ENVIRONMENTAL AND SOCIAL IMPACT ASSESSMENT (ESIA) SUMMARY

FOR

PROPOSED CONSTRUCTION OF MAIN CANAL FROM INTAKE TO LENGWE NATIONAL PARK UNDER THE SHIRE VALLEY TRANSFORMATION PROGRAM (PHASE 1)

COUNTRY – MALAWI

JUNE 2018
1 Introduction:

This document is the summary of the Environmental and Social Impact Assessment report (ESIA) for the Shire Valley Irrigation Project (SVIP). The project is an agricultural project aiming at irrigating about 43,370 ha of land in Chikwawa and Nsanje Districts, in order to increase their economic prospects and food security. It involves a water intake from inside Majete Wildlife Reserve (MWR) and three main canals of a total length of about 133 km.

The ESIA carried out for the project is presented in 3 volumes: Baseline report, Impact assessment report, Environmental and Social Management Plan (ESMP) as well as a Pest Management Plan (PMP).

The Ministry of Agriculture, Irrigation and Water Development of Malawi has approached the African Development Bank for the financing of the project. The ESIA summary highlights different aspects of the analysis carried out to ensure the adequate management of the environmental and social impacts of the project as required by the laws of Malawi and the African Development Bank’s Integrated Safeguards System. These analyses cover aspects of the policy, legal and administrative framework, project alternative analysis and justifications, potential impacts and mitigations measures, disclosure and public consultation as well as provisions for monitoring the management of impacts.

2 Policy, Legal and Administrative Framework

The policy framework applicable to the project include the Malawian national policies related to agriculture, irrigation and sustainable natural resources management. This includes the National Constitution of the Republic, the National Road Map Malawi Vision 2020, the Umbrella National Development Planning instrument, the National Growth and Development Strategy (MGDS), various sectoral policies in agriculture, land, forestry, irrigation, environment; the various strategies to implement international conventions on biodiversity, sustainable development, climate change, desertification etc.

In addition, the project is guided by the safeguards policy and procedure requirements of multilateral development banks, which are financing the project. These MDBs include African Development Bank and the World Bank and these environmental and social safeguard provisions cover aspects of biodiversity conservation, pollution control, involuntary resettlement, public consultation, pest management etc.

Within the country system, the Environment Management Act, 1996 of Malawi provides that the project require an Impact Assessment based on its description. In addition, as the project involves work in national parks, it falls under the Malawi National Parks and Wildlife Act (1992).

In general, these different legislations and safeguards provisions are aligned towards similar objectives of environmental and social sustainability.
3 Project Description and Justification

The project is an agricultural project aiming at irrigating about 43,370 ha of land in Chikwawa and Nsanje Districts, in order to increase their economic prospects and food security. It involves a water intake from inside Majete Wildlife Reserve and three main canals of a total length of about 133 km. The water intake will start from within the Kapichira reservoir, via 12 sluice gates.

The project is divided into two phases and the following discussions and considerations are solely for Phase I while Phase II is not currently scheduled, but is expected to begin after Phase I completion.

The Phase I project includes the following components:

**Water Intake:** Water intake will start from the Kapichira Reservoir and will involve construction activities and dredging to achieve up to 20 and 50 m³/s rate of water extraction by gravity. During operation, the 12 gates, divided into two partitions (8 gates, and 2 gates) will be fully automated; responding in real-time to water demand in the system.

**Canals:** The irrigation system will be comprised of 3 main canals which are based on gravity including:

1. A feeder canal (Main 1),
2. The Supini Canal (Main Canal 3, previously Illovo Canal), and
3. The Bangula Canal (Main Canal 2, Phase II of the Project).

The rest of the irrigation system will be composed of branches, complemented with siphons and culverts. It is planned that half of the canal will be underground in the vicinity of the Majete Wildlife Reserve (MWR) due to topographic constraints and to reduce risks of drowning of wildlife.

**Command Areas:** During the Phase I which is currently being considered, three zones of between 5,199ha and 11,250ha will be implemented. The main irrigation method expected to be used will be furrow irrigation, but farmers cooperatives will be able to develop sprinkler or drip irrigation if they so choose. Figure (1) Below shows the layout of the Shire Valley Irrigation Project.
Figure 1: Layout of the Shire Valley Irrigation Project
4 Description of the Project Environment and Socioeconomic Baseline

This section provides a brief description of the main physical, biological and human (social, cultural and economic) conditions prevailing in the study area.

4.1 Climate: The climate of the study area is tropical, marked by high temperatures and two distinct seasons; a rainy season from November to April, and a dry season from May to October. Temperatures range from a minimum average of 15°C in June and July to a maximum average of 35°C in October and November. Humidity ranges between 50% to 80% throughout the year, and average sunlight between 7 and 9 hours a day. There is an effective rainfall of 52%, and the region is qualified as semi-arid.

4.2 Local topography: The project is located in the Lower Shire Valley. The area starts with the ESCOM reservoir, upstream from Kapichira Falls at 144 meters above sea level (masl). From there, the Shire River flows via the dam spillway and Kapichira Falls, down into the valley, which includes a large lowland wetland, Elephant Marsh.

North of the study area, the Majete Wildlife Reserve (MWR) is bordered by hills (780masl) and the Majete escarpment to the North-West, where the Mwanza River flows down. The left bank of the Shire is lined with the Thyolo escarpment (1500 masl) from where numerous tributaries flow.

4.3 River Geomorphology: The project area includes a portion of the lower Shire catchment from Kapichira reservoir, to the end of Elephant Marsh. There are two main sections to consider:

   (i) A 20km section from Kapichira to Chikwawa where the river cuts through alluvial terraces; in this section, the river it is fed by tributaries from the Majete and Thyolo Escarpments.

   (ii) The second section runs for about 100km through an alluvial plain, and receives a number of tributaries, including perennial rivers (e.g. Mwanza and Ruo Rivers) from Thambani Hills, Salambidwe Hill, the Marangwe Range, the Matundwe Range, Thyolo Escarpment and Mulanje Mountain.

The Lower Shire River is known for its high mobility throughout the alluvial plain, with its drainage area covering up to 11470 km². It is noted that 16 of the 27 tributaries are left bank and are generally smaller than right-bank tributaries, except for Ruo River, which is a large tributary. The Lower Shire itself has an average slope of 1‰, whilst its tributaries have a more marked slope (e.g. 7‰ for Mwanza River), which accelerates runoff.

4.3 River Hydrology: The hydrological flow in the Shire River is determined by the water levels in the Lake Malawi, as well as by an upstream dam, Kamuzu Barrage, at Liwonde. In addition, water levels are also influenced by an irrigation scheme at Mtengula and the drinking water supply for Blantyre Water Board. The average flow at Kapichira Dam is 395 m³/s and the hydrological year is marked by two peaks, one in January, one in May, with the latter being more pronounced in dry years. The Shire is responsible for a minimum of 75% for the hydrological behaviour of the Elephant Marsh, throughout the year.

The Lower Shire Valley districts, notably Chikwawa and Nsanje districts are prone to floods due to the increased influx of both the Shire and Ruo River during the rainy season. At these times, the Ruo River forces the Shire back at their confluence, often causing breaching of the embankment. In addition, increased erosion upstream due to deforestation has led to higher sedimentation, which intensifies the flood threat.
Though climate models show little change to the Shire Basin flow and runoff due to climate change, the region is still at risk to extreme flood and droughts scenarios. In addition, the Shire River is more at risk to increased evaporation than most rivers in Malawi due to the large surface area of Lake Malawi.

4.4 **Shire River Water Quality:** Based on recent data, the water quality in the Shire River is indicated to be a mesotrophic environment, which present a risk of nuisance growth of aquatic plants. In addition, due to the high population density in the region, may contribute to lower domestic water use standards in terms of turbidity, faecal coliform and total coliform.

4.5 **Soil, Erosion, Sediment Transport and Geology:** Erosion in the catchment is an important and well-documented issue. Material transported by the Shire River, mainly originating from the West and North-West hills, is deposited in the centre of the valley. Due to increased human activity, there is increased runoff and erosion. In the top part of the basin, the deposits are mainly stratified sandy and silty alluvium. Salinity and alkalinity is reported in depressions, clay-like soils, and around marshes. Vertisols dominate the centre of the study area, with some areas being characterised by heavy Vertisols.

4.6 **Aquifer and Groundwater:** Previous studies have noted that groundwater in the area qualifies as brackish (91%) or salty (5%), with salinity increasing as it flows towards the Shire. The Shire therefore does not significantly affect the water table, with water moving slowly from the river to the aquifer.

**Socioeconomic Baseline:**

The proposed project will affect up to 100,000 smallholder farms from two districts, Chikwawa and Nsanje, who irrigation. should benefit from the installation of gravity. Common crops grown in the area include maize, sorghum, cotton, rice, and high value crops like tomatoes, onions, beans and sweet potato.

4.7 **Population:** The 2008 Population Census estimated the population to be at 434,648 and 238,103 in Chikwawa and Nsanje districts, respectively. Survey results from the area put the average household size between 4.9 and 5.1. The 2008 census suggested a 52:48 female: male ratio, whilst a recent survey found that there were more men than women on average in the project area. Settlements are concentrated around communal infrastructures such as markets, schools and water points, while communities are based around family groups, communal cultural beliefs and language. There are over 10 ethnic groups in the project area, with Sena and Mang’anja representing the largest two.

4.8 **Gender Indicators:** There are distinct gender inequalities in agricultural work. Women are found to be most active in the small-scale farms. However, men continue to be in charge of the financial undertaking for both farm produce and livestock. In addition, men are more likely to be hired for casual labour in the surrounding farm estates, which provides more income. This is perceived to be one of the reasons why women make up a larger portion of those engaged in government and NGO sponsored projects in the area.

4.9 **Vulnerable Groups:** Outcomes of the consultation process indicated that the communities identified orphans and the elderly as vulnerable group. The youth between 15 and 35 years of age are viewed as marginalised due to unemployment rates, whilst female-headed households are also considered as marginalised due to the lack of property and land rights in their culture.

4.10 **Literacy Level:** Within the project area, about 60% of both males and females complete primary level schooling. However, only 10.6% of females attend secondary education, compared to 14.5% of males.
The overall low attendance is mainly due to the tuition fees. Generally, the lack of school infrastructure and underage marriage could also account for some of the primary level dropouts.

4.11 Infrastructure: The area is served by one main asphalted road, three secondary roads, four district roads and a number of unclassified roads, which are often impassable during the rainy season. Transport is primarily limited to push bicycles, as well as motorcycles and ox-carts. Telecommunication is provided by two mobile network companies, but is unreliable in areas far from the main road; phone ownership is below 55%. Boreholes are the most utilised water source, followed by public taps; in some areas, boreholes are saline or brackish, and communities draw water from unprotected wells in the riverbeds. While water sanitation seems to be important to communities, approximately 40% of people simply cover their water containers, while 50% use more efficient ways (e.g. boiling, chlorination, filtering). About 81% of households have a toilet facility.

Both the Chikwawa and Nsanje districts have district hospitals, which are supported by a network of dispensaries and clinics. Common diseases include malaria, diarrhoea, bilharzia and STIs. In addition, the communities have initiated a number of health-related issues, from shortages of medication for common ailments, to shortages of staff and bed spaces.

Only urban and larger trading centres benefit from access to electricity, as the connection to the national grid is uncommon. Most households rely on candles, kerosene lamps and solar lanterns for lighting instead. Firewood remains the most important fuel for cooking, followed by charcoal with attendant deforestation and health risks.

4.12 Land: There are four categories of land ownership in Malawi: customary, government, public and private. About 60% of land that will be developed for this project is customary held land, while the rest is divided between public land and private land.

Land holding size is predominately small, with over two thirds of surveyed farmers with 0.5 ha or less. About 80% of the workforce relies on rain-fed agriculture, with crops such as maize, rice and sorghum. The second main land use is irrigated agriculture, through larger schemes such as Nchalo Sugar Estate. A few smaller, government-funded or independent schemes exist on either side of the river, with rice being the main crop, sometimes alternating with maize.

This area has one of the highest livestock populations of Malawi, with 12% of farms owning livestock. Animals are kept free-range on communal land, with little additional feeding: manure is rarely used as fertilizer. Keeping the animals on communal land gives rise to a number of conflicts, especially when harvest is near.

4.13 Economics: Most households rely on agriculture, primarily maize cropping. Overreliance on agriculture causes economic distress from November through to February, as food reserves grow low, and crops are not yet ready for harvesting. The two main cash crops are cotton, grown by smallholder, and sugar cane, grown in Illovo sugar estates. Other key economic activities include livestock farming, which mainly happens near trading centres, and fishing. Fishing is mainly the occupation of the riverine households, and helps to complement income in bad crop years. More than half of the population indicated an annual income of less than $150 per year, with about 85% living on less than one dollar a day. However, through the development of Majete Wildlife Reserve, and its inclusive management style, the surrounding communities have benefited from growing tourism as well as from trainings, income generating activities, and community infrastructure.

4.14 Health issues: The leading health issues of Malawi are present in the region including malaria, schistosomiasis, soil-transmitted helminthiasis, onchocerciasis, cholera, and leptospirosis. In addition, the
HIV infection rate is high; in the Chikwawa district alone, up to 11.4% of pregnant women were reported as affected.

Cultural Heritage

The ESIA preparation included a systematic survey of the Main Canal right-of-way and other planned civil works sites, checking for archaeological relics, fossils, human graves, shrines, sacred trees or groves, and other physical cultural resources. Based on this survey, the ESMP specifies nine sites of archaeological interest where pre-construction salvage of pottery fragments and other items should take place, led by Malawi’s Department of Antiquities.

4.15 Natural Heritage

a. The Majete Wildlife Reserve (MWR) covers 689 km², and was established as a game reserve in 1955. Since 2003, it has been under the management of African Parks, and it is the main touristic attraction of the Lower Shire Valley. The park is divided into five sections, notably the Mkulumadzi Concession Zone, the high Intensity Tourism Zone, the Low Intensity Tourism Zone, the Resource Use Zone, and the Utility Zone. Management objectives and goals are outlined in a draft five-year business plan (2015-2019).

b. The Lengwe National Park (LNP) was established as a game reserve in 1928. The area was later declared a National Park and extended in 1970 and 1975, respectively. It is currently covering an area of 887 km². Like Majete, the park is subdivided into zones, namely the Wilderness Unit, the Semi-Wilderness Area, the Resource Use Zones and the Utility Area. The most recent management plan was produced by the Shire Basin Management Program, and outlines new objectives, notably to rehabilitate LNP for wildlife, communities and tourism.

c. The Mwabvi Wildlife Reserve (MwWR) covers about 104-km² area, was gazetted in 1951, and is managed by the same staff as LNP. The reserve has the seasonal Thangadzi River, and it is punctuated by a number of small hills. It is outside of the Project Right of Way.

Ecology

Both districts that will benefit from the project are broadly divided into similar land use zones. Natural or semi-natural terrestrial vegetation cover the largest portion in both districts, 55.2% and 43.5% in Chikwawa and Nsanje, respectively given the presence of two parks. On the other hand, cultivated or managed land is the second largest, with 38.8% and 37.4%. Natural or semi-natural aquatic vegetation, mainly found in Elephant Marsh and Bangula lagoon, further represent an additional 3.4 and 11.1% in either district. Finally, urban areas represent 3.6% of land cover in Chikwawa, 4.7% in Nsanje.

Anthropogenic modifications: The study area is subject to anthropogenic pressure, notably logging and land transformation, unsustainable fishing practice, encroachment in Lengwe National Park (LNP), and incursion into wetlands by subsistence farmers (dimba agriculture). With much of the land around the national parks inhabited, most of the current modifications are occurring close to the park and reserve, as well as Elephant Marsh.
Figure 2: Approximate map showing priority areas for natural resource management relative to the project.
4.16 Terrestrial habitats: Natural habitats in the area are found in the parks and reserve, with some woodland remaining around, but too small to support large fauna. Majete Wildlife Reserve has successfully decreased human wildlife conflict through the erection of an electrical fence. Within the project area, the plant community in Majete Wildlife Reserve include two main plant communities: riverine and alluvial associations, and low-altitude, mixed, tall, deciduous woodland. With the animals unable to move outside the reserve, their movements are limited in the park, and mainly dictated by water availability.

On the other hand, the LNP experiences the problem of illegal logging, grazing and poaching. In addition, as fencing does not cover the whole area of the park, there are movements of animals, notably buffalo, in surrounding fields. The vegetation is dominated by Acacia and Combretum in thicket communities, as well as well-preserved riparian forest. Due to fencing and high human density around the parks, there is little or no animal movement between LNP, MWR and Mvawbi.

4.17 Wetland habitat: Downstream from Kapichira falls, past the Mwanza junction, the Shire River floodplain expands in to a first section known as Elephant Marsh, and past the Ruo River a second section known as Bangula Lagoon – covering an area of 1,100 km². The system is fed by both the Shire and its tributaries. The vegetation is dominated by grasses, with few ligneous plants. A preliminary study noted the presence of 130 plant species, 62 species of butterfly, and a number of wetland birds, as well as larger wetland fauna (e.g. crocodiles and hippos).

In addition to this encroachment, this area is also at threat due to its lack of official status, invasive plants, silt deposition from upstream erosion, and human-wildlife conflict. Elephant Marsh remains one of the most productive ecosystems in Malawi.

4.18 Wildlife: Most of the wildlife encountered reside in the parks and reserve. Overall, 73 species of mammal can be encountered in this area, though MWR was restocked with a number of larger mammals. Additionally, while LNP was created to protect the rare Nyala (Antelope), their numbers is dropping due to poaching. On the other hand, bird life is thriving in the area with approximately 340 resident species, 250 regular migrant species, and an additional 50-60 species as vagrants; the valley is an important wintering ground for a number of Palaearctic migrants.

4.19 IUCN and Local Vulnerability: At least 23 species present in the area are listed on the IUCN Red List: 11 near threatened, 5 vulnerable, 5 endangered, and 2 critically endangered. In addition, this area is a biogeographical limit for thicket of the South-East African region, associated bird species are at risk. Finally, within both LNP and MWR, locally rare plants have been identified.

4.20 Aquatic Ecology: Malawi is known for its numerous waterbodies, which includes the fish biodiversity hotspot like the Lake Malawi. The Shire river, which flows from Lake Malawi, is divided into three main sections: Upper, Middle and Lower Shire. The project area is within this last stretch, which has similar fish fauna to the Zambezi River as they are connected. The Lower Shire is physically separated from the upper stretches of the River due to Kapichira Falls, which constitutes an impassable obstacle that keeps fishes from migrating upstream. As such, fish assemblage is different in the Lower Shire from the rest of the river.

The main fish species include African Catfish (Clarias gariepinus) and Tilapia (Oreochromis mossambicus), which alone account for 90% of the local fisheries. There are about 49 species present in the system. The ten species of highest economic importance are: Tilapia; African Catfish; Straightfin Barb; Synodontis njassae; Tiger fish; Lake Salmon; Redeye labeo; Barbus eurystomus; and Barbus johnstonii. Fisheries in the Lower Shire account for about 4.2% of total fish landings in Malawi; as they are poorly regulated, such fisheries are a major threat to the aquatic ecosystem, alongside habitat loss, and water hyacinth blooms.
5 Project Alternatives

Several alternative scenarios were considered in the feasibility study for the project. The no project scenario would mean the absence of the infrastructure development and irrigation capacity envisaged through the project. However, the need to implement the Shire Valley Irrigation Project (SVIP) dates as far back as the 1940s and is justified by four critical factors. These factors include: (1) the vulnerability of the area to droughts caused by the El Nino and Southern Oscillation (ENSO) phenomena, resulting in crop failure; (2) the frequent occurrence of long dry spells during the rainy season which disrupt crop growth and maturity; (3) the seasonality of crop production in Malawi as whole which forces farmers to stay idle during the dry season, and lastly; (4) the inadequacy of feed and drinking water in the dry season to sustain livestock production.

The feasibility study further explored alternative options for the implementation of the project. These options are linked to different aspects of topography, geotechnical and hydro geological assessments, management of flood regimes, engineering design of canals, irrigable areas etc.

Based on the topographical analysis it was decided that the intake of SVIP should be located on the western side of Shire River at Kapichira Dam at an elevation of 144.0 m above sea level. The Feeder Canal would then convey the abstracted water from the Shire over a distance of 46.8 km to its outlet point at an elevation 134.5 m above sea level, which is also the starting point of both Bangula and Illovo Canals.

Since the route of the Feeder Canal would pass through Majete Game Reserve, the feasibility study indicated the need to minimize adverse environmental impacts on the game reserve by putting in place appropriate mitigation measures. For example, the design of the Feeder Canal would include fencing in order to safeguard animals from drowning in the water compared to a scenario with the conveyance system open to the atmosphere.

Geotechnical assessments were conducted along the route of Feeder and the Main Canals to quantify the seepage and percolation rates, and to provide the requisite information for the preliminary design. Additionally, the investigations were intended to identify the different options of construction material available in the project area. The geotechnical options analysis indicated that the soils along the feeder canal were prone to high seepage loses. Accordingly, the analysis indicated that the feeder canal should constructed of concrete pipes and should be buried under the ground to reduce losses arising from seepage and evaporation.

Hydrogeological investigations examined the suitability of groundwater resources for drinking water supply as well as irrigated agriculture, and determining the water balance. Generally, the quality of groundwater resources in SVIP was found to be suitable drinking water supply and generally suitable for irrigated agriculture although in some cases there might be need for the implementation of water management practices, such as seed placement and pre-plant irrigation.

The feasibility study also included a flood frequency analysis using a regional flood frequency model for the SVIP. The analysis resulted in the delineation of flood zoning map for the project area based on return periods of 5, 10, 20, 50, and 100 years.

Consequently, an irrigable area analysis was also carried out. This enabled the delineation of irrigable areas based on several factors, namely: topography, soil fertility, existing farming systems, grazing areas, flood prone areas, residential areas, graveyards, and places of cultural heritage. By using maps showing the spatial distribution of the above highlighted aspects, the preliminary outline of developable irrigation areas were selected and these were ascertained by field surveys.
6  Project Impacts and Mitigation/Enhancement Measures

Impacts arising from the Project have been assessed using four criteria, namely, the affected component’s value; impact intensity; impact extent; and impact duration. The impacts were also analysed in terms of probability occurrence. Accordingly, mitigation measures were proposed for the identified impacts.

6.1. Involuntary Resettlement

Among the key identified impacts is that the project will involve resettlement of a total of 869 people and will also involve compensation of a number of assets. Therefore a Full Resettlement Action Plan (FRAP) is under preparation to specify the procedures to be followed and the actions to be taken to compensate affected people and communities at the same time make provisions for the opportunity the project offers to improve the socio-economic conditions of the affected population. The preparation of the RAP involved open, inclusive and extensive consultation with a wide range of stakeholders at the nationals, district and village level with special sessions held directly with project affected people.

Deliberate actions were taken to ensure consultation with, and participation by, both women and men and individuals that were considered to be vulnerable. Particular attention was paid to the location and scheduling of consultation activities to ensure that people of all ages and social groupings can attend and participate with confidence and ease. The Project design has in-built mechanisms for continued participation of beneficiaries and other stakeholders in the project activities. The FRAP that is currently under preparation as a supplementary document to the Environmental and Social Impact Assessment (ESIA) report will be posted on the Bank’s website for public review and comment, in accordance with the Bank’s ESAPs.

A separate summary of the RAP has also be prepared and will be disclosed alongside the ESIA on the Bank website for 120 before Board presentation. Therefore the project impacts and mitigation/enhancement measures presented in this summary will not include those that are associated with resettlement.

6.1  Impacts during pre-construction phase

The overall impacts during the pre-construction phase are mainly with respect to community organisation and the natural heritage. These include community reorganisation and resettlement, which will be addressed in the Resettlement Action Plan. In addition, the final decisions on canal design and alignment was influenced by the type of long-term consequences on the National Parks. Finally, the use of a tendering process for construction will need to be inclusive and closely monitored in order to ensure the adherence to the environmental mitigation recommendations determined in the ESIA and its ESMP. On the other hand, there will be no impacts on the physical environment or ecology during the pre-construction phase.

6.2  Impacts during construction phase

The following is a summary of impacts during construction phase. The ESMP provide further details on the role of each of the actors in the implementation of mitigation measures and monitoring of impacts.

**Impacts from the tender process for a construction contractor:** The selection of a construction contractor and the inclusion of appropriate mitigation measures in call for tender and contract is a crucial step as many contractors are not environmentally and/or socially proactive and most have no experience in working in sensitive areas.

**Mitigation:**
- The bidding document and contract shall reflect the new requirements of the AfDB ISS and the World Bank as highlighted in the document “Summary of Environmental, Social, Health and Safety (ESHS) Enhancements Standard Procurement Documents (SPDs) & Standard Bidding Documents (SBDs)”; 

- African Parks and the Department of National Parks and Wildlife (DNPW) shall have a right to review the Design for the upcoming Phase I and to propose improvements. African Parks and the DNPW shall also be involved in the pre-qualification selection of the construction contractor as advisors; 

- In addition, many measures proposed in the ESIA and ESMP involve costs for the construction contractor, call for tender shall be clear on the requirement to quantify measures in the Bills of Quantities; 

- It shall be required that the contractor has experience working in wildlife parks and its reputation must be assessed by a Tender panel. 

6.3 Impacts on river geomorphology and water quality: The construction of the irrigation system will require extensive construction work around existing rivers, and as such will affect the geomorphology of rivers, as well as the water quality. 

Mitigation: 
- In order to minimise impacts, the mobile nature of the rivers shall be taken into account; 
- Crossing of tributaries shall be done in straight lines; 
- A buffer zone will be maintained around river so that irrigated fields are not too close to river banks; 
- Infrastructure to solidify banks shall be installed (e.g. gabions). 

6.4 Soil excavation and land levelling: the project will require extensive excavation work for canals, as well as rock blasting. 

Mitigation: 
- All reusable excavated soil shall be either provided free of charge to surrounding communities, or flattened and revegetated; 
- Burrow pits from blasting should be repurposed whenever possible and in consultation with communities (e.g. creation of wetland, filled with unusable soil, etc.). 

6.5 Impacts on workforce: The construction site will offer a number of job opportunities for the local populace, both skilled and unskilled. 

Enhancement and mitigation measures: 
- Employment of local workers will be prioritised in order to revitalise the local economy, and actions will be taken to minimize the negative impacts which could result from the influx of foreign workers (e.g. increased human pressure on natural resources, gender based violence, etc.); 
- These actions are the enforcement of a workers code of conduct, the development of a grievance redress mechanism encompassing the construction phase to allow community to communicate with the construction contractor about their concerns and grievances (and behaviour of workers), and the fight against encroachment in Lengwe National Park and Mwabvi Wildlife Reserve;
• To minimize the risk of sexual harassment and gender-based violence due to the influx of male workers in the Project area, the presence of the local law enforcement agents will be increased in the area.

6.6 Impacts on infrastructure agriculture and cultural heritage: The project will have manifold impacts on the human infrastructure, natural and cultural heritage throughout its construction.

Mitigation:
• Chance finds Procedures for the civil works contractors to follow during irrigation canal construction, along with pre-construction training and awareness for contractor personnel shall be incorporated within all relevant bidding documents and contracts;
• The canal alignment is being selected with a view toward minimising interference with physical cultural resources. No graveyards or shrines are expected to be affected by the project;
• Items of cultural interest will be systematically catalogued and stored or displayed, in accordance with guidance to be provided by the Department of Antiquities;
• In addition, new infrastructure accompanying the construction (e.g. bridges) should be developed simultaneously in order to limit disruptions, health and safety risks, and facilitate reprise of activities by local communities. The ESMP has recommended that one cattle/pedestrian bridge be built every km of main canal.

6.7 Impacts on the wildlife parks and reserves: Considering the passage of canals through Majete Natural Reserve (during Phase I) and Lengwe National Park (during Phase II), the impacts during construction in these areas are non-negligible. Infrastructure and fences will be impacted during construction, as well as tourism due to the noise, earth work and machine and truck traffic.

Mitigation:
• To minimise the impacts, the park/reserve managers shall work hand in hand with the contractors based on agreed schedules and mitigation measures (e.g. fencing off areas, road diversion, right of way, etc.);
• Appropriate clauses and all applicable mitigation measures will be included in the call for tender (and terms of references) and in the contract of the construction contractor including sanctions such as non-payment for non-compliance and on-site audit by a Supervising engineer;
• Certified noise barriers will have to be installed in MWR as work will take place very close to all important building and touristic sites;
• There will be a need to phase and confine the work in the areas inside MWR, in order minimize disruptions. The scheduling of these shall be made clear within the construction tender. The ESMP has describe three phases for construction which distinguishes the area along the Shire inside MWR, Ng’ona lodge private property and the Southern tip of MWR;
• For inevitable impacts such as loss of revenue and infrastructure destruction, a compensation schedule shall be drawn up based on the ESMP.

6.8 Impacts on terrestrial biome: In this aspect, there are two major issues namely the rapid change in land cover and the disruption to wildlife and vegetation. The construction will inevitably modify the current vegetative landscape, though much land area is already converted agricultural lands.

Mitigation:
• A reforestation scheme in LNP and MWR shall be implemented: in MWR, 25 ha of forest will have to be compensated and in LNP 60 ha of forest;
• Setting aside lands for conservation purposes, i.e. Open woodland (including riparian forest), Marshes and flood prone area, Heavy Vertisols area, Grazing area, Rivers and their banks,
wetland and buffer zones around LNP. This will require that the Design study fine tunes the irrigated areas to create set-aside lands and access for cattle to grazing sites along the Elephant marsh;
- Carefully designed and implemented safeguarding plans for protected trees and avoiding communal forests.

6.9 **Impacts on aquatic habitats:** Construction activities will entail temporary activities on rivers, which are habitats and migration territory for a number of fish species.

**Mitigation:**
- In order to limit unforeseen damage to these channels, temporary earth dikes and other structures that can modify the channel or destabilise earth banks should be avoided;
- The ESIA recommends that channelization of some rivers be avoided or done in consultation with stakeholders to minimize impacts (for example: Nkombedzi Wa Fodya River which crosses LNP);
- In addition, appropriately placed and sized culverts should be provided in order to ensure that there are no floods (super-sized culverts with natural bottoms), and work prohibited on these channels during fish spawning season.

**IMPACTS DURING OPERATIONAL PHASE**

The following provides a summary of identified impacts and mitigation measures during the operational phase of the project.

6.10 **Hydrological impacts:** This project represents a consumptive demand on the Shire system at the level of the Kapichira reservoir, which will not be – for the main part – reintegrated into the system. Increased demand on the reservoir will have effects downstream, notably a significant decrease in flow at the Kapichira Falls. The main mitigation effort proposed would be to increase the debit of upstream barrages (i.e. Kamuzu Barrage); however, in the current situation, this is not an option.

**Hydraulic transparency:** Due to the dynamic nature of the riverine landscape, poorly designed culverts and other infrastructure could lead to damming of tributary rivers and flooding of villages upstream. Any floods inside main canals could also lead to colonisation of Lower Shire fish species upstream of Kapichira falls.

**Mitigation:**
- In order to avoid such occurrences, the culverts sizes should adhere strictly to the designs that are informed by highest flow data.

6.11 **Changes in soil properties:** Irrigated agriculture sometimes trigger a series of changes in soil properties including salinization, sodicity, waterlogging.

**Mitigation:**
- Monitoring of soil properties shall be carried out including soil water level, salinity to provide early warning of problems;
- In addition, due to the presence of poorly drained Vertisoils in two of the three canal zones (B and C), alternative crops such as rice should be considered.
6.12 Rapid social change and hinterland effect: The successful installation of a modern irrigation scheme will necessitate the social acceptance and behaviour modifications from local communities. Furthermore, increased economic and demographic growth in the area could increase pressure on natural resources, including on water, wood and fish. The community level communication is currently addressed in the communication strategy. On the other hand, the project stakeholders will address the issues of economic and demographic changes on an on-going basis as the project evolves.

6.13 Lack of proper maintenance of infrastructure: This ESIA requires that a number of mitigation infrastructure be installed (e.g. bridges, wildlife passes, walls) which will need to be adequately maintained in order to ensure their efficacy.

Mitigation:
- Responsibility of maintenance shall be assigned for all infrastructure. It is recommended that the Bulk Water Operator be responsible for maintenance of infrastructures proposed in the ESMP including:
  - a. Bridges (cattle, pedestrian, and vehicle)
  - b. Safety stairs and ladders for villagers to bathe and wash and to exit in case of falls - Invasive fish barriers
  - c. Water intake trash rack (to hold back debris, crocodiles and floating Water Hyacinth)
  - d. Walls around the open canal section in MWR;
- In order to prepare for long term risks and to ensure that stakeholders interests and mainly those of parks are not affected by others, clear chain of responsibilities have to be defined taking into account all possible situations and “worst case scenarios”;
- Training shall be given to users of the canal system to ensure proper use of the irrigation canals (e.g. avoid waste-dumping);
- In addition, due to the presence of water hyacinth in the Kapichira Reservoir, regular eradication plans should be continued and extended to the canal as needed.

6.13 Changes and delays in agricultural development: Whilst the project is designed to allow further agricultural development beyond subsistence agriculture, delays to the start of operation and or of behavioural shift could potentially postpone benefits, especially at a household (e.g. food security) and community level (e.g. access to improved health and education facilities). In addition, the successful rolling out of the project could also lead to an over-supply in crops, which would decrease the market value of these.

Mitigation:
- Adaptive research and development;
- Creation of best practices based on the lessons from Phase I (before starting Phase II);
- Increased market-linkages;
- Emphasis on the export industry and the food transformation industry.

6.14 Livestock rearing: Livestock rearing practices will need to be adapted to the new conditions, as canals and command areas will represent obstacles to movement of cattle and grazing lands and water points will be reduced.

Mitigation:
- In order to avoid conflicts, infrastructure will be put into place along main canals, including drinking troughs at every village and cattle bridges at each kilometre of main canal;
• In addition, conflict management structures between cattle herders and irrigation farmers shall be put in place, alongside access to unfarmed land for grazing and new business opportunities (e.g. organic manure).

6.15 Decline in fisheries: Fisheries, which are already in decline, may further be affected by the decrease in flows in the Elephant Marsh.

Mitigation:
• In order to decrease the extent of this impact, fish farms are proposed, in line with the Agricultural Development Planning Strategy;
• A wetland management plan under the Shire River Basin Management Program (SRBMP) also aims at sustainable development.

6.16 Health and Safety: The intricacy of the canal system will increase the risk of drowning and injuries, specifically for children, as they are at risk even in the shallowest channels.

Mitigation:
• Sensitisation campaigns to be implemented, notably in schools, but also the addition of safety features such as ladders at every 500 meters in main canals (Feeder, Bangula and Supini). Large safety stairs shall be built at every villages along main canals;
• As schistosomiasis infection is expected to rise farmers and canal workers will be expected to wear suitable protective clothing. In addition, sensitisation campaigns will be put in place as well as preventative treatment campaigns (e.g. praziquantel for Schistosomiasis), and construction of pit latrines.
• The ESMP also recommends providing funds for capacity building for local health specialists to use up-to-date detection method for both urinal and intestinal schistosomiasis.

6.17 Impact on gender and vulnerable groups: The project has both the potential to benefit women through improving their access to water, as well as affecting them by increasing their workload in agricultural yield. Furthermore, as financial services often remain unattainable to women and youth, they may not have access to the same opportunities as men arising from the operation of the irrigation system. Likewise, landless people may be disadvantaged by the project.

Mitigation:
• Mitigation efforts on this aspect are fully described in the Gender and Youth Strategy Study, and are to be implemented from the preparatory phase through to operation;
• Additional mitigation will be included in the Resettlement Action Plan.

6.18 Kapichira falls attractiveness: The present project will decrease the environmental flow released by the sluice gates, known as Kapichira Falls. Currently, the flow is under 10m3/s less than one month a year, but this could rise to over 6 months a year, decreasing the touristic value of this site. It is crucial that the falls should remain visible during the rainy season, when irrigation needs are less important.

6.19 Impacts in wildlife parks: The passage of the project through two wildlife parks will inevitably cause long-term changes in the park through the creation of new infrastructure, the introduction of new stakeholders (such as the bulk water operator) as well as new chains of responsibility (especially regarding maintenance of infrastructure). These changes have the potential to greatly encumber the reserves and their management’s mission, and present a number of unknown risk factors, from changes in animal behaviour
and drownings, to increase in encroachment and poaching. The latter are of particular concern in Lengwe National Park, which already suffers from imposing human pressures.

Mitigation:
- A Memorandum of Understanding shall be signed between African Parks/Department of National Parks and Wildlife (DNPW) and the bulk water operator for MWR, and DNPW and the bulk water operator in LNP;
- The canals shall remain part of the MWR and the right-of-way of the canal not be alienated from MWR. Access to the intake and canals for maintenance will be managed in accordance with African Parks’ access restrictions (and inspection to avoid poaching);
- The presence of a canal in LNP, if designed to avoid animal drowning, could be a positive impact because this park suffers from water shortages. This could produce a net gain from a conservation standpoint for LNP. An artificial wetland with water pumped from the main canal shall be installed in both MWR and LNP to create a drinking spot for wildlife;
- Most illegal wood cutting activities and illegal grazing originate from communities in Zone A and B. This is therefore an opportunity for their inclusion in the scheme, which shall be conditional upon a signed agreement to comply with the rules prohibiting wood logging, grazing, or other unauthorized activities within Lengwe National Park (this also applies to MWR and surrounding communities). Village headmen shall sign a contractual agreement or some form of formal engagement to respect this rule prior to their inclusion in the scheme. The SVIP should be used as an opportunity to request some environmental engagement in exchanges of irrigation;
- Dredging will extract more than 500,000 m³ of fine sediment from the reservoir. Transport of these sediments through MWR shall be avoided (as transport will require about one truck per every 2 minutes through MWR).
- Ng'ona lodge, a private property beside MWR, will be affected by the Feeder canal RoW and work. Compensation, which should be developed within the Resettlement Action plan, shall be paid to the owner.

6.20 Habitat fragmentation: The building of canals will invariably fragment usable habitat, which will be of most relevance in MWR and LNP.

Mitigation:
- The construction of buried canal sections in MWR would reduce this issue; currently, about half of the Feeder canal will be buried in MWR;
- In LNP, there are also options of creating wildlife over- or underpasses at same locations as vehicle bridges.

6.21 Wildlife drowning hazards: The concrete structures that will be implemented in the project like the canals present a risk of drowning for animal species that may drink or feed near these structures especially in the dry season.

Mitigation:
- It is required that a concrete and brick wall will be erected along the canal in MWR in section where the canal will be open (about half of the canal length will be buried in MWR);
- It is required that gripping material or earth canal are provided in the canal in LNP (earth canals offer good grip so animals can exit the canal);

6.22 Changes in wetland plant communities: A decrease in flow is expected due to abstraction at the most critical period of the year (the dry season). This may lead to a decrease in suitable habitat for some
wetland vegetation and a potential increase in human encroachment that may affect plant community diversity.

**Mitigation:**
- Under the Natural Resources Management Component, the SVTP phase I project will also enhance the conservation of the Elephant Marsh through support for its designation as a RAMSAR Wetland of International Importance, and with the establishment of Malawi’s first Community Wetland Conservation Area under the administration of the Department of National Parks and Wildlife (DNPW). Therefore, future agricultural encroachment within Elephant Marsh is likely to be limited;
- In addition, the 2015 flooding altered the course of the Ruo River, which now joins the Elephant Marsh directly. The ESIA recommends that this new channel be maintained to mitigate effects from the Project, though human resettlement from around the banks of the Ruo River would be advised to limit flooding risks.

**6.23 Increased wildlife-human conflict:** Human-wildlife conflict will be exacerbated, notably with crocodiles and hippopotamus because they will be impacted by changes in Elephant marsh.

**Mitigation:**
- While there are a number of mitigation efforts that can be considered based on the species being dealt with (e.g. non-food crops close to canals to avoid hippo raiding), sensitisation programs will be the main action to avoid risky behaviour;
- The Natural Resources Management Component includes investments intended to reduce human-wildlife conflicts in the Elephant Marsh.

**Invasion of Lower Shire fishes:** Kapichira Falls constitutes a barrier between the Lower Shire to the Middle and Upper Shire. Currently, the Tiger Fish and other Zambezi River fishes are present only in the Lower Shire. The gentle slopes of the envisaged main canals could allow downstream fishes (including the Tiger fish) to by-pass Kapichira Falls. The Tiger fish can potentially create an ecological problem if it were present in the rest of the Shire basin. This is mainly due to its piscivorous and aggressive nature; it has the potential to significantly alter the mainly endemic cichlid populations of Lake Malawi.

**Mitigation:**
- An effective automated and low-maintenance fish barrier shall be put into place. The Technical Feasibility Study recommends a high fish weir consisting of a 3.5-meter drop structure topped off with a 1-meter crest. This will result in a vertical free fall of at least 2 meters when the canal is conveying the maximum amount of water (50 m³/s) and a higher free fall with any lower water flow. This fish weir will be incorporated within the Main Canal Detailed Design, with the incremental cost included as part of the total canal construction cost. This high weir is intended to effectively prevent any entry of Tiger fish- or any other non-native fish species to Lake Malawi - into the upper Shire River above Kapichira Falls through the Main Canal. To minimise the risks from human interference (including the accidental or deliberate release of non-native fish into the canal, above the barrier), the fish weir will be located within the Majete Wildlife Reserve, where human access is carefully controlled. In addition, this area is farther upstream and outside of flood prone area.
- Maintenance of the fish barriers will be the Bulk Water Operator’s responsibility (this shall be highlighted in the call for tender).

**6.24 Reduction of aquatic habitat quality:** With a reduction of flow, Elephant Marsh will be impacted; as such, there will be a decrease of suitable habitat for fish as well as a possible decline in quality.
Mitigation:

- Much of the management and mitigation efforts for Elephant Marsh fall under the mandate of the Shire River Basin Management Programme. In addition, Natural Resources Management Component of SVTP-I includes investments in community fisheries management, intended to make fisheries in the Elephant Marsh more sustainable.

6.25 Pesticides uses: As presented in the Pest Management Plan, development of the SVIP will lead to increased use of pesticides. Pesticides can affect water quality, biodiversity and human health. The risks of such impacts are heightened with improper pesticide use and disposal. The PMP has described an Integrated Pest Management (IPM) aiming at:

- Sustainable control of pests in sugarcane plantation;
- Sustainable control of weeds in sugarcane plantation;
- Sustainable control of diseases in sugarcane plantation;
- Management of post-harvest pests of cereal crops;
- Sustainable control of pest for other crops;

The measures developed in the IPM fall in the following categories:

- Pesticide application and disposal of pesticide containers (including incinerator, registration of pesticides, etc.);
- A list of recommended selective pesticides;
- Safety management principle and best practices for environmental and human safety;
- IPM capacity building for farmers (workshops, training session, etc.);
- IPM monitoring;
- Development of an IPM implementation team.

6.26 ESMP Costs

The estimated costs of implementing the ESMP are detailed below:

<table>
<thead>
<tr>
<th>Mitigation / compensation</th>
<th>Cost for mitigation / compensation in USD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Compensation Plan for Majete Wildlife Reserve</strong></td>
<td><strong>One year construction period in MWR</strong></td>
</tr>
<tr>
<td>1,351,830 (best case scenario no loss of business revenue) to 1,961,830 (worst case scenario no business revenue)</td>
<td></td>
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<tr>
<td><strong>Two year construction period in MWR</strong></td>
<td></td>
</tr>
<tr>
<td>1,370,990 (best case scenario no loss of business revenue) to 2,610,990 (worst case scenario no business revenue)</td>
<td></td>
</tr>
<tr>
<td><strong>Action Plan for the potentially invasive fishes</strong></td>
<td>Costs are presented in the Feasibility study*</td>
</tr>
<tr>
<td><strong>Cost of Action Plan for health and safety</strong></td>
<td>169,000</td>
</tr>
<tr>
<td><strong>Cost of Action Plan for socioeconomic impacts (including cattle bridge, footpath and vehicle bridge) and cultural heritage Plan</strong></td>
<td>4,063,280</td>
</tr>
<tr>
<td><strong>Total cost (excluding the fish barrier)</strong> **</td>
<td>From 5,584,110 to 6,843,270</td>
</tr>
</tbody>
</table>
* Cost for the invasive fish barrier inside MWR, as estimated by KRC (2017) is 4.3 million USD, as this is a tentative estimate and the concept of the fish barrier is still under analysis the amount has not been taken into account in the ESMP costing.

** The total cost also excludes costs to implement measures to address construction-related impacts that detailed in the Construction Environmental and Social Management Plan (CESMP) that will be prepared by the contractors as specified in bidding documents. The costs will be part of the contract costs and will be reflected in the bill of quantities.

Indicative costs for the Pes Management plan, in view of the typical activities is estimated at 199,000 USD over five (5) years.

The ESMP shall be implemented in conjunction with the other measures proposes in other technical studies taking part of SVIP.

7 Public Consultations and Public Disclosure

Several public consultation activities, onsite meetings and workshops were carried out during the project ESIA studies. These include the:

- Inception mission (June 2015) with an inception Workshop in Lilongwe with the Task Force;
- Baseline mission (January 2016) : meeting with stakeholders;
- Public consultations (June 2016) : two meetings with stakeholders : one in Chikwawa and one in Nsanje to present key findings of the baseline report and presentation of a first set of mitigation measures;
- Mitigation workshops (November 2016): two meetings with stakeholders - one in Chikwawa and one in Nsanje to present key findings of the ESIA.
- An additional presentation on the mitigation measures to the Task Force, Lilongwe stakeholders and World Bank was held to discuss the technical and financial feasibility of the measures.

Public perception of the project is generally positive. In addition, a number of concerns were raise. Some of the concerns include drowning hazards posed by the canal for people, wildlife and livestock and employment opportunities, gender and youth issues, and compensation.

8 Roles and Responsibilities

Based on the Environmental and Social Management Plan (ESMP) that has been developed for the project, the different actors for the different mitigation measures have been organized under different headings including:

- Measures to be included in the contractual documents of the construction contractor:
- Measures to be study at Design phase
- Compensation Plan for Majete Wildlife Reserve
- The Action Plan against invasive fishes
- The Action Plan for health and safety
- The Action Plans for social impacts
- Measures aiming at the Government
Monitoring Plan

The ESMP has specified roles and responsibilities for the different actors for the implementation and monitoring of the different mitigation measures. These actors include the design engineers, procurement specialist, construction contractor, government agencies including the Ministry of Agriculture, Irrigation and Water Development, Malawian Department of Antiquities, Department of National Parks and Wildlife etc. The ESMP has also specified the monitoring frequency and monitoring indicators that will be applied for the project.

The MoAIWD who will have the overall responsibility for the coordination, planning and implementation of the Project will principally drive the implementation of the ESMP. In this respect, MoAIWD will hire a construction Supervision (Management) Consultant with the responsibility of supervising the contractors implementing the works.

The Program will have a steering and technical committee at national level, a consultative committee and a technical team at local level.

9 Conclusion

As stated in the project’s ESIA and ESMP documents, the project’s overall goal is to benefit local communities specifically in improving irrigation water supply in the area and consequent improvement in the livelihood of the beneficiary communities. Improving livelihood will lead to other indirect positive impacts: improved access to education and health, new opportunities for agribusiness. As is typical of similar projects, various aspects of the projects design and implementation requires the mainstreaming of environmental and social considerations to ensure sustainability.

Mainstreaming these considerations therefore requires the commensurate analysis, financing and expertise to ensure that the proposed infrastructure and operational modalities of the project meet the overarching objectives of sustainability. In particular, this will require:

- appropriate wording and inclusion of all applicable mitigation measures in the call for tender (and terms of reference) and in the contract of the construction contractor including leverages such as non-payment for non-compliances;
- inclusion of all applicable mitigation measures in the Scheme operator (Bulk Water Operator) call for tender (and terms of reference and contract);
- selection of a construction contractor with good reputation who is environmentally and socially proactive;
- phasing and confining work in MWR to minimize impacts on tourism in MWR;
- proper compensation for impacts on tourism in MWR;
- installation of low maintenance and self-reliant wildlife infrastructures in MWR such as a fish barrier to maintain the separation between the Lower Zambezi and the Upper Shire fish assemblage, an artificial wetland, noise barriers, and walls around the Feeder canal;
- installation of sufficient troughs and cattle bridges along the main canals;
- measures to prevent drownings of people (safety ladders) and treatment against schistosomiasis (Bilharzia), as common disease in irrigation schemes.
The application of these measures and the mitigation measures identified so far in the project’s ESIA and ESMP ensure that the project is designed and implemented in such a way that impacts are identified, avoided where possible, minimized and mitigated or compensated for.

10 References and Contacts

The following document have been used and consulted in the preparation of this summary:

- Environmental and Social Impact Assessment (ESIA) and Pest Management Plan (PMP) for the Shire Valley Irrigation Project (SVIP). Volumes I, II and III

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