles**

Sampling sites for amphibians and reptiles were concentrated in areas and habitats that could support these animals. The study area was actively searched for potential breeding areas of amphibians (e.g. streams, marshes, small water pools, water channels) and suitable microhabitats for both amphibians and reptiles (e.g. stones, ponds, crevices, leaf litter/debris, rotten log).

### **iii. Fish**

The fisheries team did not manage to sample the fish from the water holes and rivers within Lengwe National Park most of which were not close to the proposed path of the canal. However, key informants were used to provide information on the types of fish found within the rivers and water holes.

#### **3.2.1.2.3 Data analysis**

Data were analysed using excel which helped to calculate totals, means and frequencies. Determination of status global status was done using IUCN Red List Guidelines and website.

### **3.2.2 Elephant Marsh**

#### **3.2.2.1 Data collection**

##### **3.2.2.1.1 Sampling**

The landing sites were not randomly sampled, but the sampling also depended on accessibility by vehicle, and how active the landing site is. The landing sites that were eventually sampled for the rapid assessment were Yolodani and Lisule in Chikwawa district and Chisamba in Nsanje district. Due to poor road network, the researchers did not manage to visit the east bank side of the elephant marsh. A total of 13 boats were sampled from the three landing sites.

There was a total of 6 community members at Lisule, 4 members at Yolodani, and 5 members at Chisamba landing site

##### **3.2.2.1.2 Assessment method**

A fishery can be assessed by using fisheries independent and fisheries dependent method the latter also known as catch based method. These two methods differ in the way that, in fishery dependent, fish is sampled from the fishermen themselves, scientists rely on the catch from the fishermen hence catch based, while in fisheries independent, the scientist design the methods of catching fish, by considering the types of fishing ground, duration of the fishing, the type of gear to use, so as to maximize the chances of observing as many fish species as possible. With fishery independent method the scientist is able to determine the closest or exact geolocation (depending on the type of gear used, active or sedentary) where each fish species was caught from. Due to the time limitation and considering that this was just a rapid assessment, **fishery dependent survey method** was used

Apart from sampling the catch from the fishers, the researchers had two (2) informal group interviews with the beach village committee members, fishers and business women to understand the ecosystem services which they benefit from the water body. Through these informal group interviews, information about the priority fish species preferred by the communities was elucidated. The members also highlighted some of the conservation measures

that they felt should be enforced to protect some of the most important fish species that sustain the livelihoods of the community.

#### **3.2.2.1.3 Fish identification and analysis**

Fish identification, analysis and descriptions was done using a publication by Paul Skelton (2001). This publication has pictures and descriptions of all fish species in the Elephant Marsh.

## Chapter 4: Results and Discussions

### 3.3 Desk Research

#### 3.3.1 Lengwe National Park

##### 3.3.1.1 Fauna

##### 3.3.1.1.1 Large Mammals

Lengwe National Park harbours several species of large mammals. Table 1 below presents 11 key as large mammals. According to this table, the IUCN conservation status for most of these mammals (91%) is ‘Least Concern’. At national level, 7 species are categorised as Endangered, 3 are protected and 1 is listed and protected.

**Table 4:** Common Large Mammals of Lengwe National Park and their conservation status

Species	IUCN Status	National Status
Nyala ( <i>Tragelaphus angasii</i> )	Least Concern	Endangered
Impala ( <i>Aepyceros melampus</i> )	Least Concern	Endangered
Buffalo ( <i>Syncerus caffer</i> )	Least Concern	Endangered
Warthog ( <i>Phacochoerus africanus</i> )	Least Concern	Protected
Kudu ( <i>Tragelaphus strepsiceros</i> )	Least Concern	Endangered
Bush pig ( <i>Potamochoerus larvatus</i> )	Least Concern	Protected
Bushbuck ( <i>Tragelaphus scriptus</i> )	Least Concern	Protected
Grysbok ( <i>Raphicerus sharpie</i> )	Least Concern	Endangered
Common duiker ( <i>Moschus grimmia</i> )	Least Concern	Endangered
Suni ( <i>Nesotragus moschatus</i> )	Least Concern	Endangered
Pangolin ( <i>Smutsia teminckii</i> )	Critically Endangered	Listed, Protected

##### 3.3.1.1.1.1 Large Mammal Population Estimates

**Table 5:** New Lengwe Large Mammal Population Estimates and trends

Animal Species	2019	2020	2021	2022
Buffalo	0	0	0	0
Impala	0	0	0	26
Nyala	0	0	0	0
Warthog	0	0	0	78
Kudu	0	196	81	414
Bushpig	0	0	0	26

Klipspringer	20	0	0	0
Bushbuck	20	0	0	52
Grysbok	39	0	0	0
Common duiker	98	137	81	104
Suni	0	0	0	78
Pangolin	0	0	27	0
Hare	0	0	0	26
Cane rat	0	0	0	78

According to Table 5, in 2019 four species of large mammals were sighted along the transects in New Lengwe. In 2021, only three animal species were sighted. The results show that in 2019, common duiker had the highest population and grysbok came second. In 2021, common duiker was still the most abundant (98). Other animals such as impala, occur in the area but were not sighted during the survey. In the 1980s, John Hough reported the existence of species such as sable antelope, Lichtenstein's hartebeest and zebra. According to the population estimates and patrol reports from rangers, these animals are no longer seen and are therefore feared to be locally extinct.

The comparison is on 2019 and 2021 because these are the years when data on large mammal population estimates were available for New Lengwe.

**Table 6:** Old Lengwe Large mammal population trends (2015-2020).

Year	Buffalo <i>(Syncerus caffer)</i>	Impala <i>(Aepyceros melampus)</i>	Nyala <i>(Tragelaphus angasii)</i>	Warthog <i>(Phacochoerus africanus)</i>	Kudu <i>(Tragelaphus strepsiceros)</i>	Bush pig <i>(Potamochoerus larvatus)</i>	Bushbuck <i>(Tragelaphus scriptus)</i>	Grysbok <i>(Raphicerus sharpie)</i>	Common duiker <i>(Moschus grimmia)</i>	Suni <i>(Nesotragus moschatus)</i>
2015	850	3396	296	62	12	12	105	12	49	12
2016	936	3031	101	99	37	25	111	12	0	62
2017	776	2009	136	99	12	0	37	12	37	37
2018	904	2073	154	104	36	0	81	36	63	58
2019	936	1060	148	197	0	0	25	0	12	62
2020	1678	1392	86	62	99	0	49	12	49	12
<b>Change</b>	<b>+828</b>	<b>-2004</b>	<b>-210</b>	<b>0</b>	<b>+87</b>	<b>0</b>	<b>-56</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>%</b>	<b>+97.4</b>	<b>-59.0</b>	<b>-70.9</b>	<b>0</b>	<b>+725</b>	<b>0</b>	<b>-37.3</b>	<b>0</b>	<b>0</b>	<b>0</b>



Table 6 above shows that the populations of Buffaloes and Kudus increased by 97.4 % and 725 % respectively. The impalas, nyalas and bushbuck population declined by 59 %, 70.9 % and 37 % respectively. The declines are attributed to poaching, encroachment, fires and general habitat destruction.

### 3.3.1.1.1.2 Large mammal distribution

#### a. Distribution by vegetation type

**Table 5:** Large mammal distribution by vegetation type: 2015 (Old Lengwe)

Animal Species	Total sighted	% sightings per vegetation type		
		<i>Acacia nigrescens</i> tree savanna	<i>Combretum/Diospyros</i> tree savanna	Thicket Clump Savanna
Buffalo	69	100	0	0
Bush buck	17	77	23	0
Common Duiker	4	75	25	0
Grysbok	1	100	0	0
Impala	360	94	6	0
Kudu	1	0	100	0
Mongoose	1	100	0	0
Nyala	24	66	17	17
Suni	1	100	0	0
Warthog	5	80	20	0

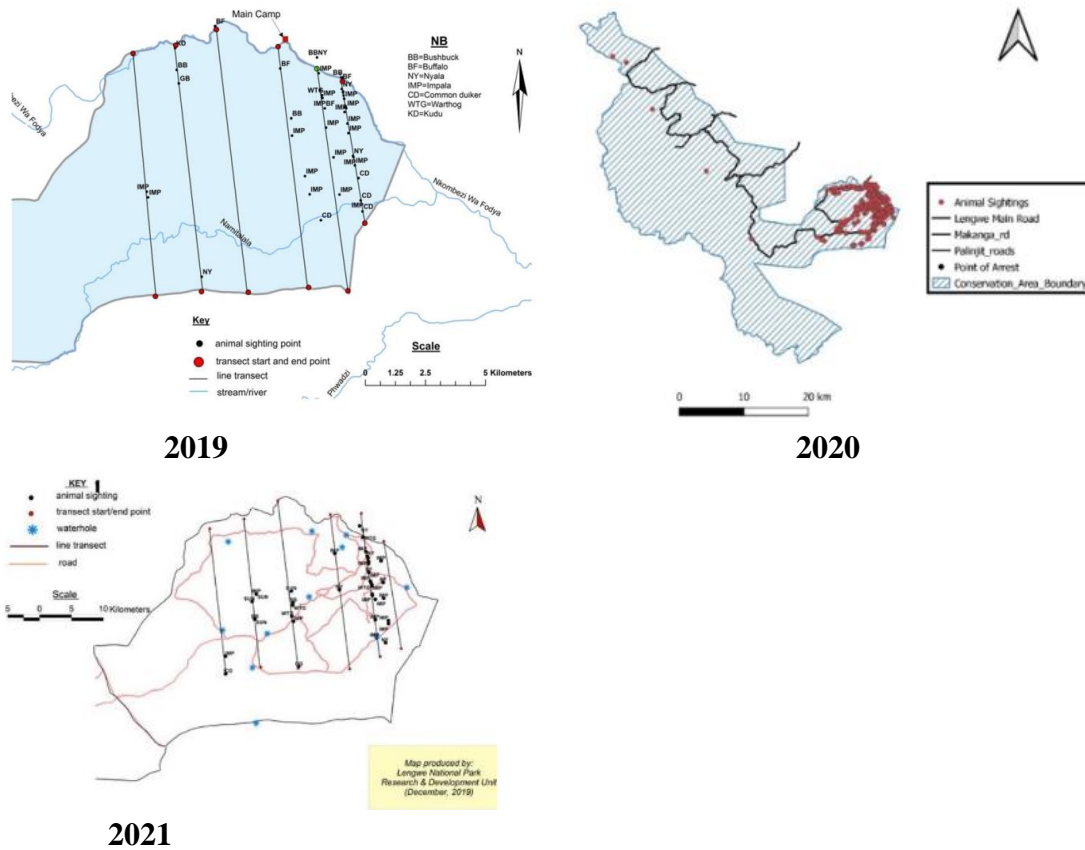
From table 5, it is clear that most of the mammals were sighted in tree savanna type of vegetation, seconded by thicket savanna. The fact that nyala were usually spotted resting in the thickets, the Department of National Parks had reservations regrading construction of the canal in Lengwe National Park. For this reason, this report has provided more insights on the nyala. The significance of the Nyala antelope dates back to 1928. At that time Lengwe was established as a Game Reserve to protect large mammals found in the Lower Shire Valley, especially the **nyala antelope** (*Tragelaps angasii*) and its **habitat** (the thicket) (Mkanda, 1996). As seen in table 4, 66 % of the nyalas were seen in Tree Savanna type of vegetation, falsifying the hypothesis that nyala prefers the thicket. That most nyala were sighted in Tree Savanna would also be a surrogate measure of increased poaching. The nyala move out of the thicket so that they can see poachers from a far.

**Table 6:** Large Mammal Distribution by vegetation type: 2019 (Old Lengwe)

Species	% sightings per vegetation Type			
	<i>Acacia nigrescens</i> tree savanna	<i>Combretum/Diospyros</i> tree savanna	Thicket clump	Thicket community
Suni	0.36	0.00	0.12	0.12
Bushbuck	0.00	0.00	0.12	0.12
Buffalo	9.00	0.00	0.00	0.00
Common duiker	0.00	0.12	0.00	0.00
Grysbok	0.12	0.00	0.00	0.00
Impala	5.57	0.00	5.09	0.00
Nyala	0.83	0.36	0.12	0.12
Warthog	1.30	0.00	0.47	0.12
<b>Total density per vegetation type</b>	<b>17.18</b>	<b>0.47</b>	<b>5.92</b>	<b>0.47</b>

A comparison between 2015 and 2019 shows that most large mammals, including nyalas, were still being mostly sighted in tree savanna.

## b. Large Mammal Distribution by Geographic Location



**Figure 6:** Large mammal distribution according to geographic location (2020), old Lengwe

**Error! Reference source not found.** shows that most large mammals were consistently more sighted in the Eastern side of the park, closer the Lengwe Ranger Camp than in the other areas. The animals congregate closer to the camp because they feel more secure than in the other areas of the park which are prone to poaching.

### 3.3.1.1.3 Large Mammal Mortality (Old Lengwe)

**Table 7:** Large mammal mortality and causes in Old Lengwe

Cause	Species												Total
	Buffalo	Bushbuck	Bush pig	Genet	Impala	Kudu	Mongoose	Nyala	Pangolin	Porcupine	Sumi	Warthog	
Gin Trap	3	1	1	0	6	0	0	2	0	0	0	1	14
Stray Dog	0	2	0	0	0	0	2	0	1	1	0	0	6
Gun shot	18	6	1	0	13	0	0	16	0	0	0	4	58
Pit Trap	0	0	0	0	0	0	0	3	0	0	0	0	3
<b>Wire Snare</b>	<b>33</b>	<b>8</b>	<b>22</b>	<b>0</b>	<b>137</b>	<b>4</b>	<b>1</b>	<b>59</b>	<b>0</b>	<b>4</b>	<b>6</b>	<b>18</b>	<b>292</b>
Stuck in mud	0	2	0	0	0	0	0	0	0	0	0	0	2
Spear	0	0	0	0	0	0	0	1	0	0	0	0	1
<b>Unknown</b>	<b>23</b>	<b>9</b>	<b>4</b>	<b>2</b>	<b>112</b>	<b>3</b>	<b>0</b>	<b>55</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>10</b>	<b>220</b>
<b>Total</b>	<b>77</b>	<b>28</b>	<b>28</b>	<b>2</b>	<b>268</b>	<b>7</b>	<b>3</b>	<b>136</b>	<b>1</b>	<b>6</b>	<b>7</b>	<b>33</b>	<b>596</b>

According to

Table 7 above, wire snares are the major causes of mortality in Old Lengwe, seconded by Unknown causes which could include poisoning, diseases or aging. Figure 7 below shows some of the large mammals found dead but causes were unknown.



(a)



(b)

**Figure 7:** A male nyala (a) and female nyala (b) found dead in July 2017 and November 2019, respectively

#### 3.3.1.1.2 Birds

Lengwe National Park is one of the important bird areas in Malawi with number MW021 on Bird Life International. According to Dowsett (2000) about 312 species were recorded in the park while other records indicate there are about 350 species mostly in Old Lengwe.

In 2015, the list was updated to 368 by the Wildlife and Environmental Society of Malawi (WESM). In 2020, WESM continued with bird surveys and 79 species were recorded in Old Lengwe that included the rarely seen Crested Guinea fowl *Guttera pucherani*, Swallow-tailed Bee-eater *Merops hirundineus*, Cinnamon-breasted Bunting *Emberiza tahapisi*. In New Lengwe, 778 birds were sighted comprising of 153 species. The surveys identified some rare species which included Rudd's Apalis *ruddi*, common in Mozambique but rarely seen in Southern Malawi and was thought to be extinct in Lengwe. Vincent Bunting *Emberiza vincenti* was also recorded for the first time near the Mozambique boundary. The new list consists of 374 species of birds (See Annex 2).

The majority of recorded bird species fall under the least concern on IUCN Red List Category while about 19 species are under vulnerable, near threatened, endangered and critically endangered (IUCN 3.1). The populations for these species which are mostly birds of prey (eagles and falcons) and scavengers (vultures) have been declining due to variety of threats including poisoning, persecution and ecosystem alterations. Such species have small populations and local extinctions may be accelerated by major poisoning events in isolated localised subpopulations. (Datazone Bird Life <http://datazone.birdlife.org/species/factsheet>) The critically endangered species found in Lengwe include Basra Reed Warbler *Acrocephalus griseldis* and Hooded Vulture *Necrosyrtes monachus* while the vulnerable species include Woolly-necked Stork *Ciconia episcopus*, Lanner Falcon *Falco biarmicus* and Southern Ground Hornbill *Bucorvus leadbeateri*.

#### **3.3.1.1.3 Reptiles and Amphibians**

There are no records available at this stage. The National Museums of Malawi also does not have specimens from Lengwe NP. A full Herpetological survey of Lengwe NP is therefore required.

#### **3.3.1.1.4 Butterflies**

There are very few records on the butterflies of Lengwe NP prior to observations made by Sherry and Ridgeway (1984), and those collated by Bob Dowsett in 2002. Generally, the Lower Shire has been overlooked in terms of butterfly surveys. Gifford (1965) mentions J. D. Handman collecting intensively around Nsanje. More recently observations made by J. Bayliss and specimens collected by Steve Collins (ABRI) through the SRBMP surveys have added to the database of butterflies recorded from Lengwe NP.

Between November and January and March-April (2015-2016) observations by J. Bayliss on butterflies was carried out in all areas visited with selective collection of specimens for correct identification (247 specimens of 93 species, with an additional 11 species based on sight records).

One butterfly hitherto unrecorded from Malawi was collected in Lengwe, *Acraea atergatis* (Acraeidae), a dry country species known further west in south-central Africa. Other interesting records include *Euxanthe wakefieldi* (Nymphalidae) in Lengwe and the neighbouring Nyala Park at Sucoma. This Eastern biome lowland forest-associated species was previously known in Malawi only from the Malawi Hills and the Nkhata Bay lakeshore, though there is apparently an unpublished record of a vagrant from Blantyre. Also unexpected were the Eastern biome *Hypolimnas deceptor* from Lengwe and Mwabvi, and *Neptidopsis ophione* from Lengwe (both Nymphalidae). These are also unrecorded from southern Malawi. Among the Lycaenidae, *Pentila tropicalis* is an Eastern forest associated species (known hitherto from Malawi only in the Malawi Hills), while a number of species are newly reported from the Lower Shire Valley, including such scarce butterflies as *Baliochila hildegarda* and *Lachnocnema durbani*.

The combined list of 104 species is far from complete and an additional survey of the butterflies of Lengwe NP would be recommended. One would expect 150-200 species in such an area. Based on the mix of habitat types and the large area that the park occupies the area could yield rare and interesting species.

#### **3.3.1.2 Vegetation**

The 2021-2025 Lengwe National Park General Management Plan provides detailed information regarding vegetation type including plant species found in each of the vegetation type. The common vegetation types highlighted include mopane woodland, thicket/savannah, mixed woodland, and Riparian. A vegetation survey conducted in new Lengwe from 26<sup>th</sup> Nov to 8<sup>th</sup> December 2022, identified one hundred and three (103) species of which 4 were endangered, 8 vulnerable and 22 were identified as least abundant, *Combretum zeyheri* was the only abundant species identified. Annex 5 provides information on conservation status and invasiveness of some of the plant species identified in the survey. Out of the 90 species 59 were categorized as of Least Concern at Global Level under IUCN, only one species was in this category at national level. Three species in Lengwe have been categorized as Vulnerable, which include; *Pterocarpus angolensis*, *Dalbergia melanoxylon* and *Azelia quanzensis* (Annex 5). The report does not provide detailed

information on number of occurrences for each species identified to justify the categories assigned to the species. Similarly, it is not clear on the methodology used to categorize species in the different conservation statuses. The report has not specified if the number of invasive species found in the study area which needs to be managed and controlled for ecosystem sustainability. Furthermore, the report seems to have targeted higher plants only, overlooking some plant families including grasses (Poaceae). The Poaceae family is one of the most diverse families in the plant kingdom with species that are adapted to different environmental conditions and their contribution to herbivores and reducing soil erosion cannot be overemphasized.

Another vegetation survey conducted in 2021 on the right of way along the canal in Lengwe national park did not provide information on all species found in the proposed canal route. Instead, only one species was highlighted as dominant, *Lecaniodiscus fraxinifolius* was the most abundant species with a maximum value of 13.92 (Utila, 2021).

### 3.3.1.2.1 Trends in Vegetation Cover

**Table 8:** Changes in vegetation cover between 2019 and 2021

Class	Trees cover	Grassland Cover
2019 (ha)	71,898.39	2,413.64
2020 (ha)	62,598.31	2,880.79
2021 (ha)	67,104.22	1,121.68

Source: GoM, 2021

Table 8 indicates that Lengwe National Park is more covered by trees than by grass. For both tree and grass cover, there is a reduction between 2019 and 2021. This is attributed to encroachment and fires by surrounding communities.

### 3.3.1.3 Illegal Activities in Lengwe National Park

The management of Lengwe National Park is challenged by several illegal activities as Figure 8 shows. A total of 805 illegal activities were recorded in the park between 2011 and 2020. The most common illegal activities include poachers foot prints (138), wire snares (129), gin traps (68), tree cutting (61), and firewood collection (46).

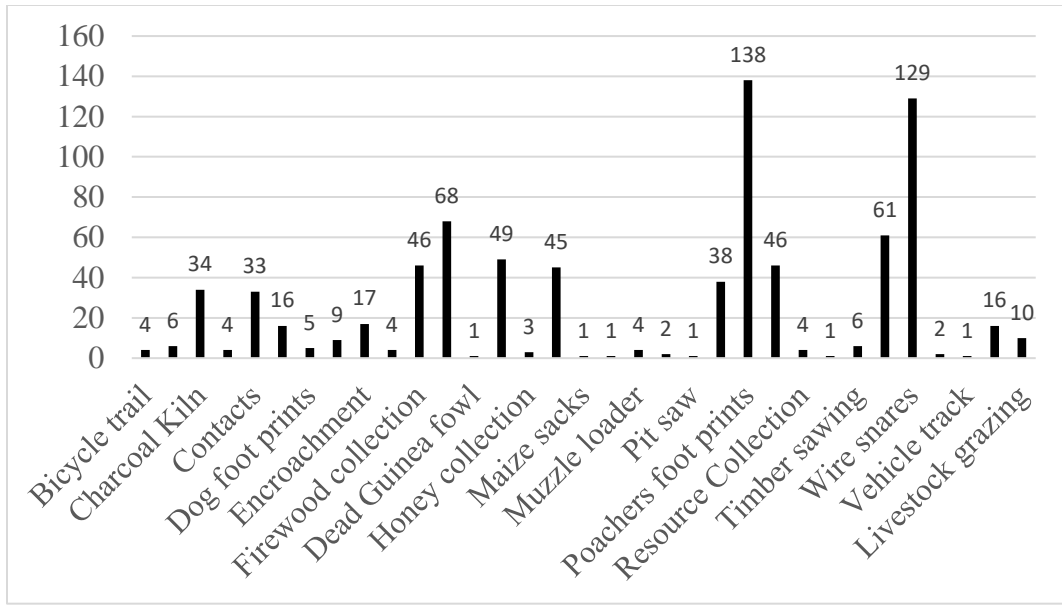


Figure 8: Illegal Activities in Lengwe National Park (2011-2020)

Serious illegal activities such as charcoal production, poaching, timber sawing and tree cutting including bush fires have significantly impacted on biodiversity and ecosystem services in the park.

An aerial survey conducted in Lengwe national park in July 2022 confirms a lot of illegal activities in the area. A total of 601 hotspots area were identified covering an average of 2.5 hectares in the park. In terms of degradation, the survey revealed that Old Lengwe is pretty much intact and is more secure than New Lengwe (extension). The Lengwe extension is extensively modified by humans but spread out in a dispersed manner. This is not a well-managed extension area and has not very much of its boundary fenced and not patrolled regularly so security is considered low. This certainly exposes the park to illegal activities such as poaching, agricultural encroachment and illegal logging which was all evident from both the aircraft observations and the detailed mapping described above Old Lengwe has some wildlife such as buffalo and antelope mostly around the northern part. The remainder of Lengwe is catastrophically depleted of animals with nothing being observed from the air during the survey. Table 9 below shows trends in encroachment generated through the aerial survey

**Table 9:** Trends in levels of encroachment in Lengwe National Park

Year	Crop land (Ha)	Clearing (Ha)	Built/Settlement (Ha)	Bare Land (ha)
2019	96.01	17899.76	17.36	7.74
	0.10%	19.39%	0.02%	0.01%
2020	481.77	26345.27	19.72	7.09
	0.52%	28.53%	0.02%	0.01%
2021	125.85	23970.21	11.62	3.32

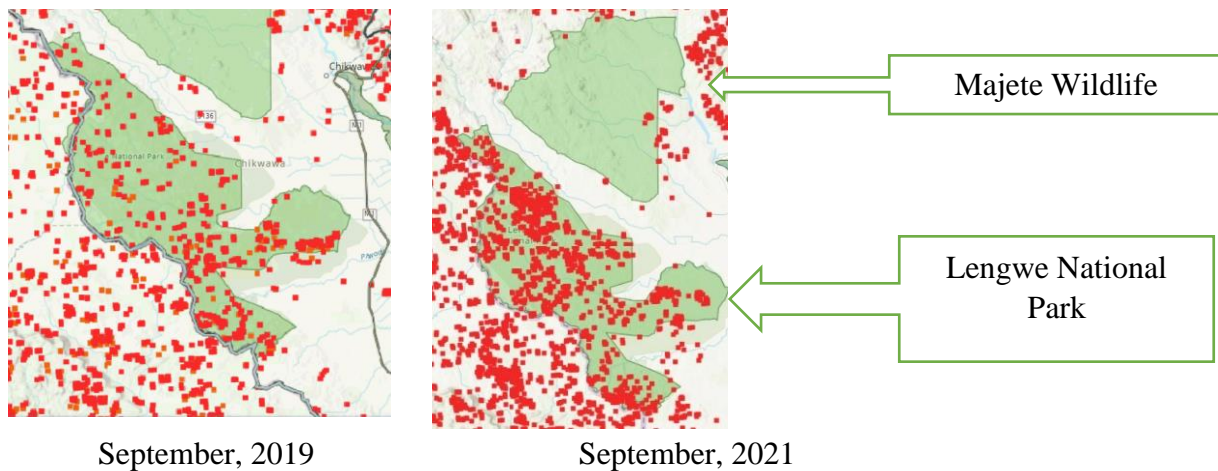


	0.14%	25.96%	0.01%	0.00%
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**Source:** GoM, 2021

Table 9 above indicates that crop land, clearing increased from 0.10 % to 0.14 % and 19.39 % to 25.96 % respectively. On a positive note, settlement and bare land reduced from 0.02 % to 0.01 % and 0.01 % to 0.00 % respectively.

Besides encroachment, the survey also identified areas burnt by fire in Lengwe National Park. Figure xxx below shows locations of these fires.



**Figure 9:** Fires in Lengwe National Park, 2019 and 2021.

**Source:** GoM, 2021

Based on the red dots, it can be inferred that in September 2021, there were more fires than 2019. The adjacent Majete Wildlife Reserve had relatively few fires because of the strong law enforcement and community engagement programs.

### 3.3.2 Elephant Marsh

#### 3.3.2.1 Fauna

##### 3.3.2.1.1 Large Mammals

Elephant Marsh probably remains the most important and largest wetland in Malawi which harbors large mammals. For instance, outside protected areas, it is only Elephant Marsh that harbors Hippopotamus.

##### 3.3.2.1.2 Population estimates of the hippopotamus

Hippopotamus, is listed as Vulnerable under IUCN remains present at the Elephant Marsh, outside of the protected areas. The hippopotamus population is estimated to be less than 100, far fewer than the more than 1 000 individuals that are expected to have occurred under more natural

conditions [Government of Malawi (GoM, 2016)]. Table 10 below shows estimated population of hippopotamus between 1994 and 2022.

**Table 10:** Hippo numbers in the Elephant Marsh.

<b>Year</b>	<b>Hippopotamus number</b>
1994	1611
2008	13
2020	19
2021	18
2022*	28

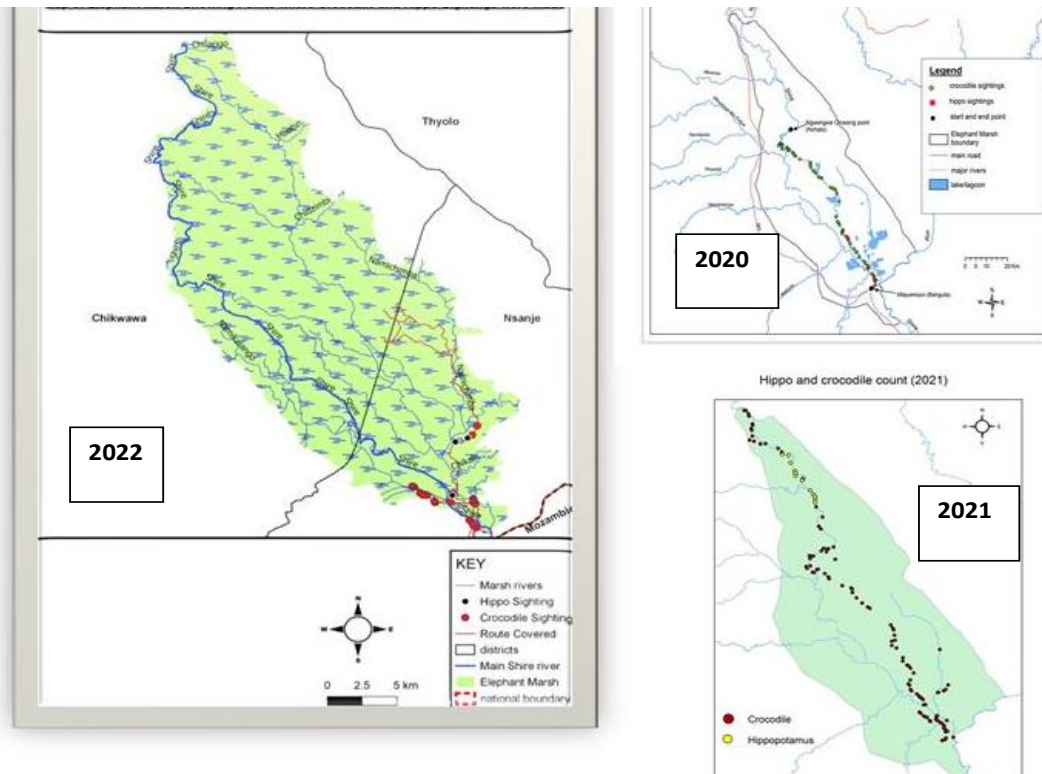
\* Hippo count not completed due to floods caused

by Cyclone Ana

These results show that the hippo population has declined drastically although it is stable in the last three years. In the early 1990s they were in thousands. Currently the number has reduced to less than 50. Habitat alteration through farming is contributing to the hippo demise.

#### **3.3.2.1.2.1 Hippopotamus Distribution by geographic location**

Figure 10 below shows distribution of hippopotamuses in the Elephant Marsh. Except for 2022 where the count was discontinued because of Cyclone Ana, the figure shows that hippos tend to concentrate more in the southern part of the marsh than in the northern part. It should be noted that the northern part has faced more habitat destruction by people than the south. The southern part has some places which are hard to reach in the form of lagoons as described by GoM (2016).



**Figure 10:** Hippopotamus distribution according to geographic location in Elephant Marsh

### 3.3.2.1.3 Reptiles

There are 58 species of reptiles in the Elephant Marsh (about 45% of the reptiles recorded for Malawi). This is composed of 19 lizards, of which skinks (7 species) are the most diverse; 32 snakes, with colubrid (10) being the most diverse family, and with nine venomous species of which five have caused fatalities; a single crocodylian, and six chelonians of which side-necked *Pelomedusid terrapins* (3) are the most diverse.

### 3.3.2.1.4 Crocodiles

The Research and Development Unit at Lengwe National Park has been monitoring the Nile Crocodile *Crocodylus niloticus* for three consecutive years (2020 – 2022). Below are the results.

**Table 11:** Crocodile population Estimates in the Elephant Marsh (1987-2021)

Year	Crocodile	No. per Km
1987	1345	14.40
1994	-	-
2008	234	2.51
2020	86	0.92
2021	193	2.07
2022*	27	0.29

\* Crocodile count not completed due to floods caused by Cyclone Ana

The figures in table above show that the Elephant Marsh had a very high population of crocodiles in the 1980s. However anthropogenic activities such as habitat destruction and farming have reduced the numbers to as low as not more than 200. The conservation status of the Nile Crocodile under IUCN is of Least Concern or Low Risk.

#### **3.3.2.1.5 Birds**

The Marsh is rich in abundance and diversity of water birds. This has enabled it to meet three criteria of the Ramsar Convention on Wetlands as follows:

- Criterion 3. Elephant Marsh has biological diversity
- Criterion 5. It supports over 20,000 water birds
- Criterion 6. It has 1% or more of a delineated population of water birds

Since the Marsh meets these criteria, it is designated a Ramsar Site, that is a wetland of international importance.

A total of 199 bird species were recorded in the Elephant Marsh area, of which 68 species were waterbirds. A total of 20 238 birds were estimated to occur in the marsh. The most abundant species were Openbilled Stork and White-faced Tree Duck, African Jacana, Common squacco heron and cattle egret (GoM, 2016). An estimated 26 waterbird species have been found breeding in the area; among them are the threatened Madagascar Squacco Heron (*Ardeola idae*), Wattled Crane (*Grus carunculatus*) and Grey Crowned Crane (*Balearica regulorum*).

However, the recent (2022) bird count conducted by Lengwe National Park Research Unit showed that there are 42 species of birds, out of these 31 are common residence are Palearctic and 4 are Intra- African migrant (

Table **12**).

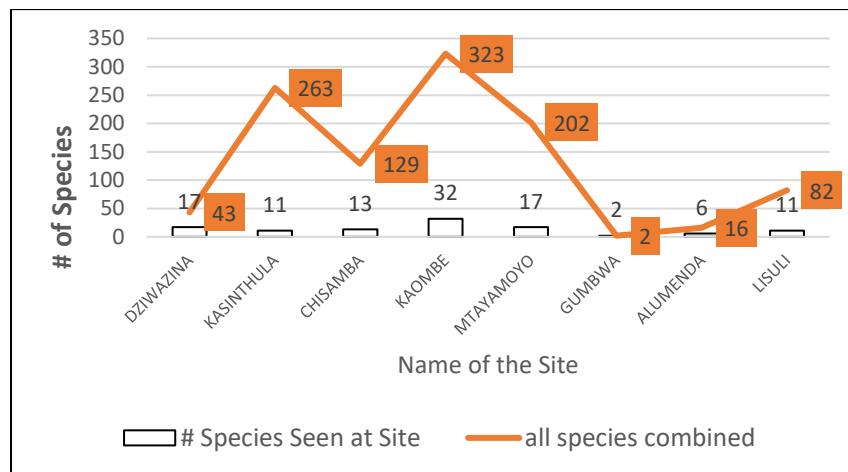
**Table 12:** Listed species found in Elephant Marsh during 2022 survey

English Name	Scientific Name	Status
African Fish Eagle	<i>Haliaeetus vocifer</i>	common resident
African Sacred Ibis	<i>Threskiornis aethiopicus</i>	common resident
African Skimmer	<i>Rynchops flavirostris</i>	Common resident/ local Migrant
Bateleur	<i>Terathopius ecaudatus</i>	Common resident
Black Stork	<i>Ciconia nigra</i>	palaearctic migrant
Great White Pelican	<i>Pelecanus onocrotalus</i>	local residence
Greater Flamingo	<i>Phoenicopterus roseus</i>	intra-african migrant
Marabou Stork	<i>Leptoptilos crumeniferus</i>	common resident/ local migrant
Red-Footed Falcon	<i>Falco vespertinus</i>	local residence
Woolly-Necked Stork	<i>Ciconia episcopus</i>	Un common intra-african migrant
Yellow-billed Stork	<i>Mycteria ibis</i>	Partial intra- african migrant
African Spoonbill	<i>Platalea alba</i>	Common resident/ local Migrant
Pink-backed pelican	<i>Pelecanus rufescens</i>	local residence

**Note:** The listing of these species is in accordance with Wildlife Regulation of Malawi of May 2017.

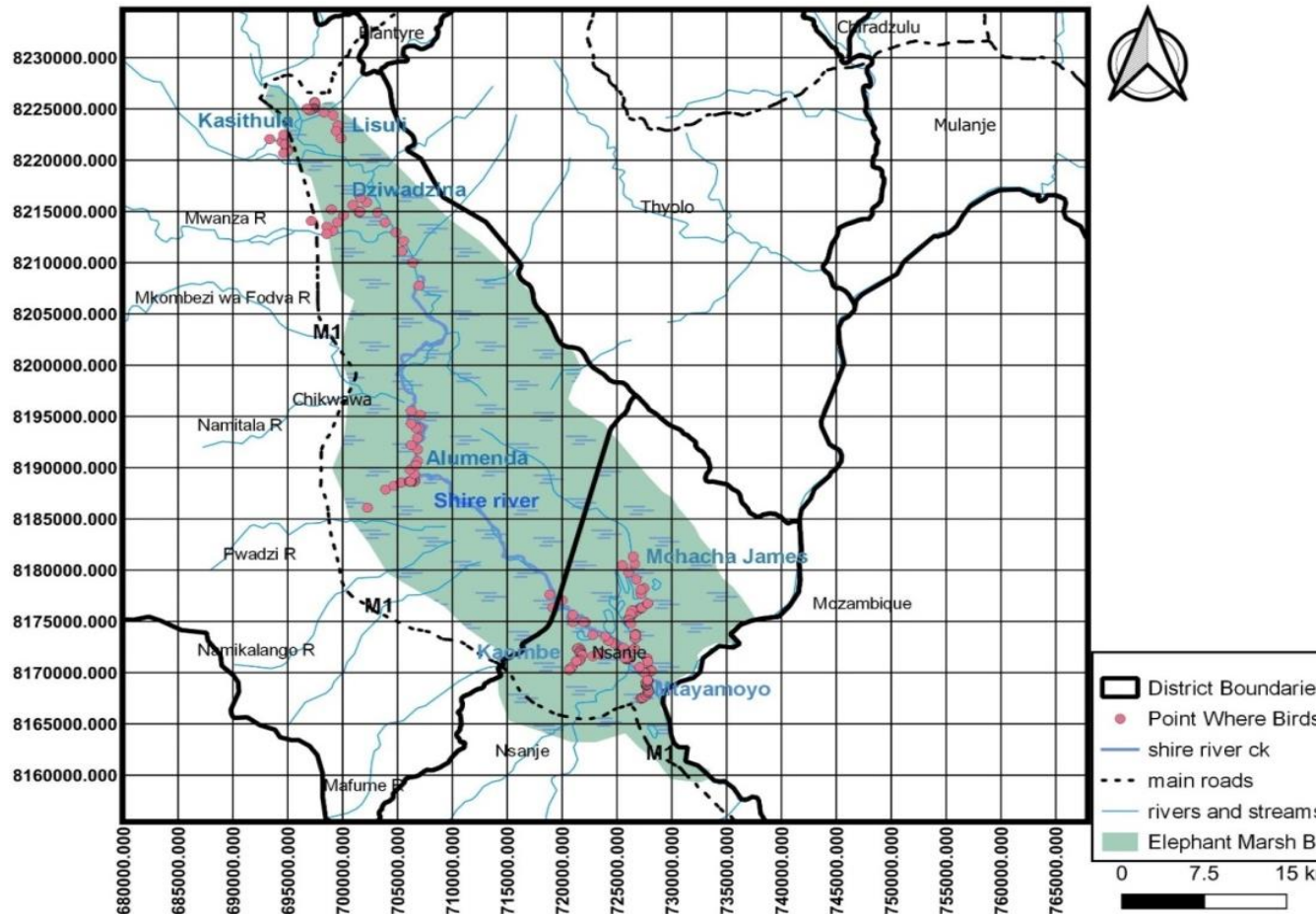
### 3.3.2.1.5.1 Bird species distribution in the Elephant Marsh

The 2022 bird count indicated that Kaombe had the largest populations of birds i.e. 32 Species with a bird population of 323 representing 30% of all birds seen. The number of birds decreased as one moved northward. This probably due to the fact that more habitat damage is done the area between Illovo and Kamudzu Bridge. Refer to Figure 11 below for other sites.



**Figure 11:** The graph showing number of bird species seen from each site in 2022 survey.

Birds were sighted in several points within each of the sites indicated in Figure 11. These points are indicated in figure



**Figure 12:** Map of Elephant Marsh showing points where bird sightings were made

### 3.3.2.1.6 Fish

Besides bird life, the marsh has many fish species, some of which are endemic to the wetland only in Malawi, such as Makakana.

The Government of Malawi report (2016) indicates that a total of 52 fish species from 17 families were observed or strongly expected to be resident in the Elephant Marsh (See Annex 8). This list combines species recorded during the survey in November 2015 and species expected to be present but not seen, based on previous surveys by Tweddle & Willoughby (1979). Among the the species expected but not seen, the common mountain catfish *Amphilius uranoscopus*, was a notable absentee. According to Tweddle and Willoughby this species used to be to be widespread in the east bank streams and in the Wankurumadzi Stream in Majete Wildlife Reserve during the late 1970s. The report further indicates one new species not previously reported by Tweddle and Willoughby. This species is the non-native mosquito fish *Gambusia affinis*, native to Gulf of Mexico drainages in North America.

While other species are abundant, others are less commonly and these include *Synodontis zambensi* (Nkhonokono/squeaker), *Momyrus spp* (Mphuta and Mkupe), and *Marcusenius macrolepidotus* (Nyesi/elephant fish). Fish species on IUCN Red List include *Labeo altivelis*, *Labeomesops*, *Protopterus annectens* and *Marcusenius macrolepidotus*.

#### **3.3.2.1.7 Invertebrates**

There are also important aquatic invertebrates including the newly identified sub-species of the butterfly *Colotis amata* that breeds exclusively on the lake edge surrounded by the evergreen shrub *Salvadora persica*.

On the basis of the biodiversity sub-study, it appears that the central sub-area of the Elephant Marsh, which is less accessible, is currently the least impacted, while the Northern and Western sub-areas, where there is extensive agricultural development and roads, have seen a higher degree of modification and losses of natural habitats and biota as a result.

#### **3.3.3 Vegetation**

The information on the Flora of Elephant Marsh is based on the GoM (2016) report which compiled a list of wetland plant species expected in the elephant Marsh from the scientific literature on wetlands of the Zambezi river basin. In 2015 a field survey as part of the same report was also conducted to collect data on cultivated and non-cultivated land, marshes, lakes, river channels, roads and main town of elephant Marsh. This data was used to develop a plant species list and used to describe dominant vegetation communities and ecological condition of the vegetation in Elephant Marsh.

There is also some recent unpublished literature for the vegetation of the Elephant Marsh through a recent environmental and social impact assessment (ESIA; SMEC 2013) which has provided provide species lists and their conservation status for targeted sites and list of invasive species at the marsh.

The marsh has six wetland habitats (



Table **13**) each of which is associated with a particular species of fauna. For example, the ‘lake’ habitat contain submerged and floating-leaved aquatic plants; the marshes contain megagraminoids.

**Table 13:** Six wetland habitats expected to occur in Elephant Marsh

<b>Wetland habitat</b>	<b>Definition</b>	<b>Description</b>
Lakes	Bodies of barely flowing water of varied depth.	Shallow lakes with clear water normally contain submerged and floating-leaved aquatic plants throughout whereas deeper or turbid lakes normally contain emergent plants at the shoreline only.
Marshes	Marshes may be perennial or seasonally inundated areas with slow flow that are well vegetated.	Permanently-inundated marshes are inhabited by megagraminoids, such as <i>Cyperus papyrus</i> , <i>Phragmites australis</i> and <i>Vossia cuspidata</i> . Seasonally-inundated marshes are inhabited by plant species able to survive drier conditions as seed or underground storage organs, such as <i>Miscanthus junceus</i> and <i>Phragmites australis</i> .
Floodplains	Seasonally inundated grasslands that border perennial rivers.	Floodplains are normally dominated by graminoids (grasses, rushes, sedges and reeds) as the higher water table and poor drainage preclude most trees and shrubs.
River banks	The terrain alongside a river variously inundated by floods of different magnitude within and between years.	River banks are inhabited by a dense layer of shrubs and trees adapted to regular inundation by floods. These so-called riparian areas are characterised by zones of different plant assemblages adapted to different flood magnitudes and inundation frequencies.
Sandbanks	Temporary lateral or mid-channel bars comprised of alluvium (river washed sands).	Typically sandbanks are poor in organic matter and therefore populated by ‘weeds’ with short life cycles. In some cases, reeds and pioneering riparian trees may colonise sandbanks, increasing their stability and permanence.
Channels	Perennial rivers or distributaries through swamps	Perennial rivers tend to flow faster than swamp distributaries and therefore flow velocity, with corresponding rooting strength, are important determinants of the plant species found.

### 3.3.3.1 Plant Species List

The GoM report (2016) identified 60 plant species with their conservation status for the Elephant Marsh (See Annex 7). Another unpolished report by ESRC (2022) recorded sixty-one species around Elephant Marsh, 19 which were under Least Concern (LC) and were Not Evaluated (NE).

### **3.3.3.2 Species Abundance and distribution**

In terms of species abundance, the GoM (2016) report indicates that across all habitats and in general, the most abundant plants were common reed *Phragmites australis*, bulrush *Typha domingensis*, hippo grass *Vossia cuspidata* and papyrus sedge *Cyperus papyrus*, which were also the dominant species occupying marsh habitats. The most common plants of the floodplains were common reed, bulrush and vlei grass (*Miscanthus junceus*). Common reed, bulrush and papyrus sedges were more abundant on uncultivated river banks but were also present on cultivated river banks, along with crops not found elsewhere; beans, maize *Zea mays* and kweek (grazing grass) *Cynodon dactylon*. Water lettuce *Pistia stratiotes* and the white lotus (lily) *Nymphaeae lotus* were both common at marsh and lake habitats and along uncultivated river banks (

Table 13). These two species were not dominant at cultivated banks where hippo grass, morning glory *Ipomoeae aquatica* and Guinea grass were common. Hornwort *Ceratophyllum demersum* and white lotus were more dominant in the lakes than the exotic water lettuce.

### 3.3.3.3 Exotic species

The most commonly-encountered exotic aquatic species, according to GoM (2016), was water lettuce *Pistia stratiotes*, while water hyacinth *Eichhornia crassipes*, red water fern *Azolla filiculoides* and Kariba weed *Salvinia molesta* were encountered much less frequently. These four species were found in the lake habitats, which were dominated by indigenous white lotus and hornwort. Non-aquatic pest species encountered, again infrequently, where the giant sensitive tree *Mimosa pigra* and honey mesquite *Prosopis glandulosa*. The rest of the exotic species encountered were disturbance adapted perennials, annuals, or forbs, commonly encountered where humans inhabit and cultivate crops, and many of them are planted aside the crops for a variety of medicinal and herbal uses.

Some species like *Borassus aethiopicum* (borassus palm or *muvo*) which were not listed as endangered in the IUCN at the time of the study, were found to be listed as endangered in an FAO2F report on plant genetic resources (GoM, 1996). This species is used for the construction of mokoros (GoM, 2016). In this study *Borassus aethiopicum* was found on the seasonal floodplain adjacent to Bangula Lagoon (SF2) and also on a cultivated river bank of the Shire River, recruiting palm saplings were also found on the cultivated fields.

### 3.3.3.4 Conservation status of lora in Elephant Marsh

The 2015 condition of the Elephant Marsh vegetation – based on its historic extent - was estimated to be Largely modified based on Kleynhans et al. 2007 description. A large loss of natural habitat, biota and basic ecosystem functions was found to have occurred meaning that it was largely modified from the historically natural condition and/or associated with a large loss of habitat, biota and basic ecosystem functioning. The reasons for the relatively poor condition of the marsh the extensive cultivation and consequent reduction in the extent of the marsh, the diversion of the Shire River main stem and the almost complete removal of woody plant. It is likely that the regulation of flow at upstream impoundments and elevated suspended sediment loads due to erosion in the upstream catchment have also contributed to the decline in ecological condition of the marsh.

The ecological condition of the current extent of the marsh (i.e. excluding the cultivated, inhabited and the infrequently inundated cleared woodland areas) was estimated to be moderately modified from the historical condition and/or associated with a loss or change in natural habitat and biota but that basic ecosystem functions persist.

According to a recent (2022) survey by Precision, it was observed that in the elephant Marsh, the Majority of the swamp was modified leaving a core unsettled area where man made activities were dominant.

**Table 14:** Type of vegetation in the Elephant Marsh and coverage

<b>Class</b>	<b>Area</b>	<b>Percentage</b>
Natural Vegetation, marshes and water	2388 hectares	47%
Man-made (hotspots)	2689 hectares	53%
Total	5077 Hectares	100%

Source: GoM, 2022.

Precision reported that from its photography and accurate mapping that this area has been severely affected by human encroachment and only pockets of areas remain that would need zoning to protect them. Considering the Elephant Marshes is a new Ramsar (Convention of Wetlands) site which is therefore designate as a “Wetland of International Importance” that requires protection and monitoring it is clear that there is currently a large amount of human activity (farming, poaching hippopotamus and other human conflicts) that need attention. It would be possible to use the survey and hotspots data to draw up zones within the marshes that are better to protect given that many areas are already in a catastrophic state. In terms of wildlife in the marshes, there were observations of some thriving birdlife, particularly in the southern part where more water was available and less human interventions. Some crocodile and hippopotamus populations are likely to be sustained in the pockets of areas that are still under natural vegetation and marsh away from human activities in this regard STVP 1 started and continues in STVP 2 to reorganize communities in various zones in community conservation area (CCA) committees. The overall goal is to designate the selected biodiversity hotspot into a CCA to give strength for communities to effectively manage the marsh while respecting the Ramsar wise use principles.

### **3.3.4 General overview of main threats in the Elephant Marshes**

The Elephant Marsh has been significantly altered from its natural state in many different ways over the past 150 years. The processes which have negatively the nature and functioning of the Elephant Marsh were summarized by GoM (2016) and these include:

- Intense pressure on the natural resources due to increasing human populations.
- Increased water abstraction, conversion of natural vegetation, sediment input, movement and deposition, as well as biodiversity losses.
- Agriculture development by communities in the Marsh (Figure 13): Clearing and burning of wetland vegetation and land conversion to agriculture; water abstraction for cultivation;
- Exotic species;
- Increased incidence and severity of fire;
- Human-wildlife conflicts.



**Figure 13:** Clearing, Burning and Agriculture in the Marsh

In spite of the fact that the Elephant Marsh system has been significantly altered and has lost much of its original wetland and floodplain area to agricultural use and human settlement, it still contains large enough areas of functional marshes and floodplain habitats to support significant biodiversity and ecosystem services. The populations in these areas have been impacted on by direct harvesting, however, as much of the study area is accessible by foot or mokoro (canoe). Only a small proportion of the original Marsh area remains relatively intact. Nevertheless, wetlands and their fauna are naturally fairly resilient. The Elephant Marsh is therefore considered to be in a D category in terms of its overall health (Table 15) (GoM, 2016)

**Table 15:** Health rating for different biotic groups in the Elephant Marsh

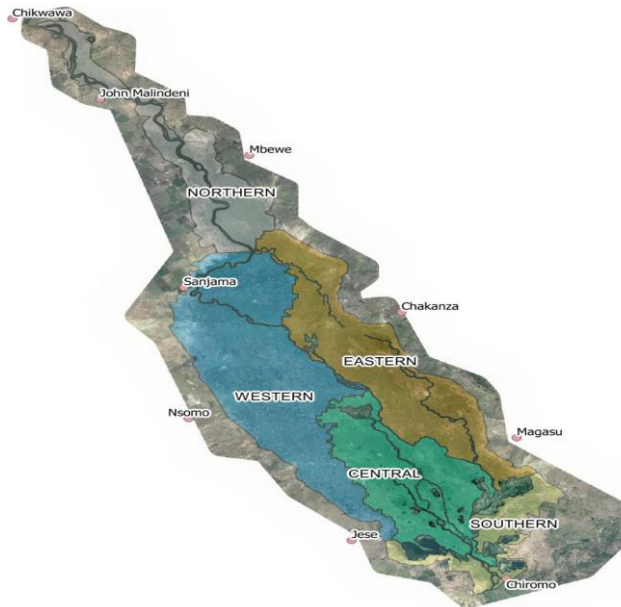
<b>Group</b>	<b>Description</b>	<b>Rating</b>
Vegetation	Largely modified	D
Aquatic Invertebrates	Moderately modified.	D
Odonata	Slightly modified.	B
Butterflies	Seriously modified	E
Reptiles & Amphibians	Moderately to largely modified.	C/D
Fish	Moderately to largely modified.	C/D
Birds	Slightly to moderately modified	B/C
Mammals	Seriously modified	E
<b>Overall</b>	<b>Largely modified</b>	<b>D</b>

### 3.3.5 Specific illegal activities in the Elephant Marsh

Data for specific illegal activities in the Elephant are available for fish and large mammals.

### 3.3.5.1 Fish

Fishing pressure is reasonably high in some parts of the Elephant Marsh, particularly the southern area, while the Northern and Central sub-areas are fished at low intensity due to the nature of the habitat (Northern) and difficulty in access (Central). Figure 14 below shows these zones.



**Figure 14:** Map of Elephant Marsh and its 5 Ecological Zones

The 2022, data from Fisheries Department on illegal fishing gears show that 47 mosquito nets, 57 monofilaments and 9 Kambuzi sein nets were confiscated. From previous years, data are not available, making it difficult to show trends.

### 3.3.5.2 Large Mammals

Data on illegal activities occurring in the Elephant Marsh is scant mainly due to the fact that the staff tasked with protecting crops and human life through problem animal control program, mainly scare or kill problem animals that include hippos, crocodiles, baboons, monkeys, bush pigs and python. Available data shows that only one crocodile and one hippo were illegally killed by communities in 2022.

## 3.4 Field Assessments

### 3.4.1 Lengwe National Park

#### 3.4.1.1 Fauna

##### 3.4.1.1.1 Mammals

Sixteen (16) species of large mammals were recorded along the proposed canal route (Table 16). Mammals were recorded at each of the 10 sample points with the highest record being site 6 (6 recordings), seconded by sites 4 and 8 (5 recordings). Of these species, the African buffalo (*Syncerus caffer*) is listed as being Near threatened (NT) under IUCN. None of the recorded species is listed under CITES.

According to the National Parks and Wildlife Act (Cap 66: 07): *National Parks and Wildlife (Protected, Endangered and Listed Species) (Declaration) Order, 2017*, all mammal species in a protected area are listed as protected species. Lengwe National Park being a gazetted protected area it means that all the large 16 mammal species recorded in the park are protected.

**Table 16:** Mammal species recorded in the project area and their conservation status

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

#### 3.4.1.1.2 Birds

Fourty-one (41) species of birds were recorded in the project area, as shown in Annex 4. Birds were recorded at each of the 10 sampling points though the highest was at site 8 (19 recordings), seconded by sites 5 and 6 (16 recordings).. According to the National Parks and Wildlife Act (Cap 66: 07), all bird species in a protected area are listed as protected species. Lengwe National Park being a gazetted protected area it means that all the bird species recorded are protected. As per IUCN categorisation, the Martial Eagle (*Polemaetus bellicosus*) is a Near Threatened (NT) species. All the 41 species recorded fall under the category of INCN Least Cncern (LC). No species is listed under CITES from the list of 41 .

#### 3.4.1.1.3 Reptiles

Seven species of reptiles were recorded at the project site, as shown in Table 17. Reptlies were only observed at **4 sampling sites (2, 3,4, 5 and 9)**. 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 (Table 17). However, based on National Parks and Wildlife Act (Cap 66: 07), all reptile species in Lengwe are protected.

**Table 17:**List of reptile species recorded in the project area in Lengwe NP

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

#### 3.4.1.1.4 Amphibians

The researchers did not see any ambiabians or their signs along the proposed canal route.

#### 3.4.1.1.5 Summary of large mammals, birds and reptiles diversity in different sampling site

**Table 18:** Distribution of species recorded along the proposed canal

Site	Mammals	Birds	Reptiles
1	3	13	0
2	3	10	3
3	1	14	3
4	5	14	3
5	4	16	2
6	6	16	0
7	2	9	0
8	5	19	0
9	4	14	1
10	2	13	0

Table 18 reveals that distribution of animal species was not uniform across the 10 sample sites.

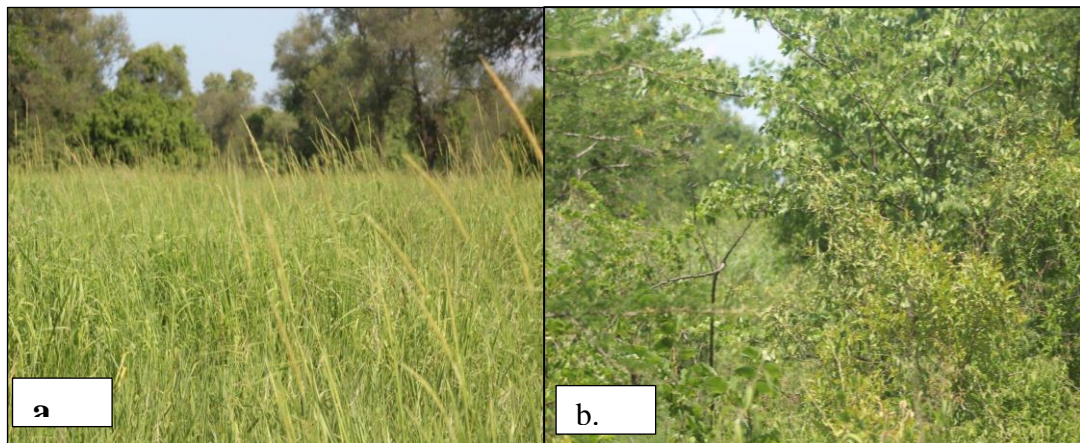
#### 3.4.1.1.6 Fish Diversity of fish in the water holes in Lengwe National Park

The key informants indicated that 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 key informants from the Lengwe national Park office indicated that the commonest fish that is in these pools is the catfish.

#### 3.4.1.2 Flora

Field observations of the canal passage vegetation comprise largely of open deciduous forests and some dense thickets of dry savanna woodlands. Within the open deciduous forest woodlands, two classes of vegetation compositions were distinct specifically along the canal passage corridor (Figure 15). These comprise of:

- a. low-lying deciduous savanna forest with isolated islands of forest patches that are dominated by *Senegalia nigrescens* and *Ziziphus mucronata* (Plot No. 1,3,5,7,9,11 and 13); Grasses and herbs cover approximately 50-60% of the open areas between the forest patches;
- b. 'low-lying open savanna woodland dominated by *Colophospermum mopane* mixed with *Vachellia (Acacia) nilotica* (Plot 13, 15, 17). Grasses and herbs cover approximately 30 to 40% of the open areas.



**Figure 15:**Vegetation type compositions along the proposed Lengwe agriculture canal

Note: a = low lying sparse deciduous forest dominated by *Senegalia nigrescens* and *Ziziphus mucronata*; b = low deciduous woodlands dominated by *Colophospermum mopane* and *Vachellia nilotica*

### Diversity and richness of plants found

Table 19 below shows a summary of major plant groups, families and species found. From this table, it is observed that trees and shrubs constituted the largest number of families (21) and species (58).

**Table 19:** Summary of plant groups and the corresponding number of species found

Plant species Life form	Number of plant families	Number of species found
Climber/creepers	6	18
Herbs	14	33
Trees and shrubs	21	58
<b>Total</b>	<b>41</b>	<b>109</b>

Forty 41 plant families, one hundred and six (109) plant species were recorded within the corridor of the proposed canal (Table 19). The most dominant plant families observed were Fabaceae (13.8%), followed by Covulvulaceae (6.4%), Poaceae, (6.4%), Tiliaceae (5.5%), Acanthaceae, (4.6%) and Capparaceae (4.6%) respectively.

#### 3.4.1.2.1.1 Herbs and grasses

Thirty-three (33) plant species in the category of herbs and grasses were recorded from 13 plant families (Table 19). The dominant families in the sub-group were Poaceae (22%), Acanthaceae (12%) and Commelinaceae (9%) respectively. *Urochloa mosambicensis*, *Panicum simplex*, *Echinochloa colona*, *Setaria sphacelata*, and *Sporobolus pyramidalis* from the family Poaceae were the dominant species respectively. The grass species approximately covered 50 to 60% of the survey areas along the canal. *Commelina benghalensis* and *C. diffusa* were the second dominant species found in Commelinaceae family.

#### 3.4.1.2.1.2 Climber/creepers

The survey recorded 18 plant species in the category of creepers and climbers from 6 plant families (Table 19). Convolvulaceae and Cucubitaceae dominated the creepers and climbers plant group (Figure 4). The preponderant species recorded was *Cucumis hirsutus*, and *Momordia foetida* which are part of the species are identified as crop wild relatives.

The wild crop relatives identified in the canal floral represented (15%) percent of the total flora found. The relative abundance show the top five dominant wild relative crops as *Cucumis hirsutus* (28.9%), *M. foetida* (19.3%), *Ipomoea crassipes* (14.3%), *Vigna unguiculata* (11.8%) and *Coccinia mildbraedii* (5.7%) respectively.

#### 3.4.1.2.1.3 Trees and shrubs species

Fifty-eight (58) trees and shrub species recorded from 21 plant families were found in the survey (Table 19). Detrended Canonical Analysis (DCA) revealed that the most preponderant family of the trees and shrubs were Fabaceae, Tiliaceae, Capparaceae, Ebenaceae and Olacaceae.

Seventy-eight (78) trees per hectare was the average density of mature trees (diameters greater than 5cm) found in the canal passage area. This low density of trees observed is a result of empty pockets of the woodland which are largely covered by herbs and grasses. However, the top six dominant trees recorded were *Ziziphus mucronata*, *Senegalia(Acacia) nigrescens*, *Lepidotrichilia volkensis*, *Colophospermum mopane*, *Vachellia (Acacia) nilotica*, and *Dalbergia melanoxylon* with a relative density ranging from 7 to 17%

Within the study sites, plant species richness ranged between 13 and 34 plants (

Table 20). Species richness (34) was the highest in areas dominated by *Colophosperm mopane* (Plot no.13 and 15) while the low richness (13) was observed in areas dominated by *Vachellia (Acacia) nilotica* and *Ziziphus mucronata*. Furthermore, Shannon Wiener diversity index (H) ranged from 2.57 to 3.52. High species diversity index was recorded in plot 15 (H=3.52) followed by plot 7 (H=3.37)., while low diversity of plants (H=2.57) was recorded in plot no.1 (

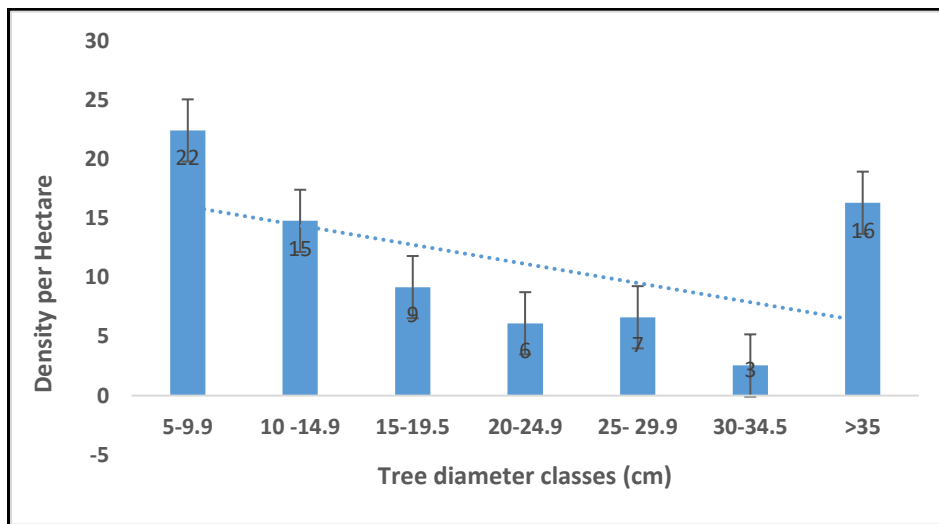
Table 20). The observed differences could perhaps be ascribed to variances in soil/edaphic factors.

**Table 20:** Plant species richness and diversity recorded in study sites of the proposed agriculture canal, Lengwe National Park

Plot ID	Mean	St.Dev	Richness (s)	Plant species diversity		
				E	H	D'
Plot 1	0.118	0.324	13	1	2.565	0.9231
Plot 3	0.164	0.440	16	0.976	2.707	0.9259
Plot 5	0.191	0.395	21	1	3.045	0.9524
Plot 7	0.264	0.443	29	1	3.367	0.9655
Plot 9	0.164	0.396	17	0.993	2.813	0.9383
Plot 11	0.164	0.372	18	1	2.89	0.9444
Plot 13	0.382	1.292	30	0.866	2.944	0.8878
Plot 15	0.318	0.487	34	0.997	3.516	0.9698
Plot 17	0.182	0.387	20	1	2.996	0.95
Plot 19	0.136	0.345	15	1	2.708	0.9333
<b>AVERAGE</b>	<b>0.1893</b>	<b>0.4436</b>	<b>19</b>	<b>4 0.894</b>	<b>2.686</b>	<b>0.8537</b>

### 3.4.1.2.2 Diameter distribution of mature trees

Diameter distribution of the woody plants found in the Lengwe canal project influence area displayed an inverse J shape of the mature trees (Figure 2). In such a pattern, there are many young trees and saplings that could be recruited into successive growth stages and therefore enhance the sustainable conservation of woody plant species in the area. The observed presence of trees with diameter sizes greater than 35cm is an indication of a healthy forest with mature seed-bearing trees which implies that regeneration outplays disturbances. Juvenile trees in the range of 5 to 9.9cm were the highest followed by the 10 to 14.9cm (Figure 16).



**Figure 16:** Density of woody tree species inventoried in diameter classes

### 3.4.1.2.3 Conservation status of species found and uses

Annex 6 shows the composition of species recorded along the proposed canal. Out of the 109 recorded 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.

## 3.4.2 Elephant Marsh

### 3.4.2.1 Fauna

For Elephant Marsh, the only fauna assessed was fish and this is what is discussed in this report.

#### 3.4.2.1.1 Diversity of fish in the Elephant marsh

The elephant marsh is endowed with several fish species from cichlids to cyprinids that are not available in Lake Malawi. As indicated in section 3.3.2.1.6 (Fish in the Elephant Marsh), there are 52 species of fish in the Elephant Marsh (See Annex 8). During the rapid assessment, 8 families and 17 species were observed (Table 21)

**Table 21:** Fish species and families observed during the rapid assessment

Family	Species	English name	IUCN Red List status
Chicliidae	<i>Oreochromis mossambicus</i>	Mozambique tilapia	Near Threatened
	<i>Oreochromis placidus</i>	Black tilapia	Least Concern
	<i>Oreochromis shiranus shiranus</i>	Shire tilapia	Not assessed
Clariidae	<i>Clarias gariepinus</i>	Sharptooth catfish	Least Concern
	<i>Clarias ngamensis</i>	Blunttooth catfish	Least Concern
Cyprinidae	<i>xxBarbus macrotaenia</i>	Broadband barb	Least Concern
	<i>Brycinus imberi</i>	Imberi	Least Concern
	<i>Labeo congoro</i>	Purple labeo	Least Concern
	<i>Opsaridium tweddleorum</i>	Dwarf sanjika	Least Concern
Gobiidae	<i>Glossogobius callidus</i>	River goby	Least Concern
Mormyridae	<i>Mormyrus longirostris</i>	Eastern bottlenose	Least Concern
Mochokidae	<i>Synodontis nebulosus</i>	Clouded squeaker	Least Concern
	<i>Synodontis zambezensis</i>	Brown squeaker	Least Concern



Protopteridae	<i>Protopterus annectens brien</i>	Lungfish	Least Concern
Schilbeidae	<i>Schilbe intermedius</i>	Silver catfish	Least Concern

#### 3.4.2.1.2 Most Important fish species in the Marsh

Through the informal interviews with some beach village committee members and some fishermen, it became more evident that the cichlids especially the *Oreochromis* species and *Gangafodya* (*Astatotilapia calliptera*) formed the back bone of the fishery in terms of providing the livelihoods of the riparian communities. However, they were quick to point out that different seasons bring in different species of fish and sustain their livelihoods within that season. At Chisamba, *Protopterus annectens brien* was the largest fish that was being landed. The business women reported that, this fish is very tasty when smoked and fetches a good price at N'chalo or Chadzunda market. The story has it that, previously they used to behead the fish before smoking to prevent scaring some customers. Over time, the fish has become a favorite to more customers, such that they have asked the business women to smoke the fish together with its head so that they can appreciate and relate the tasty fish with its appearance.

#### 4. 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 10<sup>th</sup>, 2016) and Chickwawa (November 11<sup>th</sup> 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 17: 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 18: Farmer Workshop at GVH Njeredza (SVTP)*

SVTP facilitated a meeting of the Phata Cooperative, Agrichem and the World Bank Mission at Phatai with an objective of establishing lessons on how cooperatives operate in the Shire Valley and the role of service providers, i.e Agricane.





Figure 19: 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 commulative 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. To date the trust, in collaboration 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 hectre Kama-Kasinthula Scheme, starting with 1,069 hectares in 2022. The design abstraction rate is 2.5 M<sup>3</sup> / 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 fruition.
- 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 M<sup>3</sup> 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 hectares 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 20:: 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.

(v) 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 District Council. The main objective of these meetings was to understand from these various stakeholders looked at the social trends particularly GBV issues, if any, since the start of the project activities. Importantly to also understand from them the proposed mitigation measures that may be needed with regard to GBV issues.





*Figure 21: GBV mitigation stakeholder Consultation meeting at Mologeni*

#### **4.1 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 it is 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 meetings in all the project areas and the development of a shared information base for the service provider to interface with all concerned stakeholders.

#### **4.2 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 22: Stakeholder Consultation Results

SN	STAKEHODER	MAJOR ISSUE RAISED	SUGGESTED ENHANCEMENT / MITIGATION
1	<b>DNPW – Lengwe National Park</b>	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	<b>DNPW, African Parks - Majete Wildlife Reserve</b>	Loss of revenue from tourism;  Habitat destruction for wildlife;  Soil Erosion and water resources degradation;  Lack of access to Kapichirwa falls and Reservoir	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;

SN	STAKEHODER	MAJOR ISSUE RAISED	SUGGESTED ENHANCEMENT / MITIGATION
		<p>Extended working area in the park due to Cyclone Anna impacts,</p> <p>Increased incidences of poaching Loss of artifacts in the Kapichira area;</p> <p>Lack of capacity to monitor biodiversity</p> <p>Risk of tiger fish reaching upper Shire River and Lake Malawi</p>	<p>Support DNPW in acquiring the services of Biodiversity Monitoring Expert and monitoring and radio equipment;</p> <p>Support DNPW to strengthen enforcement capacity;</p> <p>Construct alternate route to Kapichira reservoir</p> <p>Construct tiger fish barrier to resitric movement of tiger fish</p>
3	<b>DESC, Chikwawa and Nsanje District Council</b>	<p>Increase in employment opportunities;</p>	<p>Efforts must be applied to ensure local population benefits.</p>
		<p>Migrant workers impregnating and leaving the locals with fatherless children but also transmission of HIV/AIDS.</p> <p>Increased cases of GBV and child labour.</p>	<p>Responsible NGOs to sensitize both the locals and the construction workers</p> <p>Hire a GBV service provider to address GBV, SEA and SH issues related to SVTP</p>
		<p>Increase in cases of chistosomiasis</p>	<p>Support the district council in controlling schistosomiasis</p> <p>Raise awareness among communities and children on the risks involving bilharzia</p>
		<p>Accidents will increase due to speeding</p>	<p>Put humps and road signs to reduce over-speeding</p> <p>Install speed monitoring gadgets on construction vehicles</p>
4	<b>Community FGD, men</b>	<p>Loss of houses and buildings in the canal RoW;</p>	<p>Develop and implement RAP</p>

SN	STAKEHODER	MAJOR ISSUE RAISED	SUGGESTED ENHANCEMENT / MITIGATION
		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
5	<b>Community FGD, women</b>	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	<b>Community FGD, youth</b>	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

## **Chapter Five : Impact identification and mitigation**

Potential impacts of the canal construction have been well documented in the ESIA report (See Annex 1) in which detailed scientific techniques and scenarios predicting project impacts of the physical environment are presented. This section will focus on the anticipated impact of the project on flora and fauna in Lengwe National Park and Elephant Marsh areas in light of the new biodiversity information presented in Chapter 4.

### **5.1 Impact Identification**

The magnitude of an impact depends on the overall size, setting, and its severity. A project that will disturb a few hundred square feet of land might be considered small in area, but if it destroys 100% of a rare species habitat, the severity of that impact would be considered large. The construction of the canal which in this case will involve clearing the entire canal area will have a significant impact on the surrounding vegetation. Further, the operation of the canal will have significant impacts on elephant Marsh and the ecosystem services that are provided to communities' dependent on these resources. In this section, anticipated impacts and mitigation measures **based on the initial canal alignment** are discussed for each natural habitat. As indicated in the background section of this report, these impacts and mitigation measures were broad apparently due to lack of biodiversity data, Presented below are these generic impacts and mitigation measures

#### **5.1.1 Lengwe National Park**

The impacts of the initial canal construction in LNP are well stipulated in the draft ESMP for Phase 2 and are actegorised into fauna and flora. Key impacts are as follows:

#### **5.1.2 Impacts During Construction**

Construction works in Lengwe National Park will give rise to a number of negative impacts as indicated below:

##### **5.1.2.1 Impacts on Fauna**

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 spesces such as African Buffaloes.

The impacts of the canal construction will be both direct and indirect.

- (i) Drowning of animals: From the list of mammals identified along the proposed cannal (Table 16) , only three species are good swimmers namely bushpig, African buffalo and warthog. The rest of the mammals can swim **but will get into trouble under unfamiliar waters like the proposed cannal.**
- (ii) Restricted access between eastern and western sides of the park: Among the mammals, the buffaloes, bushpigs and warthog will easily swim across the canal. The rest will face some problems since they are not excellent swimmers. The birds will easily fly over.
- (iii) Physical destruction: Two replite species namely common flap-necked chameleon, and variable stick face physical destruction during construction works because they are slow movers and cannot easily run away. As indicated in section 3.3.1.1.2, forty-one (41)

species of birds were recorded along the proposed canal. While the mature birds will fly away during construction phase, bird nests, eggs and young birds might be destroyed.

#### **5.1.2.2. Impacts on Flora**

Just like fauna, impacts on flora will be both direct and indirect.

Referring to section 3.4.1.2 (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 *Colophospermum mopane*.

It is expected that the canal right of way will range from 30 m to 45 m and run a total 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.

#### **5.1.2.3 Impacts on soil**

Canal construction will include excavation, among various activities. The soil will be heaped on either side of the canal and this will subject it to erosion since the soil will be loose.

#### **5.1.3 Elephant Marsh**

For the Elephant Marsh, the only field assessment was on fisheries as already pointed out in section 3.3.2.1. Therefore, the impacts indicated in this section are of general nature.

#### **5.1.2.5 Impacts on fauna**

The impacts on fauna will be more indirect than direct.

#### **5.1.2.6 Introduction of exotic plants**

The canal will likely transport exotic plants to the Elephant Marsh where they would establish themselves at the expense of the indigenous species. As a result, this will affect animal distribution. Earthworks during construction (digging canal), will involve movements of big machines that will produce noise. Both aquatic and terrestrial fauna will be scared and will retreat away from construction site. The fauna species to be affected will be fish, birds, hippopotamus and crocodiles identified through desk research (see section 3.3.2.1)

#### **5.1.2.7 Increase in plastic wastes carried by water from upland**

It is feared that the coming of a canal in the Lower Shire Valley will worsen the situation of plastic papers in the Elephant Marsh. Despite the fact that plastic papers are found all over, it is in urban areas where a larger part of them come from. The canal would therefore carry the plastic paper and dump them in the Shire. Plastic papers accumulation in the marsh may upset animal life.

### **5.1.2.8 Increase in levels of herbicides and pesticides**

There is a risk of increased usage of herbicides and pesticides in irrigation blocks. These may be ingested by wild animals resulting in bioaccumulation and biomagnification within the animals, resulting into death.

### **5.1.2.9 Decrease in water levels in the Elephant Marsh**

Elephant Marsh relies on Shire River for its water supply. Irrigation may abstract water flowing to the canal. This will adversely affect aquatic animals particularly hippopotamus, crocodiles and fish. The birds might fly away.

## **5.2 Mitigation, restoration and monitoring**

The canal route will be marked based on the design right of way (RoW) of 45 meters and DNPW will be invited to ascertain the area marked, and provide any advice or comment on the area marked to optimize it. DNPW will be consulted on the most appropriate way to ensure that there are no animals (including Nyala) present during the clearance of the trees and shrubs.

A tree survey will be undertaken of the marked area to record the species present and their approximate numbers, and to identify and mark suitable shrubs for storing to aid restoration.

The clearance of the trees and shrubs from the area will be through cutting of the vegetation at ground level, under the supervision of an environmental specialist and/or DNPW. Trees and shrubs that are cut during the clearance of the site will be offered to DNPW, then the local communities. Trees and shrubs that are not wanted will be disposed of off-site, in accordance with the contractor's waste management procedures approved for SVTP Phase 2. DNPW will advise the contractor on methods for off-taking the valuable tree species such as *Colophospermum* (Tsanya) and determine method of disposal.

The mitigation and conservation hierarchy is key in guiding the identification, implementation and monitoring of specific actions that contribute to the overarching biodiversity goal of living in harmony with nature. The framework for mitigation hierarchy is structured around four steps, 1) Avoid, 2) Minimize impacts as far as possible 3). Restore/Remediate impacts that are reversible and 4) Offset any residual impacts to achieve a desired net outcome (<https://conservationhierarchy.org>). The first two steps are preventive measures, preventing adverse impact and reducing significant impact of the project on biodiversity. Restoration and offset steps are remedial measures, repairing environmental damage and compensating for residual impacts. These steps were applied in the first ESIA/ESMP but they are still useful since they are generic in nature.

SVTP will work with DNPW and NHBG regarding possibilities of compensatory planting measures to compensate for any residual significant, adverse impacts that cannot be avoided, minimized and / or rehabilitated or restored including proposed location for planting, area in ha, type of plant species to be planted

SVTP and the contractor shall take into account the following measures for the better avoidance of further damage to the areas inside and outside of protected areas:

- (i) Do not undertake construction activities at night to avoid disturbance to nocturnal fauna from increased noise and vibration.
- (ii) Undertake pre-clearance checks of trees to support roosting of fauna species
- (iii) Night working and the use of artificial lighting shall not be permitted to avoid adverse impacts to priority nocturnal fauna
- (iv) Project vehicles shall not be used at night within the project area to avoid adverse impacts to priority nocturnal fauna
- (v) Avoid accidental machinery and vehicle collisions with wildlife: Vehicle operation shall be restricted to daylight hours to minimize the risk of vehicle collisions with wild life
- (vi) Avoid spills of hydrocarbon, oil, chemicals and other hazardous materials
- (vii) Avoid introduction of invasive species and pests

### **5.2.1 Avoid/ refrain**

This study has identified a rich diversity of flora in the project influence area including those which are threatened and listed as protected both at national and global level. The project should refrain from clearing protected species at all cost. Siting of camping sites and access road should strictly avoid further loss of any of the protected species by limiting clearance to right of way. Such species include *Pterocarpus angolensis* DC, *Azelia quanzensis*, *Colophospermum mopane* (J. Kirk ex Benth.) J. Kirk ex J. *Khaya anthotheca* (Welw.) DC, *Pericopsis angolensis* (Baker) Meeuwen, *Indigofera hiliaris* Eckl. & Zeyh., and *Dalbergia melanoxylon* Guill. & Per.

### **5.2.2 Minimise**

Efforts must be taken to reduce the amount of vegetation cleared during all phases of the project, including:

- (i) No new access roads should be created where a well-established road is available.
- (ii) Siting for opening of access roads and camp construction should, where possible, target open spaces or areas with less vegetation cover.
- (iii) Movement of exotic trees through vehicles and other use into the park should be well monitored and discouraged at all costs.
- (iv) Areas scheduled for vegetation clearance shall be demarcated and activities outside the designated areas (spill over effects) shall be strictly forbidden
- (v) Environmentally sensitive areas shall be clearly marked and mapped as 'No Go Areas'
- (vi) Herbicide and fire shall not be permitted as a means to clear vegetation to ensure a minimal impact footprint during habitat clearance and to reduce the risk of mortality and injury to wildlife.
- (vii) Reduced speed limits shall be signposted to minimize the risk of accidental injury and mortality to fauna
- (viii) Vehicle traffic shall be slowed at wildlife crossing point. This reduction in speed limit shall be signposted
- (ix) Signs shall be installed to identify wildlife crossing point to vehicle traffic

### **5.2.3 Restore**

Ecological restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Roberts et al, 2005). Afforestation with native species and allowing coppicing of cut trees are examples of *in situ* restoration initiatives that need to be

considered. Establishment of nurseries with indigenous flora and *ex situ* conservation at the herbarium and botanical Gardens of Malawi and Malawi Plant Genetic Resources Center can be used as source of seedlings for future restoration of the project impact areas. Implementation of restoration plans depends on responsible sharing of commitments by public agencies, private sectors, and individuals. Monitoring is required to assess progress and to document the needed information and lessons learned.

Annex 9 provides detailed information on risks, mitigation measures, responsible institutions and associated budgets.



## **Chapter 6: Recommendations**

Much as the report has provided comprehensive information on biodiversity status in Lengwe National Park and the Elephant Marsh, there is need for further work on three fronts: follow-up and additional biodiversity assessments, biodiversity monitoring during and after construction works, impact of the canal construction on livelihoods.

### **6.1 Follow-up and additional biodiversity assessments**

- For Elephant Marsh, field assessments were only done for fish. Therefore, only generalized impacts could be determined. There is need for more field assessments on birds, hippopotamus, crocodiles and flora. The additional assessments will be conducted by the Biodiversity Monitoring Expert that DNPW will, hire with support from SVTP; and
- Results of the assessment presented in this report are based on rainy season field work. There might be seasonal variations in abundance, distribution, species richness and threats. Consequently, dry season assessments should be done along the proposed canal using the same methods employed presented in this report.

### **6.2 Biodiversity Monitoring during after construction works**

This report has revealed that canal construction will have negative impacts on biodiversity, directly and indirectly. There will be need for continuous monitoring of biodiversity status through out construction phase and even after. For effective monitoring and evaluation, there is need for:

- vi. Training and capacity building of DNPW staff on impact assessments, monitoring, evaluation and reporting.
- vii. Recruitment of a Biodiversity Monitoring Expert to provide technical assistance to DNPW on assessments, monitoring, evaluation and reporting.
- viii. Develop and implement a restoration plan for negative impacts on biodiversity identified in this report
- ix. Revise the ESIA report in light of the new information generated from field assessments;

### **6.3 Impact of the canal construction on livelihoods**

Community members around Lengwe and the Elephant Marsh directly benefit from these conservation areas. Canal construction may have both negative and positive impacts on livelihoods of surrounding communities. There is therefore need to conduct rapid community surveys to generate information on community perceptions on the canal and how it will affect their livelihoods.

It is anticipated that with the proposed strategies and mitigation actions, project will not cause Net Loss in biodiversity in Lengwe National Park and the Elephant Marsh.

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- Mkanda, F.X. (1996). Potential impacts of future climate change on nyala *Tragelaphus angasi* in Lengwe National Park, Malawi. *Climate Research*. Vol 6, 157-164.

## List of annexes

### Annex 1: Databases consulted for nomenclature under Flora

1. Binns, B. (1972) Dictionary of Plant Names in Malawi, The Government Printer, Zomba, Malawi.
2. Flora of Malawi, <https://www.malawiflora.com/>: This site provides information about the flowering plants and ferns of Malawi. This is one of 6 e-floras which cover the Flora Zambesiaca area in south-central Africa.
3. World Checklist of Selected Plant Families (WCSP): the most up to date, actively curated taxonomy database, which is peer-reviewed by over 120 collaborators worldwide. It provides taxonomy and distributions for approximately 50% of plant families and is refreshed daily [<http://apps.kew.org/wcsp/home.do>].
4. The Plant List (TPL): was built in collaboration with the Missouri Botanical Garden and other systematists worldwide. It is a working list of all known plant species and is comprehensive for all species of vascular plants and bryophytes (mosses and liverworts). Though complete, TPL is a static list that was built from data sets, including WCSP, supplied before August 2012, and thus does not reflect subsequent additions and improvements to these data sets [<http://www.theplantlist.org/>].
5. Name Parser (<https://www.gbif.org/tools/name-parser>) is a free online tool listed on GBIF tools and it allows to divide scientific names into their components and to check them against the taxonomic backbone used by GBIF. It can be used to automate some processes while digitizing or curating lists of scientific names. Furthermore the identified samples were validated using the GBIF data validator (<https://www.gbif.org/tools/data-validator/about>), a service that allows anyone with a GBIF-relevant dataset to receive a report on the syntactical correctness and the validity of the content contained within the dataset.
6. 5World Flora Online "An Online Flora of All Known Plants" searchable by species, genus or family name, or any words describing the plant.
7. Tropicos Tropicos, is an online database which was originally created for internal research but has since been made available to the world's scientific community. This system has over 1.2 million scientific names and 4.0 million specimen records.
8. Name Parser (<https://www.gbif.org/tools/name-parser>) is a free online tool listed on GBIF tools and it allows to divide scientific names into their components and to check them against the taxonomic backbone used by GBIF. It can be used to automate some processes while digitizing or curating lists of scientific names. Furthermore the identified samples were validated using the GBIF data validator (<https://www.gbif.org/tools/data-validator/about>), a service that allows anyone with a GBIF-relevant dataset to receive a report on the syntactical correctness and the validity of the content contained within the dataset.

9. Plants Of the World Online (POWO) launched in 2017, POWO is an international collaborative programme that has as a primary aim to make available digitized data of the world's flora gathered from the past 250 years of botanical exploration and research. All data incorporated into POWO are attached to the currently accepted name from the WCV names backbone. Plants of the World Online

**Annex 2: Options report for the canal route of Main Canal 2 in the Lengwe Park area**

**31<sup>st</sup> May 2022**

**Prepared by the Design Team of  
Consultant (KRC JV)**

## **PART 1: THREE OPTIONS OF CANAL ALIGNMENT**

### **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.

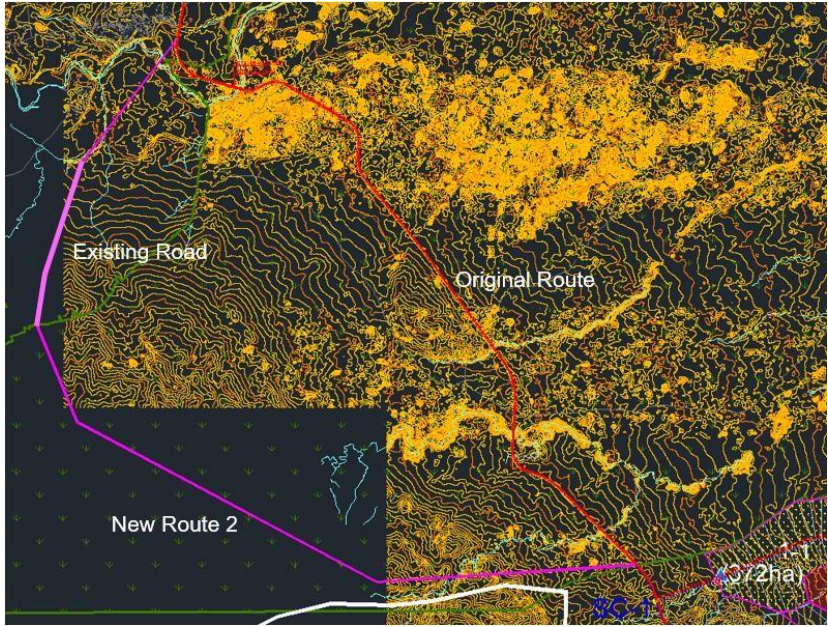
### **3) Alignment 3: New Route No.2**

- 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 22:** Original Route and New Route 1 in the Lengwe Park Area



**Figure 23:** Original Route and New Route 2 in the Lengwe Park Area

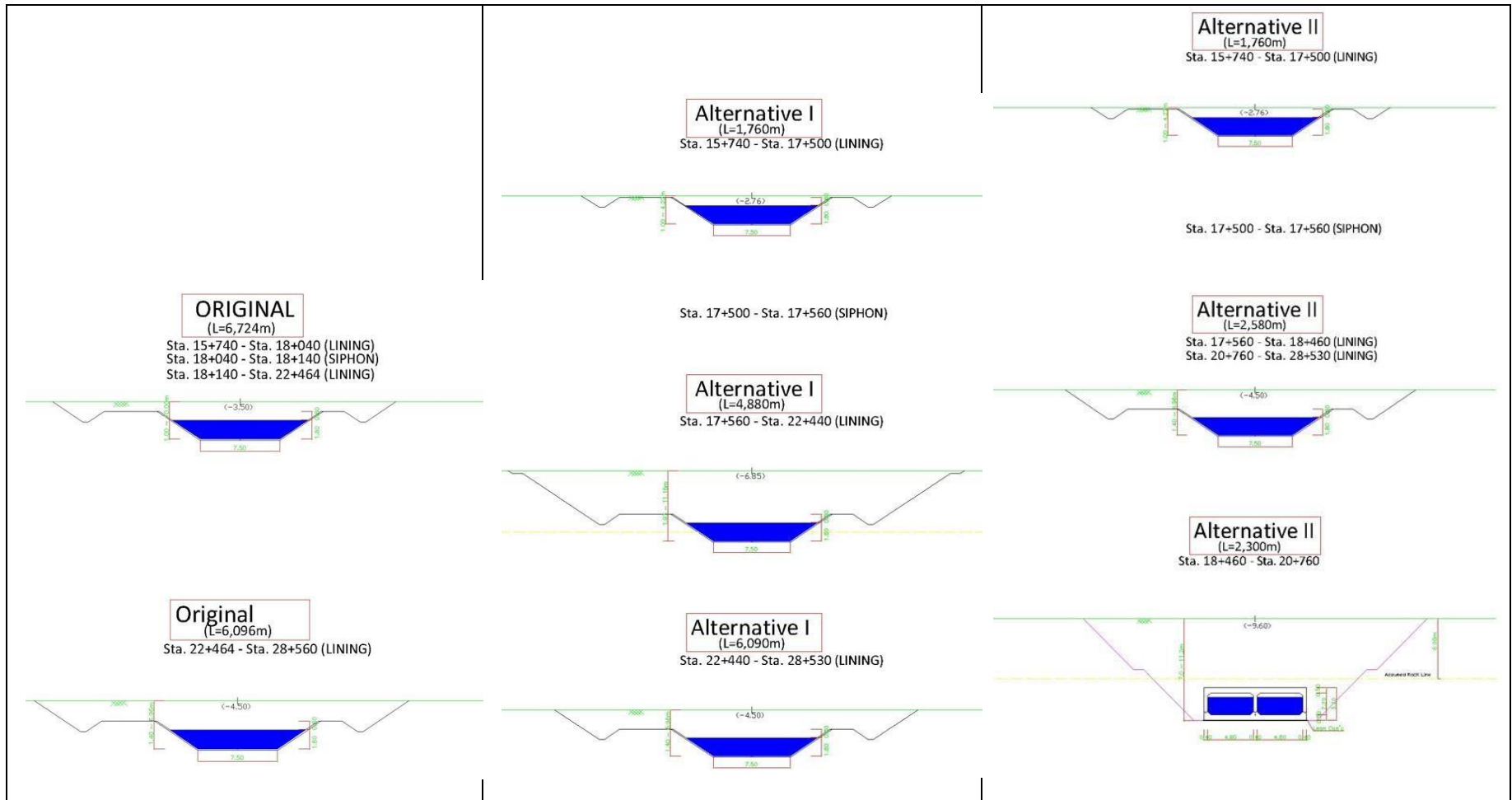


**Table 23:** Important Construction Items

Parameter	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 <sup>2</sup>	280,500	456,900	408,100	972,000
Area of Natural Habitat lost temporarily	m <sup>2</sup>	85,000	127,900	127,900	167,800
Area of Critical Habitat permanent lost	m <sup>2</sup>	142,560	-	-	-
Area of Critical Habitat temporarily lost	m <sup>2</sup>	43,200	-	-	-
Area of compensation planting	m <sup>2</sup>	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 <sup>3</sup>	1,063,416	1,680,337	1,011,292	23,120,161

<b>Approximate cost (Lengwe Section 14km)</b>	<b>USD</b>	<b>10,456,509</b>	<b>12,292,489</b>	<b>24,762,679</b>	<b>130,686,882</b>
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**Canal Sections for four options**



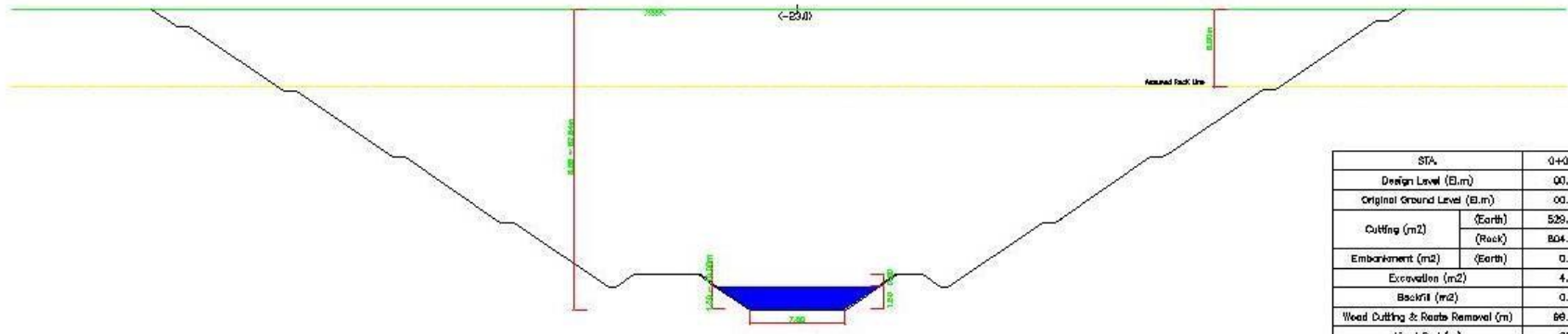
**Alternative III**  
(L=1,380m)  
Sta. 15-740 Sta. 17-120 (LINING)



Sta. 17-120 Sta. 17-220 (SIPHON)

STA.		0+000
Design Level (El.m)		00.00
Original Ground Level (El.m)		00.00
Cutting (m <sup>2</sup> )	(Earth)	34.40
	(Rock)	0.00
Embankment (m <sup>2</sup> )		0.00
Excavation (m <sup>2</sup> )		4.00
Backfill (m <sup>2</sup> )		0.00
Wood Cutting & Roots Removal (m)		30.00
Lined Sod (m)		0.00
Side Slope Farming (m)	(E)	0.00
	(C)	0.00
Lining(m)	Machine	18.78
	Lining	0.00

**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 (m <sup>2</sup> )	(Earth)	528.40
	(Rock)	804.87
Embankment (m <sup>2</sup> )		0.00
Excavation (m <sup>2</sup> )		4.00
Backfill (m <sup>2</sup> )		0.00
Wood Cutting & Roots Removal (m)		86.00
Lined Sod (m)		86.4
Side Slope Farming (m)	(E)	0.00
	(C)	72.0
Lining(m)	Machine	18.78
	Lining	0.00

**Table 24:** 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)	
<b>Whether to pass through the thicket area</b>	- Pass through the thicket area - Unfavourable for preservation of vegetation in thicket area	- Does not pass through the thicket area - Favourable for preservation of vegetation in thicket area	- Does not pass through the thicket area - Favourable for preservation of vegetation in thicket area	- Does not pass through the thicket area - Favourable for preservation of vegetation in thicket area
<b>Impact of ground excavation (Landscape, disposal of excavated soil, animal safety, etc.)</b>	- 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. - Unfavourable 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.

<b>Installation of Animal Passages</b>	<ul style="list-style-type: none"> <li>- Length of conduit section for Animal Passages installation: 34 m x 2ea</li> <li>- Construction cost of conduit: 403,821\$ (Favourable)</li> </ul>	<ul style="list-style-type: none"> <li>- Length of conduit section for Animal Passages installation: 42 m x 2ea</li> <li>- Construction cost of conduit: 498,665\$ (Unfavourable)</li> </ul>	<ul style="list-style-type: none"> <li>- No need to install additional conduit for Animal Passages as the conduit is installed in 46% of the new route section.</li> </ul>	<ul style="list-style-type: none"> <li>- Unreasonable to install conduit section</li> </ul>
<b>Construction Cost</b>	- The smallest	- The medium	- The larger	- The Largest

## 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)	<p>The Cross Sectional Slope will be designed as 1:1.5, and the reasons for this are as follows:</p> <ul style="list-style-type: none"><li>- 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.</li><li>- If the canal sectional slope is alleviated, the occupied area of the canal will be further expanded, creating more unfavourable conditions for the environment in the park. In addition, if the canal width is enlarged, the floor friction force is increased and the</li></ul>

	water head is reduced, which causes an obstacle to the downstream water supply.
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## 2. Canal Paving Material

Request of Environment Expert	Application in the Design
Install the armorflex on the floor.	<p>The canal floor will be constructed with a concrete lining, for the following reasons:</p> <ul style="list-style-type: none"> <li>- As described above, it is not necessary to install an armorflex 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.</li> </ul>

## 3. Eco Passages

Request of Environment Expert	Application in the Design
5 over passes (50m wide) and one under pass	<p>5 over passes (50m wide) will be installed, but not under pass. The reasons for this are as follows:</p> <ul style="list-style-type: none"> <li>- 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.</li> </ul>

**4. Compensation Planting**

<b>Request of Environment Expert</b>	<b>Application in the Design</b>
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 3: Birds of Lengwe National Park Based on Literature Review**

No.	ENGLISH NAME	SCIENTIFIC NAME	LAST RECORDED	OCCURRENCE	REMARKS
1	Abdim's Stork	<i>Ciconia abdimii</i>	2015	Resident, Rare	unconfirmed
2	African Barred Owlet	<i>Glaucidium capense</i>	2015	Resident, Rare	
3	African Black Swift	<i>Apus barbatus</i>	2015	Resident, Rare	unconfirmed
4	African Broadbill	<i>Smithornis capensis</i>	2015	Resident, Rare	unconfirmed
5	African Crake	<i>Crecopsis egregia</i>	2015	Resident, Rare	unconfirmed
6	African Crowned Eagle	<i>Stephanoaetus coronatus</i>	2020	Resident, Common	unconfirmed, NTH*
7	African Cuckoo	<i>Cuculus gularis</i>	2015	Resident, Rare	unconfirmed
8	African Cuckoo-Hawk	<i>Aviceda cuculoides</i>	2015	Resident, Rare	unconfirmed
9	African Firefinch	<i>Lagonosticta rubricate</i>	2020	Resident, Rare	
10	African fish Eagle	<i>Haliaeetus vocifer</i>	2020	Resident, Rare	confirmed
11	African Golden Oriole	<i>Oriolus auratus</i>	2002	Resident, Common	unconfirmed
12	African Goshawk	<i>Accipiter tachiro</i>	2020	Resident, Common	confirmed
13	African Grey Hornbill	<i>Lophoceros nasutus</i>	2020	Resident, Common	confirmed
14	African Hawk Eagle	<i>Aquila spilogaster</i>	2020	Resident, Rare	confirmed
15	African Hoopoe	<i>Upupa Africana</i>	2020	Resident, Common	unconfirmed
16	African Jacana	<i>Actophilornis africanus</i>	2020	Resident, Rare	confirmed
17	African Marsh Harrier	<i>Circus ranivorus</i>	2020		
18	African Mourning Dove	<i>Streptopelia decipiens</i>	2015	Resident, Common	unconfirmed
19	African Moustached Warbler	<i>Melocichla mentalis</i>	2002	Resident, Rare	unconfirmed
20	African Openbill Stork	<i>Anastomus lamelligerus</i>	2020	Resident, Common	confirmed
21	African Palm Swift	<i>Cypsiurus parvus</i>	2020	Resident, Common	confirmed
22	African Paradise Flycatcher	<i>Terpsiphone viridis</i>	2020	African Migrant, Common	
23	African Penduline-Tit	<i>Anthoscopus caroli</i>	2020	Resident, Common	
24	African Pied Wagtail	<i>Motacilla aguimp</i>	2015	Resident, Common	unconfirmed
25	African Pipit	<i>Anthus cinnamomeus</i>	2020		
26	African Pygmy Kingfisher	<i>Ispidina picta</i>	2020	African Migrant, Rare	confirmed
27	African Reed Warbler	<i>Acrocephalus baeticatus</i>	2002	African Migrant	unconfirmed

28	African Rock Martin	<i>Hirundo fuligula</i>	2002	Resident, Rare	unconfirmed
29	African Scops Owl	<i>Otus senegalensis</i>	2015	Resident, Rare	unconfirmed
30	African-barred owlet	<i>Glaucidium capense</i>	2002	Resident, Rare	unconfirmed
31	Amethyst Sunbird	<i>Chalcomitra amethystine</i>	2020	Resident, Rare	confirmed
32	Arnot's Chat	<i>Myrmecocichla arnoti</i>	2020	Resident, Common	confirmed
33	Arrow-marked Babbler	<i>Turdoides jardineii</i>	2020	Resident, Rare	confirmed
34	Ashy Flycatcher	<i>Muscicapa caerulescens</i>	2020	Resident, Common	unconfirmed
35	Ayres's Hawk Eagle	<i>Hieraaetus ayresii</i>	2015	Resident, Rare	unconfirmed
36	Barn Owl	<i>Tyto alba</i>	2002	Resident, Common	unconfirmed
37	Barn Swallow	<i>Hirundo rustica</i>	2015	Migrant, Common	unconfirmed
38	Barred Long-tailed Cuckoo	<i>Cercococcyx montanus</i>	2015	African Migrant, Rare	unconfirmed
39	Basra Reed Warbler	<i>Acrocephalus griseldis</i>	2015	Migrant, Rare,	unconfirmed, CEN*
40	Bateleur	<i>Terathopius ecaudatus</i>	2020	Resident, Common.	confirmed, END*
41	Bat-like Spinetail	<i>Neafrapus boehmi</i>	1983	Resident, Rare	unconfirmed
42	Bearded Scrub-robin	<i>Cercotrichas quadrivirgata</i>	2020		
43	Bearded Woodpecker	<i>Thripias namaquus</i>	2020	Resident, Common	confirmed
44	Bennett's Woodpecker	<i>Campethera bennettii</i>	2020	Resident, Rare	confirmed
45	Black (Yellow-billed) Kite	<i>Milvus migrans</i>	2002	African Migrant	unconfirmed
46	Black Cuckoo	<i>Cuculus clamosus</i>	2015	African Migrant, Common	unconfirmed
47	Black Cuckoo Shrike	<i>Campephaga flava</i>	2015	Resident, Common	unconfirmed
48	Black Goshawk	<i>Accipiter melanoleucus</i>	2002	Resident, Rare	unconfirmed
49	Black Saw-wing	<i>Psalidoprocne pristoptera</i>	2015	African Migrant, Common	unconfirmed
50	Black Stork	<i>Ciconia nigra</i>	2015	Resident, Rare	unconfirmed
51	Black-and-white Flycatcher	<i>Bias musicus</i>	2015	Resident, Rare	unconfirmed
52	Black-backed puffback	<i>Dryoscopus cubla</i>	2020	Resident, Common	unconfirmed
53	Black-bellied Bustard	<i>Eupodotis melanogaster</i>	2020	Resident, Rare	confirmed
54	Black-breasted Snake Eagle	<i>Circaetus gallicus pectoralis</i>	2020	Resident, Rare	unconfirmed
55	Black-collared Barbet	<i>Lybius torquatus</i>	2020	Resident, Common	confirmed

56	Black-crowned Night Heron	Nycticorax nycticorax	2015	Resident, Rare	unconfirmed
57	Black-crowned Tchagra	Tchagra senegalus	2020	Resident, Common	
58	Black-headed Heron	ardea melanocephala	2015	Resident, Rare	unconfirmed
59	Black-rumped Buttonquail	Turnix nanus	2015	African Migrant, Rare	unconfirmed
60	Black-shouldered Kite	Elanus axillaris	2015	Resident, Rare	unconfirmed
61	Black-throated Wattle-eye	Platysteira peltata	2020	Resident, Common	confirmed
62	Black-winged Red Bishop	Euplectes hordeaceus	2015	Resident, Common	unconfirmed
63	Black-winged Stilt	Himantopus himantopus	2015	Resident, Rare	unconfirmed
64	Bleating camaroptera	Camaroptera brachyura	2015	Resident, Common	unconfirmed
65	Blue Quail	Excalfactoria adansonii	2015	African Migrant	unconfirmed
66	Blue-cheeked Bee-eater	Merops persicus	2015	Parlearctic Migrant, Common	unconfirmed
67	Blue-mantled Flycatcher	Trochocercus cyanomelas	2015	Resident, Common	unconfirmed
68	Blue-spotted Dove	Turtur afer	2020	Resident, Rare	confirmed
69	Böhm's Bee-eater	Merops boehmi	2020	Resident, Common	confirmed
70	Booted Eagle	Hieraaetus pennatus	2015	Parlearctic Migrant, Rare	unconfirmed
71	Broad-billed Roller	Eurystomus glaucurus	2015	African Migrant, Common	unconfirmed
72	Broad-tailed paradise whydah	Vidua obtusa	2015	Resident, Rare	unconfirmed
73	Bronze Mannikin	Lonchura cucullata	2020	Resident, Rare	confirmed
74	Bronze-winged Courser	Rhinoptilus chalcopterus	2020	Resident, Common	confirmed
75	Brown-backed Honeyguide	Prodotiscus regulus	2015	Resident, Rare	unconfirmed
76	Brown-crowned tchagra	Tchagra australis	2015	Resident, Common	unconfirmed
77	Brown-headed Parrot	Poicephalus cryptoxanthus	2020	Resident, Rare	confirmed
78	Brown-hooded Kingfisher	Halcyon albiventris	2020	Resident, Common	unconfirmed
79	Brown-necked (Cape) Parrot	P. fuscicollis fuscicollis	2015	Resident, Rare	unconfirmed
80	Brubru	Nilaus afer	2020	Resident, Common	confirmed
81	Bully Canary	Crithagra sulphurata	2020	Resident, Rare	confirmed
82	Burchell's Coucal	Centropus burchellii	2020	Resident, Common	confirmed
83	Burnt-necked Eremomela	Eremomela usticollis	2020	Resident, Common	confirmed

84	Bushveld Pipitica	<i>Anthus caffer</i>	2020	Resident, Common	unconfirmed
85	Cabanis bunting	<i>Emberiza cabanis</i>	2020	Resident, Rare	unconfirmed
86	Cape bunting	<i>Emberiza capensis</i>	2020	Resident, Rare	unconfirmed
87	Cape Turtle Dove	<i>Streptopelia capicola</i>	2020	Resident, Common	confirmed
88	Cardinal Woodpecker	<i>Dendropicos fuscescens</i>	2020	Resident, Common	confirmed
89	Cattle Egret	<i>Bubulcus ibis</i>	2015	Resident, Rare	unconfirmed
90	Chestnut-backed Finch Lark	<i>Eremopterix leucotis</i>	2002	Resident, Common	unconfirmed
91	Chinspot Batis	<i>Batis molitor</i>	2020	Resident, Common	confirmed
92	Cinnamon-breasted Rock Bunting	<i>Emberiza tahapisi</i>	2020	African Migrant, Common	confirmed
93	Collared Palm Thrush	<i>Cichladusa arquata</i>	2015	Resident, Common	unconfirmed
94	Collared Sunbird	<i>Hedydipna collaris</i>	2020	Resident, Common	confirmed
95	Common Bulbul	<i>Pycnonotus barbatus</i>	2002	Resident, Common	unconfirmed
96	Common Buzzard	<i>Buteo buteo</i>	2015	Parlearctic Migrant, Common	unconfirmed
97	Common Cuckoo	<i>Cuculus canorus</i>	2015	Parlearctic Migrant, Common	unconfirmed
98	Common Moorhen	<i>Gallinula chloropus</i>	2015	Resident, Rare	unconfirmed
99	Common Sandpiper	<i>Actitis hypoleucos</i>	2020	Parleactic Migrant, Rare	confirmed
100	Common Scimitarbill	<i>Rhinopomastus cyanomelas</i>	2015	Resident, Rare	unconfirmed
101	Common Swift	<i>Apus apus</i>	2015	Parlearctic Migrant, Common	unconfirmed
102	Common Waxbill	<i>Estrilda astrild</i>	2020	Resident, Common	confirmed
103	Coppery Sunbird	<i>Nectarinia cuprea</i>	2015	Resident, Common	unconfirmed
104	Crested Barbet	<i>Trachyphonus vaillantii</i>	2020	Resident, Common	confirmed
105	Crested Francolin	<i>Dendroperdix sephaena</i>	2015	Resident, Common	unconfirmed
106	Crested Guineafowl	<i>Guttera pucherani</i>	2020	Resident, Common	confirmed
107	Croaking Cisticola	<i>Cisticola natalensis</i>	2015	Resident, Rare	unconfirmed
108	Crowned Hornbill	<i>Lophoceros alboterminatus</i>	2020	Resident, Common	confirmed
109	Cut-throat Finch	<i>Amadina fasciata</i>	2020	Resident, Rare	confirmed
110	Dabchick	<i>Tachybaptusruficollis</i>	2020	Resident, Rare	unconfirmed
111	Dark-backed Weaver	<i>Ploceus bicolor</i>	2020	Resident, Common	confirmed

112	Dark-caped Bulbul	<i>Pycnonotus capensis</i>	2020	Resident, Common	
113	Dickinson's Kestrel	<i>Falco dickinsoni</i>	2020	Resident, Rare	confirmed
114	Diederick Cuckoo	<i>Chrysococcyx caprius</i>	2020	African Migrant, Common	confirmed
115	Dusky Flycatcher	<i>Muscicapa adusta</i>	2002	Resident, Rare	unconfirmed
116	Dwarf Bittern	<i>Ixobrychus sturmii</i>	2015	African Migrant, Rare	unconfirmed
117	Eastern Bearded Scrub Robin	<i>Erythropygia quadrivirgata</i>	2002	Resident, Rare	unconfirmed
118	Eastern Black-headed Oriole	<i>Oriolus larvatus</i>	2020	Resident, Common	unconfirmed
119	Eastern Nicator	<i>Nicator gularis</i>	2020	Resident, Common	
120	Eastern Red-footed Falcon	<i>Falco amurensis</i>	2015	Parleartic Migrant, Common	unconfirmed, NTH*
121	Egyptian Goose	<i>Alopochen aegyptiaca</i>	2015	Resident, Rare	unconfirmed
122	Emerald Cuckoo	<i>Chrysococcyx cupreus</i>	2002	African Migrant, Common	unconfirmed
123	Emerald-spotted Dove	<i>Turtur chalcospilos</i>	2020	Resident, Common	confirmed
124	European Bee-eater	<i>Merops apiaster</i>	2015	Parleartic Migrant, Common	unconfirmed
125	European Golden Oriole	<i>Oriolus oriolus</i>	2015	Parleartic Migrant, Rare	unconfirmed
126	European Hobby	<i>Falco subbuteo</i>	2015	Parleartic Migrant, Common	unconfirmed
127	European Marsh Warbler	<i>Acrocephalus palustris</i>	2002	Parleartic Migrant, Common	unconfirmed
128	European Nightjar	<i>Caprimulgus europaeus</i>	2015	Parleartic Migrant, Rare	unconfirmed
129	European Roller	<i>Coracias garrulus</i>	2020	Migrant, Common	confirmed, NTH*
130	European Sand Martin	<i>Riparia riparia</i>	2015	Parleartic Migrant, Rare	unconfirmed
131	Familiar Chat	<i>Cercomela familiaris</i>	2015	Resident, Rare	unconfirmed
132	Fan-tailed Widowbird	<i>Euplectes axillaris</i>	2020		
133	Fiery-necked Nightjar	<i>Caprimulgus pectoralis</i>	2015	Resident, Common	unconfirmed
134	Flappet Lark	<i>Mirafraga rufocinnamomea</i>	2020	Resident, Common	confirmed
135	Fork-tailed Drongo	<i>Dicrurus adsimilis</i>	2020	Resident, Common	confirmed

136	Freckled Rock Nightjar	Caprimulgus tristigma	2015	Resident, Rare	unconfirmed
137	Gabar Goshawk	Micronisus gabar	2020	Resident, Rare	confirmed
138	Gaboon Nightjar	Caprimulgus fossii	2002	Resident, Common	unconfirmed
139	Garden Warbler	Sylvia borin	2015	Parleactic Migrant, Rare	unconfirmed
140	Giant Eagle Owl	Bubo lacteus	2002	Resident, Common	unconfirmed
141	Giant Kingfisher	Megaceryle maxima	2002	Resident, Rare	unconfirmed
142	Glossy Ibis	Plegadis falcinellus	2015	Resident, Rare	unconfirmed
143	Golden-rumped Tinkerbird	Pogoniulus bilineatus	2002	Resident, Common	unconfirmed
144	Golden-tailed Woodpecker	Campethera abingoni	2020	Resident, Rare	confirmed
145	Goliath Heron	Ardea goliath	2015	Resident, Rare	unconfirmed
146	Great Reed Warbler	Acrocephalus arundinaceus	2015	Migrant, Rare	unconfirmed
147	Great Spotted Cuckoo	Clamator glandarius	2015	African Migrant, Rare	unconfirmed
148	Great Spotted Eagle	Clanga clanga	2002	Parleactic Migrant, Rare	unconfirmed, VUL*
149	Great White Egret	Ardea alba	2015	Resident, Rare	unconfirmed
150	Great White Pelican	Pelecanus onocrotalus	2015	Resident, Rare	unconfirmed
151	Greater Black-backed Cisticola	Cisticola galactotes	2002	Resident, Common	unconfirmed
152	Greater Blue-eared Starling	Lamprotornis chalybaeus	2020	Resident, Common	confirmed
153	Greater Honeyguide	Indicator indicator	2020	Resident, Common	confirmed
154	Greater-painted Snipe	Rostratula benghalensis	2015	Resident, Rare	unconfirmed
155	Green Coucal	Ceuthmochares aereus	2015	Resident, Common	unconfirmed
156	Green Indigo bird	Vidua codringtoni	1991	Resident, Rare	unconfirmed
157	Green Pigeon	Treron australis	2020	Resident, Rare	unconfirmed
158	Green Sandpiper	Tringa ochropus	2002	Parleactic Migrant, Common	unconfirmed
159	Green Shank	Tringa nebularia	1981	Parlearctic Migrant, Rare	unconfirmed
160	Green Twinspot	Mandingoa nitidula	2015	Resident, Rare	unconfirmed
161	Green Wood Hoopoe	Phoeniculus purpureus	2020	Resident, Common	
162	Green-backed Camaroptera	Camaroptera brachyura	2020	Resident, Common	confirmed
163	Green-backed Heron	Butorides striatus	2015	Resident, Rare	unconfirmed

164	Green-capped Eremomela	Eremomela scotops	2020	Resident, Common	unconfirmed
165	Green-winged Pytilia	Pytilia melba	2020	Resident, Common	
166	Grey Go-away Bird	Crinifer concolor	2020		
167	Grey Heron	Ardea cinerea	2020	Resident, Rare	confirmed
168	Grey Hornbill	<i>Tockus nasutus</i>	2020	Resident, Common	
169	Grey Lourie	Corythaixoides concolor	2020	Resident, Common	confirmed
170	Grey Penduline Tit	Anthoscopus caroli	2020	Resident, Common	confirmed
171	Grey Sunbird	Cyanomitra verreauxii	2015	Resident, Common	unconfirmed
172	Grey-backed Camaroptera	Camaroptera brevicaudata	2020	Resident, Common	unconfirmed
173	Grey-headed Bush Shrike	Malaconotus blanchoti	2020	Resident, Common	
174	Grey-headed Sparrow	Passer griseus	2020	Resident, Common	
175	Grey-headed Kingfisher	Halcyon leucocephala	2015	African Migrant, Rare	unconfirmed
176	Grey-rumped Swallow	Pseudhirundo griseopyga	2020		
177	Gymnogene	Polyboroides typus	2020	Resident, Common	unconfirmed
178	Hadeda Ibis	Bostrychia hagedash	2020	Resident, Common	confirmed
179	Half-collared Kingfisher	Alcedo semitorquata	2020	Resident, Common	confirmed
180	Harlequin Quail	Coturnix delegorgei	2020	Resident, Common	unconfirmed
181	Harmekop Scopus	Scopus umbretta	2020	Resident, Common	confirmed
182	Helmeted Guineafowl	Numida meleagris	2020	Resident, Rare	unconfirmed
183	Heuglin's Robin	Cossypha heuglini	2002	Resident, Common	unconfirmed
184	Hildebrandt's Francolin	Pternistis hildebrandti	2015	Parleactic Migrant, Rare	unconfirmed
185	Holub's Golden Weaver	Ploceus xanthops	2002	Resident, Rare	unconfirmed
186	Honey Buzzard	Pernis apivorus	2020	Migrant, Rare	confirmed
187	Hooded Vulture	Necrosyrtes monachus	2015	Resident, Rare	unconfirmed, CEN*
188	Horus Swift	Apus horus	2015	Parleactic Migrant, Rare	unconfirmed
189	House Martin	Delichon urbicum	2015	Parleartic Migrant, Rare	unconfirmed
190	Icterine Warbler	Hippolais icterina	2015	Parleactic Migrant, Rare	unconfirmed
191	Jacobin Cuckoo	Clamator jacobinus	2020	Resident, Common	confirmed

192	Jameson's Firefinch	Lagonosticta rhodopareia	2020	Resident, Common	unconfirmed
193	Klaas's Cuckoo	Chrysococcyx klaas	2015	Resident, Common	unconfirmed
194	Knob-billed Duck	Sarkidiornis melanotos	2019	Resident, Rare	unconfirmed
195	Kurrichane Buttonquail	Turnix sylvaticus	2020	Resident, Common	confirmed
196	Kurrichane Thrush	Turdus libonyana	2020	Resident, Rare	unconfirmed
197	Lanner Falcon	Falco biarmicus	2015	Resident, Rare	unconfirmed
198	Lappet-faced Vulture	Torgos tracheliotos	2015	Resident, Rare	unconfirmed, VUL*
199	Large-striped Pipit	Anthus lineiventris	2020	Resident, Rare	confirmed
200	Laughing Dove	Spilopelia senegalensis	2020	Resident, Common	unconfirmed
201	Lazy Cisticola	Cisticola aberrans	2020		
202	Lead-coloured Flycatcher	Myioparus plumbeus	2020	Resident, Rare	confirmed
203	Lemon-breasted Canary	Crithagra citrinipectus	2020	Resident, Common	unconfirmed
204	Lesser Black-winged Plover	Vanellus lugubris	2002	Resident, Common	unconfirmed
205	Lesser Blue-eared Starling	Lamprotornis chloropterus	2002	Resident, Common	unconfirmed
206	Lesser cuckoo	Cuculus poliocephalus	2002	Migrant, Rare	unconfirmed
207	Lesser Honeyguide	Indicator minor	2020	Parlearctic Migrant, Rare	confirmed
208	Lesser Masked Weaver	Ploceus intermedius	2020	Resident, Common	confirmed
209	Lesser Spotted Eagle	Clanga pomarina	2020	Parleactic Migrant, Rare	confirmed
210	Lesser Swamp Warbler	Acrocephalus gracilirostris	2020	Resident, Rare	confirmed
211	Levaillant's cisticola	Cisticola tinniens	2020	Resident, Common	confirmed
212	Lilac-breasted Roller	Coracias caudatus	2020	Resident, Common	confirmed
213	Little Bee-eater	Merops pusillus	2020	Resident, Rare	unconfirmed
214	Little Egret	Egretta garzetta	2002	Resident, Rare	unconfirmed
215	Little Sparrowhawk	Accipiter minullus	2015	Resident, Rare	unconfirmed
216	Little Spotted Woodpecker	Campethera cailliautii	2002	Resident, Common	unconfirmed
217	Livingstone's Flycatcher	Erythrocerus livingstonei	2020	Resident, Common	confirmed
218	Lizard Buzzard	Kaupifalco monogrammicus	2020	Resident, Common	confirmed
219	Long-billed Crombec	Sylvietta rufescens	2020	Resident, Rare	unconfirmed
220	Long-crested Eagle	Lophaetus occipitalis	2015	Resident, Rare	unconfirmed



221	Long-tailed (Mountain) Wagtail	Motacilla clara	2002	Resident, Rare	unconfirmed
222	Long-tailed Paradise Whydah	Vidua paradisaea	2015	Resident, Common	unconfirmed
223	Madagascar Bee-eater	Merops superciliosus	2015	Resident, Common	unconfirmed
224	Malachite Kingfisher	Corythornis cristatus	2015	Resident, Rare	unconfirmed
225	Marabou Stork	Leptoptilos crumenifer	2020	Resident, Common	
226	Marsh Sandpiper	Tringa stagnatilis	2020	Parleactic Migrant, Rare	unconfirmed
227	Martial Eagle	Polemaetus bellicosus	2020	Resident, Rare	unconfirmed, END*
228	Mascarene Martin	Phedina borbonica	2015	Resident, Common	unconfirmed
229	Miombo Barred Warbler	Calamonastes undosus	2002	Migrant, Rare	unconfirmed
230	Miombo Blue-eared Starling	Lamprotornis elisabeth	2020	Resident, Common	unconfirmed
231	Montagu's Harrier	Circus pygargus	2015	Parleactic Migrant, Rare	unconfirmed
232	Mosque Swallow	Cecropis senegalensis	2015	Resident, Rare	unconfirmed
233	Mottled Spinetail	Telacanthura ussheri	2020	Resident, Rare	confirmed
234	Mourning Dove	Zenaida macroura	2020	Resident, Common	confirmed
235	Namaqua Dove	Oena capensis	2020	Resident, Common	unconfirmed
236	Narina Trogon	Apaloderma narina	2015	Resident, Common	unconfirmed
237	Neddicky	Cisticola fulvicapilla	2015	Resident, Common	unconfirmed
238	Olive Tree Warbler	Hippolais olivetorum	2015	Resident, Rare	unconfirmed
239	Orange-breasted Bush Shrike	Chlorophoneus sulfureopectus	2020	Resident, Rare	confirmed
240	Orange-winged Pytilia	Pytilia afra	2020	Resident, Rare	unconfirmed
241	Ovambo Sparrowhawk	Accipiter ovampensis	2015	Resident, Rare	unconfirmed
242	Pale-billed Hornbill	Lophoceros pallidirostris	2020	Resident, Common	confirmed
243	Pale-chanting goshawk	Melierax canorus	2020	Resident	unconfirmed
244	Pallid Flycatcher	Melaenornis pallidus	2015	Resident, Common	unconfirmed
245	Paradise Flycatcher	Terpsiphone	2002	African Migrant, Common	unconfirmed, VUL*
246	Parasitic Weaver	Anomalospiza imberbis	2002	Resident, Common	unconfirmed
247	Pearl-spotted Owlet	Glaucidium perlatum	2015	Resident, Rare	unconfirmed

248	Pel's Fishing Owl	Scotopelia peli	2015	Resident, Common	unconfirmed
249	Pennant-winged Nightjar	Caprimulgus vexillarius	2015	Resident, Common	unconfirmed
250	Pied Crow	Corvus albus	2015	Resident, Rare	unconfirmed
251	Pied Kingfisher	Ceryle rudis	2015	Resident, Rare	unconfirmed
252	Pink-backed Pelican	Pelecanus rufescens	2015	Resident, Rare	unconfirmed
253	Pin-tailed whydah	Vidua macroura	2015	Resident, Rare	unconfirmed
254	Purple Heron	Ardea purpurea	2020	Resident, Rare	confirmed
255	Purple Indigobird	Vidua purpurascens	2020	Resident, Rare	unconfirmed
256	Purple Roller	Eurystomus azureus	2015	African Migrant, Rare	unconfirmed
257	Purple-banded Sunbird	Cinnyris bifasciatus	2015	Resident, Common	unconfirmed
258	Purple-crested Turaco	Gallirex porphyreolophus	2015	Resident, Common	unconfirmed
259	Racket-tailed Roller	Coracias spatulatus	2020	Resident, Common	confirmed
260	Rattling Cisticola	Cisticola chiniana	2020	Resident, Common	unconfirmed
261	Red-backed Mannikin	Spermestes nigriceps	2020	Parleactic Migrant, Common	confirmed
262	Red-backed Shrike	Lanius collurio	2020	Parleactic Migrant, Common	confirmed
263	Red-bellied Helmet Shrike	Prionops caniceps	2020	Parleactic Migrant, Common	confirmed
264	Red-billed Firefinch	Lagonosticta senegala	2020	Resident, Rare	unconfirmed
265	Red-billed Oxpecker	Buphagus erythrorhynchus	2020	Resident, Common	confirmed
266	Red-billed Quelea	Quelea quelea	2020	Resident, Common	unconfirmed
267	Red-capped Robin Chat	Cossypha natalensis	2020	Resident, Common	unconfirmed
268	Red-chested Cuckoo	Cuculus solitarius	2015	Resident, Rare	unconfirmed
269	Red-collared Wydah	Euplectes ardens	2020	Resident, Common	confirmed
270	Red-eyed Dove	Streptopelia semitorquata	2020	Resident, Common	confirmed
271	Red-faced Cisticola	Cisticola erythroptus	2020	Resident, Common	confirmed
272	Red-faced Crombec	Sylvietta whytii	2020	Parleactic Migrant, Common	confirmed
273	Red-faced Mousebird	Urocolius indicus	2020	Resident, Common	unconfirmed
274	Red-headed Quelea	Quelea erythroptus	2020	African Migrant, Common	confirmed
275	Red-headed Weaver	Anaplectes rubriceps	2020	Resident, Rare	unconfirmed

276	Red-necked Falcon	<i>Falco chicquera</i>	2002	Resident, Common	unconfirmed, NTH*
277	Red-necked Francolin	<i>Pternistis afer</i>	2015	Resident, Common	unconfirmed
278	Red-throated Twinspot	<i>Hypargos niveoguttatus</i>	2020	Resident, Common	unconfirmed
279	Red-winged Starling	<i>Onychognathus morio</i>	2015	Resident, Rare	unconfirmed
280	Reed Cormorant	<i>Microcarbo africanus</i>	2015	Resident, Common	unconfirmed
281	Retz's Red-billed Helmet Shrike	<i>Prionops retzii</i>	2015	Resident, Common	unconfirmed
282	Richard's Pipit	<i>Anthus richardi</i>	2015	Resident, Rare	unconfirmed
283	River Warbler	<i>Locustella fluviatilis</i>	2015	Resident, Rare	unconfirmed
284	Rudd's Apalis	<i>Apalis ruddi</i>	2020	Resident, Rare	unconfirmed
285	Saddle-billed stork	<i>Ephippiorhynchus senegalensis</i>	2015	Resident, Rare	unconfirmed
286	Scaly-throated Honeyguide	<i>Indicator variegatus</i>	2020	Resident, Common	confirmed
287	Scarlet-chested Sunbird	<i>Chalcomitra senegalensis</i>	2020	Resident, Common	confirmed
288	Secretary Bird	<i>Sagittarius serpentarius</i>	2015	Rare	unconfirmed, END*
289	Shelley's Francolin	<i>Scleroptila shelleyi</i>	2015	Resident, Rare	unconfirmed
290	Shikra	<i>Accipiter badius</i>	2020	Resident, Common	confirmed
291	Short-winged Cisticola	<i>Cisticola brachypterus</i>	2020	Resident, Common	unconfirmed
292	Sombre Bulbul	<i>Andropadus importunus</i>	2020	Resident, Common	confirmed
293	Sourthen Masked Weaver	<i>Ploceus velatus</i>	2015	Resident, Rare	unconfirmed
294	Southern Black Flycatcher	<i>Melaenornis pammelaina</i>	2020	Resident, Common	confirmed
295	Southern Black Tit	<i>Melaniparus niger</i>	2020	Resident, Rare	confirmed
296	Southern Blue Waxbill	<i>Uraeginthus angolensis</i>	2020	Resident, Common	confirmed
297	Southern Brown-throated Weaver	<i>Ploceus xanthopterus</i>	2020	Resident, Common	unconfirmed
298	Southern Carmine Bee-eater	<i>merops nubicoides</i>	2020	Resident, Common	confirmed
299	Southern Grey-headed Sparrow	<i>Passer diffusus</i>	2020	Resident, Common	unconfirmed
300	Southern Ground Hornbill	<i>Bucorvus leadbeateri</i>	2015	Resident, Common	unconfirmed, VUL*
301	Southern Hyliota	<i>Hyliota australis</i>	2015	Resident, Common	unconfirmed
302	Southern Red Bishop	<i>Euplectes orix</i>	2020	Resident, Rare	confirmed

303	southern Red-billed Hornbill	<i>Tockus rufirostris</i>	2020	Resident, Common	confirmed
304	Southern Yellow-billed Hornbill	<i>Tockus leucomelas</i>	2020	Resident, Common	confirmed
305	Southern-banded Snake Eagle	<i>Circaetus fasciolatus</i>	2002	Resident, Common	unconfirmed
306	Speckled Mousebird	<i>Colius striatus</i>	2020	Resident, Common	confirmed
307	Spectacled Weaver	<i>Ploceus ocularis</i>	2020	Resident, Rare	unconfirmed
308	Spotted Dikkop	<i>Burhinus capensis</i>	2015	Resident, Common	unconfirmed
309	Spotted Eagle Owl	<i>Bubo africanus</i>	2015	Resident, Common	unconfirmed
310	Spotted Flycatcher	<i>Muscicapa striata</i>	2020	Parleactic Migrant, Common	confirmed
311	Spur-winged goose	<i>Plectropterus gambensis</i>	2020	Resident, Common	confirmed
312	Squaco Heron	<i>Ardeola ralloides</i>	2000	Resident, Rare	unconfirmed
313	Square-tailed Drongo	<i>Dicurus ludwigii</i>	2020	Resident, Common	unconfirmed
314	Starred Robin	<i>Erithacus rubecula</i>	2002	Parleactic Migrant, Rare	unconfirmed
315	Steppe Eagle	<i>Aquila nipalensis</i>	2015	Parleactic Migrant, Rare	unconfirmed, END*
316	Striped Cuckoo	<i>Tapera naevia</i>	2020	Resident, Common	confirmed
317	Striped Kingfisher	<i>Halcyon chelicuti</i>	2020	Resident, Common	confirmed
318	Swallow-tailed Bee-eater	<i>Merops hirundineus</i>	2020	Resident, Rare	unconfirmed
319	Tambourine Dove	<i>Turtur tympanistria</i>	2020	Resident, Rare	confirmed
320	Tawny Eagle	<i>Aquila rapax</i>	2020	Resident, Common	confirmed
321	Tawny-flanked Prinia	<i>Prinia subflava</i>	2020	Resident, Common	unconfirmed
322	Temminck's Courser	<i>Cursorius temminckii</i>	2020	African Migrant, Rare	confirmed
323	Thick-billed Cuckoo	<i>Pachycoccyx audeberti</i>	2015	Resident, Common	unconfirmed
324	Thick-billed Weaver	<i>Amblyospiza albifrons</i>	2015	Resident, Rare	unconfirmed
325	Three-banded Plover	<i>Charadrius tricollaris</i>	2015	Parleactic Migrant, Common	unconfirmed
326	Thrush-Nightingale	<i>Luscinia luscinia</i>	2020	Resident, Common	confirmed
327	Tropical Boubou	<i>Laniarius major</i>	2020	Resident, Common	confirmed
328	Trumpeter Hornbill	<i>Bycanistes bucinator</i>	2020	Resident, Rare	unconfirmed
329	Variable Indigo bird	<i>Vidua funerea</i>	2020	Resident, Rare	confirmed

330	Variable Sunbird	<i>Cinnyris venustus</i>	2020	Resident, Rare	
331	Verreaux's eagle-owl	<i>Bubo lacteus</i>	2015	Resident, Common	
332	Village Indigo bird	<i>Vidua chalybeata</i>	2020	Resident, Rare	confirmed
333	Village Weaver	<i>Ploceus cucullatus</i>	2020	Resident, Rare	
334	Vincent Bunting	<i>Emberiza vincenti</i>	2020	Resident, Rare	unconfirmed
335	Violet-backed Starling	<i>Cinnyricinclus leucogaster</i>	2020	Resident, Rare	confirmed
336	Violet-backed Sunbird	<i>Anthreptes orientalis</i>	2020	Resident, Rare	confirmed
337	Wahlberg's Eagle	<i>Hieraaetus wahlbergi</i>	2020	African Migrant, Rare	unconfirmed
338	Wattled Starling	<i>Creatophora cinerea</i>	2020	African Migrant, Rare	confirmed
339	Western Banded Snake Eagle	<i>Circaetus cinereus</i>	2020	Resident, Common	confirmed
340	Western Banded Snake Eagle	<i>Circaetus cinerascens</i>	2020	Resident, Common	unconfirmed
341	Western Red-footed Falcon	<i>Falco vespertinus</i>	2020	Resident, Common	confirmed, NTH*
342	White Stork	<i>Ciconia ciconia</i>	2020	Palearctic Migrant, Common	confirmed
343	White-backed Vulture	<i>Gyps africanus</i>	2020	Resident, Common, CEN*	confirmed
344	White-bellied Sunbird	<i>Cinnyris talatala</i>	2020	Resident, Common	unconfirmed
345	White-breasted Cuckoo-shrike	<i>Cebilepyris pectoralis</i>	2020	Resident, Common	confirmed
346	White-browed Scrub Robin	<i>Cercotrichas leucophrys</i>	2020	Resident, Common	confirmed
347	White-browed Sparrow-weaver	<i>Plocepasser mahali</i>	2020	Resident, Common	unconfirmed
348	White-crested Helmet Shrike	<i>Prionops plumatus</i>	2020	Resident, Common	confirmed
349	White-faced Duck	<i>Dendrocygna viduata</i>	2015	Resident, Rare	unconfirmed
350	White-faced Owl	<i>Otus leucotis</i>	1989	Resident, Rare	unconfirmed
351	White-headed Vulture	<i>Trigonoceps occipitalis</i>	2015	Resident, Common	unconfirmed, CEN*
352	White-throated Swallow	<i>Hirundo albigularis</i>	2020	African Migrant, Rare	confirmed
353	White-winged Whydah	<i>Euplectes albonotatus</i>	2020	Palearctic Migrant, Common	unconfirmed

354	Willow Warbler	<i>Phylloscopus trochilus</i>	2015	Resident, Common	unconfirmed
355	Wood Owl	<i>Strix woodfordii</i>	2020	Palearctic Migrant, Rare	unconfirmed
356	Wood Sandpiper	<i>Batis fratrum</i>	2020	Resident, Rare	confirmed
357	Woodwards' Batis	<i>Batis Batis fratrum</i>	2020	Resident, Rare	unconfirmed
358	Woolly-necked Stork	<i>Ciconia episcopus</i>	2015	Resident, Rare	confirmed, VUL*
359	Yellow Bishop	<i>Euplectes afer</i>	2015	Migrant, Rare	unconfirmed
360	Yellow Wagtail	<i>Motacilla flava</i>	2015	Resident, Rare	unconfirmed
361	Yellow White-eye	<i>Zosterops senegalensis</i>	2020	Resident, Common	unconfirmed
362	Yellow-bellied Eremomela	<i>Chlorocichla flaviventris</i>	2020	Resident, Common	confirmed
363	Yellow-bellied Greenbul	<i>Nectarinia venusta</i>	2020	Resident, Rare	confirmed
364	Yellow-bellied Sunbird	<i>Neodrepanis hypoxantha</i>	1981	Resident, Rare	unconfirmed
365	Yellow-billed Bulbul	<i>Alophoixus phaeocephalus</i>	2020	Resident, Common	unconfirmed
366	Yellow-billed Egret	<i>Ardea nycticorax</i>	2015	Resident, Common	unconfirmed
367	Yellow-billed Kite	<i>Milvus aegyptius</i>	2020	Resident, Common	unconfirmed
368	Yellow-billed Oxpecker	<i>Buphagus africanus</i>	2015	Resident, Common	unconfirmed
369	Yellow-billed Stork	<i>Mycteria ibis</i>	2015	Resident, Common	unconfirmed
370	Yellow-breasted Apalis	<i>Apalis flavida</i>	2020	Resident, Common	unconfirmed
371	Yellow-fronted Canary	<i>Serinus mozambicus</i>	2020	Resident, Common	unconfirmed
372	Yellow-fronted Tinkerbird	<i>Pogoniulus chrysoconus</i>	2020	Resident, Common	unconfirmed
373	Yellow-throated Bush Sparrow	<i>Gymnoris superciliosus</i>	2020	Resident, Common	unconfirmed
374	Yellow-throated Petronia	<i>Pytilia hypogrammica</i>	2020	Resident, Common	unconfirmed

**Annex 4: Bird species recorded in the project area in Lengwe NP**

No.	Common name	Scientific name	Malawi gazetted	IUCN	CITES
1	Burchel's Coucal	<i>Centropus superciliosus</i>	Yes	LC	Not listed
2	Black Sunbird	<i>Chalcomitra amethystina</i>	Yes	LC	Not listed
3	Yellow-bellied Bulbul	<i>Chlorocichla flaviventris</i>	Yes	LC	Not listed
4	Claas's Cuckoo	<i>Chrysococcyx klaas</i>	Yes	LC	Not listed
5	Amethyst Starling	<i>Cinnyricinclus leucogaster</i>	Yes	LC	Not listed
6	Black-breasted Snake Eagle	<i>Circaetus pectoralis</i>	Yes	LC	Not listed
7	Short-winged Cisticola	<i>Cisticola brachypterus</i>	Yes	LC	Not listed
8	Rattling Cisticola	<i>Cisticola chiniana</i>	Yes	LC	Not listed
9	Red-faced Cisticola	<i>Cisticola erythrops</i>	Yes	LC	Not listed
10	Cardinal Woodpecker	<i>Dendropicos fuscescens</i>	Yes	LC	Not listed
11	Southern Puff back	<i>Dryoscopus cubla</i>	Yes	LC	Not listed
12	Common Waxbill	<i>Estrilda astrild</i>	Yes	LC	Not listed
13	Yellow-Rumped Bishop	<i>Euplectes capensis</i>	Yes	LC	Not listed
14	Red-necked Francolin	<i>Francolinus afer</i>	Yes	LC	Not listed
15	Brown-hooded Kingfisher	<i>Halcyon albiventris</i>	Yes	LC	Not listed
16	Blue billed firefinch	<i>Lagonosticta rubricata</i>	Yes	LC	Not listed
17	Tropical Boubou	<i>Laniarius aethiopicus</i>	Yes	LC	Not listed
18	Black-collared Barbet	<i>Lybius torquatus</i>	Yes	LC	Not listed
19	Yellow-throated Longclaw	<i>Macronyx croceus</i>	Yes	LC	Not listed

20	Eurasian Bee Eater	<i>Merops apiaster</i>	Yes	LC	Not listed
21	Southern Carmine Bee Eater	<i>Merops nubicoides</i>	Yes	LC	Not listed
22	Little Bee Eater	<i>Merops pusillus</i>	Yes	LC	Not listed
23	Yellow-bellied Sunbird	<i>Nectarinia venusta</i>	Yes	LC	Not listed
24	Helmeted Guinea Fowl	<i>Numida meleagris</i>	Yes	LC	Not listed
25	White-browed Sparrow weaver	<i>Plocepasser mahali</i>	Yes	LC	Not listed
26	Yellow-fronted Tinkerbird	<i>Pogoniulus chrysoconus</i>	Yes	LC	Not listed
27	Martial Eagle	<i>Polemaetus bellicosus</i>	Yes	EN	Not listed
28	Tawny-flanked Prinia	<i>Prinia subflava</i>	Yes	LC	Not listed
29	Black-eyed Bulbul	<i>Pycnonotus barbatus</i>	Yes	LC	Not listed
30	Yellow-fronted Canary	<i>Serinus mozambicus</i>	Yes	LC	Not listed
31	Cape Turtle Dove	<i>Streptopelia capicola</i>	Yes	LC	Not listed
32	Red-eyed Dove	<i>Streptopelia semitorquata</i>	Yes	LC	Not listed
33	Red-capped Crombec	<i>Sylvietta ruficapilla</i>	Yes	LC	Not listed
34	Brown-headed Tchagra	<i>Tchagra australis</i>	Yes	LC	Not listed
35	African Paradise Flycatcher	<i>Terpsiphone viridis</i>	Yes	LC	Not listed
36	African Grey Hornbill	<i>Tockus nasutus</i>	Yes	LC	Not listed
37	Blue Spotted Wood Dove	<i>Turtur afer</i>	Yes	LC	Not listed
38	Blue Waxbill	<i>Uraeginthus angolensis</i>	Yes	LC	Not listed
39	Red-faced Mousebird	<i>Urocolius indicus</i>	Yes	LC	Not listed
40	Village indigobird	<i>Vidua chalybeata</i>	Yes	LC	Not listed



41	Long-tailed Paradise Widow	<i>Vidua paradisaea</i>	Yes	LC	Not listed
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**Annex 5: Plant species in the New Lengwe with their Conservation statuses and invasiveness based on literature review**

NO	SPECIES NAME	FAMILY	CONSERVATION STATUS		INVASIVENESS	
			GLOBAL	NATIONAL	GLOBAL	NATIONAL
1	<i>Acacia polyacantha</i> Willd	Fabaceae	NE	NE	Not invasive	not invasive
2	<i>Acacia galpinii</i> Burt Davy	Fabaceae	NE	NE	invasive	not invasive
3	<i>Acacia goetzei</i> Harms	Fabaceae	LC	NE	Not invasive	not invasive
4	<i>Acacia xanthoploea</i>	Fabaceae	LC	NE	Not invasive	not invasive
5	<i>Acacia nigrescens</i> Oliv.	Fabaceae	NE	NE	Not invasive	not invasive
6	<i>Acacia tortilis</i> (Forssk.) Hayne	Fabaceae	LC	NE	invasive	not invasive
7	<i>Acacia nilotica</i> (L.)Delile	Fabaceae	NE	NE	invasive	not invasive
8	<i>Adansonia digitate</i> L	Fabaceae	NE	NE	invasive	not invasive
9	<i>Albizia harveyi</i> E.Fourn.	Fabaceae	LC	LC	not invasive	not invasive
10	<i>Azelia quanzensis</i>	Fabaceae	LC	VU	Not invasive	not invasive
11	<i>Albizia globiflora</i>	Leguminosae	NE	NE	Not invasive	not invasive
12	<i>Allophylus Africanus</i> P. Beauv	Sapindaceae	LC	NE	Not invasive	not invasive
13	<i>Annona senegalensi</i> sPers	Annonaceae	LC	NE	invasive	not invasive
14	<i>Baihinia petersiana</i> Bolle	Fabaceae	LC	NE	Not invasive	not invasive
15	<i>Bolosanthus</i> species	Fabaceae	NE	NE	not invasive	not invasive
16	<i>Boscia salifolia</i> Oliv.	Capparaceae	LC	NE	not invasive	not invasive

17	<i>Brachystegia spiciformis</i> Benth	Fabaceae	LC	NE	Not invasive	not invasive
18	<i>Brachystegia microphylla</i> Harms	Fabaceae	LC	NE	Not invasive	not invasive
19	<i>Brachystegia stipulata</i> De Wild	Fabaceae	NE	NE	not invasive	not invasive
20	<i>Brachystegia glaucescens</i> Hutch. & Butt Davy	Fabaceae	LC	NE	not invasive	not invasive
21	<i>Brachystegia floribunda</i> Benth.	Fabaceae	NE	NE	Not invasive	not invasive
22	<i>Burkea Africana</i> Hook	Fabaceae	LC	NE	Not invasive	not invasive
23	<i>Cassia abbreviate</i> Oliv.	Fabaceae	LC	NE	not invasive	not invasive
24	<i>Cassipourea mossambicensis</i> ????	Menispermaceae	NE	NE	not invasive	not invasive
25	<i>Colophospermum mopane</i> (J.Kirk ex Benth	Fabaceae	LC	NE	not invasive	not invasive
26	<i>Combretum adenogonium</i> Steud. ex A.Rich.	Combretaceae	LC	NE	Not invasive	not invasive
27	<i>Combretum imberbe</i> Wawra	Combretaceae	LC	NE	Not invasive	not invasive
28	<i>Combretum heroensis</i> Schinz	Combretaceae	LC	NE	Not invasive	not invasive
29	<i>Combretum molle</i> R.Br. ex G.Don	Combretaceae	LC	NE	invasive	not invasive
30	<i>Combretum fragrans</i> F. Hoffm	Combretaceae	LC	NE	invasive	not invasive
31	<i>Combretum collium</i> Fresen	Combretaceae	LC	NE	Not invasive	not invasive
32	<i>Combretum zeyheri</i> Sond.	Combretaceae	LC	NE	Not invasive	not invasive
33	<i>Commiphora africana</i> (A.Rich.) Endl.	Burseraceae	LC	NE	Not invasive	not invasive
34	<i>Commiphora mossambicensis</i> (Oliv.) Engl.	Burseraceae	LC	NE	Not invasive	not invasive
35	<i>Commiphora caerulea</i> Burt	Burseraceae	LC	NE	Not invasive	not invasive
36	<i>Crossopteryx febrifuga</i> (Afzel. ex G.Don) Benth.	Rubiaceae	LC	NE	Not invasive	not invasive

37	<i>Croton gratissimus</i> Burch	Euphorbiaceae	LC	NE	Not invasive	not invasive
38	<i>Dalbergia melanoxylon</i> Guill. & Perr.	Fabaceae	NT	VU	invasive	not invasive
39	<i>Dichrostachys cinerea</i> Wight et Arn.	Fabaceae	LC	NE	not invasive	not invasive
40	<i>Diospyros kirkii</i> Hiern	Ebenaceae	LC	NE	not invasive	not invasive
41	<i>Diplorhynchus condylocarpon</i> (Mull.Arg.) Pichon,	Apocynaceae	LC	NE	Not invasive	not invasive
42	<i>Grewia bicolor</i> Juss.	Malvaceae	LC	NE	Not invasive	not invasive
43	<i>Dalbergia boehmii</i> Taub	Fabaceae	LC	NE	not invasive	not invasive
44	<i>Dichrostachys cinerea</i> R. V.G	Fabaceae	LC	NE	invasive	not invasive
45	<i>Diospyros mesipiliformis</i> Hochst ex ADC	Ebenaceae	LC	NE	Not invasive	not invasive
46	<i>Diospyros quiloensis</i> (Hiern) F. White	Ebenaceae	NE	NE	invasive	not invasive
47	<i>Diospyros kirkii</i> ,	Ebenaceae	LC	NE	Not invasive	not invasive
48	<i>Diplorhynchus condylocarpon</i> (Mull. Arg) Pichon	Apocynaceae	LC	NE	Not invasive	not invasive
49	<i>Euphorbia mataballensis</i> Pax	Euphorbiaceae	NE	NE	Not invasive	not invasive
50	<i>Feretia aeruginescens</i> Stapf	Rubiaceae	NE	NE	not invasive	not invasive
51	<i>Flacourtia indica</i> (Burm. Fil) Merr	Salicaceae	LC	NE	invasive	not invasive
52	<i>Holarrhena pubescens</i> ( Buch-Hem)Wall ex G Don	Apocynaceae	LC	NE	not invasive	not invasive
53	<i>Homalium dentatum</i> (Harv) Warb	Salicaceae	LC	NE	not invasive	not invasive
54	<i>Euphorbia kirkii</i> (N. E. Br) Bruyns	Euphorbiaceae	LC	NE	Not invasive	Not invasive

55	<i>Julbernardia globiflora (Benth) Troupin</i>	Fabaceae	NE	NE	invasive	not invasive
56	<i>Lannea discolor (Sond) Engl.</i>	Anacardiaceae	LC	NE	Not invasive	not invasive
57	<i>Lannea stuhlmannii (Engl.) Eyles</i>	Anacardiaceae	NE	NE	not invasive	not invasive
58	<i>Lecaniodiscus fraxinifolia Baker,</i>	Sapindaceae	NE	NE	not invasive	not invasive
59	<i>Lonchocarpus capassa Rolfe</i>	Fabaceae	NE	NE	invasive	not invasive
60	<i>Lonchocarpus bussei Harms</i>	Fabaceae	NE	NE	Not invasive	not invasive
61	<i>Margaritaria discodia(baill) G. L Webster</i>	Phyllanthaceae	LC	NE	not invasive	not invasive
62	<i>Olax dissitiflora Oliv</i>	Olacaceae	LC	NE	Not invasive	not invasive
63	<i>Parinari curatellifolia Planch.ex Benth</i>	Chrysobalanaceae	LC	NE	not invasive	not invasive
64	<i>Pericopsis angolensis, (Baker) meeuwen</i>	Fabaceae	LC	NE	not invasive	not invasive
65	<i>Protea angolensis Welw</i>	Proteaceae	NE	NE	invasive	not invasive
66	<i>Psorospermum febrifugum Spach</i>	Hypericaceae	LC	NE	not invasive	not invasive
67	<i>Ptaeroxylon obliquum (Thunb) Radlk</i>	Rutaceae	NE	NE	not invasive	not invasive
68	<i>Pteleopsis myrtifolia ( M. A Lawson) Engl &amp; Diels</i>	Combretaceae	NE	NE	not invasive	not invasive
69	<i>Pterocarpus angolensis DC</i>	Fabaceae	LC	VU	not invasive	not invasive
70	<i>Pterocarpus rotundifolius (Sond) Joruce</i>	Fabaceae	LC	NE	invasive	not invasive
71	<i>Rauvolfialeptophylla var orientaris Mark key</i>	Apocynaceae	NE	NE	Invasive	not invasive
72	<i>Rothmannia engleran(K Schum)</i>	Rubiaceae	LC	NE	not invasive	not invasive
73	<i>Schinus mole L</i>	Anacardiaceae	NE	NE	not invasive	not invasive

74	<i>Schrebera alata</i> (Hochst.) Welw	Oleaceae	LC	NE	not invasive	not invasive
75	<i>Sclerocarya birrea</i> ( A Rich.) Hochst.	Anacardiaceae	NE	NE	Not Invasive	Not invasive
76	<i>Senna singueana</i> (Delile) Lock	Fabaceae	LC	NE	not invasive	not invasive
77	<i>Sterculia quinqueloba</i> (Garcke) K.Schum.	Malvaceae	LC	NE	not invasive	not invasive
78	<i>Sterculia appendiculata</i> K Schum	Malvaceae	NE	NE	Not invasive	not invasive
79	<i>Sterculia africana</i> ( Lour) Flori	Malvaceae	LC	NE	Invasive	not invasive
80	<i>Strychnos innocua</i> Delile	Loganiaceae	LC	NE	Not invasive	not invasive
81	<i>Strychnos potatorum</i> L Fil	Loganiaceae	NE	NE	Not invasive	not invasive
82	<i>Strychnos madagascariensis</i> Poir	Loganiaceae	LC	NE	not invasive	not invasive
83	<i>Tamarindus indica</i> L	Fabaceae	LC	NE	invasive	not invasive
84	<i>Tecomaria capensis</i> (Thunb) Fenzl	Bignoniaceae	NE	NE	not invasive	not invasive
85	<i>Tecomaria sericea</i> Burch. Ex DC	Combretaceae	LC	NE	Invasive	not invasive
86	<i>Vanchelia nilotica</i> (L.) P.J.H Hurter & Mabb.	Fabaceae	LC	NE	not invasive	not invasive
87	<i>Vanchelia nolotica</i>	Combretaceae	NE	NE	invasive	not invasive
88	<i>Xeroderris stuhlmannii</i> (Taub.) Mendonca & E. P. Sousa	Fabaceae	NE	NE	not invasive	not invasive
89	<i>Ximenia caffra</i> Sond.	Ximeniaceae	LC	NE	not invasive	not invasive
90	<i>Zanha africana</i> (Radlk.) Exell	Sapindaceae	NE	NE	not invasive	not invasive

**Annex 6: Plant Species in Lengwe National Park along the proposed canal**

No	Species	Family	Frequency of occurrence	Life form		
					Global	National
1	<i>Senegalia ataxacantha</i> (DC.) Kyal. & Boatwr.	Fabaceae	1	Shrubby climber	LC	NE
2	<i>Senegalia nigrescens</i> (Oliv.) P.J.H. Hurter	Fabaceae	8	Tree	NE	NE
3	<i>Vachellia nilotica</i> (L.) P.J.H.Hurter & Mabb	Fabaceae	2	Tree	LC	NE
4	<i>Acalypha chirindica</i> S. Moore	Euphorbiaceae	1	Shrub	NE	NE
5	<i>Acalypha ornata</i> Hochst. ex A. Rich.	Euphorbiaceae	1	Shrub	NE	NE
6	<i>Afzelia quanzensis</i> Welw.	Fabaceae	1	Tree	LC	VU
7	<i>Ampelocissus africana</i> (Lour.) Merr.	Vitaceae	1	Climber	LC	NE
8	<i>Asparagus africanus</i> Lam.	Asparagaceae	3	Herb	NE	NE
9	<i>Borassus aethiopum</i> Mart.	Palmae	1	Tree	LC	NE
10	<i>Boscia salicifolia</i> Oliv.	Capparaceae	1	Tree	LC	NE
11	<i>Cadaba kirkii</i> Oliv.	Capparaceae	4	Shrub	NE	NE
12	<i>Canthium glaucum</i> Hiern	Rubiaceae	2	Shrub	LC	NE

13	<i>Capparis tomentosa</i> Lam.	Capparaceae	4	Shrub	NE	NE
14	<i>Chlorophytum cameronii</i> (Baker) Kativu	Anthericaceae	1	Herb	LC	NE
15	<i>Cissus cornifolia</i> (Baker) Planch.	Vitaceae	1	Climber/Creeper	NE	NE
16	<i>Cissus rubiginosa</i> (Welw. ex Baker) Planch.	Vitaceae	1	Climber/Creeper	NE	NE
17	<i>Cleistochlamys kirkii</i> (Benth.) Oliv.	Annonaceae	3	Tree	LC	NE
18	<i>Coccinia mildbraedii</i> Gilg ex Harms	Cucurbitaceae	1	Climber/Creeper	NE	NE
19	<i>Coffea mufindiensis</i> Hutch. ex Bridson	Rubiaceae	1	Tree/Shrub	LC	NE
20	<i>Colophospermum mopane</i> (J.Kirk ex Benth.) J.Léonard	Fabaceae	2	Tree	LC	NE
21	<i>Combretum adenogonium</i> Steud. ex A. Rich.	Combretaceae	1	Tree	LC	NE
22	<i>Combretum imberbe</i> Wawra	Combretaceae	4	Tree	LC	NE
23	<i>Combretum microphyllum</i> Klotzsch	Combretaceae	7	Climber	NE	NE
24	<i>Combretum mossambicense</i> (Klotzsch) Engl.	Combretaceae	3	Climber	LC	NE



25	<i>Combretum psidioides</i> Welw.	Combretaceae	1	Tree	LC	NE
26	<i>Commelina benghalensis</i> L.	Commelinaceae	4	Herb	LC	NE
27	<i>Commelina diffusa</i> Burm.f.	Commelinaceae	1	Herb	LC	NE
28	<i>Commelina vengliensis</i>	Commelinaceae	1	Herb	NE	NE
29	<i>Commiphora edulis</i> (Klotzsch) Engl.	Burseraceae	2	Tree	LC	NE
30	<i>Commiphora marlothii</i> Engl.	Burseraceae	1	Tree	LC	NE
31	<i>Convolvulus sagittatus</i> agg.	Convolvulaceae	1	Climber/Creeper	NE	NE
32	<i>Cordyla africana</i> Lour.	Fabaceae	1	Tree	LC	NE
33	<i>Crossandra fruticulosa</i> Lindau	Acanthaceae	1	Herb	NE	NE
34	<i>Crotalaria cleomifolia</i> Welw. ex Baker	Fabaceae	1	Herb	NE	NE
35	<i>Cucumis hirsutus</i> Sond.	Cucurbitaceae	1	Climber/Creeper	NE	NE
36	<i>Dalbergia melanoxydon</i> Guill. & Perr.	Fabaceae	2	Tree	NT	VU
37	<i>Dalbergiella nyasae</i>	Fabaceae	1	Tree	NE	NE
38	<i>Dichrostachys cinerea</i> Wight et Arn.	Fabaceae	3	Tree	LC	NE
39	<i>Diospyros natalensis</i> (Harv.) Brenan	Ebenaceae	4	Tree	LC	NE
40	<i>Diospyros zombensis</i> (B.L. Burtt) F. White	Ebenaceae	6	Tree	LC	NE
41	<i>Dolichos kilimandscharicus</i> Harms ex Taub.	Fabaceae	1	Herb	NE	NE

42	<i>Echinochloa colona</i> (L.) Link	Poaceae	1	Herb	NE	NE
43	<i>Echinochloa crus-galli</i> (L.) P.Beauv.	Poaceae	1	Herb	NE	NE
44	<i>Euclea crispa</i> (Thunb.) Gürke	Ebenaceae	1	Tree	LC	NE
45	<i>Euclea natalensis</i> A.DC.	Ebenaceae	1	Tree	LC	NE
46	<i>Gloriosa superba</i> L.	Colchicaceae	1	Herb	LC	NE
47	<i>Gonatopus boivinii</i> (Decne.) Engl.	Araceae	1	Herb	NE	NE
48	<i>Grewia bicolor</i> Juss.	Tiliaceae	5	Tree/Shrub	NE	NE
49	<i>Grewia forbesii</i> Harv. ex Mast.	Tiliaceae	11	Tree	NE	NE
50	<i>Grewia microthyrsa</i> K.Schum. ex Burret	Tiliaceae	1	Tree	NE	NE
51	<i>Grewia mollis</i> Juss.	Tiliaceae	1	Tree	LC	NE
52	<i>Grewia villosa</i> Willd.	Tiliaceae	3	Tree	LC	NE
53	<i>Hewittia malabarica</i> (L.) Suresh	Convolvulaceae	3	Herb	NE	NE
54	<i>Hibiscus diversifolius</i> Jacq.	Malvaceae	1	Herb	NE	NE
55	<i>Hibiscus physaloides</i> Guill. & Perr.	Malvaceae	1	Herb	NE	NE
56	<i>Hippocratea goetzei</i> Loes.	Celastraceae	1	Climber	NE	NE
57	<i>Hugonia orientalis</i> Engl.	Linaceae	1	Tree	LC	NE
58	<i>Ipomoea cairica</i>	Convolvulaceae	1	Climber/Creepers	LC	NE

	<i>(L.) Sweet</i>					
59	<i>Ipomoea crassipes</i> <i>Hook.</i>	Convolvulaceae	1	Climber/Creeper	NE	NE
60	<i>Ipomoea pes-caprae</i> <i>(L.) R.Br.</i>	Convolvulaceae	1	Climber/Creeper	LC	NE
61	<i>Ipomoea sinensis</i> <i>(Desr.) Choisy</i>	Convolvulaceae	1	Climber/Creeper	NE	NE
62	<i>Jasminum fluminense</i> <i>Vell.</i>	Oleaceae	2	Shrub	NE	NE
63	<i>Siphonochilus</i> <i>kirkii (Hook. f.) B.L.</i> <i>Burt</i>	Zingiberaceae	2	Herb	NE	NE
64	<i>Lannea schweinfurthii</i> <i>var. stuhlmannii (Engl.)</i> <i>Kokwaro</i>	Anacardiaceae	1	Tree	NE	NE
65	<i>Ledebouria apertiflora</i> <i>(Baker) Jessop</i>	Hyacinthaceae	2	Herb	NE	NE
66	<i>Lepidotrichilia</i> <i>volkensis (Gürke) Leroy</i>	Meliaceae	4	Tree	NE	NE
67	<i>Leucas martinicensis R.</i> <i>Br.</i>	Lamiaceae	1	Herb	NE	NE
68	<i>Lippia javanica</i> <i>(Burm.f.) Spreng</i>	Verbenaceae	2	Herb/Shrub	NE	NE
69	<i>Luffa aegyptiaca</i> <i>Mill.</i>	Cucurbitaceae	1	Climber/Creeper	NE	NE
70	<i>Maerua angolensis</i> <i>DC.</i>	Capparaceae	1	Tree	LC	NE
71	<i>Maerua kirkii F. White</i>	Capparaceae	1	Tree	NE	NE
72	<i>Markhamia zanzibarica</i> <i>(Bojer ex DC.)</i> <i>K.Schum</i>	Bignoniaceae	1	Tree	LC	NE

73	<i>Mellera submutica</i> C.B. Clarke	Acanthaceae	1	Herb	NE	NE
74	<i>Merremia tridentata</i> (L.) Hallier f.	Convolvulaceae	1	Climber	NE	NE
75	<i>Momordica foetida</i> Schumach.	Cucurbitaceae	3	Climber	NE	NE
76	<i>Ocimum americanum</i> L.	Lamiaceae	2	Herb	NE	NE
77	<i>Panicum monticola</i> Hook. f.	Poaceae	4	Herb	NE	NE
78	<i>Panicum simplex</i> Rottler ex Trin.	Poaceae	9	Herb	NE	NE
79	<i>Pavonia urens</i> Cav.	Malvaceae	2	Herb	NE	NE
80	<i>Phyllanthus ovalifolius</i> Forssk.	Euphorbiaceae	0	Shrub	LC	NE
81	<i>Searsia longipes</i> (Engl.) Moffett	Anacardiaceae	2	Tree	LC	NE
82	<i>Ruellia cordata</i> Thunb.	Acanthaceae	2	Herb	NE	NE
83	<i>Ruspolia hypocrateriformis</i> (Vahl) Milne-Redh.	Acanthaceae	4	Herb	NE	NE
84	<i>Salvadora persica</i> L.	Salvadoraceae	2	Shrub	LC	NE
85	<i>Sclerocarya birrea</i> (A. Rich.) Hochst	Anacardiaceae	4	Tree	NE	NE
86	<i>Sesbania sesban</i> (L.) Merr.	Fabaceae	3	Shrub	LC	NE
87	<i>Setaria sphacelata</i> (Schumach.) Stapf & C.E. Hubb.	Poaceae	4	Herb	LC	NE
88	<i>Solanum incanum</i> L.	Solanaceae	3	Herb	LC	NE
89	<i>Solanum panduriforme</i> E.Mey.	Solanaceae	6	Herb	NE	NE

90	<i>Sporobolus pyramidalis</i> <i>Beauv.</i>	Poaceae	1	Herb	NE	NE
91	<i>Sterculia appendiculata</i> <i>K. Schum.</i>	Sterculiaceae	1	Tree	NE	NE
92	<i>Strombosia scheffleri</i> <i>Engl.</i>	Olacaceae	1	Tree	LC	NE
93	<i>Strychnos potatorum</i> <i>L.f.</i>	Logoniaceae	2	Tree	NE	NE
94	<i>Synsepalum brevipes</i> <i>(Baker) T.D.Penn</i>	Sapotaceae	1	Tree	LC	NE
95	<i>Teclea gerrardii</i> <i>I.Verd.</i>	Rutaceae	1	Tree	LC	NE
96	<i>Urochloa</i> <i>mosambicensis (Hack.)</i> <i>Dandy</i>	Poaceae	9	Herb	NE	NE
97	<i>Vepris lanceolata</i> <i>(Lam.) G.Don</i>	Rutaceae	1	Shrub	NE	NE
98	<i>Vernonia adoensis</i> <i>Sch.</i> <i>Bip. ex Walp.</i>	Asteraceae	8	Herb	NE	NE
99	<i>Vigna unguiculata (L.)</i> <i>Walp.</i>	Fabaceae	1	Climber	Cultivated	
100	<i>Xanthocercis</i> <i>zambesiaca</i> <i>(Baker) Dumaz-le-</i> <i>Grand</i>	Fabaceae	1	Tree	LC	NE
101	<i>Xeroderris stuhlmannii</i> <i>(Taub.) Mendonça &amp;</i> <i>E.P. Sousa</i>	Fabaceae	1	Tree/Shrub	NE	NE
102	<i>Ximenia americana</i> <i>L.</i>	Olacaceae	4	Tree/Shrub	LC	NE
103	<i>Ximenia caffra</i> <i>Sond.</i>	Olacaceae	3	Tree/Shrub	LC	NE
104	<i>Zanha golungensis</i> <i>Hiern</i>	Sapindaceae	2	Tree	LC	NE

10 5	<i>Ziziphus abyssinica</i> <i>Hochst. ex A. Rich</i>	Rhamnaceae	3	Tree	LC	NE
10 6	<i>Ziziphus mucronata</i> <i>Willd.</i>	Rhamnaceae	5	Tree	LC	NE

**Annex 7: Plant Species identified in the Elephant Marsh with their conservation statuses and invasiveness based on desk research**

NO	SPECIES NAME	FAMILY	CONSERVATION STATUS		INVASIVENESS	
			GLOBAL	NATIONAL	GLOBAL	NATIONAL
1	<i>Ageratum conyzoides</i> L.	Asteraceae	NE	NE	invasive	invasive
2	<i>Amaranthus hybridus</i> L.	Amaranthaceae	LC	NE	invasive	not invasive
3	<i>Blumea brevipes</i> (Oliv. & Hiern) Willd	Asteraceae	NE	NE	not invasive	not invasive
4	<i>Bolboschoenus maritimus</i> (L.) Palla	Cyperaceae	LC	NE	invasive	not invasive
5	<i>Brachiaria brizantha</i> (Hochst. ex A. Rich.) Stapf	Poaceae	NE	NE	Not invasive	not invasive
6	<i>Ceropegia meyeri-johannis</i> Engl.	Apocynaceae	NE	NE	not invasive	not invasive
7	<i>Ceropegia papillata</i> N.E.Br.	Apocynaceae	NE	NE	not invasive	not invasive
8	<i>Cissampelos mucronata</i> A.Rich.	Menispermaceae	NE	NE	not invasive	not invasive
9	<i>Cissus integrifolia</i> (Baker) Planch.	Vitaceae	NE	NE	Not invasive	not invasive
10	<i>Cissus quadrangularis</i> L	Vitaceae	NE	NE	invasive	not invasive
11	<i>Cocculus hirsutus</i> (L.) Diels	Menispermaceae	NE	NE	not invasive	not invasive
12	<i>Convolvulus sagittatus</i> Thunb Var. sagittatus.	Convolvulaceae	NE	NE	not invasive	not invasive
13	<i>Crotalaria globifera</i> E.Mey.	Fabaceae	NE	NE	not invasive	not invasive
14	<i>Cynodon dactylon</i> Pers	Poaceae	NE	NE	Invasive	not invasive

NO	SPECIES NAME	FAMILY	CONSERVATION STATUS		INVASIVENESS	
			GLOBAL	NATIONAL	GLOBAL	NATIONAL
15	<i>Cyperus alternifolius</i> L.	Cyperaceae	LC	NE	invasive	not invasive
16	<i>Cyperus articulatus</i> L.	Cyperaceae	NE	NE	not invasive	not invasive
17	<i>Cyperus aterrimus</i> Hochst. ex Steud	Cyperaceae	LC	NE	not invasive	not invasive
18	<i>Cyperus denudatus</i> L.F.	Cyperaceae	LC	NE	invasive	not invasive
19	<i>Cyperus derreilema</i> Steud.	Cyperaceae	LC	NE	not invasive	not invasive
20	<i>Cyperus distans</i> L.f.	Cyperaceae	LC	NE	invasive	not invasive
21	<i>Cyperus esculentus</i> L.	Cyperaceae	NE	NE	not invasive	not invasive
22	<i>Cyperus flavescens</i> L.	Cyperaceae	LC	NE	invasive	not invasive
23	<i>Cyperus papyrus</i> L.	Cyperaceae	LC	NE	invasive	not invasive
24	<i>Cyperus rotundus</i> L.	Cyperaceae	NE	NE	not invasive	not invasive
25	<i>Cyperus squarrosus</i> L.	Cyperaceae	LC	NE	invasive	not invasive
26	<i>Eichhornia crassipes</i> (Mart.) Solms	Pontederiaceae	NE	NE	invasive	not invasive
27	<i>Eragrostis namaguensis</i> (Thunb.) trin	Poaceae	NE	NE	not invasive	not invasive
28	<i>Eragrostis aethiopica</i> Chiov.	Poaceae	LC	NE	not invasive	not invasive
29	<i>Eragrostis ciliaris</i> (L.) R.Br.	Poaceae	NE	NE	invasive	not invasive
30	<i>Euphorbia heteropodum</i> Pax	Euphorbiaceae	NE	NE	not invasive	not invasive
31	<i>Euphorbia hirta</i> L.	Euphorbiaceae	NE	NE	Invasive	not invasive



NO	SPECIES NAME	FAMILY	CONSERVATION STATUS		INVASIVENESS	
			GLOBAL	NATIONAL	GLOBAL	NATIONAL
32	<i>Festuca abyssinica</i> A.Rich.	Poaceae	NE	NE	not invasive	not invasive
33	<i>Fimbristylis bisumbellata</i> (Forssk) Bubani	Cyperaceae	LC	NE	invasive	not invasive
34	<i>Glinus lotoides</i> L.	Molluginaceae	LC	NE	invasive	not invasive
35	<i>Heliotropium indicum</i> L	Heliotropiaceae	NE	NE	invasive	not invasive
36	<i>Hibiscus diversifolius</i> Jacq.	Malvaceae	NE	NE	invasive	not invasive
37	<i>Indigofera arrecta</i> - Hochst. ex A.Rich.	Fabaceae	NE	NE	invasive	not invasive
38	<i>Jasminum fluminense</i> Vell.	Oleaceae	NE	NE	Invasive	not invasive
39	<i>Leersia hexandra</i> Sw.	Poaceae	LC	NE	invasive	not invasive
40	<i>Ludwigia erecta</i> (L.) Hara	Onagraceae	NE	NE	invasive	not invasive
41	<i>Ludwigia stolonifera</i> (Guill. & Perr) Raven.	Onagraceae	LC	NE	not invasive	not invasive
42	<i>Mimosa pudica</i> L.	Fabaceae	LC	NE	invasive	invasive
43	<i>Monechma debile</i> (Forssk.) Nees	Sterculiaceae	NE	NE	not invasive	not invasive
44	<i>Mucuna pruriens</i> (L.) DC	Fabaceae	NE	NE	invasive	not invasive
45	<i>Neojeffreya decurrens</i> (L.) Cabrera	Asteraceae	NE	NE	invasive	not invasive
46	<i>Ocimum americanum</i> L.	Lamiaceae	NE	NE	Invasive	not invasive
47	<i>Oxygonum sinuatum</i> (Hochst. & Steud. ex Meisn.) Dammer	Polygonaceae	NE	NE	invasive	not invasive

NO	SPECIES NAME	FAMILY	CONSERVATION STATUS		INVASIVENESS	
			GLOBAL	NATIONAL	GLOBAL	NATIONAL
48	<i>Paederia bojeriana</i> (A. Rich. ex DC.) Drake	Rubiaceae	NE	NE	not invasive	not invasive
49	<i>Pistia stratiotes</i> L	Araceae	LC	NE	invasive	not invasive
50	<i>Prosopis juliflora</i> (Sw.) DC.	Fabeceae	NE	NE	invasive	invasive
51	<i>Ricinus communis</i> L.	Euphorbiaceae	NE	NE	Invasive	invasive
52	<i>Rumex abyssinicus</i> Jacq.	Polygonaceae	NE	NE	Invasive	not invasive
53	<i>Rumex abyssinicus</i> Jacq.	Polygonaceae	NE	NE	invasive	not invasive
54	<i>Rumex bequaertii</i> De Wild.	Polygonaceae	NE	NE	not invasive	not invasive
55	<i>Sesbania sesban</i> (L.) Merr.	Fabaceae	LC	NE	invasive	not invasive
56	<i>Spermacoce dibrachiata</i> Oliv.	Rubiaceae	NE	NE	not invasive	not invasive
57	<i>Spermacoce princeae</i> (K. Schum.) Verdc.	Rubiaceae	NE	NE	not invasive	not invasive
58	<i>Sterculia appendiculata</i> K.Schum.	Malvaceae	NE	NE	not invasive	not invasive
59	<i>Vossia cuspidata</i> (Roxb.) Griff	Poaceae	LC	NE	Invasive	not invasive
60	<i>Xanthium strumarium</i> L.	Asteraceae	NE	NE	invasive	invasive



### Annex 8: List of fish species observed in the Elephant Marsh

These were observed during fieldwork surveys in November 2015, or expected in the area based on surveys by Tweddle and Willoughby (1979), and their current IUCN Red List status. Non-native species are not included.

Family	Species	English name	IUCN Red List status
Alestidae	<i>Hydrocynus vittatus</i>	Tigerfish	Least Concern
	<i>Micralestes acutidens</i>	Silver robber	Least Concern
Amphiliidae	<i>Zaireichthys monomotapa</i>	Eastern sand catlet	Not assessed
Anguillidae	<i>Anguilla bengalensis labiata</i>	African mottled eel	Near Threatened
Chiclidae	<i>Astatotilapia calliptera</i>	Eastern happy	Least Concern
	<i>Coptodon rendalli</i>	Redbreast tilapia	Not assessed
	<i>Oreochromis mossambicus</i>	Mozambique tilapia	Near Threatened
	<i>Oreochromis placidus</i>	Black tilapia	Least Concern
	<i>Oreochromis shiranus shiranus</i>	Shire tilapia	Not assessed
	<i>Pseudocrenilabrus philander</i>	Southern mouthbrooder	Not assessed
Clariidae	<i>Clarias gariepinus</i>	Sharptooth catfish	Least Concern
	<i>Clarias ngamensis</i>	Blunttooth catfish	Least Concern
	<i>Clarias theodora</i>	Snake catfish	Least Concern
Cyprinidae	<i>Barbus afrohamiltoni</i>	Hamilton's barb	Least Concern
	<i>Barbus cf. lineomaculatus</i>	(Unnamed)	Not assessed
	<i>Barbus cf. viviparus</i>	Bowstripe barb	Not assessed
	<i>Barbus haasianus</i>	Sicklefin barb	Least Concern
	<i>Barbus kerstenii</i>	Red-spotted barb	Least Concern
	<i>Barbus macrotaenia</i>	Broadband barb	Least Concern
	<i>Barbus paludinosus</i>	Straightfin barb	Least Concern
	<i>Barbus radiatus</i>	Beira barb	Least Concern
	<i>Barbus trimaculatus</i>	Threespot barb	Least Concern
	<i>Brycinus imberi</i>	Imberi	Least Concern
	<i>Labeo altivelis</i>	Hunyani labeo	Least Concern
	<i>Labeo congoro</i>	Purple labeo	Least Concern
<i>Labeo cylindricus</i>	Redeye labeo	Least Concern	

	<i>Labeobarbus johnstonii</i>	Short-barbeled yellowfish	Not assessed
	<i>Opsaridium microcephalum</i>	Sanjika	Vulnerable
	<i>Opsaridium tweddleorum</i>	Dwarf sanjika	Least Concern
Distichodontidae	<i>Distichodus mossambicus</i>	Nkupe	Least Concern
	<i>Distichodus schenga</i>	Chessa	Least Concern
Gobiidae	<i>Glossogobius callidus</i>	River goby	Least Concern
Malapteruridae	<i>Malapterurus shirensis</i>	Electric catfish	Least Concern
Mochokidae	<i>Chiloglanis</i> sp. nov.	Rock catlet	Not assessed
	<i>Synodontis nebulosus</i>	Clouded squeaker	Least Concern
	<i>Synodontis zambezensis</i>	Brown squeaker	Least Concern
Mormyridae	<i>Cyphomyrus discorhynchus</i>	Zambezi parrotfish	Least Concern
	<i>Marcusenius macrolepidotus</i>	Bulldog	Least Concern
	<i>Mormyrops anguilloides</i>	Cornish jack	Least Concern
	<i>Mormyrus longirostris</i>	Eastern bottlenose	Least Concern
Poeciliidae	<i>Micropanchax katangae</i>	Striped topminnow	Not assessed
Protopteridae	<i>Protopterus annectens brienii</i>	Lungfish	Least Concern
Schilbeidae	<i>Schilbe intermedius</i>	Silver catfish	Least Concern
<b><i>Species expected but not seen during fieldwork, based on Tweddle and Willoughby (1979)</i></b>			
Alestidae	<i>Hemigrammopetersius barnardi</i>	Barnard's robber	Least Concern
Amphiliidae	<i>Amphilius uranoscopus</i>	Common mountain catfish	Least Concern
Anabantidae	<i>Ctenopoma multispinis</i>	Many spined climbing perch	Least Concern
	<i>Microctenopoma intermedium</i>	Blackspot climbing perch	Least Concern
Clariidae	<i>Heterobranchus longifilis</i>	Vundu	Least Concern
Cyprinidae	<i>Barbus atkinsoni</i>	(Unnamed)	Least Concern
	<i>Barbus</i> cf. <i>toppini</i>	(Unnamed)	Not assessed
Gobiidae	<i>Glossogobius giuris</i>	Tank goby	Least Concern
Poeciliidae	<i>Micropanchax hutereaui</i>	Mesh-scaled topminnow	Least Concern

### Annex 9: Risks and Mitigation Measures

No.	Risks/Impacts	Proposed enhancement measures	Rating	Implementation Schedule	Responsible	Budget
POSITIVE IMPACTS						
1	Improved knowledge base of species and the existence of potential areas of high conservation value in the project area	<p>Develop monitoring protocol for threatened species and identified areas/habitats of conservation value;</p> <p>Collaborate with conservation NGOs and MDAs (responsible Ministries, Departments and Agencies) in conservation and management of these areas;</p> <p>Undertake fresh biodiversity studies annually to determine species and species abundance of fauna in project area.</p> <p>Strengthen and expanding the implementation of CCA</p>	High	During planning, design, construction, and operation.	DNPW	\$30,000
2	Improved safety of threatened and	Develop Rescue protocol for all protected species	High	During Construction and Operation	DNPW	\$150,000

No.	Risks/Impacts	Proposed enhancement measures	Rating	Implementation Schedule	Responsible	Budget
	protected fauna species due to fauna rescue program	Intensify law enforcement to check illegal activities  Employ well qualified and well-trained wildlife cares.				
	Improved attraction infrastructure features for the park	Eco bridges will being an additional attractive feature to the park for tourism and education Rescue center will be important for tourism and education			Supervision Engineer (SE), Contractor, DNPW,SVTP	Included in contractor's contract
	Restoration of temporally used parts of the park	Rehabilitate previously encroached areas (Extension Area)  Implement afforestation activities with Park boundary communities  Promote natural seed bank germination;  Collect indigenous seed and saplings multiply them for	Medium	During Planning, Design, and Construction	DNPW, Department of Forestry (DoF), MPGRC	\$67,000

No.	Risks/Impacts	Proposed enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		restoration planting and aftercare				
4	Improved biodiversity in the Elephant Marsh due to tree, shrubs, and grass planting in disturbed areas	<p>Plant pioneer site specific and site adaptive trees, shrubs and grasses;</p> <p>Promote natural generation and soil seed bank and samplings;</p> <p>Improve Riverbank protection by putting an additional buffer zone of 100 m for tributaries (Thangadzi,Ruo,Soligin Ngabu and East bank rivers),of the Elephant Marsh</p> <p>Water the planted trees, shrubs, and grasses especially during the dry season.</p> <p>Support CCA's to regulate</p>	Medium	During Construction Operation	DoF, EAD	\$67,000



No.	Risks/Impacts	Proposed enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		harvesting of wildlife and fish I elephant Marsh				
5	Provision of 6 water holes on the western side of the canal and the eastern side (Solar panel operated /fed by water from the canal)	Water holes will be sunk closer to camps  Water from canal will be in areas that are dry, based on hydrological assessments	High	During Construction	SVTP	\$100,000
6	Fence Canal entrances to prevent access from outside					Included in the contractor's contract
7	Improve existing and providing new facilities such as camps sites, roads in LNP	2 New ranger camps, with semi detached houses and Makeshift Camp at the centre of the park 3 Land cruisers Communication equipment				Included in the ESMP for SVTP 2

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
<b>NEGATIVE IMPACTS</b>						
1	Disturbances of nesting birds and breeding fauna species due to frequent movement of developers team in Lengwe National Park	<p>-Stick to given construction times and avoid construction after 6 pm</p> <p>Avoid making noise and unnecessary movements in the park and Stick to the given routes given for construction team</p> <p>Develop an MOU with developer to enhance compliance to park regulations</p>	High	During Construction	SE, SVTP and DPNW	5000
2	Loss of fauna species due to construction activities in Lengwe National Park	<p>Undertake fauna evacuation surveys prior to the construction works; and evacuate identified fauna animals if applicable</p> <p>Prohibit workers from cutting down trees outside the right of way of canal alignment;</p>	High	Construction and operation	SVTP, DPNW, SE, CONTRACTOR	200,000

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		<p>Avoid cutting down trees carelessly as much as possible from the project area and ensure large trees are retained wherever possible;  Check trees for bird nests before they are cut down during clearing activities; and wait until construction starts before it is removed to give it chance to hatch</p> <p>Prohibit constructing campsites and workshops in protected areas and identified areas of conservation concern; and take care where machinery and working items are placed away from crucial sites</p> <p>Install appropriate bird and squirrel nesting boxes around the periphery of the site to compensate for nesting</p>				

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		<p>sites (e.g. cavity trees, squirrel dreys) that may be removed during land clearance;</p> <p>Cooking shall not take place in the park to avoid fire incidences , the contractor(s) must provide meals to workers at work fronts;Construct an animal rescue centre for animals injured from the canal, rescued from poachers, rescued from drowning in canal and evacuated from construction sites</p> <p>Collect and relocate all threatened, endemic and protected species, including other fauna species observed to fauna rescue centres using staff from the Department of National Parks and Wildlife and;</p> <p>Restrict construction</p>				

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		<p>activities within the right of way of canal alignment proposed;</p> <p>Prohibit wildlife poaching and trafficking by workers, job seekers and communities; and</p> <p>Arrestt and prosecute all law breakers involved in wildlife poaching and trafficking before the court of law.</p>				
	<p>Loss of flora species due to construction activities in Lengwe National Park</p>	<p>Undertake flora surveys prior to the construction works; and identify species for restoration and collection to gene bank and herbarium if applicable</p> <p>Identify valuable forest species like Mopane that will be removed from clearing of the site and identify creative uses of the species including furniture, shelters and art that can decorate the</p>	<p>High</p>	<p>Construction and operation</p>	<p>DPNW, SVTP, CONTRACTOR</p>	<p>200,000</p>

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		<p>park and creative signage for the park</p> <p>Prohibit workers from cutting down trees and removing plants outside the right of way of canal alignment;</p> <p>Avoid cutting down trees carelessly as much as possible from the project area and ensure large trees are retained wherever possible;</p> <p>Prohibit constructing campsites and workshops in protected areas and identified areas of conservation concern; and take care where machinery and working items are placed away from crucial sites</p> <p>Cooking shall not take place in the park to avoid fire incidences ,</p>				

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		<p>the contractor(s) must provide meals to workers at work fronts;</p> <p>Identify area for restoration and develop a restoration plan for critical plant species</p> <p>Collect seeds and saplings and relocate all threatened, endemic, wild relatives and protected species</p> <p>Preserve top soil for restoration of plants</p> <p>Restrict construction activities within the right of way of canal alignment proposed;</p> <p>Prohibit wildlife poaching and trafficking by workers, job seekers and communities; and</p> <p>Arrest and prosecute all law breakers involved in</p>				

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		wildlife poaching and trafficking before the court of law.				
4	Wildlife poaching and trafficking by workers, job seekers and local communities	<p>Prohibit wildlife poaching by workers, job seekers and local communities through awareness ;</p> <p>Job Seekers should not seek jobs on site but should be encouraged to go through the labour office</p> <p>Arrest and prosecute all law breakers involved in wildlife poaching and trafficking before the court of law;</p> <p>Establish a community wildlife policing committee to assist with enforcement of wildlife laws and monitoring; and</p>	High	Construction	DPNW, POLICE, CONTRACTOR	100,000



No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		Intensify wildlife law enforcement and monitoring in collaborating with relevant authorities.				
	Fragmentation of wildlife habitat in Lengwe National Park forming a barrier for the movement of species	<p>Construct 5 eco-bridges across the canal;</p> <p>Provide over passes and under passes to a minimum of 6 crossings (50 meters wide and height should allow giraffe crossings in case of future restocking);</p> <p>Construct a gentle gradient (1:2.5) and concrete lined where by animals will be able to gain traction on the banks</p>	High	During Construction	SVTP and Contractor, Supervising Engineer	Included in construction budget
7	Risks to disruption of wildlife migratory routes due to	Install fauna species crossings from one side to another side wherever possible;	High	Construction	Contractor, SVTP, Supervising Engineer	Included on contractor's contract

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
	habitat clearing, construction and canal activities	Do not disturb/disrupt any wildlife migratory routes that are outside the right of way of the canal alignment ;				
8	Disturbance of fauna due noise pollution	<p>Ensure all noise sources are located far away from biologically important areas (e.g. nursery areas, important foraging habitat) and breeding of other fauna species;</p> <p>Optimize movement of vehicles and machinery to reduce noise;</p> <p>Procure or hire construction, drilling, blasting and pile-driving machinery or equipment that produce very low noise and vibration levels;</p> <p>Restrict time for blasting to periods</p>	High	Construction	Supervising Engineer, Contractor, SVTP, DPNW	Included in construction budget

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		<p>stipulated in the MoU between contractor and DNPW</p> <p>Minimize engine idling time;</p> <p>Use construction and drilling equipment and machinery with high rate of energy efficiency;</p> <p>Use construction, drilling and blasting machinery that produce very low noise;</p> <p>Fit all heavy equipment and machinery with noise pollution control devices (i.e., silencers) that are operating correctly and efficiently; and</p> <p>Erect a fence or a barrier around the active construction sites and/or rock blasting sites to</p>				

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		minimize the spread of noise and vibrations to surrounding areas.				
9	Loss of fauna species due to poor disposal of waste in Lengwe National Park	<p>Contractor to develop a waste management Plan for LNP;</p> <p>Prohibit workers against disposing waste in undesignated sites;</p> <p>Discipline and fine any worker found disposing of waste in undesignated sites; and;</p> <p>Dismiss any worker failing to obey the by-law.</p>	High	During Construction	Supervising Engineer, Contractor SVTP	Included in construction budget
12	Risks to deaths of some fauna species due to effects (floods, bush fire, drought) of climate change	<p>Increase moisture loss reduction from soils by planting more understory plant species;</p> <p>Synchronise water abstraction with water demand to prevent flooding of canals</p> <p>Restoration of grasses to</p>	Moderate	Construction, Operation	DPNW, SVTP, SE and contractor	50,000

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		<p>enhance availability of animal feed and shelter for some fauna species;</p> <p>Implement the fire management plan;</p> <p>Install fire detection systems;</p> <p>Establish fire-fighting community committees;</p> <p>Plant fast growing indigenous tree species and underground cover grasses in identified areas to mitigate loss of tree species removed from construction</p> <p>Strengthen Early warning system for floods in Nkombezi</p>				
	Drowning animals in the canal	<p>Construction of evacuation stairs in the canal for every 500 meters;</p> <p>Install barriers (for landing of drowning</p>	High	Operation	DPNW, Contractor, Supervising Engineers, SVTP	<p>Included in Budget of construction ,</p> <p>For monitoring and rescuing</p>

<b>No.</b>	<b>Risks/Impacts</b>	<b>Proposed/mitigation enhancement measures</b>	<b>Rating</b>	<b>Implementation Schedule</b>	<b>Responsible</b>	<b>Budget</b>
		animals) and siphons; Continuous monitoring by Park Staff to spot and rescue animals that are drowning				20,000 per annum
	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 trapped on the sieve (grit)	High	Construction and Operation	EAD, DPNW, CONTRACTOR, SITE SUPERVISOR , SVTP	30,000 USD and included in budget of constructing sieving elements
	Creation of perception of a divide park	Institute a camp on the divided park of the canal; Waterholes to encourage animals to visit the other side of the canal;	High	Construction	Contractor, SVTP, Supervising Engineer	Included in project ESMP and budget
	Introduction of exotic species	Routine checks upon entry of the park;	Moderate	Construction	DPNW	40,000

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
	into the park by workforce and vehicles	<p>Sniffing Dogs to check the entry and exit of biological materials into the park;</p> <p>Training Park staff on detection of biological materials;</p> <p>Procure detection scanners</p>				
	Fluctuation of water levels in Elephant Marsh due to diversion of water to irrigated sites by the primary and secondary canals	Maintain optimal environmental flow of 17M <sup>3</sup> / second at Kapichira to sustain water levels in the Marsh	Moderate	Operation	Electricity Generation Company (EGENCO) SVTP	Within routine budgets
	Worsened vulnerability of elephant Marsh to climate change through droughts and floods	<p>Enhance adaptation activities in communities;</p> <p>Enhance alternative livelihood activities for communities dependent on elephant Marsh;</p> <p>Institute a human</p>	Moderate	Operation	Elephant Marsh Committees, District Council, DPNW,	80000

No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
		wildlife conflict management plan				
	Pollution from agro chemicals including pesticides causing pollution of aquatic species and proliferation of IAS	<p>Monitor implementation of pesticides management plan for irrigation land;</p> <p>Assess baseline water quality levels and undertake routine monitoring of water quality</p> <p>Enhance the institutional capacity for the management of obsolete pesticides and herbicides;</p> <p>Institute set aside areas to reduce areas that are in contact with pesticides closer to the Marsh;</p> <p>Buffer zone of an unirrigated land for attenuation before entry of effluent into the elephant Marsh</p>	High	Operation	PCB, Environmental Affairs Department (EAD) SOCFES <sup>1</sup> , Water, Agriculture	80000

<sup>1</sup> Small Holder Owned Commercial Farm Enterprises



No.	Risks/Impacts	Proposed/mitigation enhancement measures	Rating	Implementation Schedule	Responsible	Budget
	Worsening of Plastic Pollution in Elephant Marsh from Secondary Canals which may affect animal and plant survival	<p>Erect Grit (Trash rack) at exist of secondary canals to prevent flow down of plastics;</p> <p>Raise awareness among communities on plastic pollution;</p> <p>Clean up days at Elephant Marsh for removal of plastics and other waste in the Marsh;</p> <p>Develop and implement a waste management plan;</p>	High	Operation	EAD, DPNW, FISHERIES, ELEPHANT MARSH ASSOCIATION , COUNCIL	<p>180000</p> <p>Covered under Component 4 of SVTP 2</p>
	Secondary canals may transport exotic and invasive species to the canal where they may replace indigenous species of the canal	<p>Include Grits (Trash Rack) at the exits of secondary canal;</p> <p>Develop and Implement Procedures for early detection and Rapid Response;</p> <p>Train Elephant Marsh communities on Identification and Management of IAS</p>	High	Operation	EAD, DPNW, Forestry, Fisheries, contractor, SE	80000

<b>No.</b>	<b>Risks/Impacts</b>	<b>Proposed/mitigation enhancement measures</b>	<b>Rating</b>	<b>Implementation Schedule</b>	<b>Responsible</b>	<b>Budget</b>
	Risks to deaths of some fauna species due to effects (floods, bush fire, drought) of climate change	Monitor species prevalence in the Shire Valley;  Develop fire prevention plans  Construct flood co	Moderate	Operation	EAD, DNPW	Part of on-going monitoring under DNPW

**Annex 10: Biodiversity Management and Monitoring Plan (during construction operation phases)**

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
<b>1. POSITIVE IMPACTS</b>							
Improved knowledge base of species and the existence of potential areas of high conservation value in the project area	<p>Develop monitoring protocol for threatened species and identified areas/habitats of conservation value;</p> <p>Collaborate with conservation NGOs and MDAs (responsible Ministries, Departments and Agencies) in conservation and management of these areas;</p> <p>Undertake fresh biodiversity studies annually to determine species and species abundance of fauna in project area.</p> <p>Strengthen and expanding the</p>	Lengwe National Park, Elephant Marsh	Species monitoring	<p>Number of habitats of conservation value;</p> <p>Number of fresh biodiversity studies conducted annually;</p> <p>Number of CCAs under improved management</p>	Annually	DNPW, Department of Fisheries, NHBG, Forestry Department	SVTP

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	implementation of CCA						
Improved safety of threatened and protected fauna species due to fauna rescue program	Develop Rescue protocol for all protected species  Intensify law enforcement to check illegal activities  Employ well qualified and well-trained wildlife carers.	Lengwe National Park, Elephant Marsh	Enforcement records;  Employment records	Rescue Protocol in place;  Number of qualified and well trained wildlife carers hired.	Throughout the project	DNPW, Fisheries Department	SVTP
Improved attraction infrastructure features for the park	Eco bridges constructed will be an additional attractive feature to the park for tourism and education;  Rescue center will be important for tourism and education	Lengwe National Park	Site visits	Number of eco-bridges constructed	Throughout construction and operation	Supervision Engineer (SE), Contractor, DNPW,SVTP	SVTP
Restoration of temporally used parts of the park	Rehabilitate previously encroached areas (Ha)  Implement afforestation activities with Park boundary communities	Lengwe National Park	M&E Visits	Area (Ha) rehabilitated;  Park boundary area	Bi-Annually	DNPW, Forestry department, SE, Contractor	SVTP

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	<p>Promote natural seed bank germination;</p> <p>Collect indigenous seed and saplings multiply them for restoration planting and aftercare</p>			<p>reforested (Ha);</p> <p>Number of Species in seed bank;</p>			
Improved biodiversity in the Elephant Marsh due to tree, shrubs, and grass planting in disturbed areas	<p>Plant pioneer site specific and site adaptive trees, shrubs and grasses;</p> <p>Promote natural generation and soil seed bank and samplings;</p> <p>Improve Riverbank protection by putting an additional buffer zone of 100 m for tributaries (Thangadzi,Ruo,Soligin Ngabu and East bank rivers),of the Elephant Marsh</p> <p>Water the planted trees, shrubs, and grasses</p>	Elephant Marsh	<p>Site visits;</p> <p>Monitoring reports</p>	<p>Area planted under Site specific and adaptive species (Ha);</p> <p>Length (km) of 100m buffer zone adopted.</p> <p>Number of CCA supported to regulate wildlife and fish harvest</p>	During Construction Operation	Forestry Department; Ministry of Agriculture (LRCD)	SVTP

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	<p>especially during the dry season.</p> <p>Support CCA's to regulate harvesting of wildlife and fish elephant Marsh</p>						
Provision of 6 water holes on the western side of the canal and the eastern side (Solar panel operated /fed by water from the canal)	Sink boreholes for water supply in LNP; Construct water troughs in Lengwe National Park	Lengwe National Park	Site visits; SE progress reports	<p>Number of water holes sunk;</p> <p>Number of water troughs established.</p>	Bi-Annually	DNPW, Contractor	SE, DNPW
Fence Canal entrances to prevent access from outside	Restrict access to canal alignment to prevent drowning; Develop maintenance program for the fence	Canal alignment in Lengwe National Park	Site visits	Length (km) of canal alignment fenced;	Throughout construction and operation	Contractor, DNPW	SE, SVTP
Improve existing and providing new facilities such as camps	Construct 2 New ranger camps, with semi detached houses and Makeshift Camp at the centre of the park Procure 3 Land cruisers	Lengwe National Park	Site visits, Progress reports	<p>Number of ranger camps constructed;</p> <p>Number of vehicles</p>	Construction phase	DNPW	SVTP

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
sites, roads in LNP	Procure Communication equipment			procured for DNPW;  Quantity and type of communication equipment procured.			
<b>2. NEGATIVE IMPACTS</b>							
Disturbances of nesting birds and breeding fauna species due to frequent movement of developers team in Lengwe National Park	Adhere to given construction times and avoid construction after 6 pm;  Avoid making noise and unnecessary movements in the park; Stick to the given routes given for construction team  Develop an MOU with developer to enhance compliance to park regulations	Lengwe National Park	Minutes of meetings; Site visits;  MoU document	Number of non compliance reports;  MoU in place	Construction period	DNPW, Contractor	SE, SVTP and DPNW
Loss of fauna species due to construction activities in	Undertake fauna evacuation surveys prior to the construction works;	Lengwe National Park	Fauna evacuation survey reports	Number of fauna evacuation	Construction and operation	DPNW, CONTRACTOR	SVTP, DPNW, SE

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
Lengwe National Park	<p>Evacuate identified fauna animals if applicable</p> <p>Prohibit workers from cutting down trees outside the right of way of canal alignment;</p> <p>Avoid cutting down trees carelessly as much as possible from the project area and ensure large trees are retained wherever possible;</p> <p>Check trees for bird nests before they are cut down during clearing activities and wait until construction starts before it is removed to give it chance to hatch</p> <p>Prohibit constructing campsites and workshops in protected areas and identified areas of conservation</p>			<p>surveys conducted;</p> <p>Number of animal evacuated by species;</p> <p>Number of trees spared for bird nesting;</p> <p>Number of bird and squirrel nesting boxes installed;</p> <p>Number of animal rescue centres established</p>			



Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	<p>concern;</p> <p>Install appropriate bird and squirrel nesting boxes around the periphery of the site to compensate for nesting sites (e.g. cavity trees, squirrel dreys) that may be removed during land clearance;</p> <p>Prohibit cooking in the park to avoid fire incidences;</p> <p>Construct an animal rescue centre for animals injured from the canal, rescued from poachers, rescued from drowning in canal and evacuated from construction sites;</p> <p>Collect and relocate all threatened, endemic and protected species, including other fauna species observed to fauna rescue centres</p>						

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	<p>using staff from the Department of National Parks and Wildlife and;</p> <p>Prohibit construction activities outside the right of way of canal alignment proposed;</p> <p>Prohibit wildlife poaching and trafficking by workers, job seekers and communities; and</p> <p>Arrestt and prosecute all law breakers involved in wildlife poaching and trafficking before the court of law.</p>						
Loss of flora species due to construction activities in Lengwe National Park	<p>Undertake flora surveys prior to the construction works;</p> <p>Identify species for restoration and collection to gene bank and herbarium if applicable</p>	Lengwe National Park	<p>Flora survey reports;</p> <p>Site visits;</p> <p>Progress reports</p>	<p>Number of flora surveys conducted;</p> <p>Number flora species identified for restoration;</p>	During construction	DPNW, CONTRACTOR	SVTP, DPNW, SE,

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	<p>Identify valuable forest species like Mopane that will be removed from clearing of the site</p> <p>Prohibit workers from cutting down trees and removing plants outside the right of way of canal alignment;</p> <p>Avoid cutting down trees carelessly as much as possible from the project area and ensure large trees are retained wherever possible;</p> <p>Prohibit constructing campsites and workshops in protected areas and identified areas of conservation concern;</p> <p>Identify area for restoration and develop a restoration plan for critical plant species</p>			<p>Number valuable forest species affected by clearing;</p> <p>Number of illegal activities reported</p> <p>Number of bird and squirrel nesting boxes installed;</p> <p>Number of animal rescue centres established;</p> <p>Area of land (Ha) earmarked for restoration;</p> <p>Number of species earmarked for restoration;</p>			

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	<p>Collect seeds and saplings and relocate all threatened, endemic, wild relatives and protected species</p> <p>Preserve top soil for restoration of plants</p> <p>Restrict construction activities within the right of way of canal alignment proposed;</p> <p>Prohibit wildlife poaching and trafficking by workers, job seekers and communities; and</p> <p>Arrest and prosecute all law breakers involved in wildlife poaching and trafficking before the court of law.</p>			Number of soil spoil sites and area (Ha) identified			
Wildlife poaching and trafficking by workers, job seekers and local	Prohibit wildlife poaching by workers, job seekers and local communities through awareness ;	Lengwe National Park Elephant Marsh	Enforcement reports; Prosecution records	Number of illegalities reported; Number of cases brought		Construction	Dpnw, Police, Contractor

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
communities	<p>Encourage job seekers to go through the labour office</p> <p>Arrest and prosecute all law breakers involved in wildlife crimes before the court of law; Establish a community wildlife policing committee to assist with enforcement of wildlife laws and monitoring; and</p> <p>Intensify wildlife law enforcement and monitoring in collaborating with relevant authorities.</p>			<p>before court and prosecuted;</p> <p>Community wildlife policing committee in place</p>			
Fragmentation of wildlife habitat in Lengwe National Park forming a barrier for the movement of species	<p>Construct 5 eco-bridges across the canal;</p> <p>Provide over passes and under passes to a minimum of 6 crossings (50 meters wide and height should allow giraffe crossings in case of future restocking);</p>	Lengwe National Park	Site visits, Progress reports	<p>Number of eco-bridges constructed;</p> <p>Number of over-passes constructed;</p>	Monthly	Contractor	SE, SVTP, DNPW

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	Construct a gentle gradient (1:2.5) and concrete lined where by animals will be able to gain traction on the banks						
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 ;	Lengwe National Park	Site visits, M&E visits	Number of eco-bridges constructed;  Number of over-passes constructed;	Monthly	Contractor	SE, SVTP, DNPW
Disturbance of fauna due noise pollution	Ensure all noise sources are located far away from biologically important areas (e.g. nursery areas, important foraging habitat) and breeding areas of other fauna species;  Optimize movement of vehicles and machinery to reduce noise;	Lengwe National Park, Elephant Marsh	Site inspections	Number of complains related to noise received;  Presence of fence and noise barriers at blasting sites	Throughout construction period;  Operation period	Contractor, OM&M Operator	SVTP, SE, DNPW

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	<p>Procure or hire construction, drilling, blasting and pile-driving machinery or equipment that produce very low noise and vibration levels;</p> <p>Restrict time for blasting to periods stipulated in the MoU between contractor and DNPW</p> <p>Minimize engine idling time;</p> <p>Use construction and drilling equipment and machinery with high rate of energy efficiency;</p> <p>Use construction, drilling and blasting machinery that produce very low noise;</p> <p>Fit all heavy equipment and machinery with</p>						

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	<p>noise pollution control devices (i.e., silencers) that are operating correctly and efficiently; and</p> <p>Erect a fence or a barrier around the active construction and/or rock blasting sites to minimize the spread of noise and vibrations to surrounding areas.</p>						
Loss of fauna species due to poor disposal of waste in Lengwe National Park	<p>Develop a waste management Plan for LNP;</p> <p>Prohibit workers against disposing waste in undesignated sites;</p> <p>Discipline and fine any worker found disposing of waste in undesignated sites; and;</p> <p>Dismiss any worker failing to obey the by-law.</p>	Lengwe National Park	Site visits	<p>Presence of an approved waste management plan;</p> <p>Number of non-compliance cases reported</p>	Throughout construction and operation	Contractor, OM&M Operator	SE, SVTP, MEPA, Ministry



Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
<p>Risks to deaths of some fauna species due to effects of floods, bush fire, drought and climate change</p>	<p>Increase moisture loss reduction from soils by planting more understory plant species;</p> <p>Synchronise water abstraction with water demand to prevent flooding of canals;</p> <p>Install emergency spillways along the canals;</p> <p>Restoration of grasses to enhance availability of animal feed and shelter for some fauna species;</p> <p>Implement the fire management plan;</p> <p>Install fire detection systems;</p> <p>Establish fire-fighting community committees;</p>	<p>Lengwe, SVTP command area</p>	<p>Irrigation water demand analysis;</p>	<p>Number of emergency spillways installed;</p> <p>Flora mortality rates due to floods, bush fires, drought and climate change;</p> <p>Area (Ha) restored;</p> <p>Fire management plan in existence;</p> <p>Area (Ha) planted with fast growing tree species</p>			

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	<p>Plant fast growing indigenous tree species and underground cover grasses in identified areas to mitigate loss of tree species removed from construction</p> <p>Strengthen Early warning system for floods in Nkombezi</p>						
Drowning animals in the canal	<p>Construction of evacuation stairs in the canal for every 500 meters;</p> <p>Install barriers (for landing of drowning animals) and siphons;</p> <p>Continuous monitoring by Park Staff to spot and rescue animals that are drowning</p>	Lengwe National Park	Supervision visits	<p>Number of evacuation stairs constructed;</p> <p>Number of barriers installed;</p> <p>Number of animals rescued;</p> <p>Animal mortality rates due to drowning</p>	Throughout construction operation	Contractor, OM&M Operator, SOCFEs	SVTP, SE, DNPW

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
Introduction of exotic and invasive species into Lengwe National Park through inflow of water into the canal and water holes	<p>Develop Early detection and rapid response procedures to control IAS;</p> <p>Train Park staff on identification of IAS and management of IAS;</p> <p>Construction of sieving elements of water before entering the national park and removal and destruction of seeds trapped on the sieve (grit)</p>	Lengwe National Park	Site monitoring visits	<p>Early detection and rapid response procedures in place;</p> <p>Number of DNPW staff trained in identification and management of IAS;</p> <p>Number of sieving elements constructed.</p>	Construction and Operation	Contractor, OM&M operator	DNPW, EAD, NHBG
Creation of perception of a divided park	<p>Institute a camp on the divided park of the canal;</p> <p>Drill waterholes to encourage animals to roam the western side of the canal;</p>	Lengwe National Park	Site visits	<p>Number of ranger camps on the western side of the park;</p> <p>Number of waterholes sunk in the western side of the park</p>	Construction	Contractor	SE, DNPW, SVTP

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
Introduction of exotic species into the park by workforce and vehicles	Routine checks upon entry into the park;  Employ sniffing dogs to check the entry and exit of biological materials into the park;  Training Park staff on detection of biological materials;  Procure detection scanners	Lengwe National Park	Physical checks, Sniffing dogs	Number of DNPW staff trained in biological detection;  Number of scanners procured	Throughout construction	Contractor, DNPW	SE, DNPW
Fluctuation of water levels in Elephant Marsh due to diversion of water to irrigated sites by the primary and secondary canals	Maintain optimal environmental flow of 17M <sup>3</sup> / second at Kapichira to sustain water levels in the Marsh	Kapichira	Daily water flow measurements	Number of days with water flows below 17M <sup>3</sup> / second	Operation	OM&M Operator, EGENCO	EGENCO
Worsened vulnerability of elephant Marsh to	Enhance adaptation activities in communities;  Enhance alternative	Elephant Marsh and 100 m radius	Progress reports; Site visits	Number of alternative livelihood introduced;	Operation	SVTP, CCAs around the marsh	DNPW, SOCFEs

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
climate change through droughts and floods	livelihood activities for communities dependent on elephant Marsh;  Institute a human wildlife conflict management plan	of the marsh		Number of climate change adaptation projects implemented;  Number of beneficiaries of alternative livelihoods and climate change adaptation projects;  Human Wildlife Conflict (HWC) Management Plan in place			
Pollution from agro chemicals including pesticides causing pollution of aquatic species and	Monitor implementation of pesticides management plan for irrigation land;  Assess baseline water quality levels and undertake routine monitoring of water quality;	Elephant Marsh	Chemical pollution surveys;  Progress reports on implementation of PMP;  Site visits	Number of surveys conducted;  Number of people trained in chemical management	Operation	SOCFE, DNPW	Pesticides Board;  NWRA

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
proliferation of IAS	<p>Enhance the institutional capacity for the management of obsolete pesticides and herbicides;</p> <p>Institute set aside areas to reduce areas that are in contact with pesticides closer to the Marsh;</p> <p>Buffer zone of an unirrigated land for attenuation before entry of effluent into the elephant Marsh</p>			<p>Number and area (Ha) of sites set aside to reduce pesticide contact with the marsh;</p> <p>Existence of buffer zone (Ha) set aside</p>			
Worsening of Plastic Pollution in Elephant Marsh from Secondary Canals which may affect animal and plant survival	<p>Erect Grit (Trash rack) at exist of secondary canals to prevent flow down of plastics;</p> <p>Raise awareness among communities on plastic pollution;</p> <p>Clean up days at Elephant Marsh for removal of plastics and other waste in the Marsh;</p>	Elephant Marsh	Site visits	<p>Number of grit trashes installed;</p> <p>Number of awareness campaigns conducted;</p> <p>Existence of waste management plan;</p>	Construction; Operation	Contractor; SOCFEs	NWRA, MEPA, District Councils

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
	Develop and implement a waste management plan;			Number of clean-up days commemorated			
Secondary canals may transport exotic and invasive species to the canal where they may replace indigenous species of the canal	<p>Include Grits (Trash Rack) at the exits of secondary canal;</p> <p>Develop and Implement Procedures for early detection and Rapid Response;</p> <p>Train Elephant Marsh communities on Identification and Management of IAS</p>	Elephant Marsh	Site visits' progress reports	<p>Number of grits installed;</p> <p>Procedures for early detection and Rapid Response in place;</p> <p>Number of community members trained in Identification and Management of IAS</p>			
Risks to deaths of some fauna species due to effects (floods, bush fire, drought)	<p>Monitor species prevalence in the Shire Valley;</p> <p>Develop fire prevention plans</p> <p>Construct flood control bunds</p>	Shire Valley	<p>Field visits and reports;</p> <p>Biodiversity survey reports</p>	<p>Number of biodiversity surveys conducted;</p> <p>Fire Prevention Plan developed;</p>	Monthly During construction	Contractor, DNPW	SE, DNPW, SVTP

Impacts	Enhancement / Mitigation measures	Monitoring Location	Method	Monitoring indicators	Frequency	Implementing body	Monitoring body
of climate change				Flood control bunds (km) constructed			



## **ANNEX 11: TERMS OF REFERENCE FOR THE DEVELOPMENT OF THE BIODIVERSITY MANAGEMENT PLAN FOR LENGWE NATIONAL PARK AND ELEPHANT MARSH**

### **1. Background**

SVTP is a 14-year Program supported by a Series of Projects (SoP) with three sequential but partially overlapping projects (see Figure 1 on the next page). The scale and complexity of the development challenges in the Shire Valley can only be effectively addressed through an integrated multi-sector approach. The Program is structured around four coordinated pillars: (i) providing reliable, professionally managed, and sustainably financed irrigation service to a number of irrigators in a phased construction of an irrigation and drainage scheme; (ii) supporting farmer organizations within a comprehensive land use plan, and supporting land tenure strengthening and voluntary consolidation; (iii) establishing and investing in smallholder-owned commercial farm enterprises transitioning into commercial agriculture from subsistence farming and integrating them into commercial value chains; and (iv) natural resources management in and around the Program area. These four pillars are expected to increase the beneficiaries' capacity to respond to ever-increasing drought and floods. The Program aims at providing irrigation to over 43,000 ha through the phased construction of a new gravity-fed irrigation scheme that will supply surface water to over 27,600 ha of agricultural land presently under rainfed cultivation, creating agricultural development opportunities in the fertile valley, as well as approximately 15,700 ha of existing irrigation areas that currently use electric pumps to abstract water from the Shire River (see Map at the end of this document). In case one or more existing irrigation schemes opt out from drawing water from SVTP's gravity canal, additional new lands can be developed, mostly on the right bank of the main canal in the Nsanje District.

SVTP-1 became effective on March 21, 2018, and the current closing 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. There is a careful sequencing of activities. 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 at the end of December 2023. Secondary canal/pipeline systems in the Phase 1 area have been designed and will be contracted during quarter 3 of 2022.8 While not investing heavily yet in areas of agricultural commercialization and investment promotion, SVTP-1 focuses on sensitization of landowners, district land use planning, village land use planning, registration of customary land in the irrigation blocks and establishment of district registries for both Phase 1 and 2 areas, identification of consolidated parcels of lands for Phase 1 area, and crop and irrigation method selection. It is expected that SVTP-1 will substantially complete the development of about five blocks in order for commercial agriculture to start towards the closing date of the project.

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.

The first 10.5 km of the main canal to be constructed under SVTP-2 will be through Lengwe National Park, which will require a contractor with experience in constructing infrastructure within sensitive areas. Recent studies and surveys of the park identified the presence of a small number of critically endangered (White headed Vulture) or endangered (Lappet-faced Vulture, Bateleur, Steppe Eagle, and Secretary Bird) bird species, species which have also been recorded in Majete Wildlife Reserve (approximately 30 km away). Lengwe National Park is not considered to be in optimum condition and is devoid of large mammal species, although key habitat of the park includes the last significant block of thicket forest in the Lower Shire Valley which supports the most northerly endemic population of Nyala (*Tragelaphus angasii*). This is the main reason cited for the designation of the park and the thicket is considered to be critical habitat. The detailed design for the canal infrastructure through the national park will be carefully considered to avoid and minimize impacts to this critical habitat, although the feasibility design indicates that at worst approximately two percent of the thicket may be impacted directly. Other natural habitats of Lengwe National Park include mainly tree savanna (about 35 ha may be affected) and some areas of medium-short mixed open mopane woodland and tall-mixed closed alluvial riverine woodland (about 14 ha). If not well designed, the canal may form a barrier for the movement of species and hinder the movement of game rangers to safeguard animals and habitats throughout the national park. During the detailed design, measures will therefore be taken to avoid or minimize the loss of thicket and other natural habitats, and to ensure suitable connections are provided across the canal to minimize any barrier effects from the canal and cater to the different requirements of current and potential species.

The Shire Valley floodplain contains Elephant Marsh, which provides flood attenuation, fisheries, a rich biodiversity of rooted and floating swamp vegetation, approximately 26 species of breeding water birds, and a number of fish and invertebrate species endemic to the area. The impacts on the Program area from the accumulation of herbicides, pesticides, and fertilizers as a result of the agricultural intensification have been considered and will be monitored as part of SVTP-2, to allow farm management practices to be adapted as necessary in the future. Water volume arriving at Elephant Marsh is dependent almost entirely upon the flow of water from Kapichira Reservoir. The implications of abstraction of water for SVTP has been carefully considered, in combination with other abstractions and discharge projects from the Lower Shire and are not predicted to have

a significant cumulative impact on the Elephant Marsh. The proposed Mpatamanga Hydropower project (in planning in the Middle Shire) has the potential to alter the sedimentation and hydrological flows reaching the Kapichira Reservoir.

The project will advance a series of initiatives under Component 4 in protected areas, wildlife reserves, Lengwe National Park, and forest reserves, with the aim of strengthening biodiversity resources in the valley as a whole and providing improvements to the watershed. These initiatives will include scaling up the implementation of the Community Conservation Area Management Plan in Elephant Marsh, including ecosystem-based fisheries management, integrated agriculture aquaculture, and post-harvest fish technologies as alternative income sources. Park trails and roads, ranger facilities (including utilities, vehicles and communications), fencing, and water holes or other activities will assist with achieving the management plan objectives for Lengwe National Park, Mwabvi wildlife reserve, and Matandwe and elephant Marsh

The work is additional requirement to address potential impacts the project may have on biodiversity and ecosystem services in Lengwe National Park, Elephant Marsh and propose mitigation measures. Further there is need to isolate activities already being implemented under component 4 that could contribute to the mitigation of some of the identified impact in the project.

## **2. Work That Has Already Been Undertaken for Phase 2 of SVTP**

Between November 2021 and May 2022, the Government of Malawi undertook the development of SVTP 2 and the following documents were developed and are being disclosed on the websites of SVTP and World Bank:

- (i) Environmental and Social Impact Assessment (ESIA) and Environmental and Social Management Plan (ESMP) reports;
- (ii) Environmental and Social Commitment Plan (ESCP);
- (iii) Stakeholder Engagement Plan (SEP)
- (iv) Big Mammal and tree surveys
- (v) Flora Surveys under Mpatamanga Hydropower Project

## **3. Objectives of the Study**

In line with the Environmental Management Act (2017), National parks and Wildlife Act (2017), the World Bank's Environmental and Social Framework as contained in the Environmental and Social Standard (ESS 6) and the African Development bank's Operation Safeguards 3 and 6, development of a Biodiversity Management Plan (BMP) has been triggered.

The study will therefore, be geared at promulgation of a Biodiversity Management Plan for Lengwe National Park (LNP) and Elephant Marsh.

#### **4. Specific Objectives**

The specific objectives for the study will be:

1. Conduct a rapid biodiversity assessments of the canal alignment in Lengwe with special emphasis on the adopted canal alignment;
2. Conduct plant species survey along the canal alignment adopted;
3. Develop a restoration and monitoring plan for the cleared area in Lengwe National Park;
4. In collaboration with DNPW, develop a mitigation plan that includes offsets for Lengwe National Park.

#### **5. Scope of Works)**

The GoM is seeking the support of a biodiversity Experts to perform the following activities that will complement the ongoing ESIA activities for the second phase of SVTP :

- (i) Perform field work to identify the presence of focal flora and fauna groups that are rare, endemic, endangered, and/or of critical value in Lengwe National Park and Elephant Marsh habitat for other reasons. Consider areas important for these species in terms of habitat, migratory routes, feeding, resting (caves for bats), reproduction, etc.
- (ii) Collect data on biodiversity-related crime (illegal activities and uses of natural resources), for instance the species involved and their existing prevalence and factors affecting their abundance (like pangolins, elephants, tsanya, charcoal making etc.)
- (iii)The field work should also record flora and fauna invasive species in the project area and area of influence including analyzing the potential risks during construction and operational stages of the project.
- (iv)Consider direct, indirect, residual and cumulative impacts that the project might cause to the assessed group of flora and fauna and proposed activities for inclusion in the Biodiversity Action Plan (BAP) and Offset Strategy (where applicable) for instance: a rescue and recollection plan, reproduction program; research and biodiversity support; rescue centers; restoration plan; others. Link proposed actions and measures also to National Plans like Forest Landscape restoration programs, National Biodiversity Strategy and Action Plan, regulations, etc. The proposed activities and measures should be aligned to the mitigation and conservation hierarchy.
- (v) Provide maps of the areas of high conservation value for the taxonomic group that should be protected; avoid its impact or compensated.
- (vi)Conduct a reference review on international journals, national reports that can identify species or area of conservation concern, endemism, etc. and verify if any of these species are in the project area.
- (vii) Review information sources on bird flyways in the area to verify if any migratory bird species or birds of conservation concern move through the project area

#### **6. Field and Desk Work**

The biodiversity assessment will be led by the Environmental and Social Safeguards Specialist for SVTP with backstopping support from the Protection Areas Management Specialist, Fisheries, Forestry Department, National Herbarium and Botanic Gardens of Malawi and Biodiversity Unit of EAD.

The assessment team shall compromise of the following:

**(i) Fauna Studies: Mammals (large and small), Birds, Reptiles and Amphibians**

The fauna study will be led by Mr. Wilbert Chitaukali from the University of Malawi and will be assisted by members from SVTP, Forest Research Institute (FRIM), National Herbarium and Botanical gardens of Malawi (NHBG).

**(ii) Flora Biodiversity**

The Biodiversity unit of EAD led by Mphatso Kalemba will lead in the assignment with Dr. Lillian Chimphepo and Davies Chogawana

**(iii) Fish Biodiversity in the Lengwe National Park and Elephant Marsh**

The study on Fisheries will be led by Mr. Innocent gamulira, a Fisheries Research Officer from the Fisheries Research Unit who will be assisted by the district fisheries officers for Chikwawa and Nsanje. The study will cover diversity of fish in the Elephant Marsh, description of the Elephant Marsh fishery, conservation measures, ecosystem services derived from the marsh, most important fish species in the marsh, and ecosystem health status of Elephant marsh

**(iv)**

- Field visits to the project area will be arranged by the Environmental Safeguards Specialist (ESS) of the project and informed to the GoM Biodiversity team.
- The expert will benefit to consult with relevant stakeholders (including African Parks, Department of National Parks and Wildlife, Environmental Affairs Department, Department of Forestry, Department of Fisheries, Nsanje and Chikwawa district councils, Malawi Courts (for illegal wildlife crimes) and Wildlife Environmental Society of Malawi – WESM).
- This proposed field work is estimated to be done in at least 20 days and the preparation of the report and analysis of data in 10 days. The total allocated time for this consultancy is 30 days.
- Expert may hire additional support as needed for field work and should communicate to the ESIA specialist
- The areas of interest for this work are indicated in a table below and in detail under Annex 2. The expert may sample additional sites if possible, to provide the best available information of the biodiversity of the area.
- It is estimated that the expert will divide the field work in a number of field visits, but this will be agreed based on the work plan.

*The Experts will be expected to address, **but not limited to**, the following specific questions of interest:*

- What species will be important for restoration of habitats from the different communities (herbaceous, understory and canopy; wetlands)
- What kind of invasive species will colonize the project areas?
- What are species important for firewood, house construction and medicine that could be planted by the project
- What are the species been exploited for charcoal production and could be planted by the project?
- Indicate which areas should be given priority for restoration in the project influence area
- What efforts should be made for a rescue plan of plants and animals before works begin and where the animals and plants should be re-located
- Prepare a list of local experts in different plant families that can be consulted as the project develops
- How the wetland native species will be affected by the canal operation
- What actions of plant and animal restoration will you recommend around the Ramsar site /sugar cane interface?