



THE GOVERNMENT OF THE REPUBLIC OF MALAWI

MINISTRY OF WATER DEVELOPMENT AND IRRIGATION

**SHIRE RIVER BASIN MANAGEMENT PROGRAMME (PHASE I) PROJECT
FINAL ENVIRONMENTAL AND SOCIAL ASSESSMENT REPORT**

FINAL REPORT

JULY 2013



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ACRONYMS AND ABBREVIATIONS

ADC	Area Development Committee
ADD	Agricultural Development Division
AEC	Area Executive Committee
AIDS	Acquired Immunodeficiency Syndrome
APM	African Parks Majete
APL	Adaptable Programme Loan
ART	Antiretroviral Therapy
bdI	below detection limit
BLK	Balaka
BOD	Biochemical Oxygen Demand
BT	Blantyre
CA	Conservation Agriculture
CCA	Community Conservation Area
CBD	Convention on Biological Diversity
CBOs	Community Based Organizations
CBNRM	Community Based Natural Resource Management
CBRLDP	Community Based Rural Land Development Programme
CIG	Common Interest Group
CITES	Convention on International Trade in Endangered Species
CK	Chikhwawa
COD	Chemical Oxygen Demand
CSOs	Civil Society Organizations
DADO	District Agriculture Development Officer
DANIDA	Denmark International Development Aid
DC	District Council
DODMA	Department of Disaster Management Affairs
DEA	Director of Environmental Affairs
DEAP	District Environmental Action Plan
DEC	District Executive Committee
DEM	Digital Elevation Model
DESC	District Environmental Sub-committee
DNPW	Department of National Parks and Wildlife
DODMA	Department of National Relief and Disaster Management
DOE	Department of Energy
DOF	Department of Forestry
DPD	Director of Planning and Development
DRM	Disaster Risk Management
DSS	Decision Support Systems
EA	Environmental Assessment
EAD	Environmental Affairs Department
EAM	Evangelical Association of Malawi
EDO	Environmental District Officer
EIA	Environmental Impact Assessment
EMA	Environment Management Act
EMP	Environmental Management Plan
ESA	Environmental and Social Assessment
ESCOM	Electricity Supply Corporation of Malawi
ESMF	Environmental and Social Management Framework
ESMP	Environmental and Social Management Plan
ESIA	Environmental and Social Impact Assessment
ESSF	Environmental and Social Screening Form
FAO	Food and Agriculture Organisation

FCMA	Fisheries Conservation and Management Act
FEWS	Flood Early Warning System
FBOs	Faith Based Organisations
GEF	Global Environmental Facility
GFDRR	Global Facility for Disaster Reduction and Recovery
GIS	Geographical Information System
GoM	Government of Malawi
GSM	Global System for Mobile Communication
GV	Group Village
Ha	Hectare
HIV	Human Immune Deficiency Virus
IBAs	Important Bird Areas
IDA	International Development Agency
IFRMP	Integrated Flood Risk Management Plan
IHS	Integrated Household Survey
IPM	Integrated Pest Management
ITCZ	Inter-Tropical Convergence Zone
IUCN	International Union for Conservation of Nature
JLC	Joint Liaison Committee
LDCF	Least Developed Countries Fund
MCDP	Micro Catchment Development Plan
M&E	Monitoring and Evaluation
MGDS	Malawi Growth and Development Strategy
MH	Mangochi
MHG	Machinga
MIS	Management Information System
mm	millimetres
MAFS	Ministry of Agriculture and Food Security
MGCSW	Ministry of Gender, Children and Social Welfare
MTI	Ministry of Trade and Industry
MSTT	Multi-sector Technical Team
MTPW	Ministry of Transport and Public Works
MN	Mwanza
MWDI	Ministry of Water Development and Irrigation
MS	Malawi Standard
MWDI	Ministry of Water Development and Irrigation
MWRA	Majete Wildlife Reserve Association
NAREC	Natural Resources and Environmental Centre
NCE	National Council on the Environment
ND	Not detected
NEAP	National Environmental Action Plan
NEP	National Environmental Policy
NFRI	National Forest Research Institute
NGO	Non-Governmental Organization
NHBG	National Herbarium and Botanical Gardens
NLP	National Land Policy
NN	Neno
NRM	Natural Resources Management
NRSC	National Roads Safety Council
NS	Nsanje
NSO	National Statistical Office
NTU	Nephelometric Turbidity Unit
NU	Ntcheu
NWDP	National Water Development Programme

OP	World Bank Operational Policy
PAP	Project Affected Person
PCB	Pesticides Control Board
PF	Process Framework
pH	power of hydrogen
PMCT	Prevention of Mother Child Transmission
PPA	Project Preparation Advance
ppm	parts per million
PRA	Participatory Rural Appraisal
PS	Permanent Secretary
PVA	Participatory Vulnerability Assessments
RAP	Resettlement Action Plan
RGS	River Gauging Station
RPF	Resettlement Policy Framework
RPF+PF	Resettlement Policy Framework with Process Framework
SADC	Southern Africa Development Community
SESA	Strategic Environmental and Social Assessment
SLWM	Sustainable Land and Water Management
SUCOMA	Sugar Corporation of Malawi
SOER	State of the Environment Report
SRBMP	Shire River Basin Management Project
STA	Sub Traditional Authority
TA	Traditional Authority
TCE	Technical Committee on the Environment
TCPC	Town and Country Planning Committee
TDS	Total Dissolved Solute
ToR	Terms of References
SESA	Strategic Environmental and Social Assessment
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate
VDC	Village Development Committee
VCT	Voluntary Testing and Counselling
WWEC	Water, Waste and Environment Consultants
WRA	Water Resources Area
ZA	Zomba

ACKNOWLEDGEMENT

This Environmental and Social Assessment (ESA) has been prepared with the support and consultation of many people to whom Water, Waste and Environment Consultants are very grateful.

The people consulted included workers and communities in the Shire River Basin where the proposed project activities will be implemented. The areas include districts, cities and towns of Ntcheu, Mangochi, Machinga, Balaka, Liwonde, Zomba, Blantyre, Mwanza, Neno, Chikhwawa and Nsanje.

District officials including District Commissioners, members of District Executive Committees, Directors of Planning and Development, Environmental District Officers, District Forestry Officer, Chiefs and the general public provided valuable input to this study.

In addition, a number of senior officers in the Ministry of Water Development and Irrigation, Energy Department, Forestry Department, National Water Development Programme and other key line ministries such as the Ministry of Local Government and Rural Development provided considerable administrative and logistical support during the assignment.

EXECUTIVE SUMMARY

The Government of Malawi has received a Project Preparation Advance (PPA), on the proceeds of a credit from the International Development Agency (IDA) of the World Bank, to finance the preparation of the SRBMP. The World Bank plans to assist the Government of Malawi with the financing of this Project, as part of a longer term Program (12-15 years – for which the SRBMP is the first phase of about 5.5 years).

The overall Program development objective is to make significant progress in achieving socially, environmentally and economically sustainable development in the Shire River Basin. The Project development objective is to (i) prepare a strategic planning and development framework for the entire Shire River Basin (defined from outflow of Lake Malawi to the border at Nsanje) and (ii) support targeted investments, to improve land and water resources management and livelihoods in the Basin.

The Program will address the interlinked challenges of poverty and a deteriorating natural resource base in the Shire River Basin, to halt the process of environmental degradation and improve the productive potential of natural resources. It will promote integrated climate resilient investment planning, including institutional capacity building, to plan and monitor changes in land use patterns at basin level.

The first Project is expected to have an investment portfolio of about US\$145 million; and will be implemented over five and half years to support:

- Strategic planning and implementation of large-scale infrastructure investments;
- Adoption of sustainable land, forest and water management practices to reduce land degradation;
- Improved productivity and incomes of smallholder farmers in priority catchments; and
- Improvement of flood management in the Lower Shire.

The project proposes to implement catchment management and income generating interventions that are likely to have impacts on land holdings, sources of income and livelihoods in various communities and areas where the project activities will be implemented. This ESA, together with the other safeguards have been prepared to help mitigate against the potential negative impacts and to enhance the positive attributes and benefits of the project.

According to Section 24 (1) of the Malawi Government's Environment Management Act (EMA), Number 23 of 1996; and the Government's Environmental Impact Assessment (EIA) Guidelines of December, 1997, the SRBMP would fall under the list of projects for which EIA is mandatory and must be conducted prior to implementation. The basis is that the proposed programme constitutes activities, which would generate considerable changes and significant effects to the environment.

The proposed SRBMP has been categorized as A, according to the World Bank's Operational Policy (OP 4.01) on Environmental Assessment. Therefore, the appropriate environmental work will have to be carried out.

Since not all the locations of the Project-supported infrastructure investments and their potential negative localized impacts could be determined prior to appraisal, preparation of this ESA (and ESMF as well as RPF and PF prepared as parallel documents) provides an opportunity for scoping of appropriate mitigation for potential negative environmental and social impacts. Impacts of the largest infrastructure activity to be supported under the SRBMP—upgrading of the Kamuzu Barrage at Liwonde—are addressed in a separate report, *Preliminary Environmental and Social Impact Assessment: Independent Environmental Impact Assessment for the Upgraded Kamuzu Barrage* (Government of Malawi, December 2011).

The Ministry of Water and Irrigation Development has engaged Water, Waste and Environment Consultants, to prepare this ESA, an ESME, an RPF and a PF for the project. The purpose of this ESA is to guide the integration of environmental and social considerations in the planning and design; and implementation of the SRBMP activities. The ESA is designed to guide the determination of appropriate level of environmental management, in all stages of the project cycle, from planning and design to implementation, basing on the existing environmental and social conditions in the basin.

The Shire River Basin Management Project is designed with environmental sustainability in mind, for all the components and activities. The environmental impacts of improved institutional coordination in basin water resources management, watershed management, and improved regulation of the Shire River, improved climate resilience, and ecosystem improvements are expected to be highly positive overall. Environmental and social considerations will be given prominent attention in Shire River Basin planning, as well as major civil works, to ensure that any adverse impacts are minimized and/or adequately mitigated. Key project activities that will generate considerable impacts include:

Kamuzu Barrage Upgrading (Sub-component C.1): Upgrading of the Kamuzu Barrage at Liwonde is the sub-component with the greatest environment risk under the SRBMP; and that is why the overall Project is classified as Category A. Upgrading of the Kamuzu Barrage will generate significant positive and negative environmental and social impacts. Most of these impacts relate to potential upstream changes in levels of the Shire River and Lake Malawi, as well as downstream Shire River flows. The *Preliminary Environmental and Social Impact Assessment: Independent Environmental Impact Assessment for the Upgraded Kamuzu Barrage* (Government of Malawi, December 2011) provides additional information on the positive and negative environmental and social impacts of the Kamuzu Barrage upgrading.

Flood Management (Sub-component C.2): The proposed flood mitigation civil works in the lower Shire Basin are expected to have fairly minor adverse environmental or social impacts because they are relatively small-scale and localized. Nonetheless, attention will be given to a range of environmental and associated social issues, such as ensuring sufficient river access and crossing points for animals (domestic and wild) and people, since the embankments tend to be rather steep. The wetland conservation and management activities, planned around the Elephant Marshes, are expected to be highly positive, from an environmental standpoint.

Catchment Management (Component B): The investments and activities, planned under this component, are expected to be environmentally positive overall, without significant adverse environmental impacts. These investments include (i) check dams, gabions, and other small civil works intended to reduce erosion and slow down runoff; (ii) alternative livelihood promotion and income-generating activities, which will be screened to identify environmentally and/or socially problematic investments and to design appropriate mitigation measures; (iii) community management of natural forests and woodlands on village lands and within the Mangochi-Namizimu and possibly other Forest Reserves; and (iv) investments for management of protected areas in and around the Lengwe and Liwonde National Parks.

New Water Investments (Sub-component C.3): New water investments planned under the Project might be sensitive from an environmental and/or social standpoint. In general, the Project is intended to promote increased focus on the environmental and social implications of any proposed new investments, in line with the capacity-building activities of Component A. Additionally, the Project would support preparation of environmental and social impact assessments that might be needed for any such new investments.

Shire Basin Planning (Component A): The planning, information management and capacity-building activities, to be supported under Component A, are all intended to facilitate increased awareness,

understanding, and mainstreaming of environmental and social considerations within water resources planning for the Shire River Basin.

Although the SRBMP activities will vary in size, location, scope and approach to implementation, most of these activities will involve catchment management and rehabilitation as well as income generating activities. Hence the generic and typical environmental impacts would mostly be positive, with minor negative impacts and would include:

Key Potential Positive Impacts:

- Improved reporting on comprehensive State of the Shire River Basin;
- Reduction in run-off, soil erosion and siltation in the Shire River basin;
- Increased institutional capacity for coordinated management of Shire River Basin;
- Improved sustainable use of water resources in the Shire River Basin;
- Improved catchment management and protection;
- Improved consistency in water flows in the basin;
- Improved protection of human settlements and infrastructure through a limited set of adaptation measures including flood zone demarcation;
- Sustainable and productive agriculture from small scale irrigation and efficient use of water resources;
- Improved income generation at household level within the basin;
- Improved power generation at hydro power stations on the Shire River Basin;
- Improved forest management in Eastern Escarpment, Tsamba and Mangochi Forest Reserve;
- Increased economic development within the Shire River Basin.
- Improved livelihoods through enhanced food security, nutrition and availability of disposable income;
- Decreased dependence on unsustainable exploitation of forest resources;
- Improved water availability for hydropower generation, irrigation activities and water supply;
- Improved weed management and reduced handlings costs; and
- Improved ecosystem management of the Elephant Marshes.

Key Potential Negative Impacts (in the absence of planned mitigation measures):

- Land acquisition on both banks of the Shire River and in areas where people need to relocate to make room for new construction works;
- Disruptions to aquatic life and the fishing patterns of local communities due to the construction of temporary coffer dams during to upgrading of the Kamuzu Barrage;
- Changes in water flows and levels during the upgrading of Kamuzu Barrage (addressed in a separate Environmental and Social Impact Assessment);
- Water pollution from uncontrolled agro-chemical use and pesticides use; and
- Blockage of river access and crossing points for animals (domestic and wild) people where steep embankments are constructed or reinforced for flood protection.

Mitigation measures for the negative impacts include:

- Provide adequate compensation to affected persons
- Provide for minimum flow in the engineering design as recommended by the Water Resources Department
- Train communities on safe use, storage and disposal of agrochemicals and Implement Integrated Pest Management (IPM)
- Provide for gentle-sloping river banks at key access points
- Provide alternative sources of water

Based on the findings from this environmental and social assessment study, it is recommended that the project proceeds because it will generate sustainable social, economic and environmental benefits through effective and collaborative planning, developing and managing of the natural resources in the Shire River Basin. Specifically the project will bring the following benefits:

1. Significant and direct benefits to about 430, 000 households who will be involved in integrated catchment rehabilitation activities within the basin;
2. Reduced downtime at hydropower stations, hence benefiting about 30 percent of urban households, companies and public agencies with access to electricity through within the basin;
3. Reduced erosion, run-off and soil erosion through rehabilitation of about four separate catchments of between 26,000ha and 41,000ha each, with an average size of 33,000ha in the basin;
4. Strengthened the institutional capacities and mechanisms for Shire Basin monitoring, planning, management and decision support systems;
5. Sustainable water resources management and development through water related infrastructure developments such as upgrading Kamuzu Barrage;
6. Improved livelihoods of people within the basin through improved agricultural productivity, income generating activities, and improved management of natural resources.; and
7. Improved flood management in the Lower Shire and community level adaptation and mitigation support.

The ESA recommends that the proposals made herein (and those made in the ESMF, RPF and PF) must be implemented adequately to mitigate the consequential environmental impacts of the project activities; and to enhance the positive attributes. It is also recommended that the Environmental Affairs Department and other relevant line ministries must ensure that human activities that lead to deforestation and other environmental and social problems are properly managed and monitored.

Preparation of the ESA was done through desk reviews of available literature collected from published and unpublished sources. The Consultant conducted a reconnaissance survey from 18 to 21 November 2011 and detailed field investigations from 12 to 16 February 2012, during which times most of the data was collected and verified. Field investigations and public consultations were conducted in Ntcheu, Mangochi, Machinga, Balaka, Zomba, Blantyre, Mwanza, Neno, Thyolo, Chikhwawa and Nsanje.

Key stakeholders consulted include central government officers in Lilongwe, officials from the Water Boards, City, Town and District Councils; Chiefs, communities as well as persons who would be affected either positively or negatively by the project. Consultations with traditional leaders in selected catchments were done from 20 to 24 June 2012. A list of stakeholders consulted is attached in Annex 4 and Annex 5 includes selected issues raised by stakeholders during the consultations. Photographs captured during consultations are included in the main text and in Annex 6.

CHAPTER ONE: PROJECT DESCRIPTION AND OBJECTIVES OF THE ESA

1.1 Project Description

The Government of Malawi (GoM) has received a Project Preparation Advance (PPA), on the proceeds of a credit from the International Development Agency (IDA) of the World Bank, to finance preparation of the Shire River Basin Management Project (SRBMP). The World Bank is assisting the GoM in the preparation of the SRBMP, as part of a longer term Shire River Basin Program.

The overall Program development objective is to make significant progress in achieving socially, environmentally and economically sustainable development in the Shire River Basin. The Project development objective of the SRBMP is to develop a strategic planning and development framework for the entire Shire River Basin (defined from outflow of Lake Malawi to the border at Nsanje); and to support targeted investments to improve land and water resources management and livelihoods in the Basin.

The Program investments will be designed to support the GoM's economic growth and sustainable development plans for the basin. It will address the interlinked challenges of poverty and a deteriorating natural resource base in the Shire River Basin, to halt the process of environmental degradation and improve the productive potential of natural resources. The Program will also promote integrated climate resilient investment planning in the basin, including institutional capacity building, to plan and monitor changes in land use patterns at a basin level.

The first project in the Program will support strategic planning and implementation of large-scale infrastructure investments; adoption of sustainable land, forest and water management practices (to reduce land degradation in production landscapes and improve the productivity and incomes of smallholder farmers in priority catchments); and improved flood management in the Lower Shire. The first project is expected to involve an investment of about US\$145 million and will be implemented over five and a half years.

The SRBMP is being implemented by the Government of Malawi, through the Ministry of Water Development and Irrigation. The Ministry has engaged the services of Water, Waste and Environment Consultants (WVEC) to prepare this Environmental and Social Assessment and an Environmental and Social Management Framework (a separate document) and a Resettlement Policy Framework with a Process Framework (RPF+PF) for the SRBMP.

1.2 Project Components and Activities

The Project will address the interlinked challenges of poverty and a deteriorating natural resource base in the Shire River Basin, to halt the process of environmental degradation and improve the productive potential of natural resources. It will also promote integrated climate resilient investment planning in the basin, including institutional capacity building to plan and monitor changes in land use patterns at a basin level.

The Project activities will support strategic planning and implementation of large-scale infrastructure investments; adoption of sustainable land, forest and water management practices to reduce land degradation in production and natural landscapes; and to build resilience to climate risk as well as improve the productivity and incomes of smallholder farmers in priority catchments. It will also improve flood management in the Lower Shire. Project investments will be designed to support the Government of Malawi's economic growth and development plans for the basin.

The first phase of the Program will last five and a half years and is organized in three components: (A) Shire Basin Planning, (B) Catchment Management, and (C) Water Related Infrastructure.

Component A: Shire Basin Planning (US\$M 40.2) has the objective to *lay the foundation for more integrated investment planning and system operations for the Shire Basin*. It would finance development of a modern integrated Shire River Basin knowledge base and analytical tools, as well as well-planned structured stakeholder consultation processes to facilitate investment and systems operation planning. This component is critically required to move from the current fragmented approach to investments and systems operation, to a more coordinated and holistic approach, based on a shared and sustainable vision for the development and management of the Shire River Basin. A modern knowledge base with associated knowledge products will be created along with modelling tools to support this planning. The component will support institutional coordination mechanisms for basin planning and management for the basin's socio-economic development and environmental sustainability. It is organized in four sub-components.

Sub-component A.1: Develop Shire Basin Plan, with two activity sets:

- (i) Preparing an inter-sectoral Shire River Basin Plan, including a basin wide consultative development planning process supported by planning and operational decision support systems, acquiring datasets (satellite imagery etc.); and training for water resources planning and management. This will include (a) development of a DSS based on a further developed Malawi Water System Simulation Model, complemented by a rainfall-runoff module, a flood routing module, improved DEM and mapping data; and a water allocation and use administration system); (b) continuous refining of the Flood Risk Management Action Plan for the Shire River Basin (being prepared by Department of National Relief and Disaster Management (DNRDM) and MWDI with Bank support under the Global Facility for Disaster Reduction and Recovery); and (c) survey and mapping of natural habitats to allow for the contribution of ecological infrastructure to river basin functions to be assessed and reflected in basin planning); and
- (ii) Strengthening inter-sectoral Shire Basin coordination and management institution(s), initially in the form of a Shire River Basin Authority under the Water Resources Board and perhaps later in the form of a Shire River Basin Agency or similar, with provisions for civil works (building), staffing, equipment, operational costs, communications, workshops, research and innovation. Critical for coordination within the institutional reform will be the establishment of the Shire River Basin Stakeholder Forum, with representatives from multiple stakeholders in basin management, which will form a critical platform for debate and basin vision development. The Forum will be linked to the basin management institution; and its specific mandate will be developed in unison with the institution.

Sub-component A.2: Build institutional capacity for coordinated basin management

This sub-component will strengthen the different line agencies involved in the Shire River Basin management to more effectively carry out their respective roles. In particular capacity for the following institutions will be strengthened:

- (i) Department of Water Resources;
- (ii) Department of Irrigation;
- (iii) Department of Land Resources and Conservation;
- (iv) Department of Forestry;
- (v) Department of Climate Change and Meteorological Services;
- (vi) Surveys and National Spatial Data Centre;
- (vii) Department of National Relief and Disaster Management in the Office of the President and Cabinet;
- (viii) Department of National Parks and Wildlife;
- (ix) Environmental Affairs Department;
- (x) Department of Energy; and
- (xi) Department of Fisheries.

Sub-component A.3: Improve water resources information systems, with two sets of activities:

- (i) Rolling out the framework for water resources information system, as proposed under the National Water Development Program, to monitor water flows and discharges, water quality and sediment loads, as well as groundwater, using real time low-cost modern communications such as GSM telemetry in combination with traditional gauging stations, complete with installation of operational control systems within the Basin and on critical points along the Lake and its upstream catchments; and
- (ii) Flood Forecasting and Early Warning Systems, including hosting, improving and utilizing hydrological and hydraulic flood zone modelling, as well as community level early warning systems. These information systems would also be used to refine and update a) the operational regime of the Kamuzu Barrage; and b) the Integrated Flood Risk Management Plan.

Sub-component A.4: Program management, monitoring and evaluation to ensure efficient and timely delivery of project resources in accordance with the project's objectives. A multi-sector and multi-agency Technical Team has been formed and located in MWDI, led by a Project Coordinator who reports directly to the Permanent Secretary (PS). The project will provide funding for professional and support staff to strengthen the Technical Team and facilitate its operations, including an environmental and social safeguards specialist, an institutions specialist, GIS and modelling experts, economist and water resources planner, as well as a diverse range of short term expertise and annual external audits. There are also provisions for workshops, short training courses and formal training (in hydrology and land resources). Specific provisions for Monitoring and Evaluation (M&E) include baseline and end-of-project surveys. A Mid-Term Review will assess project implementation arrangements and project performance in addressing outcomes and objectives.

Component B: Catchment Management (US\$M 45.5) has the objective to *rehabilitate degraded catchments for sustainable natural resource management and livelihoods through an integrated, participatory approach*. Development of community-based natural resource management systems is a long-term process that requires sufficient time to build the necessary capacity and ownership. Since the activities promoted ideally require a longer time horizon than the project duration, this project will institutionalize a successful approach and show early results that will be expanded upon and consolidated through the next phase in the program. There would be three stages at the local micro-catchment level:

- (i) Building conditions for micro-catchment rehabilitation and alternative livelihood development, including community sensitization, social mobilization and capacity building to ensure ownership and a strong foundation for subsequent interventions;
- (ii) Implementation of micro-catchment development plans and alternative rural livelihoods;
- (iii) Continuing financial and technical support for catchment rehabilitation and livelihood activities while phasing out project activities.

Sub-component B.1: Build institutional capacity for sub-catchment planning and monitoring with five sets of activities:

- (i) Strategic planning and facilitation will support the development of broad sub-catchment plans covering approximately 30,000 hectares each and including 10-12 Group Villages (in pre-identified catchments), and will include some strengthening of management coordination for the southern Shire protected areas cluster;
- (ii) Participatory micro-catchment planning at the Group Village level to develop integrated plans covering approximately 3,000 hectares each;
- (iii) Development of (project & national) guidelines and detailed field manuals and training on their use;
- (iv) Monitoring and evaluation (M&E) ; and

- (v) Implementation support to provide technical assistance to government and communities at the national and field level.

The monitoring model proposed for catchment management planning and implementation would apply remote sensing and Geographical Information System (GIS) along with field based data collection to track program inputs and outputs, institutional performance, impacts and outcomes. The M&E framework would combine both qualitative and quantitative parameters to be captured in a computerized Management Information System (MIS) and linked to the district and national M&E systems. The ultimate objective of the proposed M&E system is to improve the program performance, ensure transparency and accountability in the program as well as lesson learning and coordination across the Basin. Hence it will work at two levels: individual program level; as well as at the Basin Level; mapping different initiatives and creating a common methodology for assessing, documenting and reporting impacts of catchment management activities, with the aim to improve planning and aid effectiveness.

Sub-component B.2: Rehabilitate targeted sub-catchments: Will finance interventions identified in micro-catchment plans prepared under sub-component B.1, including:

- (i) Soil and water conservation for more sustainable and productive agriculture;
- (ii) Forestry and rural energy interventions to restore forest cover and reduce firewood consumption within the sub-catchments;
- (iii) Stream and water control, including check dams and small earth dams to support improved water management through smaller-scale structures built by community members. Larger infrastructure investments at sub-catchment level will be based on a strategic feasibility assessment.

Sub-component B.3: Alternative rural livelihoods would support demand and market driven income-generating activities, with special targeting of women, youth and landless groups, to gradually decrease dependence on low performance agriculture and unsustainable harvesting of forest and wetland products as sources of income. This includes:

- (i) Area-specific market demand and value chain transaction support studies and agricultural fairs aimed at identification of linkages with markets;
- (ii) Development and start-up of alternative livelihoods to support identification, mobilization, sensitization, and initial capacity building of common interest groups (CIG) for commercially oriented income-generating activities;
- (iii) Mini and small scale irrigation and fish and farm ponds on both hills and flat arable lands to assist farmers in drawing water from small storage structures; to support agricultural intensification, particularly related to agri-business development;
- (iv) District level infrastructure (for instance rural roads, market infrastructure and community-level facilities for post-harvest storage) in each sub-catchment, based on initial strategic assessments;
- (v) Capacity building and mentoring to build organizational, technical, financial and business capacities; and
- (vi) Access to rural finance to create a community fund where CIGs can apply for interest-bearing loans, to support scaling up of their small-scale enterprises, after demonstrating successful business performance and solid business plans for growth.

Sub-component B.4: Sustainable management of the Shire forests would strengthen management of remaining natural habitat blocks, in the middle and lower Shire, to protect and enhance the delivery of environmental services (such as watershed protection, flood attenuation, biodiversity conservation, and carbon storage and as a basis for generating revenues from tourism). This will include:

- (i) Investments to strengthen protected areas management and address people-park conflicts in and around Lengwe and Liwonde National Parks – including improved planning, development of sustainable financing mechanisms, development of essential infrastructure to boost revenues from tourism and improve conservation management, creation of water points, provision of training and essential equipment and cross-support to other protected areas in the middle and lower Shire;
- (ii) Establishment of community forest management in the Mangochi-Namizimu Forest Reserve adjacent to Liwonde National Park, using a methodological approach endorsed and field-tested by the Department of Forestry. These activities will complement the IDA-funded Sustainable Land and Water Management (SLWM) investments, in predominantly agricultural lands under B2, to form part of an integrated landscape management approach; and
- (iii) Improve relationships between local communities and Park authorities by providing small grant support to local CBOs and natural resources associations around Liwonde and Lengwe National Parks.

Component C: Water Related Infrastructure (US\$M 59.0) has the objective of *developing the water resource by enhancing the infrastructure platform for multi-sectoral growth in the basin and to mitigate risks posed by droughts and floods*. Development of critical infrastructure is essential to overcome annual and long-term variability in water resources availability for communities as well as the environment and economic sectors. The Shire River Basin has a unique resource base as it is the outflow of one of the largest Lakes in the World; with very complex climate response dynamics; and at the same time virtually the entire economy of the country is based on this resource, making improvements to water resources management a must. The component will build on the basin planning carried out under Component A and the priorities as set out in the national Water Resources Investment Strategy prepared in 2011. The component is organized in three sub-components.

Sub-component C.1: Kamuzu Barrage will support the construction and construction supervision of the Kamuzu Barrage upgrade at Liwonde. The major intended functions of the upgraded Barrage are:

- (i) To regulate water flow in the Shire River to meet the demands of downstream water users, particularly water supply, energy and irrigation;
- (ii) Improve weed management and reduce handling cost;
- (iii) Regulate water levels upstream to meet environmental and socio-economic conditions;
- (iv) Influence, to a certain degree, the water level in Lake Malawi; and
- (v) Improve safety and traffic circulation by physically separating road traffic from areas needed for gate operation (operation and weed handling currently takes place on the road, which is a major North-South corridor).

The Barrage can only regulate the Lake Levels within a certain range of Lake Levels, which does not cover the historic variations. The component will therefore improve the effects of the regulation, as far as possible, by slightly increasing the highest regulated water level at the Barrage (up to 40 cm, still within the natural range); and by operational measures based on improved hydrological observations, hydraulic modelling, decision support on water demand and ability to operate the Barrage in real time.

Sub-component C.2: Flood Management in the Lower Shire in collaboration with other initiatives, to support implementation of the Integrated Flood Risk Management Action Plan (IFRMAP) for the Lower Shire (see Component A):

- (i) Priority flood mitigation interventions, such as river bank stabilization, dykes, culverts, flood diversion structures etc;
- (ii) Community awareness raising and planning based on flood mapping and zoning;

- (iii) Community level support to the design and construction of adaptation measures, such as flood demarcation, elevated platforms, shelters and safe havens, connectivity to and training on the Flood Forecasting and Early Warning Systems;
- (iv) Communication and transport equipment for Civil Protection Committees and rescue teams; and
- (v) Planning and pilot investments in ecological flood mitigation and climate resilient livelihoods in the Elephant Marshes.

Sub-component C.3: New Water Investments within the Shire basin will support feasibility and design studies for additional water related infrastructure works. There is ample scope and need to further develop the Basin's resources for different economic sectors, such as: agriculture in general and irrigation agriculture in particular, aquaculture, urban and rural water supply, and hydropower, transport and disaster resilience. Special attention could be given to the design of a set of measures for flood mitigation in the Ruo River, the notoriously forceful flooding tributary to the Lower Shire, for possible financing in a second phase or a different initiative, based on the recommendations of the IFRMAP.

1.3 Objectives of the Assignment and Relation to other Safeguards Instruments

The overall objective of this ESA is to provide an overview of the anticipated environmental and social impacts, and propose generic mitigation and enhancement measures for the identified impacts of the SRBMP. Specifically, the assignment aims at analysing the environmental and social implications of the proposed project activities in order to prevent, minimize, or mitigate potential adverse environmental and social impacts, while enhancing the positive impacts of the project.

The ESA is prepared along with the ESMF, RPF and the PF; and it fits within a menu of safeguards instruments that together address the full spectrum of environmental, social and legal safeguards issues. Critical among these is the Strategic Environmental and Social Assessment; as well the instruments described in sections 1.5.

1.4 Lessons from the Strategic Environmental and Social Assessment

A Strategic Environmental and Social Assessment (SESA) has been completed for the Shire River Basin. Its recommendations have been internalized in program design, amongst which is the centrality of the Kamuzu Barrage upgrading, to help ensure sustainable future development within the Shire Basin. The SESA focused on the most critical issues that need to be addressed to achieve sustainable development in the Shire River Basin. A number of salient issues were identified, and the project is addressing many of them.

The lessons from the SESA that are reflected in project design include: (a) wide ranging and complex issues that involve every sector of the economy, and can be grouped under three key areas of: land management, water management, and human resource management; (b) the framing and implementation of policies, plans and programs that need the involvement of all relevant government ministries and district councils; (c) the private sector, which has a key role to play in sustainable development in the Shire River Basin and the need for greater involvement of NGOs, civil society groups and the public in general, in ensuring that strategic issues are kept in focus by government; (d) the dynamics of environmental change that need to be properly understood, monitored and responded to in the Shire River Basin; and (e) the effective water resource and regional land use /spatial planning that need to be introduced for sustainable development in the Shire River Basin.

The SESA indicated that many of the challenges in the Shire River Basin were due to insufficient attention to the environmental dynamics; rapid population growth that undermines current achievements; uncoordinated development planning without adequate environmental and social safeguards; unplanned urbanization; need for critical review of policy, plan, and program performance; need for strengthening water and natural resources management institutions and governance; and need for awareness-building. Addressing this situation in a comprehensive manner would require improved work on water, land, and natural resources management; as well as strengthening the associated human resources capacity. The SESA has the following recommendations, many of which have been addressed in the project and program design:

Land Use and Natural Resources Management:

- Create an autonomous Shire River Basin Management Institution (this is the focus of the proposed Component A in the proposed project).
- Create a Strategic Land Use Plan for the Shire River Basin (Basin Plan being prepared as part of Component A)
- Prepare and update biennially a report on the status of the Shire River Basin and plan implementation (proposed as a State of the Shire Basin Report in Component A)

Managing Environmental Data:

- Establish an environmental monitoring body to review all relevant environmental data, including climate, meteorological, land use, and development activities (strong M&E framework proposed at both basin-level and for catchment management; real-time hydrometric system being developed for the basin under the project, comprehensive basin knowledge base being established and synergies being established with the National Climate Change Program)
- Strengthen reporting on monitoring and anticipating effects of environmental change, particularly climate and disaster risks, with particular emphasis on Lake Malawi water levels and Shire river flows (State of the Basin report will incorporate this reporting as suggested, flood management forecasting and preparedness activities being undertaken in proposed project)
- Strategic Environmental Assessment of Shire River Basin Policies, Plans, and Programs should be reviewed and updated (will be integrated into Shire Basin Planning process)

Managing Human Resources:

- Program of public awareness raising on population management (outside scope of current project)
- Improve programs, plans, and projects to support transition from rural to urban living in the Shire River Basin (will be partially addressed in Shire River Basin planning)

Developing Energy and Natural Resources

- A new coordinated approach to solving Malawi's energy crisis should be considered, including focus on alternative energy (will be supported in overall program, with immediate support in selected catchments under Component B)
- Need for more objective and transparent appraisal of major development programs, including upstream EIAs/ESIAs (this is already being done for the proposed program and Component A will strengthen the knowledge base and capacity to facilitate this further)

Governance and Institutional Reform

- Better monitoring and reporting of results of major initiatives should be required from all agencies (the project seeks to create a comprehensive M&E system for the Shire basin and catchment management across projects as part of Components A and B).
- Great emphasis to investment in operating agencies in Shire Basin at national and district/NGO levels (improved capacity-building and coordination proposed for all key agencies working on Shire Basin as part of the project)
- Designers of all programs and projects should give careful attention to improving staff commitment and initiative (the project is one of the first transitioning out of PIUs and with investment in training, capacity-building, and coordination for shared-vision planning and management)

Critical Areas for Investment

Focus on “hotspots for action”:

- Addressing energy shortfalls (work on upgrading Kamuzu barrage and optimizing operations to improve critical downstream hydropower generation to reduce interruptions (alternative energy work in watersheds, and preparation of new investments are proposed in the project)
- More reliable water resource development (focus of planning in Component A and new investment preparation in Component C)
- Reduce current scale of deforestation in Neno and Mwanza districts (improved management of forest reserves, including two in Neno district, being targeted in Component B with GEF financing)
- Unified approach to land and water management in Mwanza River catchment (will be addressed as part of Components A and B and exploring synergies with other ongoing activities; additional support will be explored for priority catchments in next phase of program)
- Coordinate approach to flood risk management in the lower Shire Valley in Chikhwawa and Nsanje (these districts are the focus of the flood management activities in Component C)
- Re-establishment of rail/road bridge and embankments in the Lower Shire and Transportation in the East Bank of the Lower Shire (major transport activities out of scope of current project, but Basin planning may help support consideration; community-level embankments in Lower Shire being supported under Component C and any larger structures can be considered for preparation of new investments with adequate environmental and social safeguards for future phases)

1.5 Other Safeguards Instruments for the Project

In addition, an independent Environmental and Social Impact Assessment (ESIA), including an Environmental and Social Management Plan (ESMP), and a Resettlement Action Plan (RAP) of the Kamuzu Barrage Upgrading are being prepared as part of a parallel consultancy. Prior to this independent ESIA, a preliminary Environmental Impact Assessment (EIA) was completed in 2003 as part of the Feasibility Study (The Integrated Water Resources Development Plan for Lake Malawi and Shire River System “Lake Malawi Level Control”—Stage 2, Final Feasibility Report, Volume II, Part C—EIA of Upgraded Liwonde Barrage, Norconsult). The World Bank has sent, on behalf of the Government of Malawi, a Riparian Notification Letter to the governments of all the other Zambezi River Basin countries (Mozambique, Tanzania, Angola, Botswana, Namibia, Zambia, and Zimbabwe), since the Shire Basin forms part of the larger Zambezi Basin. This notification and request for any official comments is done to support good information sharing among the riparian countries and is in compliance with OP 7.50 on Projects in International Waterways.

1.6 Justification for the ESA

This environmental and social assessment has been prepared for the project to examine the potential environmental and social impacts of the proposed project activities under the SRBMP. Preparation of ESA is a requirement by financing institutions such as World Bank financing as the ESA helps financial institutions to determine the magnitude and extent of potential impacts to be generated by the proposed project. The ESA examines existing environmental and social issues within the project area and identifies potential impacts that will be generated by proposed project activities in the context of the existing situation. For the identified impacts, the ESA proposes enhancement and mitigation measures. For the SRBMP, the precise type and location of proposed project activities are not known at this time. Therefore the potential social and environmental impacts of the project activities cannot be identified in the context of a traditional EIA; hence the preparation of the ESA.

1.7 Potential Users of the ESA

The ESA has been prepared as a reference manual for use by key stakeholders to be involved in the planning, implementation, management and operation of the proposed SRBMP. As a reference material, the ESA may be useful to the following SRBMP key stakeholders:

- Funding and donors agencies;
- The Ministry of Water Development and Irrigation;
- Ministry of Environment and Climate Change;
- Ministry of Lands and Housing;
- Department of National Relief and Disaster Management;
- Electricity Supply Corporation of Malawi (ESCOM)
- Water Boards (Blantyre and Southern Region Water Boards);
- Town & Country Planning Committees and District Executive Committees in the impacted districts;
- Irrigation institutions (Illovo Sugar Corporation, Demeter Farm, Kasinthula and Nkhate Schemes and other smallholder irrigation farmers);
- Non-Governmental Organizations and Community Based Organizations;
- The Water Transport Sector including the Nsanje World Inland Port;
- Politicians and Local Traditional Leaders and;
- Senior Government officials responsible for policy making and development planning

1.8 Approach and Methodology to the Preparation of the ESA

One of the key objectives of the ESA is to identify potential environmental and social impacts for planned future project activities of the SRBMP, and to recommend a generic management plan for addressing the potential negative impacts. In order to achieve this objective, information for preparation of the ESA was collected through a number of research methods, which included review of related literature from published and unpublished documents, field investigations and public consultation with key stakeholders. Consultations with key stakeholders were carried out during the reconnaissance from 18 to 21 November 2011; and detailed field investigations were carried out from 12 to 16 February 2012. Additional consultations with traditional leaders in selected catchments were conducted from 20 to 24 June 2012. The field investigations and public consultations were conducted in Ntcheu, Mangochi, Machinga, Balaka, Zomba, Blantyre, Mwanza, Neno, Thyolo, Chikhwawa and Nsanje. Key stakeholders consulted included central government officers in Lilongwe; officials from the Water Boards; City, Town and District Councils as well as persons who would be affected either positively or negatively by the project. The rationale of these extensive consultations was to solicit views of a cross section of people, at the local, district, and central government level. Annexes 4 and 5 provide details of the consultation events (including

dates, venues and issues discussed during the meetings). Photographs captured during consultations are included in the main text and in annex 7.

The strategies for executing this assignment followed the following seven steps:

- (a) Review of existing general biophysical and socioeconomic conditions of the proposed project areas;
- (b) Review of typical implementation approach and processes for the proposed project activities;
- (c) Field investigations which included data collection on water resources, forest management, agriculture production, economic activities, biodiversity, catchment management and water quality;
- (d) Consultations with stakeholders within the project areas;
- (e) Identification and analysis of potential generic environmental and social impacts the project activities are likely to generate within and around the project areas;
- (f) Identification of appropriate generic mitigation measures for the likely potential negative environmental and social impacts and;
- (g) Compilation of a generic management and monitoring plans for addressing the impacts during project implementation.

1.9 Organization of the ESA

Chapter One: provides the background information to the SRBMP and introduces the various levels at which the project will be implemented. The chapter gives an overview of the proposed project components and activities in the Shire River Basin. The objectives, justification, and potential users of the ESA are also presented and finally the approach and methodology used in preparing the ESA are explained.

Chapter Two gives an overview of the physical setting of the proposed project area; describing the project location, general physical conditions of the upper, middle and lower Shire River Basin. It describes the geology, climate, hydrology, water quality in relation to waste management practices. Water regulation activities, flooding and problems of invasive alien aquatic weeds are also summarised in this chapter.

Chapter Three provides a description of the biodiversity within the Shire River Basin. The chapter includes a description of vegetation, wildlife, birds and fisheries in the upper, middle and lower sections of the basin.

Chapter Four gives a socio-economic setting for the basin. Issues discussed in this chapter include demography, economic activities such as agriculture, transport, energy and income generating activities. Common diseases including HIV and AIDS are also discussed in this chapter. Finally, gender and cultural issues are presented.

Chapter Five describes the relevant Malawi Environmental policies and legislation applicable to the SRBMP. The chapter also presents the relevant World Bank Operating Safeguards and Policies; and finally compares the two to highlight any gaps that exist; and to make the appropriate recommendations for addressing the gaps.

Chapter Six identifies the environmental and social impacts likely to be generated from the proposed Project activities during the planning and design, construction, and operation and maintenance phases. The environmental and social impacts include those that are perceived by the various key stakeholders consulted. The environmental and social impacts are linked to the environmental components they are likely to impact upon and the sources of the impacts are also described. These sources include the civil works for the construction of new and rehabilitation of existing structures; and the various human activities that create strains on the

natural resources and social services. The environmental and social impacts are the basis for the development of the environmental management and monitoring plans given in Chapter 7

Chapter Seven gives the Environmental and Social Management Plan (ESMP), which outlines the identified environmental and social impacts, the proposed mitigation measures and the responsible institutions for implementing the ESMP. This chapter also describes the Monitoring Plan which lists the proposed institutions to carry out monitoring activities, monitoring indicators, monitoring frequency and costs for carrying out the monitoring activities.

Chapter Eight provides an overview of institutional arrangement necessary for effective implementation of the ESA. The overview includes the functions of the institutions in relation to the activities for the Shire River Basin. The institutions include the Project Implementation Unit, government departments, non-government organization and local communities.

Chapter Nine describes the weaning strategy for the project by providing objectives and institutional arrangements to ensure sustainability of the activities after the project is phased out.

Chapter Ten gives the recommendations of the ESA, among them being that effective implementation of the SRBMP environmental and social management framework has to be looked at in the context of other existing environmental problems; and those problems that may arise from other future project activities not necessarily related to SRBMP.

CHAPTER TWO: PHYSICAL SETTING OF THE PROJECT AREA

2.1 Introduction

Development projects of the nature of the Shire River Basin Management Project bring about various changes (positive or negative) to the different components of the environment. These components include (i) physical (geology, topography, soils, water resources etc): (ii) biological and ecological (flora and fauna); cultural and socioeconomic (people's habits, rituals, settlements, land use and livelihoods, etc.).

The EIA process for Malawi (EMA, 1997) requires that the baseline situation of the existing environment be established, before any project that might significantly impact on the environment is implemented. The following sections briefly outline the physical baseline situation in the project impact areas of the SRBMP.

2.2 Shire River Basin Management Project Location

The Shire River Basin Management Project (SRBMP) is defined by the Shire River Basin catchment area that starts from the outlet of Lake Malawi in Mangochi, and extends all the way up to Nsanje District. It lies in the southern part of the East African Great Rift Valley. The Shire River Basin (Map. 2.1) lies between 9 and 20 degrees south; and between 18 and 36 degrees east.



The Shire River Basin is the largest and longest in Malawi and the fourth largest in Africa. To the north-west, the basin is bordered by rivers flowing from the Kirk Range into Lake Malawi, forming

the Water Resources Area (WRA) 3. To the north-east, it is bordered by numerous small rivers flowing into Lake Malawi, forming the WRA 11; and by rivers draining into Lakes Chiuta and Chilwa, which are part of WRA 2. The western international frontier between Malawi and Mozambique defines the western boundary of the Shire River Basin, covering the five districts of Ntcheu, Neno, Mwanza, Chikhwawa and Nsanje. To the east, the Shire Highlands form the divide between tributaries of the Shire River and the rivers flowing eastwards into Lake Chilwa. In the south east, the Ruo River, lying in WRA 14, drains from the Mulanje Massif into the Shire River at Chiromo, near Bangula.

The Shire River originates from Lake Malawi at Samama, and flows 400km south and south-east to its confluence with the Zambezi River at Ziu Ziu in Mozambique. The catchment area of the Shire River Basin is about 18,945km² and is divided into the upper, middle and lower sections

The upper Shire River Basin (with a total channel bed drop of about 15m over a distance of 130km) lies between Mangochi and Liwonde Barrage in Machinga district. From Mangochi, the Upper Shire River Basin drains into Lake Malombe, 8km south of Mangochi and exits to flow through swampy banks flanked by the Mangochi Hills and the Zomba Mountain scarp to the east; and the Kirk Range to the west. The area is almost flat at 465-600m above mean sea level, over a distance of 87km and the Shire River flows down north-south in a 15-35 km wide trough. The upper Shire River forms a catchment area of 4,500km².

The middle Shire River Basin, from Kamuzu Barrage at Liwonde to Kapichira Hydro Power Station in Chikhwawa, is characterised by a narrow valley bordered by the Shire Highlands to the east. Between Matope and Makhanga, the river drops 384m through 80km of gorges and cataracts. This section contains a series of falls, gorges and cataracts which include Kholombidzo, Nkula, Tedzani, Mpatamanga, Hamilton, and Kapichira. The middle Shire River Basin forms a catchment area of 4,700km² in the districts of Neno, Mwanza, Zomba, Chiradzulo, Blantyre, Thyolo and Mulanje.

The lower Shire Basin, from Kapichira Falls to Malaka in Nsanje, widens into the flat alluvial plain, stretching a distance of about 140km. It is dominated by the seasonally flooded Elephant Marsh with its small-scale agriculture, artisanal fisheries, and important flood attenuation characteristics. The lower Shire River Basin forms a catchment area of 7,200km². Majete and Thyolo escarpments form the border of the Lower Shire Basin to the west and east respectively.

2.3 General Catchment Condition

All catchments in the Shire River Basin are rated severely degraded (predominant yellow colour on Map 2.2); except for two catchments, which are rated moderately degraded. These two are located west of the Lower Shire River as shown in brown on Map 2.2. A significant loss of vegetation, natural habitats, biodiversity and basin ecosystems has occurred. The catchment is grossly cultivated and management of the cultivated land is poor. Modification of the catchment is aggravated by high population and land pressures, which lead to cultivation in fragile areas, steep hill slopes and non-arable land. The catchment is also infested with weeds. Overall, continuing degradation of the catchment due to siltation, flooding and the prevalence of the invasive alien aquatic weeds is negatively impacting on water resources, aquatic life, hydro – electric power generation and water transport. Although programmes of land management are promoted, these are inadequate. The only areas where catchment conditions are not degraded include national parks, wildlife reserves and forest reserves. The most serious environmental and social threats /problems in different parts of the Shire River Basin include the following:

2.3.1 Upper Shire River Basin

The Upper Shire River is affected heavily by soil erosion, particularly on the western side of the Shire River due to cultivation. It is also infested with invasive alien aquatic weeds, mainly the water

hyacinth, as observed in flooding areas of the Shire River. Generally, the Upper Shire River Basin catchments are severely degraded due to extensive and intensive agricultural activities, poor land resources management as well as charcoal production.

2.3.2 Middle Shire River Basin

Agricultural Development Division (ADD) reports indicate that land degradation in the Middle Shire River Basin emanates from cultivation of steep slopes without adequate conservation measures. As can be seen from Map 2.2, serious catchment problems are in the western side of middle shire (Balaka, Ntcheu and parts of Mwanza) which have large stretches of arable land. Main causes of land degradation include:

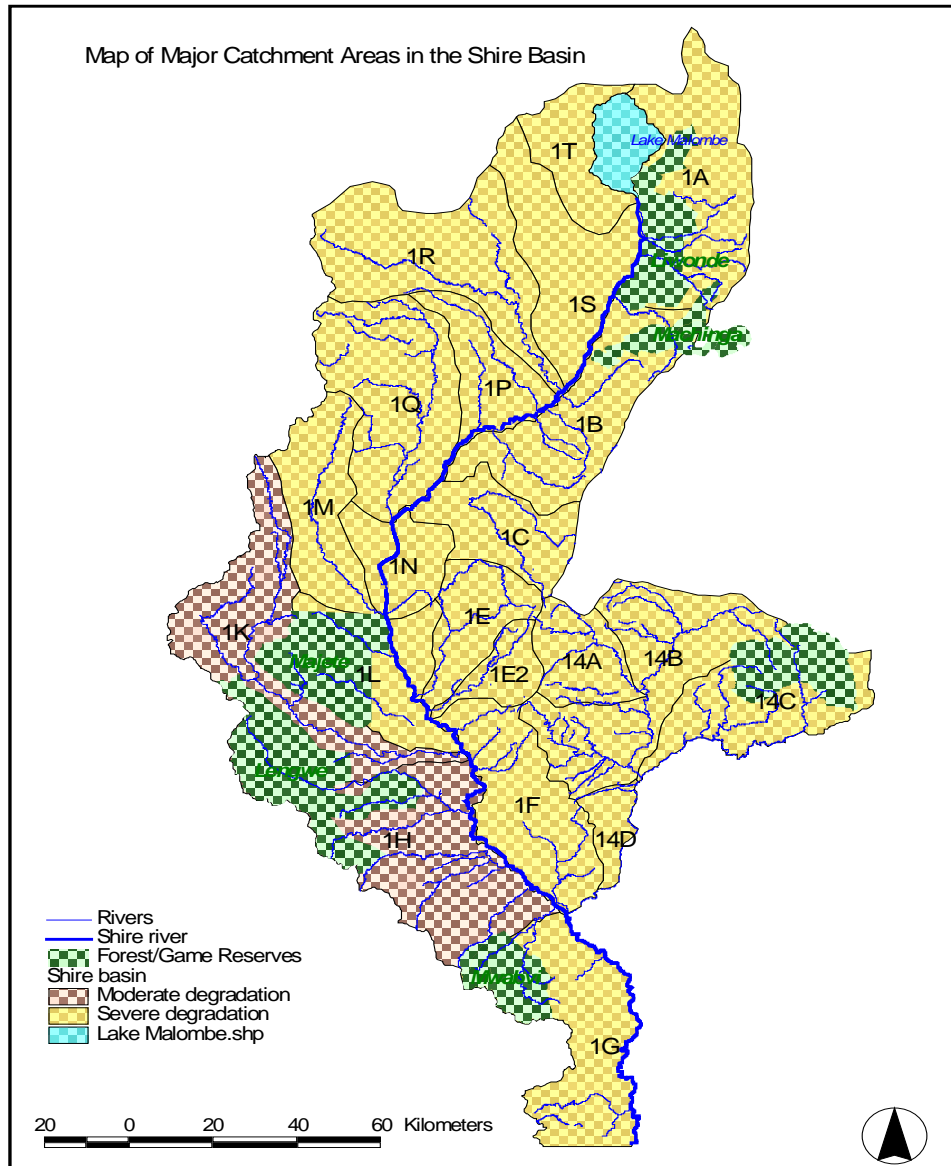
- Soil erosion in Linjisi and Lunzu River catchments, which are particularly hot spots (i.e. areas/catchments that are seriously degraded and require immediate attention);
- Rampant deforestation in the forest areas of Zomba (Malosa Mountain) in Mwanza and Neno districts due to encroachment and charcoal making;
- Deforestation and depletion of biodiversity due to firewood /charcoal harvesting for cooking; leading to a net annual deforestation rate of approximately 5,000 ha (reference);
- Siltation in localized but important areas, due to catchment cultivation, leading to reduced water flow; and
- Invasive alien aquatic weeds mainly water hyacinth as observed in the Shire River.

2.3.3 Lower Shire River Basin

The lower Shire River Basin catchment, particularly the eastern side (Thyolo /Chikhwawa escapement) is severely degraded. Intensive farming activities generate silt to the irrigation schemes, cultivated land and eventually water courses in the lower catchment. Hence, the impacts of catchment degradation on investments in the Lower Shire Catchment, which harbours the New Nsanje World Inland Port, are enormous due to the combined effects from the upper, middle and some parts of the lower Shire River Basin catchments. The Thyolo/Chikhwawa escarpment is severely degraded and the following characteristics are prominent:

- Siltation as a result of cultivation with poor land husbandry practices on hill slopes.
- Invasive alien aquatic weeds on the Shire River.
- Soil erosion due to cultivation on hilly areas of the eastern bank, hilly areas of the Thyolo/Chikhwawa escarpment and hilly areas of Chididi in Nsanje district, on the west bank of the Shire River. In the eastern bank, irrigation sites and canals have many times silted in extreme rainfall years.
- Flooding, which leads to destruction of irrigation and road infrastructure in the eastern bank
- River bank cultivation, which causes river bank collapse and river bed deposition.

Map 2.2, with the letters and symbols representing water resource units, depicts major catchments and state of degradation in the Shire River Basin.



Map 2.2: Major catchments and state of degradation in the Shire River Basin

2.3.4 Removal of Land Cover Since 1970s

The Middle Shire River Basin was covered with *brachystegia* and *mopane* woodlands in the 1970s; and there was relatively less soil erosion taking place at that time because human settlements were sparsely distributed. The population in Blantyre City was quite low, rendering charcoal business less prevalent. Problems of generation of electricity were nonexistent and the water supply from Walker’s Ferry and Mudi dams was not a problem as most rivers were flowing all year round, with little sediment.

Consultations with people within the basin indicated that in the 1980s, settlements were increasing in the Middle Shire River Basin. Agricultural activities were increasing and charcoal business was scaling up. In the late 1990s most of the catchments had been cleared of land cover for agriculture. Siltation of river beds, including the Shire River, was prevalent and drying up of rivers and streams emerged. This affected water supply to Blantyre City and electricity generation nationwide. Currently, during the rainy season, some roads especially earth roads became impassable due to flash floods sweeping away bridges and cutting off the roads or depositing soil material on the roads.

The situation is aggravated by cutting down of trees for more agricultural activities, charcoal making and firewood.

2.3.5 Major Consequences of the Present Catchment Condition

The negative effect of the Shire River Basin Catchment degradation has been significant on the hydro-electric power generation. A reduction of 10-12% in power generation has been reported due to siltation and reduced water flow. The costs of electricity generation by ESCOM; and water supply by Blantyre Water Board increase significantly during the wet season, due to siltation and presence of invasive alien aquatic weeds. Extensive flooding of rivers leads to property and infrastructure damage. Roads, bridges and social infrastructure such as schools, crops and livestock are destroyed; leading to loss of income and livelihoods of the communities. Also damaged are irrigation areas and canals. Some reports show that catchment degradation has affected ground water re-charge, thereby reducing water supply. Rural communities rely on shallow wells and boreholes that are recharged by the sub catchments in the basin and they confirmed that groundwater level in the Upper Shire is significantly lower than it was 10 years ago.

2.3.6 Desired Catchment Condition

The desired catchment condition is dependent on reversal of the effects of past and present adverse catchment modification processes, which include removal of vegetation for agricultural purposes or fire wood and charcoal production. It is also dependent on implementation of appropriate agricultural practices and conservation measures.

Catchment condition is rated into categories ranging from A to F, adapted from the habitat integrity method. The method is based on the qualitative assessment of a number of pre-weighted criteria that indicate the integrity of the total catchment. Certain modifications have a detrimental impact on the habitat integrity of a catchment, the extent of that impact being depended on their severity. The assessment of severity of impact of modifications is based on six descriptive categories with ratings from A=0 (no impact), B=1-5 (small impact), C=6-10 (moderate impact), D=11-15 (large impact), E=16-20 (serious impact) and F=21-25 (critical impact). The F category represents destroyed catchments, with changes that are irreversible (Kleyhans, 1996).

The Shire River Basin catchment is rated D (largely modified) signifying extensive loss of natural habitat, biota and basic ecosystem functions; mostly due to intensive settlements, cultivation and general vegetation cover clearance. Category D for the Shire River Basin catchment condition can be improved to C, which is moderately modified (equivalent to loss or change of natural habitat and biota, but with the basic ecosystem functions still predominantly unchanged). Catchment category C can be achieved through planting of trees on bare hills and along the river/stream banks. Some of the catchments can only be maintained in their present status because they are heavily settled and grossly cultivated. However, cultivated areas can be improved through appropriate land management practices, consistent with the objectives of the SRBMP.

Improvements to the Shire River Basin catchments will lead to reduced soil erosion and siltation, reduced invasive alien aquatic weeds and consequently increased hydro-electric power generation as well as improved river water carrying capacity, thereby improving water supply. Navigation on the Shire River and operations of the Nsanje World Inland Port will be safeguarded as the optimum depth of the river is maintained. Fish resources and aquatic life will also be saved from the impacts of invasive alien aquatic weeds.

2.4 Topography

For the first 80km stretch, the Shire River flows down an extremely gentle gradient. The river spreads over Lake Malombe, a shallow floodplain 30km long and 15km wide. Below Lake Malombe, it meanders along a very flat gradient, until reaching Liwonde, where it again spreads over a broad

flat plain. Both floodplains attenuate flood flows in the Upper Shire catchment. Tributaries to the upper catchment are highly seasonal and flashy. The flat landscape and reduced stream flow cause the river to meander, creating a network of pools and channels; and flooding the adjacent land in the rainy season. The landscape in this area takes its form from the African Rift Valley, which runs north-south in a 15-35km wide trough.

The Middle Shire, from Liwonde to Kapichira, covers a distance of about 80 km through a deeply incised narrow gorge fed by a few perennial tributaries, the most important being perennial Lisungwi and Wamkulumadzi rivers. The Shire River drops more than 380m through a series of rapids and cascades, two of which (Nkula and Tedzani falls) have been dammed for hydropower production. Around Matope, the Shire River falls below the surrounding land and is flanked by alluvial terraces.

The Lower Shire, below Makhanga, widens into a broad flat alluvial plain about 140km long. The valley is characterised by tertiary unconsolidated sediments. Tributaries to the lower catchment include Mwanza, Nkombedzi-wa-Fodya and Ruo Rivers, which flood heavily during the rainy season.

2.5 Geology and Soils

2.5.1 Geology

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

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

The Great African Rift Valley is a region that can be regarded as unstable due to the nature of its genesis. In this regard, the zone is susceptible to earth tremours such that any major structural engineering projects have to be subjected to strenuous environmental impact assessments (EIAs) before they commence (G. Bonongwe, 2012). Since the occurrence of earth tremours, their frequency and magnitudes are unpredictable, it is essential that structures are constructed according to approved building standards and codes to withstand these events.

2.5.2 Soils

Most of the soils in the Shire River Basin are of alluvial origin, rich in nutrients and suitable for agricultural production. Three major classes of soils found in the basin are: lithosols, calcimorphic and hydromorphic. The upper Shire River is largely dominated by calcimorphic soils, which occur

along the rift valley floor and are usually fertile. Typical calcimorphic soils include mopanosols, which are dark grey sandy clay soils with a low permeability; and alluvial soils which are grey to brown. Lithosols, characterised by shallow and stony soils, occur mainly on steep slopes, dominating the Middle Shire. The Lower Shire is dominated by hydromorphic soils, characterised by poorly drained, heavy soils which become water logged during the wet season. Typical hydromorphic soils include gleys. These soils are dark coloured or mottled. Calcimorphic soils such as vertisols, which are brown to dark gray clays, expand when wet but contract when dry, producing large cracks. These are also found in the Lower Shire. Vertisols are fertile soils but difficult to farm and are very prone to erosion.

2.5.2.1 Soil Erosion Hazard in the Basin

Soil erosion in areas of high risk is influenced by soil type, slope steepness and length and extent of vegetation cover (see map 2.3). These factors are very important in the Shire River Basin.

In the Upper Shire River basin, the eastern part has low risk of soil erosion as it is partially protected by the forest reserve and the Liwonde National Park. On the other hand, the western part is deforested and cultivation, combined with bad land husbandry practices, leads to serious threats of soil erosion. Likwenu catchment has a high risk of erosion because of vegetation removal. Erosion hazards in the upper Shire River Basin are mainly categorized 3-4 as shown in map 2.3.

The middle Shire River Basin catchments, particularly east of the Shire River with a higher rainfall regime, are prone to soil erosion. The Linjisi, Lirangwe and Lunzu catchments, together with the Rivi-Rivi River on the western side, have a high risk of soil erosion. In the middle Shire, the main erosion hazard categories are 4-5 (high). Mwanza, Neno, Lunzu, Lirangwe and Linjisi catchments are in the high category, with some patches of very high erosion potential (6) in Neno and Mwanza as shown in map 2.3.

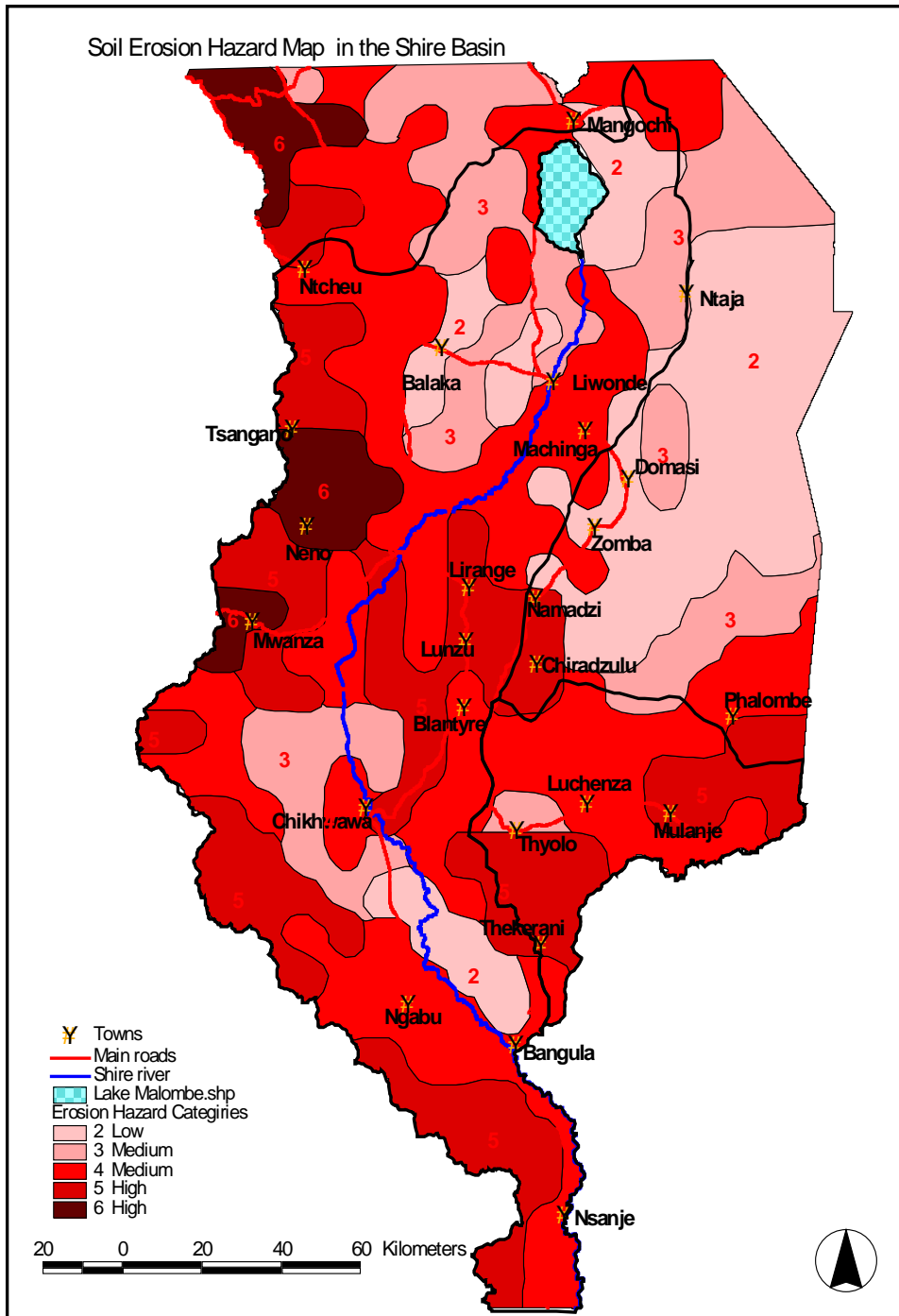
The lower Shire River Basin, where the eastern part has steep slopes, especially from the Thyolo/Chikhwawa escarpment, Thabwa, Nkhate and Muona, is deforested or cultivated and has a high rainfall regime. These areas are at high risk to soil erosion. The western part has a lower risk due to relatively flat to moderate slopes, although the soils have high compaction, causing overland flow which carries soils along with it. This could threaten downstream investments, including the Nsanje World In-land Port. The whole of the lower Shire River Basin (particularly the areas of Thyolo /Chikhwawa escarpment and Chididi areas) is in the general category of high erosion hazard at 5.

The average soil loss rate in Blantyre ADD is 29 tons/ha/yr and in some districts of the Shire River Basin is as follows:

<u>District</u>	<u>Rate of Soil Loss (Tons/ha/year)</u>
Machinga	10
Blantyre	32
Mwanza	20
Chiradzulu	39
Mulanje	29
Thyolo	34
Chikhwawa	18
Nsanje	14

(World Bank Report 1992)

It is observed that only Machinga District at that time had acceptable soil loss. The rest of the districts were above the acceptable soil loss rate of 12 tons/ha/year. Comparable studies since 1992 (World Bank), 1995 (Bishop) and 2009 (Yaron) show that national average soil loss is 20 tons/ha/yr.



Map 2.3: Soil Erosion Hazards in the Shire River Basin

From the above information, it is observed that the Nsanje World Inland Port in particular is in danger of siltation. There is a threat to water supply in the catchments as most of the streams and rivers would either be silted or dry. Map 2.2 shows how vulnerable the Shire River Basin is with respect to water supply, hydro-electric power station and transportation (water and road transport, particularly on earth roads) with regard to soil erosion.

2.6 Climate, Temperature and Rainfall

During the last two decades, the Basin has experienced significant changes in weather patterns, ranging from severe drought conditions in 1991/92, to extreme flooding events with flash floods in 2000/01.

The dominant climate in the basin is tropical savannah with distinct dry and wet seasons. Rainfall is influenced by the movement of the Inter-Tropical Convergence Zone (ITCZ). Peak rainfall occurs between December and March, and may exceed 1000 mm/annum in the high escarpment. Rainfall statistics, from stations in the Shire River catchment, show an average rainfall of 1133mm as indicated in Table 2.1.

Table 2.1: Mean monthly and annual rainfall for some stations in the Shire and Ruo River Basins.

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Ann
Station	(mm)												
Liwonde	5.7	0.6	1.0	19.9	60.6	165	199	192	160	37.0	14.1	4.1	859
Nsanje	20.0	6.2	6.8	59.8	83.1	193	202	168	156	52.8	19.0	21.3	987.5
Mulanje	47.1	29.5	41.3	163	129	283	262	245	302	210	59.2	46.3	1817

Source: Department of Climate Change and Meteorological Services (2010)

Temperatures in the basin vary with altitude. During the cold season from May to August, the temperatures go as low as 15°C -18°C. Mean annual temperature is approximately 24°C. In hot seasons, temperatures go as high as 42°C in the basin, especially in the lower sections.

Evaporation from the floodplains is high, averaging 2000 mm/annum; and greatly exceeds average annual rainfall (750 mm) in the lower Shire Valley

2.6.1 Effects of Climate Change

Climate change has undesirable impacts on the basin's economy especially with respect to agriculture, water resources availability and quality as well as access to resources. Human health, transport, energy, wildlife, fisheries, industry and the ecosystems are also affected. The impact leads to the swelling of urban population, thereby causing additional pressures on social services such as urban transport, housing, energy, water, sanitation and others. The impacts of climate change within the basin are discussed in more detail as follows:

2.6.1.1 Climate Change and Agriculture

Many people within the basin rely mainly on rain-fed agriculture and therefore recurrent droughts have been responsible for poor crop yields, crop inundation and loss or total crop failure. This has led to serious food shortages although some irrigation has been introduced even for the smallholder farmers in the rural areas. Floods have also seriously hampered food production and output in several localities such as the East Bank, within the Mwanza Valley and the West Bank.

In dealing with these challenges, interventions would include establishment or enhancement of a robust early warning system, growing of recommended improved early maturing and pest-resistant crop varieties, breeding of recommended improved livestock breeds and instituting improved crop and livestock management practices.

2.6.1.2 Climate Change and Water Resources

Water is very critical for the basin's overall social and economic development. Water scarcity resulting from instances of droughts and dry spells leads to reduced output from the agriculture sector and below average performance in all the sectors of the economy which depend on the resource and are concentrated within the basin. Floods lead to loss of life and property, destruction of infrastructure, goods and services and the emergence of water-borne diseases. Reduced surface

water supplies, as a result of drought, also lead to further pressures on groundwater

Under both drought and flood conditions, the Malawi Government has put in place response measures to these extreme events which include demand management through water allocation, construction of boreholes, water harvesting particularly through the construction of new dams and rehabilitation of existing old dams, Integrated Water Resources Management and flood management through early warning systems (Malawi Government, 2005). The project will intensify these activities to further mitigate impacts of climate change.

2.6.1.3 Climate Change and Human Health

Both droughts and floods, arising from and exacerbated by climate change, directly affect human health particularly in the middle and lower Shire River Basin. Reduced food output from the agriculture sector is a cause for worry in that it results in reduced intake of foods and compromises nutritional status of people especially infants and PLWA and droughts are common in the middle and lower Shire River Basins. Malnutrition and chronic ailments related with malaria, cholera and diarrhoea as a result of droughts and floods are frequent and contribute to a heavy burden on the budget allocated for health services. Droughts also lead to poor sanitation and increased burden especially for women who are the managers of water and households. Under such conditions, the most affected groups of the society are rural communities, particularly women, children, female-headed households, the physically-challenged and the elderly. To avert or reduce the degree of these challenges, the following measures are proposed as areas of intervention:

- Improved nutrition for infants and other vulnerable groups by expanding the agriculture sector through irrigation schemes. The use of groundwater during lean periods would assist local farmers produce adequate water for irrigating their crops.
- Prevention of diseases such as malaria through increased distribution of insect treated bed-nets (ITNs);
- Water treatment; and
- Crop diversification and food supplementations especially for the under-fives, the elderly and PLWA.

Climate change affects people directly through changing weather patterns and indirectly through modifications in water availability and quality, air, food quality and quantity and the economy. These changes influence major dynamics in mortality and morbidity.

2.6.1.4 Climate Change and Transport

Climate change impacts on transport are varied, depending on the dominant weather event (drought or incessant floods). Floods have disrupted transport services (particularly within the middle and lower Shire River Basins) especially on secondary and tertiary roads and railway lines. In some instances, bridges have been washed away thereby causing untold misery for those travelling within the basin.

2.6.1.5 Climate Change and Energy

Prolonged droughts lead to reduced levels and flows of the Shire River, with the resultant failure of generating enough power for the country. As power becomes rationed people resort to using biomass as sources of energy and this further leads to extensive degradation of the environment. Wood mainly from the indigenous species which is most sought for energy and charcoal finds its way on the markets of Blantyre, Zomba and other smaller towns in the Basin, with the serious consequences of environmental degradation. As a deliberate measure to mitigate the effects of climate change on energy sources, the government has put in place interventions which include: diversification of energy sources, reforestation of the Upper, Middle and Lower Shire Valleys catchments, arresting siltation, reducing dependence on wood fuel, and expanded use of ethanol stoves. The objectives of the SRBMP will reinforce these initiatives and introduce more interventions, thereby mitigating the impacts of climate change.

2.6.1.6 Climate Change and Wildlife

The main climatic risk to wildlife is drought which influences animal reproduction systems and migratory habits. With some of the wildlife parks located close to international boundaries, the persistence of droughts in Malawi lead to the migration of animals into neighbouring countries in search of food and water. For instance, the drought of 1979 – 80 led to substantial deaths of animal such as Nyala in the Lengwe National Park in Chikhwawa, forcing most animals to migrate from the game reserve.

2.6.1.7 Climate Change and Fisheries

Both droughts and floods are hazards to the fisheries industry. Droughts have been responsible for the decline in water levels or complete drying up of rivers, lakes, marshes and lagoons resulting in low fish production and loss of biodiversity. Currently the government has put in place measures (to avert challenges that face the fishery industry) which include: fish breeding to restock the lakes, rivers and reservoirs; undertaking research to understand how temperatures in aquatic systems disrupt fish breeding and survival; establishing climate observations or monitoring systems and mainstreaming climate change into fisheries strategies.

2.6.1.8 Climate change and Ecosystems

Various ecosystems respond differently to climate change. Droughts, depending on the duration, have devastating impacts on forest ecosystems. Extended droughts result in land degradation and loss of soil fertility as well as forest fires. Other ecosystems such as lacustrine and riverine environments are devastated by drought leading to losses in biodiversity, reduced water availability and migration of mammals and other animal species.

2.6.1.9 Climate Change and Industry

Failure of hydropower generation on the Shire River, as a result of drought leads to reduced capacities in manufacturing and processing in industries. Secondary consequences include the laying off of staff as a result of reduced revenues, reduced national annual revenue and increase in consumer prices for many commodities as well as general suffering at the household level. In addition there are negative effects such as rising costs of water production, which lead to rising cost of water, with some industries that use a lot of water preferring to shut down or relocate.

2.6.1.10 Climate Change and Gender; and HIV and AIDS

Prolonged droughts lead to land degradation and the natural resources on which people in the Basin depend for their survival are decimated. The ability of the land to support communities is reduced, leading to poverty, malnutrition, health problems and economic hardships at the household level. Women are the most affected since they often are responsible for collection and provision of water to members of the household, looking after the sick and elderly; while men would desert their families for opportunities in urban areas. Separation of family members has its own consequences such as promiscuity that leads to health problems including risks of HIV and AIDS.

2.7 Hydrology

2.7.1 Overview of the Hydrology

The Shire River Basin is drained by both large and small rivers. The Upper Shire River Basin is traversed mainly by small rivers and the only relatively larger rivers include the Nkasi which flows from the Mangochi Forest Reserve on the left bank and Lingamasa on the river's right bank near Ulongwe. Of these two, only the Nkasi River has ever been gauged and historical data on river flows is available, albeit for only a short period.

From its source at Samama to Liwonde, the Shire River and its tributaries have a small stream density and many of the rivulets are ephemeral, partly due to the nature of the terrain which is gentle to flat and consists of soils that are profusely permeable. The Shire River is joined by the

Likwenu River, some 5km upstream of the Kamuzu Barrage, within the Liwonde National Park. Likwenu is perennial, flowing from the Malosa Massif, which is a region of high rainfall. During the rainy season, the river is prone to flooding and may cause significant loss of crops and other property as it flows in areas of gentle slope.

Stream density within the Shire River Basin becomes more pronounced in the Middle Shire due to the fact that many rivers drain from both the Kirk Ranges and the Shire Highlands on both banks of the river. The major rivers flowing into the Shire in this section of the basin are the Rivi-Rivi, Lisungwi and Wankulumadzi, all of which have their headwaters in the Kirk Ranges and drain most of Ntcheu, Balaka, Neno and Mwanza Districts.

Due to the largely dissected nature of the eastern part of this section of the basin, there are numerous rivers and streams which generally originate from the Zomba Massif and flow in all directions but pour their waters either into Lake Chilwa to the east, or into the Shire River to the west. Main rivers flowing into the Shire River include the Lisanjali-Mirale-Namitembo system, the Linthipe, the Linjisi, the Lirangwe, Nkombedzi-wa-Fodya and the Mulanga River. Of these, only the Lirangwe River has ever been gauged.

Below Mpatamanga, the Shire River enters another zone – the Lower Shire Valley – which has a distinct climate and consists of a flat plain drained by numerous rivers and streams originating from the Thambani Hills, the Salambidwe Hill, the Marangwe Range and the Matundwe Range to the west of the river, which generally define the Malawi Mozambique Border; and those from the Thyolo Escarpment to the east.

From the southern slopes of Mount Xalaxacongue in Mozambique, one of the Shire River Basin's large and notorious drainage systems of the Mwanza River, which flows south with a series of rapids before turning in a south-easterly direction at Chief Lundu's Headquarters, takes its shape. Below this point, Mwanza River widens into a series of swamps and marshes before being defined again at Tomali and pours its waters into the Shire River at a point to the east of Sande Market Centre.

Rivers on the right bank of the Shire River, within the Lower Shire Valley, include the Nkombedzi-wa-Fodya, Chidyamanga, Lalanje, Thangadzi West and other smaller ones with their sources in the Matandwe Forest Reserve in Nsanje District. To the east, on the left bank of the Shire River, main rivers are the Mwamphanzi, Maperera, Masekesa, Livunzu and Thangadzi, draining from the Thyolo Escarpment. Further south, the Ruo River which flows from the Mulanje Mountain pours its waters into the Shire River at Chiromo.

2.7.2 Water Flows

Most of the medium to large river sub-basins within the Shire River Basin have had river gauging stations (RGS), with some dating back to the early 1950s. These river gauging stations were used for the measurement of river levels and discharges and in some instances they were also the same spots at which sediment loads were measured. Development of river gauging stations became a regular and vibrant engagement by the then Water Development Division for three decades up to the 1970s, during which period the Water Development Division also assumed different names and moved between different ministries.

Measurement of river flows was carried out on a monthly basis not only at stations within the Shire River Basin but throughout the country. This exercise included the measurement of minimum or dry season flows and flood flows during the rainy season, as well as what were termed miscellaneous flows from selected small catchments that offered potential for rural water supplies. From the time of their installation to about 1993, these river gauging stations provided useful data on water flows, necessary for water development programmes, for improving the socio-economic wellbeing.

Unfortunately, the once regular exercise of water level and water flow measurement within the rivers of the basin and throughout the country came to an abrupt stop by 1993. From this date up to about 2009, no regular river flow monitoring was ever being carried out as most of the river gauging stations had run down and others had been vandalised. Consequently, no data on river flows and discharges was to be available for a period close to two decades. It is only now that the hydrometric network is being revamped and some water level and flow measurements are being carried out.

Lack of data on water levels and flows for the past two decades signifies a substantial loss in scientific terms, as it is not possible to come up with conclusive estimation on the trends of river flows in recent years. Nonetheless, the Government of Malawi, through the National Water Development Programme, launched a project called, “*Establishment of Water Monitoring Systems*”, with the aim to re-install hydrometric equipment at strategic points along various river systems throughout the country, including those in the Shire River Basin. Some of the primary stations established on the Shire River are shown in the Table 2.2.

Table 2.2: Primary Water Monitoring Stations in the basin				
RGS No.	River	Station Name	Sub-Basin	Catchment Area (Km²)
1T1	Shire	Mangochi	Upper Shire	525
1B1	Shire	Liwonde		3,700
1P2	Shire	Matope	Middle Shire	7,200
1G1	Shire	Chiromo	Lower Shire	18,240

The estimated mean annual runoff volume for the Shire River Basin is about 1853m³, with a coefficient of variation of 0.40. Runoff rises sharply from December to January, peaking on average in February-March and receding steadily from April to November. Mean monthly runoff during peak flooding is about 800m³/s, with maximum annual flows ranging between 1000 to 1800 m³/s. The 20-year return period runoff (1,800 m³/s) from Shire River is substantially lower than from the Moravia-Angonia and Manica Plateaus, reflecting the significant attenuation of peak floods by lower Shire floodplains (Beilfuss & Santos, 2001).

Runoff from the upper Shire River at Liwonde (catchment area 3700km², below Lake Malawi) is given in Figure 2.1. The average annual runoff is 1,308 m³. Peak runoff generally occurs in April and May, when Lake Malawi reaches maximum annual water levels. Maximum-recorded lake outflow was 480m³/s in 1947. Water flow in the Upper Shire River is naturally regulated by the sand bar at the head of the Shire River. Water flow is also regulated at Liwonde Barrage.

Mean monthly runoff in the Middle Shire River at Matope (catchment area 7,200 km²) is given in Figure 2.1. Tributary runoff from this reach contributes to earlier peak flooding in the Shire, which typically occurs in February-March following peak rainfall. The dam at Walker’s Ferry is operated to maintain relatively high dry season flows in the Shire River for run-of-river hydropower generation at Nkula and Tedzani Falls stations (Shawinigan-Lavalin and Hidrotécnica Portuguesa 1990b).

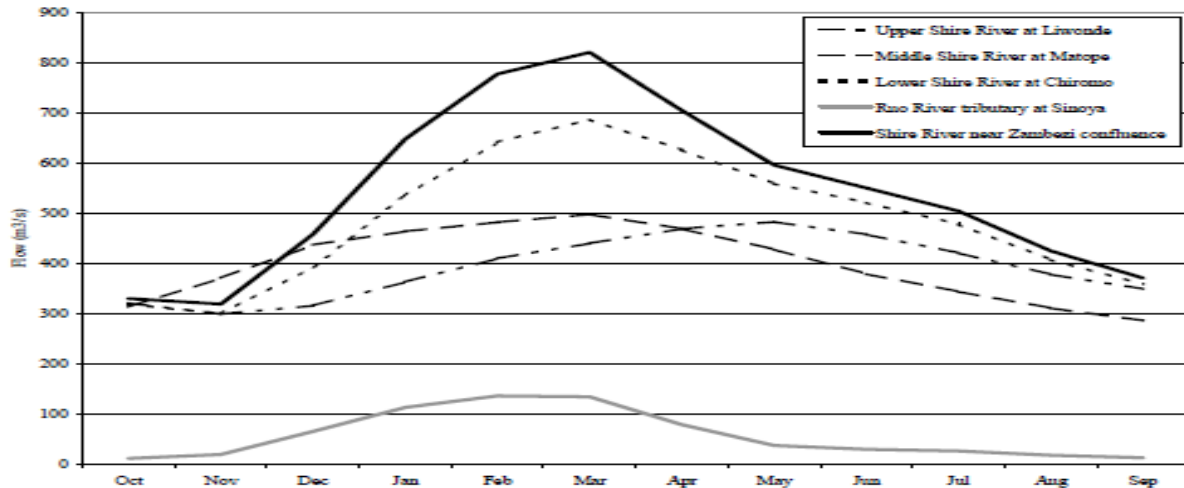


Figure 2.1: Hydrographs of mean monthly runoff from the Shire Valley, 1952-98
(Source: Beilfuss & Santos, 2001)

At high lake levels, outflow to the lower Shire River is largely unaffected. Average annual runoff in the Lower Shire River at Chiromo is $15 \times 10^9 \text{m}^3$ ($483 \text{m}^3/\text{s}$), with a coefficient of variation of 0.40. Peak flows typically occur in February and March, with maximum flows of more than $1200 \text{m}^3/\text{s}$ in February and March. Minimum discharge during the dry season ranges from 64 to 765m^3 in October and November.

The time series of monthly flows at Liwonde and Chiromo are shown for the period from 1953-81 in Figure 2.2, illustrating the importance of Lake Malawi outflows and tributary contribution to the system. About 37 per cent of the variation in Chiromo flows is explained by Lake Malawi outflows

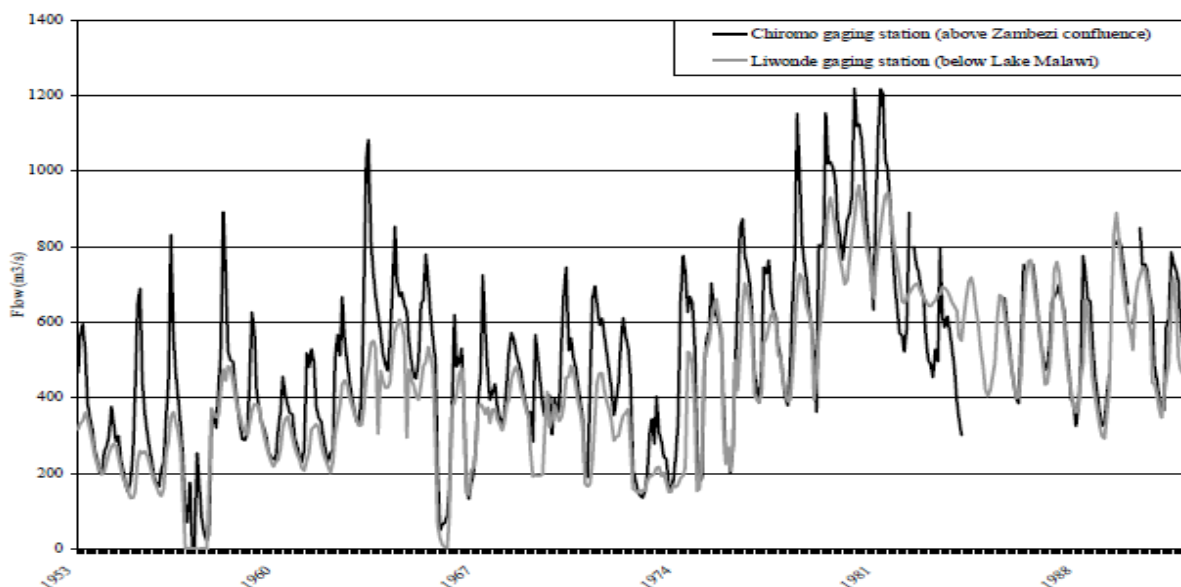


Figure 2.2: Time series of monthly runoff in the Upper and Lower Shire River showing influence of Lake Malawi outflows
(Beilfuss & Santos, 2001)

Immediately downstream of Chiromo, the Shire River captures runoff from the Ruo River, the largest of the Shire River tributaries. The Ruo drains an area of 4700km^2 , including the catchment of the Mulanje Mountains. Most of the Mulanje Mountain range is above 1500m a.m.s.l. ; with the peak

rising more than 3000m; and very high orographic rainfall (Beilfuss & Santos, 2001). Mean annual runoff from the Ruo is about $1.8 \times 10^9 \text{m}^3$ ($57 \text{m}^3/\text{s}$), with a coefficient of variation of 0.32. The Ruo can contribute substantially to peak flooding in the lower Shire Valley. Runoff increases rapidly with the onset of the rains in November, reaching a mean maximum discharge of $500 \text{m}^3/\text{s}$ in January. The five-year return period for Ruo River peak runoff is $1000 \text{m}^3/\text{s}$ (Beilfuss & Santos, 2001). Peak Shire River runoff below the Ruo River confluence is partially attenuated by the Ndindi Marsh bordering most of the Lower Shire River to the Zambezi confluence.

Runoff in the Lower Shire Valley is affected by slash and burn agriculture in the densely populated highlands. High rates of erosion and rapid surface water runoff were first reported from the Ruo River catchment and elsewhere in the valley nearly 50 years ago (Halcrow and Partners 1954). New development projects in the Shire River catchment may further alter runoff patterns.

The major tributaries of the Shire River include, among others, Rivi-Rivi, Lisungwi, Wankulumadzi, Mwamphanzi and Mwanza rivers. These tributaries currently flow through areas under severe environmental pressures due to deforestation, settlement, cultivation, charcoal burning and encroachment. The most comprehensive analysis of river flows was done in the mid-1980s where probabilities of exceedence for mean monthly and mean annual flows can be calculated. From the available data mean annual flows and their probabilities for some of the major tributaries of the Shire River, including those at Chiromo (1.G.1) appear within Figures 2.3 – 2.15.

With its headwaters in the Kirk Ranges, Rivi-Rivi River flows in a south-easterly direction towards the Shire River, passing through an area of relatively low rainfall and scanty vegetation cover. The basin occupies a geographical area of 775km^2 . The highest flows are recorded in February where on average, the mean monthly flow may reach $12.5 \text{m}^3/\text{s}$. With a 50% probability, the annual mean flow is in the order of about $4.5 \text{m}^3/\text{s}$ (see Figure 2.3).

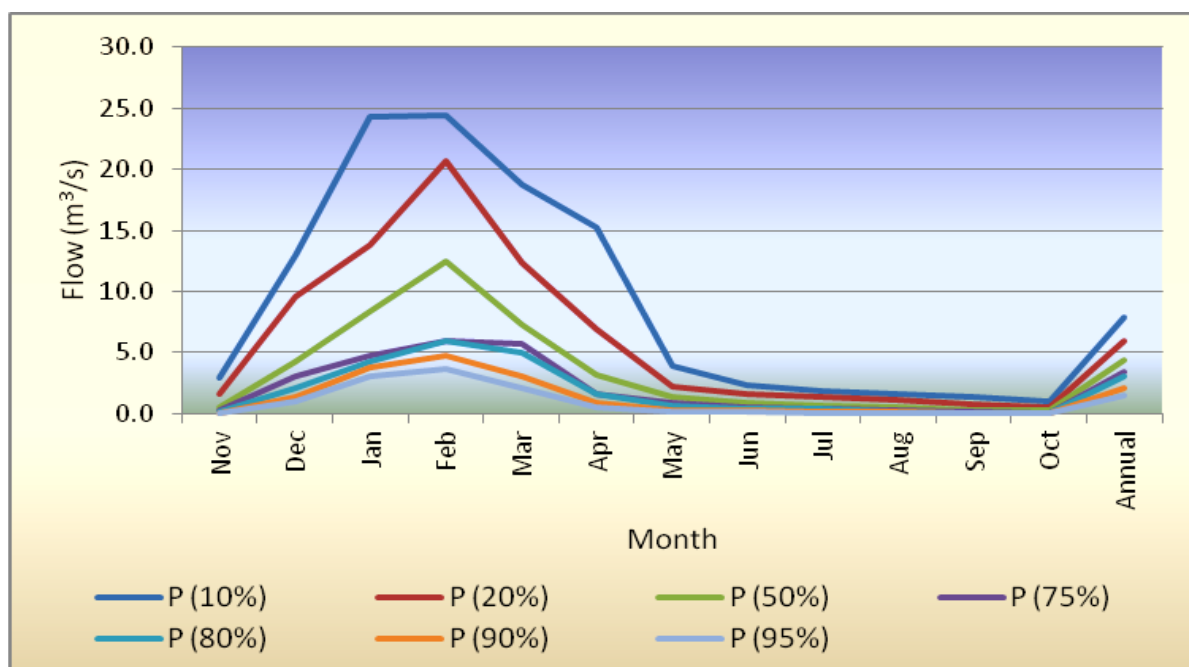


Fig. 2.3: Mean monthly and annual flows for the Rivi-Rivi at Balaka (1.R.3)

Lisungwi River (with a catchment area of $1,190 \text{km}^2$) lies south of the Rivi-Rivi River Basin. The river has more yield than Rivi-Rivi River, mainly due to the large size of its basin. With a 10% probability, the mean monthly flow in February would, on average, reach as high as $76 \text{m}^3/\text{s}$, compared to that of the Rivi-Rivi which is only in the order of $12.5 \text{m}^3/\text{s}$. In spite of the large size of the basin, the flows recede quickly from about April to May and reach close to only a cubic metre per second by October,

and rise again in November. On average, the mean annual flow is likely to reach 5.5m³/s with a 50% probability (Fig. 2.4)

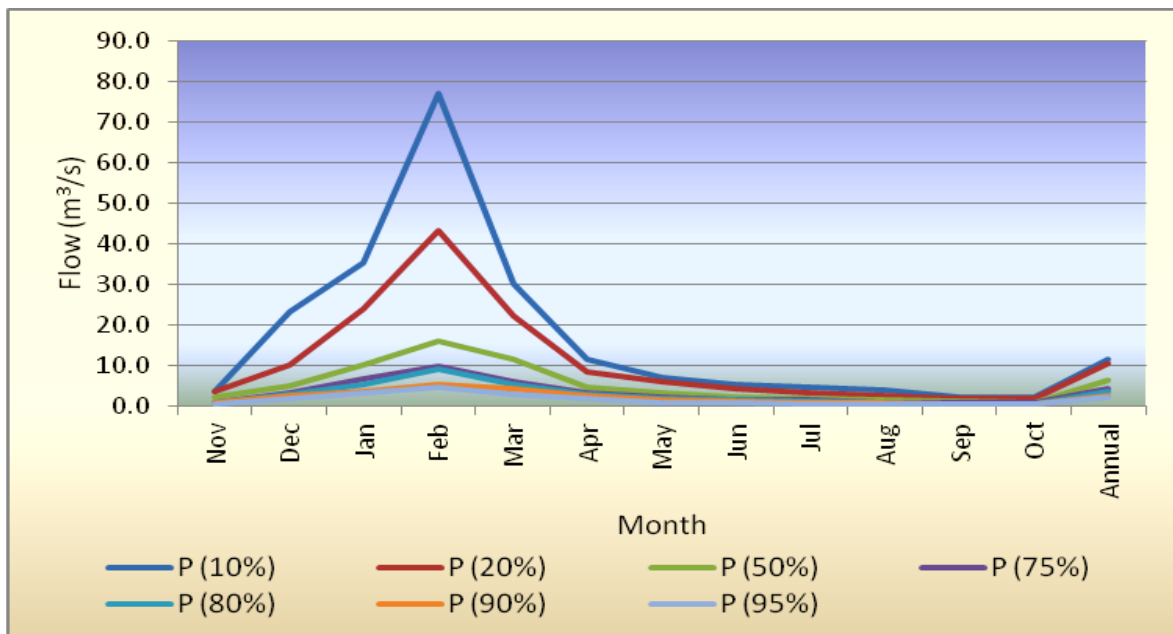


Fig. 2.4: Mean monthly and annual flows for the Lisungwi at Moffat (1.O.1)

A relatively smaller catchment basin than that of the Lisungwi – the Wankulumadzi River Basin is located further south in the Neno-Mwanza area. It has a geographical area of only 586km² and its flows (Fig 2.5) have a rather gentle recession, with the highest flows usually registered in March. With a 10% probability, the mean monthly flow for the Wankulumadzi may be as high as 34m³/s, receding gently to about 21m³/s in April and about 12.5m³/s in May. This perennial river (Fig 2.6) will still be flowing with a discharge of about 2m³/s in October when other rivers will have almost dried up. On average, the mean annual flow is about 5m³/s

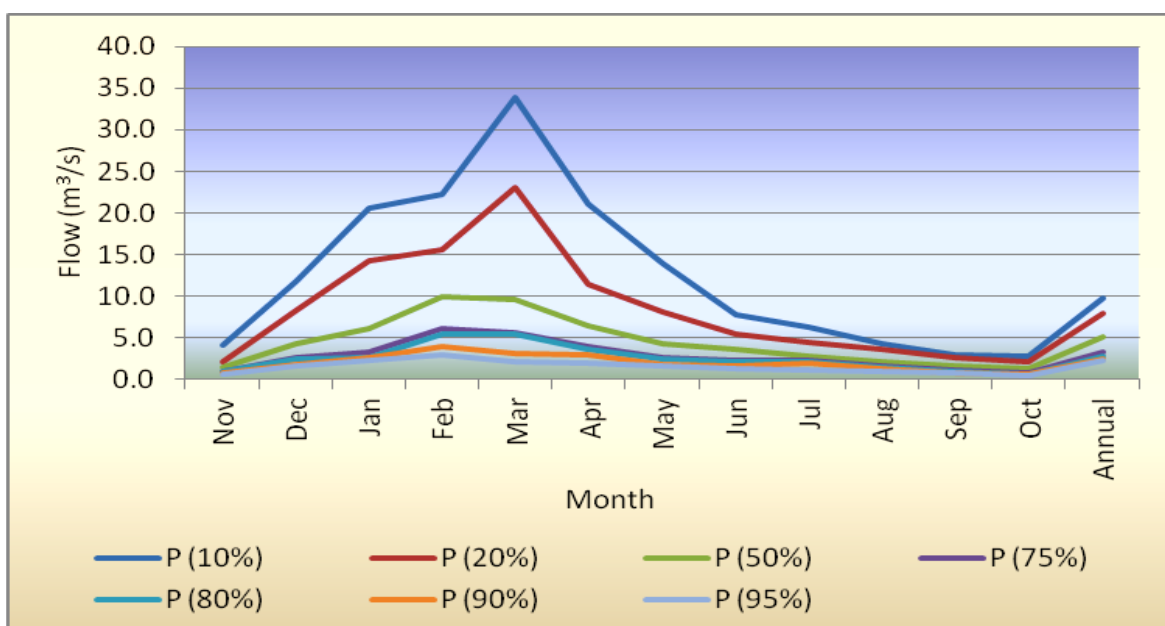


Fig. 2.5: Mean monthly and annual flows for the Wankulumadzi at Mlongola (1.M.1)



Fig. 2.6: Wankulumadzi River in February, 2012

Flowing from the Thyolo Escarpment is the Mwamphanzi River with a catchment basin area of only 311km². The river flows through an area which once was well covered with primary vegetation but has since undergone rapid deforestation due to population pressure. Flows are highest around January or February. With a 50% probability, the mean February flow can be about 5.5m³/s. Due partly to the persistent rainfall within the Shire Highlands, the river has a characteristic gentle recession from about May to October, where the mean October flow may on average be about 0.50m³/s (Fig. 2.7).

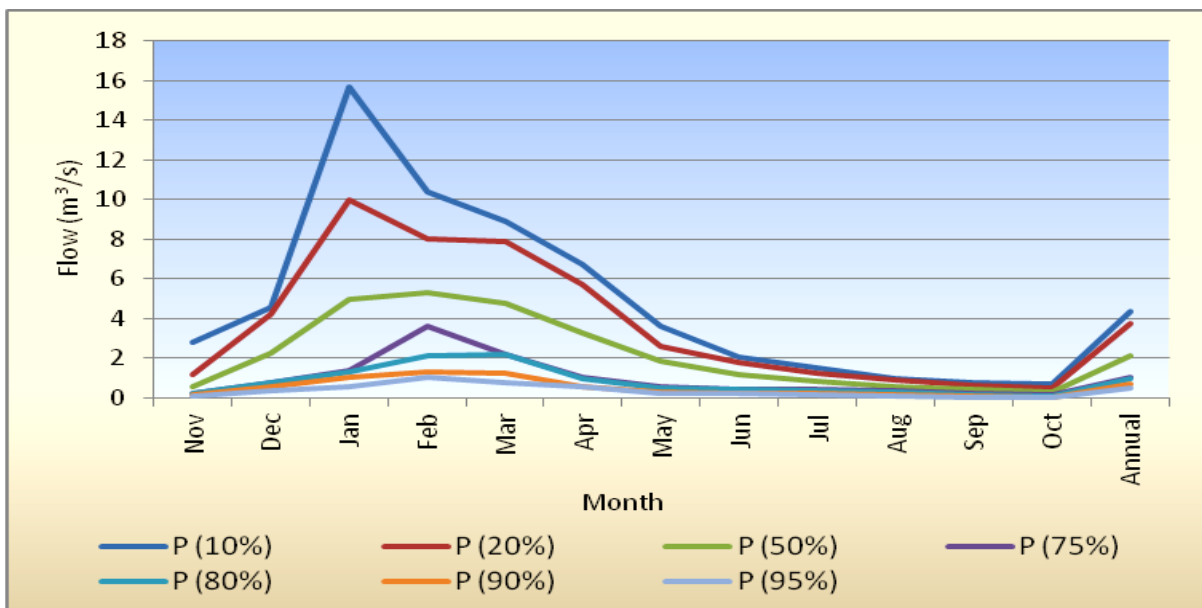


Fig. 2.7: Mean monthly and annual flows for the Mwamphanzi at Thapa (1.E.1)

Unfortunately, due to the unprecedented rate of deforestation taking place within the catchment basin, the river has accumulated a lot of silt in its senile stages and the flow may be below this formation during years of low rainfall. By February 2012, the Mwamphanzi River was only flowing sluggishly towards the Shire River, almost breaking into small distributaries.

One of the most notorious rivers within the Shire River Basin is the Mwanza River with a catchment area 1,650km². Originating from the broken and undulating countryside above Mwanza Boma, the river flows through the steep hill country and the Thambani Forest Reserve before entering the flat zone characteristic of the Lower Shire Valley at Lundu's Headquarters. The mean annual flow is in the order of about 3m³/s but mean monthly flows can reach as high as 50m³/s in February (Fig. 2.8), with a 10% chance. By June, the mean monthly flow is less than or about 1m³/s and the river will dry up in its senile stages by about late September to early October. This characteristic was manifested in February 2012; when the river was already almost dry (Fig. 2.9)

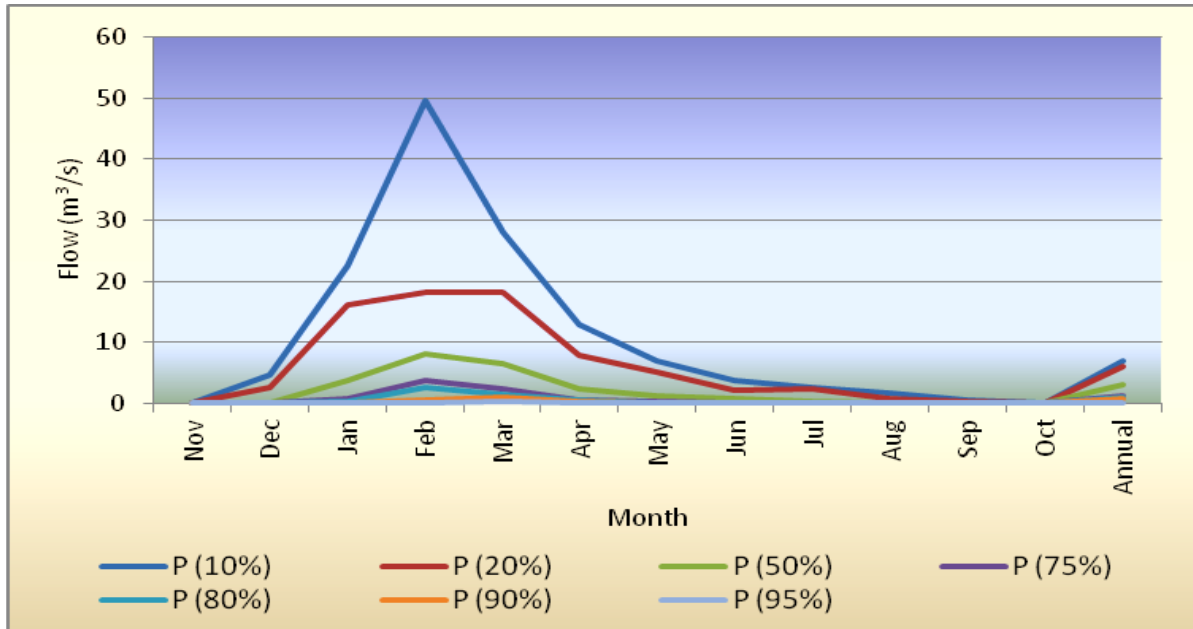


Fig. 2.8: Mean monthly and annual flows for the Mwanza at Tomali (1.K.1)



Fig. 2.9: The Mwanza River on the Chikhwawa-Ngabu Road in February, 2012.

All these rivers and numerous others contribute to the overall flow of the Shire River which is a vast socio-economic asset to the country. Discharge measurements carried out at Chiromo over the years

reveal that the mean annual flow of the Shire River at this point is about 485m³/s while the highest mean monthly flow, usually registered in March, may be as high as 670m³/s (Figure 2.10 and Fig. 2.11) with a 50% chance of occurrence.

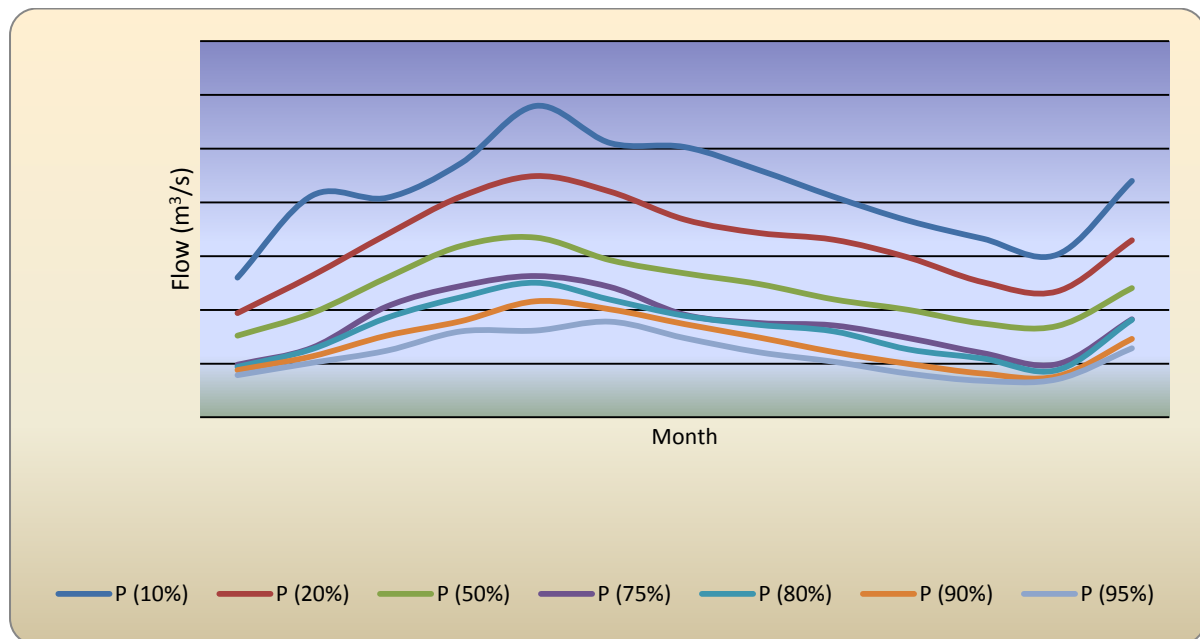


Fig. 2.10: Mean monthly and annual flows for the Shire at Chiromo (1G1)

The Shire flows at Chiromo are controlled by the attenuating effects of the Elephant Marsh upstream particularly during the dry season while the Ruo, originating from the Mulanje Massif to the north-east, usually forces the waters of the Shire at this point to back up due to the forceful nature of its flows.



Fig. 2.11: Shire at Chiromo- Looking upstream

2.7.3 Groundwater

Groundwater is the most dominant water supply source for the rural areas in the Shire River Basin where average yields vary between 1 - 2 litres/second in the weathered zone of the basement complex. The dominant aquifer types are the extensive but low yielding weathered basement aquifer in the plateau areas; and the high yielding alluvial aquifer of the lakeshore plains and the Lower Shire Valley. In the alluvial aquifers of the Upper and Lower Shire Valley, yields of greater than

20 litres per second have been obtained. However, localised water quality problems associated with high alkalinity, taste and pollution by faecal contamination have been experienced in some parts of the Lower Shire Valley.

One major challenge of groundwater in the country is absence of a comprehensive audit on availability. So far emphasis has been limited to groundwater exploitation, through drilling of boreholes usually fitted with hand pumps, for use by the rural communities (Figure 2.12).

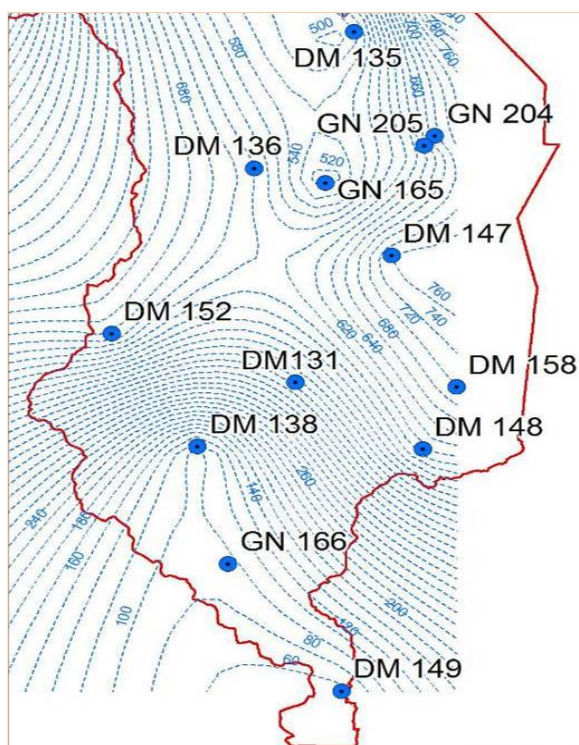


Fig. 2.12: Groundwater monitoring stations in the Southern Region including the Shire/Ruo River Basins.

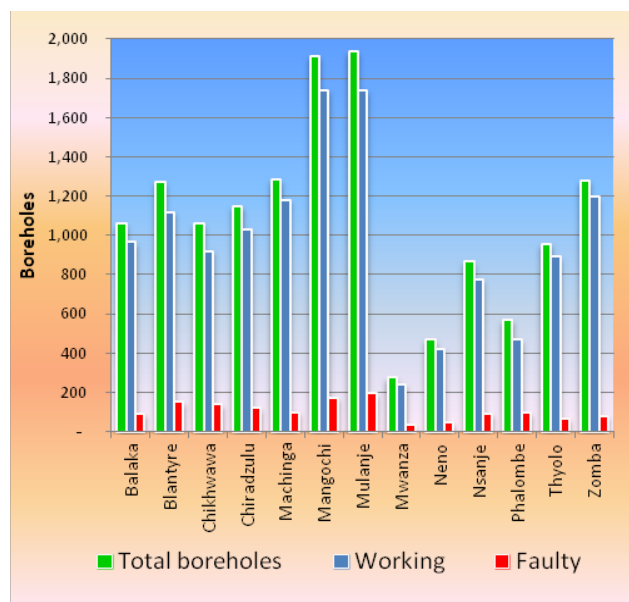


Fig. 2.13: A comparison of the status of boreholes in Southern Region of Malawi in 2010 with a focus on the Shire River Basin Districts.

Recognising this apparent omission, the ministry responsible for water resources development in the country initiated a groundwater monitoring programme by establishing groundwater monitoring stations in the country. From the source of the Shire at Samama to Malaka and extending the breadth of the southern region of the country, there are 13 groundwater monitoring stations and these appear in Figure 2.13. Those located specifically within the Shire River Basin are presented with their details of location in Table 2.3.

Table 2.3: Groundwater Monitoring Stations in the Shire/Ruo River Basins

NO.	DISTRICT	T.A	LOCATION	ID	ZONE	COORDINATES
1.	Blantyre	Machinjiri	Mzedi Dumping Site	DM 131	36L	8254317S. 724823E
2.	Mangochi	Mponda	Mangochi Water Office	DM 135	36L	8397702S.744587E
3.	Balaka	Msamala	Balaka Water Office	DM 136	36L	8341853S. 710733E
4.	Chikhwawa	Kasisi	Chikhwawa Water Office	DM 138	36L	8228042S. 691579E
5.	Mulanje	Mabuka	Mulanje Water Office	DM 148	36L	8227032S. 767928E
6.	Nsanje	Malemia	Nsanje Water Office	DM 149	36L	8128015S. 740438E
7.	Mwanza	Kanduku	Mwanza Boma	DM 152	36L	8274199S. 662532E
8.	Chikhwawa	Ngabu	Ngabu Water Office	GN 166	36L	8180063S. 701901E
9.	Machinga	Liwonde	Kawombe Dam	GN 205	36L	8351059S. 768384E

Although in its infancy, it is expected that the programme will continue to expand with the establishment of more groundwater monitoring stations in many parts of the country in general and the Shire River Basin in particular.

2.8 Water Quality

2.8.1 Water Quality Monitoring

The quality of water in some selected areas and points of the basin has been monitored by the Government's Central Water Laboratory in the Ministry Water Development and Irrigation. Academic research groups, city councils and project development groups have also carried out water quality monitoring activities according to their needs and on request by interested institutions. As a result, the existing background information on the water quality in the Shire River Basin is a reflection of the interests of the groups that generated the data and as such parameters monitored do not demonstrate consistent continuity over the years.

2.8.2 Previous Water Quality Trend

The City of Blantyre is the largest industrial urban area in the basin. Therefore an important aspect of the water quality in the basin is indicated by the quality of effluent from the Blantyre sewage treatment works over the years. The City of Blantyre has been monitoring effluent treatment parameters from its major sewage treatment works of Blantyre, Soche and Limbe. The effluent from Blantyre sewage works is discharged into Mudi River while the effluent from Soche sewage treatment plant is discharged into Mlambalala and then Naperi River, a tributary of Mudi River. Mudi River, which suffers from heavy loads of solid waste through indiscriminate dumping by individuals and industry, thereby seriously affecting the flow of water and hampering its self cleansing processes, is a tributary of Likhubula River. Likhubula River discharges into the Shire River. History of the efficiency of Soche sewage treatment works (predominantly treating domestic and commercial wastewater) is similar to that for Blantyre Sewage treatment works, which treats industrial wastewater in addition to commercial and domestic wastewater.

Table 2.4 shows typical values of water quality in 1987 and 2008 for the Mudi River above and below the discharge point of Blantyre sewage treatment plant while Table 2.6 shows typical values for the Soche sewage treatment works, which empties treated effluent into Mlambalala River.

The results in Table 2.5 show that Blantyre sewage treatment plant was very effective in treatment of effluent in the 1980s, as evidenced by the single digit value of BOD after treatment; while a six fold value is reflected in 2008. The efficiency of the treatment plant in 1987 can be attributed to its age and the low population it served compared to now.

The water quality at Mudi Dam and above the Dam indicates that in general the pollution upstream is not serious although it can increase due to farming activities in the catchment area. Data from Blantyre Water Board shows that Mudi Dam has treatable water for drinking and domestic use.

Similarly, results in Table 2.5 show a sharp deterioration of the water quality in 2008, compared with values for 1987, as seen from the BOD and alkalinity values.

Table 2.4 Typical water quality parameters above and below Blantyre Sewage works discharge point on Mudi River.

Parameter	1987		2008	
	Upper Mudi (Range)	Lower Mudi (Range)	Upper Mudi (Range)	Lower Mudi (Range)
pH	7.3 – 8.5	7.5 – 8.5	8.0 – 9.3	7.7 – 9.1
Suspended solids (ppm)	9 - 233	7 - 238	Not measured	Not measured
Conductivity ($\mu\text{s}/\text{cm}$)	199 – 464	282 – 639	Not measured	Not measured
BOD (ppm)	2 – 11	6 – 22	9.00 - 320	3.0 - 560
COD (ppm)	1.0 - 55	8 - 284	Not measured	Not Measured

Table 2.4 Typical water quality parameters above and below Blantyre Sewage works discharge point on Mudi River.

Parameter	1987		2008	
	Upper Mudi (Range)	Lower Mudi (Range)	Upper Mudi (Range)	Lower Mudi (Range)
Alkalinity (ppm)	80 - 280	120	410 - 1080	450 - 810

Source: Blantyre City Council

Table 2.5: Typical water quality parameters above and below discharge points for Soche Sewage Works. .

Parameter	1987		2008	
	Upper Mlambalala (Range)	Lower Mlambalala (Range)	Upper Mlambalala (Range)	Lower Mlambalala (Range)
pH	7.4 – 8.2	7.2 – 8.5	7.5 – 8.1	6.5 – 7.3
Suspended solids (ppm)	3 - 27	9 - 48	Not measured	Not measured
Conductivity ($\mu\text{s}/\text{cm}$)	296 – 337	346 – 414	Not measured	Not measured
BOD (ppm)	2 - 10	6 - 13	16 - 200	27 – 300
COD (ppm)	5 - 22	32 - 43	Not measured	Not measured
Alkalinity (ppm)	110 - 210	70 - 170	330 – 490	420 - 1260

Source: Blantyre City Council

Other studies by Saka and Ambali (Saka and Ambali 1999) have shown that the quality of water in the Shire River Basin has been good in general terms. Table 2.6 gives a one-time water quality status in the Middle and Lower Shire for three parameters (pH, phosphates and nitrates). Similar data on water quality with various concentrations of parameters along the Shire River is presented in Table 2.7 (Lakudzala et al 1999). Overloading the rivers with effluent or pollutants and disturbances in the river flow (i.e. slowing them down significantly) will compromise the ability of the rivers to naturally purify themselves and can lead to water quality deterioration.

Table 2.6: Physicochemical characteristics of water and soil in the Middle and Lower Shire

Site	Parameter		
	pH	PO_4^{3-} (phosphates) mg/l	NO_3^- (Nitrates) mg/l
Kudya-Liwonde	7.59	0.81	0.15
Chimwalire	7.91	518.3	0.27
Rivirivi Manjawira	7.65	0.75	0.44
Rivirivi Utale	7.01	0.73	0.06
Rivirivi Phimbi	7.66	0.95	0.04
Lisanjala - Kunchera	7.84	0.66	0.11
Shire North	7.63	0.31	0.15
Matope	7.98	0.42	0.05
Zalewa – Lufina	8.05	1.32	0.52
Walkers Ferry	8.04	0.90	0.06
Nkula Intake	7.71	1.69	0.51
Chikhwawa Bridge	7.28	1.12	1.12
Nchalo – Illovo	7.42	2.94	0.94
Chiromo Bridge	7.71	0.55	0.55
Ndindi Marsh	7.60	0.87	0.87

Source: Saka and Ambali 1999

Site	Parameter (mg/l)						
	Fe	SO ₄ ²⁻	NO ₃ ⁻	PO ₄ ³⁻	TDS	Pb	Hg
1	0.67	4.2	0.01	44	232	ND	0.000
2	0.57	5.6	0.01	44	216	0.0803	0.000
3	0.29	7.0	0.04	16	256	0.000	0.000
4	0.38	5.6	0.03	34	214	0.0047	0.000
5	0.12	14.9	<0.01	ND	ND	1.0	0.000
6	0.24	2.7	<0.01	ND	ND	0.000	0.000
7	0.34	2.7	<0.01	ND	ND	0.96	0.000
8	0.34	5.4	<0.01	ND	ND	0.000	0.000

ND: Not Detected, TDS: Total Dissolved Solutes (Source, Lakudzala et al 1999)

Key:

Site	Sampling Point
1	Likhubula River downstream confluence with Mudi River
2	Likhubula River near confluence with Shire River
3	Shire River upstream confluence with Likhubula River
4	Shire River downstream confluence with Likhubula River
5	Shire River down upstream confluence with SUCOMA flood control drain
6	SUCOMA effluent water on flood control drain
7	Shire River downstream confluence with SUCOMA flood control drain
8	Shire River at the Sports Club House

The State of the Environment Report (2002) gives a time trend on nitrates and suspended solids for Shire River as shown in Table 2.8. Although neither the point of sampling nor how the values were computed to represent the entire Shire River in the years is indicated, the data shows that there was no consistency in increasing deterioration of water in Shire River since the values are consistent of typical surface waters (Tebutt, 1998). However, it can be noted that the concentration of NO₃⁻ was generally low from 1984 to 1992 and thereafter there was a gentle increase from 1993 to 1999. Nitrates are very soluble and are likely to vary with time of sampling, probably peaking during rainy season as a result of storm water from agricultural lands in which inorganic fertilisers have been applied. Very low concentrations of nitrates (less than 0.01 mg/l) are likely due to sampling outside the rainy season. The trend for suspended solids is that Shire River has been registering average net increase from the mid 1980s to the late 1990s, probably as a result of deteriorating catchment area.

Year	Parameter	
	NO ₃ ⁻ (mg/l)	Suspended Solids (mg/l)
1984	<0.01	8
1985	<0.01	11
1986	<0.01	1.8
1987	Not reported	Not reported
1988	Not reported	Not reported
1989	Not reported	Not reported
1990	0.3	Not reported
1991	<0.01	12
1992	0.2	3
1993	1.1	32
1994	Not reported	28
1995	Not reported	22
1996	1.2	26
1997	1.1	16

1998	1.2	13
1999	1.3	16
2000	Not reported	19

Source State on the Environment Report 2002

*Unspecified sampling points

2.8.3 Current Water Quality Situation

The quality of water in the basin has all the attributes of continued degradation. This status is based on the trend of deteriorating catchment area, discharge of untreated effluent into rivers and poor waste management in the upland areas of the rivers in the basin. Some of the rivers in the basin have not depicted irreversible pollution levels due to their inherent nature of self cleansing. The main degradation parameters threatening the basin include siltation, sedimentation, and general as well as point source pollution.

There are indicators to suggest that the water quality situation in the Shire River Basin is on a deteriorating trend, as a result of mostly anthropogenic activities such as farming; leading to siltation and high levels of turbidity, suspended solids and conductivity. Rivers originating from the Thyolo and Mwanza upland areas wash down a lot of silt, as evidenced by the high turbidity and suspended solids values shown in Table 2.9. The sampling and analyses of surface water whose results are presented in Table 2.9 was done during the rainy season, which explains the high levels of turbidity in smaller rivers, while the Shire River appears to assimilate the pollution fairly well due to high dilution factors. It is expected though that as the Shire River becomes shallower and flows slowly in the Ndindi Marsh, its efficiency to assimilate the pollution would reduce significantly.

In general there is an expected increase in the concentrations (subject to dilution) of soluble analytes, as one goes down the river, due to accumulation from tributaries and runoff erosion, as demonstrated by the results of Mwanza River, sampled on the bridge to Mwanza Border (Mwanza Upper); and on the bridge to Nchalo (Mwanza Lower). The situation is expected to be similar for the Shire River. However, this may not be significantly reflected due to its large volume, which assimilates the solutes. Absolute amounts of these solutes are likely to accumulate downstream and these may be transferred to land with time more especially in areas where prolonged irrigation is practiced.

The one time data presented in Table 2.9 shows that the parameters analysed give an indication that the water quality in the rivers is within acceptable range, except for the turbidity, using drinking water as a reference. The Malawi Standard, MS 214:2005 turbidity limit for drinking water is between 0.1 to 1 NTU and except for the Shire River at Mangochi Bridge and Malombe inlet, all the rivers fall above the limit (ranging from 10 to 2813 NTU). This is consistent with high siltation of the rivers and if the water is indeed to be used for drinking a significant cost will be spent on removal of suspended matter.

2.8.3.1 Siltation

Heavy loads of silt in the rivers of the Shire River Basin are a result of increased erosion in the catchment basin. Non conservation cultivation and deforestation have contributed to the erosion. The siltation contributes significantly to sedimentation of rivers. The siltation effects are exhibited in the high values of turbidity in the rivers as seen in Table 2.9: Mwanza Upper ((253 NTU) and Mwanza Lower (2813 NTU) and on Shire River, Mangochi Bridge and Liwonde 0 NTU and 14 NTU respectively. The rivers depict high values downstream due to accumulation. The Shire River on the other hand depicted relatively low levels of turbidity due to dilution. Silt loads in surface water runoff lead to water flow problems, high turbidity, and increased water treatment costs as confirmed by the Blantyre Water Board. As reported by the staff at Nkula, during field investigations, silt loads negatively affect hydro-electric power stations, contributing to 10 – 12% reduction in power

generation. The cost of electricity generation for ESCOM increases significantly during the wet season.

2.8.3.2 Sedimentation

Sedimentation in the basin results from soil erosion and settlement of silt washed into the rivers beds as shown in Figure 2.14 and Fig. 2.15. Sedimentation is more pronounced in rivers of the lower Shire such as Mwanza, Likhubula, Mkudzi, and Mwamphanzi. This is explained by the fact that the rivers, which carry suspended materials, slow down as they approach the short plains of the Shire River. The river beds fill up in the flat sections near the Shire River, leading to excessive flooding. Suspended solids in the rivers tend to increase down the river as can be seen in the high values at Mangochi Bridge (136 ppm) and Liwonde intake (201 ppm) in the Shire River and Mwanza (794 ppm) and Lower Mwanza (2205 ppm) in Mwanza River, all sampled within a period of 24 hours, see Table 2.9. High loads of sediment continue to raise riverbeds; filling up reservoirs and flood plains; affecting irrigation canals, fisheries, water supply and hydropower generation. During reconnaissance the consultant established that problems of siltation and aquatic weeds on Shire River are a direct result of watershed degradation (Fig. 2.15), riverbank and riverbed cultivation; and unsustainable land use and management practices.



Figure 2.14: Soil erosion from riverbank cultivation in Nkasi River



Figure 2.15: Silt loads in Mwamphanzi River

Table 2.9: Selected water quality parameters in the Shire River Basin in 2012																	
Sample/Standard	EC ($\mu\text{s}/\text{cm}$)	TDS (ppm)	pH	TSS (ppm)	Turbidity (NTU)	HCO ₃ ⁻ (ppm)	F ⁻ (ppm)	Cl ⁻ (ppm)	NO ₃ ⁻ (ppm)	PO ₄ ³⁻ (ppm)	SO ₄ ²⁻ (ppm)	Na (ppm)	K (ppm)	Mg (ppm)	Ca (ppm)	Mn (ppm)	Fe (ppm)
Lisungwi	17.3	8.63	6.9	1055	332	80.09	bdl	1.282	1.680	9.33	5.802	5.00	3.02	3.61	7.92	0.47	2.56
Mwanza	90.0	44.98	7.0	794	253	56.12	bdl	1.104	0.765	10.80	1.919	5.06	2.37	2.86	4.42	0.40	2.17
Mwanza lower	169.5	84.75	7.2	2205	2813	86.07	1.18	4.132	2.875	6.87	5.763	5.50	4.77	4.04	9.83	1.77	1.01
Mangochi bridge	202.0	101.0	7.3	136	0	143.9	0.39	1.456	0.507	0.27	2.331	5.67	5.47	4.05	8.75	0.13	0.34
Likhubula	317.0	158.50	7.6	715	101	173.06	0.267	4.887	2.600	1.67	10.70	5.89	4.00	3.75	7.58	0.37	0.83
Mpalira water point	3.3	1.63	8.0	90	10	142.44	1.040	2.452	1.278	0.27	4.732	5.94	5.55	3.36	6.92	0.13	0.49
Mudi upper	157.7	78.83	7.7	279	21	95.34	bdl	2.146	0.512	1.93	1.265	5.83	0.87	3.03	6.25	0.37	1.86
Mawira hot spring	827	413.50	9.0	192	0	196.66	0.682	21.64	0.90	2.110	30.58	6.22	2.35	BDL	0.17	0.13	0.14
Mkulumadzi	85.8	42.90	8.1	1150	895	57.65	0.756	22.66	0.945	1.300	32.09	5.22	1.69	5.47	4.17	1.03	6.18
Malombe inlet	216.0	108.00	8.0	126	0	143.35	bdl	0.632	1.229	0.350	2.504	6.22	5.43	5.66	16.17	0.13	0.15
Liwonde source intake	222.0	111.0	8.0	201	14	142.92	0.269	2.049	0.937	0.35	2.227	6.39	5.58	5.65	19.08	0.13	0.43
Mkudzi	311.0	155.50	8.1	439	242	196.73	0.393	2.907	1.588	3.05	3.872	6.28	3.02	5.63	17.33	0.83	1.88
Mwamphanzi	156.0	78.00	7.8	630	402	99.37	0.586	4.470	1.625	1.57	5.427	6.06	2.45	5.54	6.92	0.50	2.23

bdl ⇒ below detection limit

2.9 Waste Management in Relation to Water Quality

The ability of water to dissolve large varieties of inorganic and organic substances, capacity to flow easily and the high surface tension which facilitates floating and hence transportation of different types of objects from one location to another renders many water bodies susceptible to pollution. The Shire River does not suffer from serious pollution of most commonly known pollutants due to its relatively large volume that enables it to dilute and hence reduce the impact of potential pollutants. The upper Shire River and its tributaries face mild threats of pollution from run-offs of domestic and solid waste leachate in semi urban centres. The middle Shire River receives treated effluent from the Liwonde waste stabilisation ponds, which are in good working conditions.

Rivers in the Lower Shire River, especially in the commercial City of Blantyre, are susceptible to pollution due to poor solid and liquid waste management practices and non functional and vandalised sewerage treatment facilities in the City of Blantyre. A number of rivers such as Naperi, Mudi, Likhubula and Limbe, which flow through Blantyre City, suffer from solid waste dumping of industrial and domestic waste. The situation is compounded by direct flow of raw sewage from vandalised sewer lines and overflows from blocked manholes.

At the time of compiling this report, Limbe sewage stabilisation ponds were not functional as they had zero inflow due to vandalised pipes that resulted in raw sewage flowing directly into the open and subsequently into Limbe River. The same situation prevailed for the Chirimba industrial sewage works at Chileka where a mixture of industrial and domestic sewage is discharged into surface waters untreated. Blantyre and Soche sewage treatment works were not fully functional due to vandalism and lack of maintenance.

An important aspect of waste management and prevention of water pollution is monitoring. Through monitoring, pollution can be detected and appropriate remedial actions can be taken. Presently Blantyre City Council and the Water Department monitor surface water quality, though not on a continuous basis, by analyzing common water pollution parameters such as pH, suspended solids, biochemical oxygen demand (BOD), chemical oxygen demand (COD), turbidity, conductivity, alkalinity, and a few metals. The majority of the parameters are characteristic of domestic sewage and sometimes from natural non-point sources. Monitoring of targeted chemicals by Blantyre City Council and the Water Department, consistent with specific industrial inputs and outputs is lacking. The City Council and the Water Department do not demonstrate the capacity to carry out certain specific analysis. It is therefore not known how the industries are fairing and affecting the environment and impacting on the water users. Blantyre City Council is the only effluent treatment institution with a monitoring laboratory for routine monitoring of its performance in the Shire River Basin, although the laboratory is not operating to adequate capacity.

The quality of water at the river sources in the Shire river basin is generally of acceptable quality for drinking as well as irrigation. Apart from sedimentation, water from Chagwa, Namikamia, Doza, Nkala and Mangale rivers is used directly for drinking. The middle and lower sections of Mudi River are so polluted that the water cannot be used for drinking due to pollution from human and industrial activities. The rivers in the upper and middle Shire River basin are subjected to non point sources from farming or semi urban poor waste management. In the lower Shire River basin, apart from nonpoint sources, there are sewage discharges. Some tributaries of the Shire River such as Lunzu, Lirangwe, and Likhubula pass through heavily cultivated areas, townships and cities, resulting in water pollution from human and industrial waste. Likhubula River is an important river for gauging the extent of industrial and municipal sewage pollution of Blantyre City with respect to pollution in the Shire River Basin.

Water pollution is also likely reflected from non point sources affecting acidity. The acidity would come from carbonates (increasing pH) being washed into the rivers in the basin, or soluble gases

such as sulphur dioxides (decreasing the pH) especially from processes that use coal as a source of energy. There is need to closely monitor the air emissions and develop strategies that may arrest runoffs that could alter the pH of water in the basin. Increase or decrease in the pH would have detrimental effects in biological processes of aquatic organisms and also undermine the integrity of structures installed in waters in the basin.

Sources of water pollution in the Shire River Basin are industrial, domestic, and agricultural point and non-point sources. Substances may enter the water environment harmless but may transform into harmful pollutants. Increased agricultural activities, in the Shire River Basin catchment areas, contribute to the accumulation of plant nutrients, which cause eutrophication in the rivers. Sources of the nutrients are inorganic fertilisers and eroded soils from agricultural activities. Major pollutants from agricultural activities are nitrates and phosphates.

2.10 Flooding

According to recent studies (IFPRI, 2010) it is estimated that, on average the country loses 1.7 percent of its gross domestic product every year due to the shared effects of droughts and floods, translating to almost US\$22 million at 2005 prices. Floods within the Shire River Basin occur almost every year with varying degrees of magnitudes.

A chronology of 23 flooding events that have occurred throughout the country in the past 29 years from 1979 to 2008 indicates that floods have been responsible for the deaths of 581 people and have affected 1.9 million people (World Bank, 2010). Flooding occurs by inundating low-lying areas such as along the shores of the country's lakes or by instantaneous rising and overflowing above the river banks. Most of the floods that occur within river basins are a consequence of sediment deposition in river channels, reservoirs and floodplains, which originate from degraded catchments. As a result there is substantial loss of arable land and damage to irrigation infrastructure.

At the national level, the highest occurrence of flooding takes place in the Lower Shire Valley, particularly in the districts of Chikhwawa and Nsanje. During some years, flooding is aggravated by the occurrence of high rainfall under cyclonic influence from the Mozambique Channel. During the rain-year 2007/08 for instance, floods affected 20 of the 28 districts of the country and damaged 11,138 ha of crops, as well as infrastructure.

Within the Shire River Basin, the most affected and flood-prone areas include the Mangochi-Chimwala area in the Upper Basin and the area on the mouths of Rivi-Rivi and the Lisungwi rivers in the Middle Shire. In the Lower Shire Valley, the notorious Mwanza River causes flooding over a very wide area, extending to and covering the low-lying areas of the Lengwe National Park, the Illovo Sugar Estates and villages around Tomali, Beleu and others.

Places that are subjected to flooding on the west bank of the Shire River include the floodplains of the Nkombedzi-wa-fodya, Thangadzi West and Lalanje. Places close to the confluence of the Ruo and the Shire rivers, especially around Sankhulani, Makhanga and Bangula; and low-lying areas along the banks of the Shire River from Chiromo to Nsanje and beyond experience severe impacts of flooding (Figures 2.16, 2. 17 and 2.18).

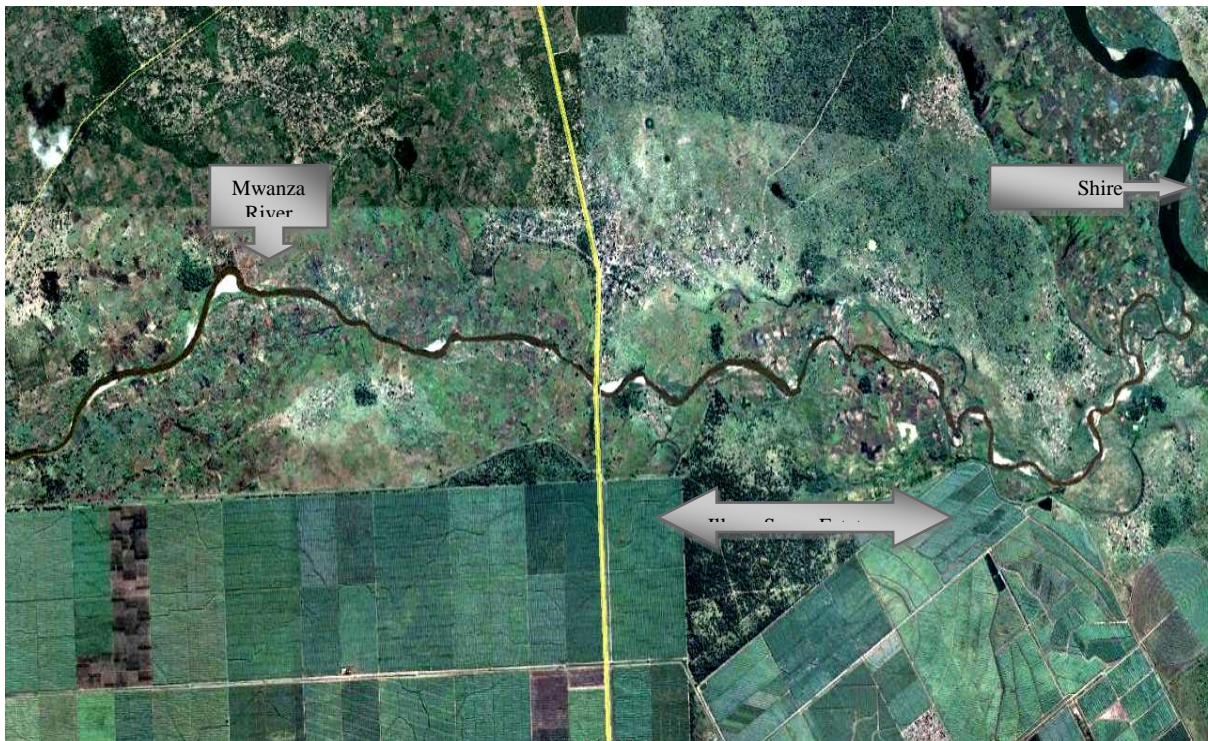


Fig. 2.16: Satellite imagery of the senile stage of the Mwanza River at Beleu



Fig.2.17: Confluence of the Ruo and the Shire at Chiromo



Fig.2.18: DNPW offices under floods by the Mwanza River in Lengwe National Park in January 2012

Due to the great force with which waters of the Ruo River cascade from the Mulanje Massif, the flow in the Shire River is forced back at the confluence of the two rivers. The build up of water pressure exerts an immense force on the Bangula - Makhanga road embankment, often breaching the road, as can be seen in Fig. 2.19. This leads to serious problems for travellers wishing to cross the Shire River.



Fig. 2.19: A breached road connecting Bangula and Makhanga on the Shire River, Feb. 2012

High water levels and flows from the Ruo River have been a cause of serious concern for the wellbeing and welfare of the people of the senile stage of this basin particularly as the Ruo flows into the Shire River (Fig. 2.20). Because of the relatively small gradient of the lower part of the basin,

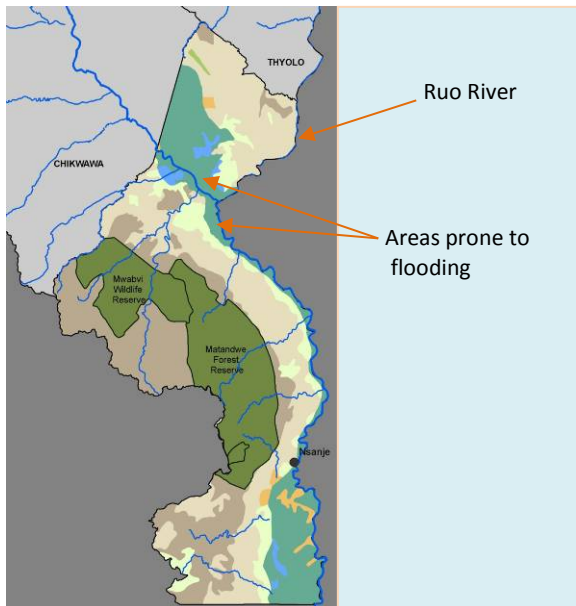


Fig. 2.20: Flood-prone areas on the Shire/Ruo River confluence.

crops and other property belonging to the people of this part of Nsanje District have been devastated and time and again almost on yearly basis, government and other aid agencies have had to provide relief food, blankets, clothing, fertilisers, seed and other farm inputs to the effected people. During times of flood disasters, people have lost their homes and more often have had to be accommodated in schools, churches and other places while they wait for opportunities to reconstruct their homes. In spite of periodic advice given to them to relocate to higher ground, the people of the area have resisted, opting to live with the floods and take advantage of the fertile soils of the banks of the Shire River where they have their fields. Proximity to the Shire River also allows them to do fishing for home consumption and for sale. The strongest reason for their refusal to leave these flood-prone places is that they would want to live with the spirits of their forefathers who once walked here.

Because of the nature of the soil types and scanty vegetation characteristic of the river basins of the west bank, flooding may occur only for a few hours and upon cessation of the rains, the rivers will dry out completely.

The heavy silt loads in the tributaries of the Shire River are also a cause for concern because they contribute to the changing of the river course, as the river bed rises upon deposition of the silt. During times of heavy precipitation, the river channel is unable to contain all the runoff from within the basin, resulting in flooding and loss of life and/or damage to property in the immediate environment. On the other hand, silt is beneficial to many households in the lower reaches of these rivers and streams as rich soil nutrients from the uplands deposit in these areas, offering high potential for soil enrichment and increased agricultural production (Figure 2.21).



Fig. 2.21: A healthy rice crop on the banks of the Likhubula River in Chikhwawa

2.11 Strategies for Mitigating Flooding

To minimise risks associated with floods, several initiatives need to be undertaken and these include the following (World Bank, 2010):

- Development of local scientific risk assessment tools for drought and floods, including local Participatory Vulnerability Assessments (PVA) and Participatory Risk Appraisals (PRA) which are important for preparedness and prevention strategies at the local level;
- Establishment of a multi-hazard online disaster risk management (DRM) geospatial database consisting of dynamic risk mapping; and
- Creation of a sustainable risk assessment mechanism coupled with technical capacity building for national institutions to be in the fore in dealing with disasters on a more proactive than reactive basis.

Risk assessments are currently carried out with external technical assistance as the country does not yet have a formal mechanism to undertake such an exercise, despite existing skills and specialised institutions.

Disasters are likely to impact adversely on the country in general and the Shire River Basin in particular, with varying degrees of magnitude from place to place as a result of climate change. It has been documented that the country's adaptation plans are fraught by the limited means available to poor communities, the extent of poverty in the country and the widespread lack of understanding of the causes and effects of climate change (One World, 2012).

2.11.1 Flood Early Warning Systems

Flood forecasting is achieved through gathering information on the movement of predominant weather systems and is usually carried out at the regional and national levels. At the regional level the Flood Early Warning System (FEWS) centre in Harare plays a significant role in tracking weather systems in the southern African region whose information is relayed to national meteorological offices for decision making. For instance, the movement of cyclones from the Indian Ocean across the Mozambique Channel into Malawi, which could cause heavy flooding in the southern region of the country, particularly in the Lower Shire Valley, will be monitored until they dissipate.

At national level, the Department of Climate Change and Meteorological Services provides useful weather information to the Water Department on the probability of occurrence of heavy precipitation. The Water Department then alerts its staff at the designated water level monitoring stations, within the flood-prone areas of the Shire/Ruo system, to relay water level information to Lilongwe for decision making. Upon attaining the "Yellow" and "Red" alert levels, the necessary flood warnings are issued in time for people in the affected areas to evacuate.

Until the 1990s, the country had a reasonably good flood early warning system, which mainly focussed on the Lower Shire Valley, particularly in the regions around Makhanga, Sankhulani, Chiromo and the neighbourhood. Monitoring of river flows during the rainy season, when floods are likely to occur, was done by the ministry responsible for water affairs, using staff gauges graduated to "Yellow" and "Red" alert levels, on the Ruo at Sandama and Sankhulani. On the Shire River, the staff gauges at Liwonde on Regular Gauging Station No. 1.B.1 are used to measure water levels at this point. In the event of a rise in the levels of Lake Malawi, it is determined as to whether it would be necessary to open the gates at the Kamuzu Barrage and to what degree. The Department of Climate Change and Meteorological Services would from time to time issue out bulletins on precipitation, especially for the areas around the Mulanje Massif and the Shire Highlands, expected to trigger a rise in the levels and flows of the Ruo River. Monitors at Sandama and Sankhulani would

accordingly watch the rise in levels to the “Yellow” and “Red” Alert levels, upon which they would communicate to the water resources headquarters in Lilongwe to prepare a warning. The flood warning bulleting was subsequently directed to the Malawi Broadcasting Corporation and aired immediately, warning people to move to higher ground and avert disaster from the impending floods.

However, the gradual decline in maintenance of the national hydrometric network and data collection from regular gauging stations meant that the flood early warning system had also been seriously affected. Currently, only a rudimentary flood monitoring and early warning system exists but is not fully operational. The DODMA issues warning information to relevant districts, and the Ministry of Water Development and Irrigation, through the Department of Water Resources provides alerts based on river water levels. Unfortunately, the Department of Water Resources has technical capacity challenges, mainly related to lack of adequate equipment, weak station coverage and lack of a flood forecasting and warning system with real time data and flood forecast modelling (World Bank 2010).

At the local level, there is also a community Flood Early Warning System, particularly in the Lower Shire Valley, which has been established with the assistance of the Evangelical Association of Malawi (EAM) in association with the Food and Agriculture Organisation (FAO) and Christian Aid. The main focus of the system is to provide resilience to local communities, towards the impacts of climate change, focusing on disaster risk reduction. Considering the challenges that communities in the districts of Chikhwawa and Nsanje face during times of droughts and floods, the programme provides training and promotes land conservation and management practices and also encourages farmers to move away from late maturing crop varieties to early-maturing ones. With the annual occurrence of floods in these areas, livestock were often found either stuck in mud or washed away by water currents. To avert this, communities are encouraged to construct kraals that stand on stilts.

Currently a simple but effective flood early warning system, using staff gauges graduated in metric units, has been installed on the Lalanje and Tombakamwa Rivers. Gauge readers are trained to read the water levels, paying special attention to the traditional “Yellow” and “Red” alert marks, in the event of heavy rains. When these levels are reached by the rising waters, appointed persons quickly run from village to village with a megaphone, to warn people of the impending flood and to advise them to take the necessary measures to evacuate.

During public consultations the people of Tomali in Chikhwawa District asserted that flooding in their area has become worse, with increasing frequency and magnitude in recent years, due to deforestation and loss of vegetative cover. They further indicate that their way of averting loss of life, during periods of floods, is to sleep in hammocks during the rainy season but acknowledged that this is now becoming ineffective due to increasing high levels of flood waters.

2.11.2 Indigenous Knowledge Systems Relevant to Flood Mitigation

People of the Lower Shire Valley have their indigenous ways of predicting the occurrence of extreme weather events and how to deal with them. Although they may be considered primitive, the indigenous knowledge ways have been effective throughout the ages and have prevented loss of lives and property. Some of the “indicators” for potential low, medium or high water levels or droughts have been the types of lightning, sudden manifestation of some eccentric kinds of birds, the density of flower blooms on local fruit trees called *Bwemba*, or the occurrence of swarms of ants or unprecedented large swam of house flies. These are, according to tradition, a sure sign of impending heavy rains.

Upon occurrence of floods in the flood-prone areas of the Lower Shire Valley, people have resorted to waiting until the floods have subsided and they have relied on using the residual moisture on the river banks to grow their crops. Alternatively, they have also relied heavily on drought-resistant crops such as millet and sorghum.

Box 2.1: Traditional knowledge systems of early warning

Traditionally, communities have Early Warning System modes that are used to predict impending disaster. These include a bird called “Choswa”. It is believed that when the bird turns to the north in its nest, there will be heavy rains resulting in floods; and when it turns south it means floods will not occur. Likewise, there is also a bird called “Katawa” which is believed to predict floods. The belief is that when it builds its nest very high up in a tree, it signifies that rivers will flood and the opposite happens when the nest is built lower in a tree.

It was also found out, during consultations, that communities always replant in their fields when they see “Mpalanthe” (clear flood waters), which they associate with the last wave of floods and rivers. They believe that when this occurs, it will not flood again that year.

Source: Falcons Media Consultants (2012).

The greatest challenge facing the communities of the basin however, has been limited access to farm inputs when their crops have been washed away by floods or scotched by the sun during times of drought. This is why the government, in collaboration with other partners and agencies, has taken steps to distribute free seed of food crops and fertilisers when disasters occur.

2.11.3 Existing and Proposed Flood Mitigation Interventions

With the ever increasing magnitude and frequency of flooding in the Shire River Basin and the districts of Chikhwawa and Nsanje in particular, it is imperative that comprehensive flood mitigation measures be established in the relevant flood-prone areas of the basin.

Currently the work being carried out by non-state actors, including the construction of dykes on the Lalanje and Tombakamwa rivers by the Evangelical Association of Malawi, is a good example of efforts being made in mitigating flooding impacts in these river basins. Extreme degradation of the headwaters of many rivers in the Shire River Basin, coupled with the gentle slope of the terrain in the districts of Chikhwawa and Nsanje, call for river training works to be carried out in these districts. For instance, the Illovo Sugar factory at Nchalo has constructed dykes that are also canals, to carry water to its sugar fields in the estate. These dykes are planted with grass to strengthen the sides and in so doing water is contained within the channels without inundating the immediate surroundings (Fig. 2.22). Similarly, such works would be undertaken on a large scale, to direct flows of major rivers that flood towards the Shire River, to protect settlements in various flood-prone areas.



Fig.2.22: A water canal at Illovo Sugar Estates which also assists in controlling road inundation

Previous studies (Shela, O. et al, 2008) have proposed that pre-feasibility studies be carried out for design and construction of levees along the Ruo River, between Chiromo and Osiana; and another one along the Bangula derelict railway line. These studies also proposed further investigations to be made for the construction of complex levees along the Chiromo-Makhanga-Osiana Ruo River front, to allow for the reclamation of about 500 – 700 ha of farmland, which is constantly under threat of flooding on a yearly basis. It is anticipated these levees would protect the villages, settlements, buildings (schools and health centres), roads and the railway line in the flood prone areas. Levees, which would run parallel to the Shire River; to protect Bangula town, the railway line and villages downstream of Bangula were also proposed for construction along the derelict Chiromo-Bangula railway line. Other areas for similar consideration include the Mwanza River opposite Illovo Sugar Estate. Unfortunately due to lack of integrated planning, the Illovo Sugar Estates have levees which have been blamed for directing water towards villages in its neighbourhood and to other low lying community gardens. Consequently, construction of any levees in the Lower Shire should firstly be preceded by comprehensive pre-feasibility studies that focus on the technical, socio-economic and environmental viability of such projects.

2.11.4 Proposed Operations and Impacts of Kamuzu Barrage

Since commissioning in the 1960s, the Kamuzu Barrage has played a vital role in many aspects including principally, the control of lake levels upstream and the flow of the Shire River downstream. Apart from this function, the barrage has also acted as a road bridge on the Shire River. Having stood for the past five or so decades, it has been necessary to upgrade the structure for a more efficient operation to control outflow from the lake; and provide better services for transport and control of aquatic weeds.

The upgrading process of the Kamuzu Barrage demands that care is taken in order to limit environmental consequences including the period of its operation, upon conclusion of the works. Environmental and social consequences are likely to arise prior to and after the works have been completed. Some of these consequences will be positive while others will be negative. Annex 3 provides the environmental and social impacts of the proposed improvements to the Kamuzu Barrage; identified for the Upper, Middle and Lower Shire River Basins (Norplan, 2011).

2.11.5 Flood Mitigation Measures for the Ruo River

To deal with flood challenges which are synonymous with the Ruo River, several measures can be put in place such as:

- Rehabilitation of degraded landscapes through forestation in order to control runoff from the many tributaries of the Ruo River;
- Construction of a dam or dams on strategic points on the Ruo River to attenuate floods. The dams would also be useful for water conservation, fisheries development, groundwater recharge, water supply and irrigation agriculture;
- Carrying out river training in the lower part of the Ruo so that flow is maintained within the main channel;
- Construction of levees in the lower section of the river to protect settlements from flood waters;
- Coercively moving people from flood-prone areas to higher ground by initially providing incentives that would pull them to those areas;
- Establishing a comprehensive real-time flood early warning system that can be used for informing affected persons to evacuate during times of very high river flows;
- Undertaking flood mapping exercise to show areas of high incidences of flooding and their magnitudes;
- Undertaking flood modelling for the Ruo River from its source to the mouth with the Shire; and
- Building capacity and creating more awareness relating to disaster management.

2.11.6 Flood Risk Management Plan for the SRB by DODMA with Bank/GFDRR support

Necessary interventions and their approach have adequately been documented before (Millennium Challenge Corporation, 2011). These interventions, though developed specifically for the Upper Shire River Basin are also relevant to the Middle and Lower Shire River Basins, as they focus on institutional arrangements, legal and policy frameworks, implementation and enforcement mechanisms, coordination and financing arrangements, technical and operational modalities and requirements, methodologies and approaches for land rehabilitation, support to community livelihoods, environmental management including control of aquatic weeds and their monitoring systems.

The long-lasting arrangement, for environmental rehabilitation and management within the Shire River Basin, would be to have a single high level authority responsible for putting in place adequate standards for environmental protection and enforcement; and to act as both a link between communities and government and as the local authority for enforcement of policy and implementation of programmes. This arrangement would guarantee sustainable environmental governance within the Shire River Basin, resulting in a coherent and coordinated protection of the environment for future generations.

Communities within the basin would have a direct advantage, considering that they almost wholly depend on the natural resource base for their wellbeing and survival. Full regeneration of the forest resources within the basin would drastically minimise incidences of erosion, sedimentation and siltation within river channels. The challenges being faced by the only power utility ESCOM, with respect to silt at Nkula and Tedzani power stations, would be reduced. In the event that the Walker's Ferry remains the source of water for the City of Blantyre, the dredging of silt at the site would not be required.

2.12 Regulation of Lake Levels and Water Flows in the Basin

The levels of the lake are an essential part for the regulation of flows at the Kamuzu Barrage. Very high water levels on the lake would inundate low-lying areas of the lakeshore including towns as it happened with Karonga Boma in May 1980. On the other hand, if the levels are too low, ships would not easily dock at the ports of Monkey Bay, Chipoka, Nkhotakota, Likoma, Nkhata Bay and Chilumba. During times of low lake levels it would also be tricky to strike a balance between the requirements of transport on the lake; the demand for power generation and water supply to the City of Blantyre; and for agriculture in the Lower Shire Valley.

2.12.1 General Regulation Activities

At the interface between Lake Malawi and the Shire River where the latter begins to flow, there is a sand dune which plays a crucial role as a natural regulator of free flow of the Shire River from the Lake. The flow of the Shire River from this point would cease if the sand dune built up. This would pose extreme socioeconomic challenges to the country. Cessation of flows of the Shire River would result in the collapse of the tourism industry along its stretch; unavailability of water for domestic and industrial use, power generation and agriculture; destruction of habitats as well as other important functions that depend on water resources availability.

Notwithstanding the role of this natural regulator, it is important for flows of the Shire River to be regulated during times of both high and low lake levels. The Kamuzu Barrage at Liwonde, among other functions, maintains the lake levels at ports along the shores and partially regulates the Shire River flows that are required for supplying adequate water for domestic and industrial use, energy generation, agriculture, fisheries, and water transport. There is thus an important relationship between the flows of the Shire River and the levels of Lake Malawi, to the extent that the whole Lake Malawi/Shire River system has to be maintained and regulated as a single hydrological unit.

2.12.2 Water Regulation to support infrastructure for ESCOM, Water Board, ILLOVO and Transport

Upon being upgraded, the Kamuzu Barrage will continue to play the crucial role of regulating the flow of the Shire River, which has to satisfy water demand for agriculture, energy generation and environmental water requirements downstream of the Liwonde Barrage; and controlling water levels for aquatic ecosystems upstream. The construction of the large metal boom at Liwonde will also be vital for controlling movement of weeds, which have caused operational problems during power generation at Nkula and Tedzani.

2.12.3 Water Regulation Control to Support Community Infrastructure

At the local level, investment in water-regulation infrastructure will be crucial by constructing levees, dykes, and aqueducts, as well as canals for irrigation schemes where feasible. The structure of the colluvial and alluvial soils of the Shire River Basin requires that proper infrastructure is in place to control the movement of water in these fragile environments. Within most river systems such as Mwanza, Nkombedzi-wa-fodya, Thangadzi and others, land can easily be inundated with the occurrence of heavy precipitation and therefore river training is necessary under such conditions.

2.13 Invasive Alien Aquatic Weeds

Cultivation of the catchments and application of inorganic fertilizers to crops result in nitrogen, phosphorus and potassium being carried into the rivers where increasing concentration of fertilizers accelerates growth of aquatic weeds. Most of the rivers in the shire river basin are ephemeral, hence are less prone to aquatic weeds. Rivers such as Lirangwe, Lunzu and the Mkurumadzi have limited potential to invasion of invasive alien aquatic weeds.

Problems of aquatic weeds on the Shire River start from the upper Shire River Basin, particularly in Lake Malombe. Water hyacinth grow on slow flowing water but as the water level and movement changes, these floating weeds break off from the main growth and float down stream with the current. These problems are more pronounced in the flood plains including the Nsanje area (Fig.2.23). A small proportion of the aquatic weeds are proliferated by the large population of animals in Liwonde National Park as they cross the Shire River. The serge type of weed grows on the banks of the Shire River.



Figure 2.23: Aquatic Weeds on the Shire River near Nsanje

Common weeds established upstream of Kamuzu Barrage at Liwonde were the water hyacinth, common reeds, papyrus and hippo grass. It was also established that germination is facilitated by the

nutrients carried from the cultivated catchments. The weeds are mainly abundant on the river banks and become pronounced in the rainy season when river flow peaks up.

At Kamuzu Barrage, it was established through consultations that on average approximately 135 tonnes of aquatic weeds, mainly the water hyacinth, are removed every day. The weeds are carried by a lorry and disposed off in the forest reserve, close to a tributary of the Shire River. However, the seeds may drift back into the Shire River and re-germinate. It was established that a new site has been acquired for disposal of the weeds, although it was not clear as to whether the seeds or spores, would find their way back into the Shire River. It was also reported that once the aquatic weeds have decomposed, they produce good organic fertilizer which some farmers collect for application in their fields particularly for maize. If the seeds for the aquatic weeds survive in the manure they would find their way back into the Shire River, carried by runoff from the fields.

Invasive aquatic weeds, especially the water hyacinth, affect the hydropower station at Nkula, Kapichira and Tedzani. In addition, they are a problem to water/river transportation especially small boats and canoes. The weeds also reduce air circulation for aquatic life. Invasive weeds are not only a problem with the Shire River but also the Elephant Marsh.

According to the Independent Environmental Impact Assessment for the Upgraded Kamuzu Barrage (Dec. 2011), the water release operating rules for the upgraded Kamuzu Barrage will need to reflect environmental and social considerations, both upstream and downstream of the Barrage, in the ESIA to be prepared for the Liwonde Barrage at a later stage. This ESIA will provide input to the future operating rules for the upgraded Barrage by providing environmental and social boundary conditions for barrage operation and will cover:

- (a) the maximum water level that should intentionally be stored above the Kamuzu Barrage (whether 40 cm above, 20 cm above, or some other figure with respect to the status quo);
- (b) the seasonal timing and amplitude of any “simulated floods” to support downstream fisheries, maintain suitable conditions within the Elephant Marsh, enable flood-recession agriculture, and meet other important objectives;
- (c) the maximum daily fluctuation (if any) in deliberate water releases from the barrage (such fluctuations could help to meet peaking power demands, but (above some amplitude) could harm downstream fisheries, aquatic biodiversity, flood-recession agriculture, the Elephant Marsh, etc.; and
- (d) the speed at which water flows from the Kamuzu Barrage are intentionally increased or decreased (too rapid a change could cause fish stranding, river bank erosion, etc.), among others.

Based on the data that are still being obtained, the Final ESIA will provide first-approximation numerical values for these environmental and social boundary conditions. These numerical values may be adjusted over time, in response to the findings from future environmental monitoring.

Monitoring the operational release strategy key issues include: the appointment of a competent Government Agency or independent organization to review gauging information and conduct their own spot checks to compare actual and recorded discharge; clear lines of communication between the discharge monitoring agency and the body overseeing the operation of the Barrage; feedback mechanisms for ecological monitoring; cross-referencing against Lake level and River discharge patterns; institutional flexibility to micro-manage release in exceptional circumstances with defined information dissemination procedures towards the discharge monitoring agency; and establishment of routines and funding arrangements that ensure the sustainability of the discharge monitoring programmed.

CHAPTER THREE: BIODIVERSITY

The Shire River Basin has important areas of forests and biodiversity conservation in Malawi. These include national parks (Liwonde and Lengwe national parks); wildlife reserves (Majete and Mwabvi wildlife reserve); forest reserves which include Mangochi Palm in the Upper Shire River Basin; Zomba Mountain, Tsamba, Michiru and Thambani in the Middle Shire River Basin; and Masenjere, Masambanjati and Matandwe forest reserves and wetlands (Elephant and Ndindi marshes) in the Lower Shire River Basin.

3.1 Vegetation in the Upper Shire River Basin

The eastern hilly areas of the Upper Shire River Basin (consisting of Mangochi, Chilole, Nafiulu and Chinguni hills) comprise of mixed woodlands dominated by *Brachystegia microphyllum*, *B. longifolia*, *Julbernardia paniculata*, *Uapaca kirkia* (Masuku) *Steculiar spp*, *Percopsis angolensis*, *Pterocarpus angolensis*, *Burkea africana* and *kirkia acuminata*. Most the eastern hilly areas fall under either Mangochi Forest Reserve (Figure 3.1) or Liwonde National park. Therefore the Vegetation is relatively intact and has reached its climax stage of growth development.



Figure 3.1: Part of Mangochi Forest Reserve in the Upper Shire Basin

On the western hilly areas of the Basin, the vegetation type is similar to that of the eastern side (i.e. mixed *Brachystegia* woodlands). However, unlike the eastern hilly areas, the vegetation does not fall under any protected areas. This has resulted in serious deforestation by mainly human settlement and agricultural expansion, even in the marginal areas. The vegetation was observed to be in a regenerative stage, requiring control measures to curb recurrent destruction. On the other hand, the rift valley of the Upper Shire River Basin supports the following major vegetation types:

3.1.1 Mangochi Palm Forest Reserve

The Palm forest Reserve is located close to Mangochi Town. Dominant tree species in the Reserve include palm trees (*Hyphaene benguellensis*) yellow fever tree (*Acacia xanthophloea*) and baobab trees (*Adansonia digitata*)

3.1.2 Floating Meadows, Lagoons and Reed Swamps

Floating meadows, lagoons and reed swamps are found along both sides of the Shire River. The vegetation varies from dense reed swamps to lagoon type vegetation. Dominant vegetation includes

rushes (*Typha domingensis*), papyrus (*Cyperus papyrus*), and reeds (*Phragmites mauritianus*). Water lilies (*Nymphae spp*), water cabbage (*Pistia stratiodes*), and hornwort (*Ceratophyllum demersum*) can also be found, particularly in the lagoons

3.1.3 Floodplain Grasslands

These floodplain grasslands are found in low-lying areas, adjacent to the reed swamps, within the Shire River banks. These grasslands frequently flood in the wet season, inhibiting most tree growth. However, some stands of palms (*Hyphaene benguellensis*) can be seen on some raised areas. Also some trees such as sausage trees (*Kigelia Africana*), baobab (*Adansonia digitata*), and fever trees *Acacia xanthophloea* are found in these raised areas. These grasslands are rich in grass species some of which include *Echinochloa haploclada*, *Echinochloa pyramidalis*, *Sporobolus robustus* and *Panicum schinzii*. The flood plains grasslands support a high population of wild mammals in Liwonde National Park, as they provide most of the fodder during the dry season.

3.1.4 Endangered Tree Species in the Upper Shire River Basin

The eastern hilly areas of the Upper Shire River Basin, covering Mangochi Forest Reserve and Liwonde National park, is home to many of Malawi's endangered tree species, mainly because of the protected area status. The endangered or protected tree species of Malawi, which are described in the Forestry Act (1997), are found in the Upper Shire River Basin and they include Redwood (*Adina microcephala*), Mahogany Bean (*Azelia quanzensis*) African Teak (*Pterocarpus angolensis*) locally called Mlombwa; Mtumbati, Mbira; Nawazi; Butterfly Tree/Turpentine (*Colophospermum mopane*) locally called Tsanya; tsanya; (*Percorpsis angolensis*) palm (*Borassus Aethiopum*), Sunbird tree, Wild Mango (*Cordyla african*), Ash (*Burkkea africana*) locally known as Mkalati; Kalinguti; Kawidzi; Nakapanga; Palm (*Hyphaene crinita*), Yellow wood (*Terminalia sericea*) locally known as Naphini; Nyapini; Mpini Nalinsi, Mkodoni, Mpululu; Njoyi, Mahogany (*Khaya nyasica*) also locally called M'bawa; Muwawa; or Bulamwiko, etc.

3.2 Vegetation in Middle Shire River Basin

3.2.1 Floating Meadows, Lagoons and Reed Swamps

The rift valley floodplains of the middle Shire River Basin have three types of the vegetation. These include the floating meadows, lagoons and reed swamps found along both sides of the Shire River. The vegetation varies from dense reed swamps to lagoons. The dominant vegetation here is rushes (*Typha domingensis*), papyrus (*Cyperus papyrus*), and reeds (*Phragmites mauritianus*). Water lilies (*Nymphae spp*), water cabbage (*Pistia stratiodes*), and hornwort (*Ceratophyllum demersum*) can also be found, particularly in the lagoons floodplain grasslands. In the hilly eastern areas covering Machinga and Blantyre Districts and the western hilly areas covering Balaka, Ntcheu, Neno and Mwanza Districts, the prominent vegetation type, where it remains, is mixed deciduous woodlands with dominant tree species from the family of *Caesalpinacea- Brachystegia*, *Julbernardia* and *Isobertlinia*. However, due to charcoal burning and firewood collection, most of the original natural vegetation is found in the areas of Chingale forest reserve, Michiru Mountain Conservation Area in Blantyre, Tsamba (Miombo) Forest Reserve in Neno; Thambani and Michiru Forest Reserve in Mwanza District. Within the Middle Shire River Basin, is the Blantyre City Fuel wood Project consisting of exotic Eucalyptus plantation.

3.2.2 Endangered Tree Species within the Middle Shire River Basin

The middle Shire River Basin, covering Thambani and Michiru Forest Reserves in Mwanza District, Tsamba Forest Reserve in Neno, Michiru Conservation Area and Shire Highlands in Blantyre District is rich in some of Malawi's National protected tree species. These include Redwood (*Adina microcephala*); Mahogany Bean (*Azelia quanzensis*); African Teak (*Pterocarpus angolensis*) locally called Mlombwa, Mtumbati, Mbira or Nawazi; Butterfly Tree/Turpentine (*Colophospermum mopane*) locally called Tsanya; Ntsano, Mopani or Mpani; (*Percorpsis angolensis*); Palm (*Borassus Aethiopum*;

Sunbird tree; Wild Mango (*Cordyla africana*); Ash (*Burkkea africana*) locally known as Mkalati, Kalinguti, Kawidzi or Nakapanga; Palm (*Hyphaene crinita*); Yellow wood (*Terminalia sericea*) locally known as Naphini, Nyapini, Mpini, Nalinsi, Mkodoni, Mpululu or Njoyi; Mahogany (*Khaya nyasica*) also locally called Mbawa, Muwawa or Bulamwiko.

3.3 Vegetation in Lower Shire River Basin

The Lower Shire River Basin consists of distinct topographical features that include the rift valley escarpment and foothills, rift valley floodplains and the low lying hilly areas. These topographic features are characterised by distinct vegetation types as summarised below:

3.3.1 The Rift Valley Escarpment and Foothills

These areas, where the vegetation remains in Masenjele Masambanjati and Thyolo hills forest Reserves, are characterised by lowland woodlands with *Brachystegia manga*, *Pterocarpus angolensis* and on the lower slopes, *Sterculia quinqueloba*. On the lower foothills the baobab (*Adansonia digitata*) with an understory of bamboo (*Oxytenanthera abyssinica*) are frequent. The grasses comprise *Hyparrhenia gracilescens*, *H. filipendula*, *Themeda triandra*, *Andropogon amplexans*, *Schmidtia bulbosa*, *Euclasta condylotricha*, *Eustachys paspaloides*, *Eragrostis superba*, and *Thyrsia undulatifolia*. Grasses form a low ground cover on the broken, stony soils.

3.3.2 Rift Valley Floodplains

On the west bank just next to the rift valley floors, lies a stretch of floodplain that runs parallel to the Shire River from Majete Wildlife Reserve in Chikhwawa to Malaka in Nsanje and near the Border with Mozambique. The flood plains are heavily settled and cultivated and hence the original vegetation is absent in most parts. Where the vegetation remains, it is mainly dominated by savannah woodland with *Acacia tortolis* and *A. nigrescens* being the most prominent. Other tree species found include scattered *Combretum imberbe* (Manangali), *Lonchocarpus capassa*, *Adansonia digitata*, *Dalbergia melanoxylon* (Phingo) and *Savadora persica*, a very nutritious shrub for browsers such as Nyala (*Tragelaphus angus*) in Lengwe National Park. The most common grass species in the rift valley floodplains is *Urochloa mossambicensis*.

3.3.3 The Low Lying Hilly Areas

On the western side of the Lower Shire River Basin, just next to rift valley floodplains, lies the extension area of Lengwe National Park, Chambuluka Uplands, Mwabvi Uplands, Mathandwe and Chididi Hills. The dominant vegetation of this part of the Basin is mixed deciduous *Brachystegia* woodlands, also known as Miombo or savannah woodland. This woodland contains species of *Brachystegia* with *Julbernardia globiflora*, *Alfezelia quanzensis*, *Pterocarpus angolensis* and *Sterculia quinqueloba*. The grass layer is depressed by the relatively light crowned trees, which have the ability to coppice freely after cutting. The woodland varies from tall fairly open woodland to dense scrub. Grass species include *Hyparrhenia filipendula*, *Themeda triandra*, *Andropogon schirensis*, *Bewsia biflora* and *Andropogon amplexans*.

3.3.4 The Rift Valley Floor

The rift valley floor consisting of floodplains in which the major physical features include lagoons, Elephant and Ndindi marshes; and the Shire River itself is characterised by a range of vegetation types. On the periphery, the flora which includes *Hyphaene benguellensis*, *Adansonia digitata*, *Lonchocarpus capassa* and several deciduous trees is almost exclusively confined to the margins of the swamps and a few scattered islands of elevated land just in from the periphery. Hygrophilous grassland occurs in the outermost zone, which is flooded only to very shallow depths in most years. Here the dominant species vary from site to site depending upon biotic and edaphic conditions. Where grazing is intense on the dry outer fringes, *Cynodon dactylon* forms an almost mono-specific sward. In wetter areas, it is joined by *Eleusine indica* and *Eragrostis aspera*.

In lightly grazed areas the dominant grass is *Sporobolus robustus*, forming clumps up to 1m high, with *Echinochloa haploclada* and *Eriochloa borumensis* becoming progressively more prominent in rich soils. Alkaline areas are characterised by the presence of *Sporobolus consimilis*. Moving deeper into the swamps, a sedge marsh is encountered in places where inundation is more prolonged, but exposure still occurs each year. The vegetation consists of free-floating species, including *Azolla nilotica*, *Eichhornia crassipes*, *Pistia stratiotes* and *Salvinia hastata*. Beneath the water surface, *Ceratophyllum demersum* and *Utricularia* spp. are common. Most of these latter species are stranded and die back in the dry season, when sedge clumps are invaded by annuals. In the broad permanent swamplands, which succeed the marshy zone towards the interior, water depths reach seasonal maxima of about 2 metres. Here tall clumps of *Cyperus papyrus* are dominant, often whitened by the guano of roosting birds and reaching 3-4m in height. In deep water they are surrounded by more open stands of *Typha domingensis* with many floating-stemmed, floating-leaved and free-floating species about the stem bases. In less deep (but still permanent water) vast, dense, non-specific stands of *Phragmites mauritianus* (reeds) and *pennisetum purpurens* (Elephant grass) occur, often isolating the papyrus clumps as islands. Years are believed to reduce their numbers, but no counts have been made. From low flying aircraft they are frequently to be seen in circular ponds in the reed beds which they appear to have cleared for themselves.

3.3.5 The Elephant Marsh

The Elephant Marsh is one of the major prominent features in the Lower Shire River Basin. The Elephant marsh (Figure 3.2) alone covers approximately 500 km² and has a rich diversity of fauna and flora. After flowing for about 32.3km from the Kapichira Falls, the Shire River forms the Elephant Marsh. It is bound by the alluvial floodplain of the river on the east and by the Thyolo Escarpment and on the immediate west. From the inflow at Chikhwawa, to the outflow at Chiromo, the Shire River loses 90m of height. The average elevation of the marsh is 200m and consists of highly bifurcated channels between 1.5 and 100m wide and rarely 4m deep. All channels are well defined, being flanked on either side by thick vegetation or banks.

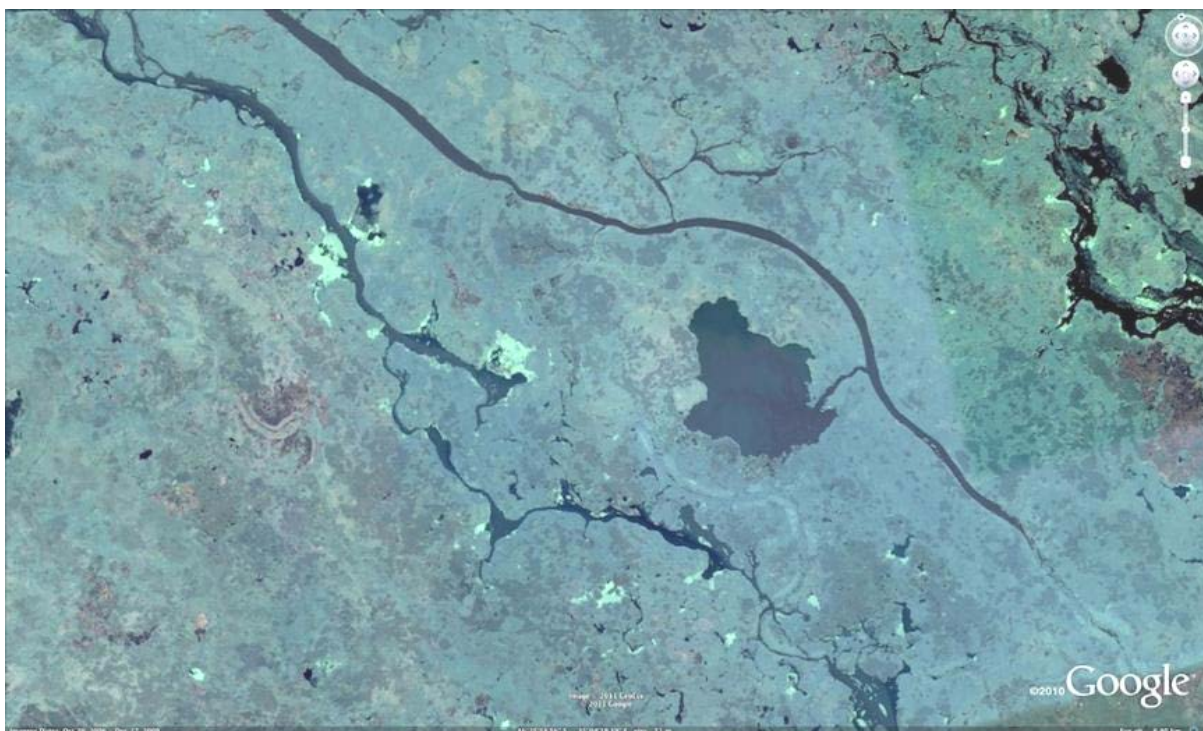


Figure 3.2: Satellite image (2010) of Elephant Marshes showing narrow channels, floating vegetation and lake systems.

Vegetation of the Marshes

There are four distinct vegetation zones within the Elephant Marsh. These include the aquatic zone, the swamp, the marsh and the hygrophilous grassland (Howard-Williams, 1972).

Aquatic Zone: The aquatic zone of the Marshes consists of floating "sudd" islands (*Echinochloa pyramidalis*), *Pycnus mundtii*, *Ludwigia stoloniferus* and *Ipomoea aquatic*. The true floating species include the fern (*Azolla nilotica*, *Salvinia hastata*), the "Shire cabbage" (*Pistia stratiotes*) and the duckweed (*Spirodela polyrhiza*). These are commonly found in lagoons or caught on "Sudd" island. The rooted plants include waterweed (*Ceratophyllum demersum*), water lily (*Nymphaea caerulea*), and water chestnut (*Trapa natans*)

Swamp Vegetation: The common swamp plants include *Typha domingensis*, *Phragmites mauritanus* and papyrus among others. In deeper waters, there is *Typha domingensis*, *Vossia cuspidata*, *Leersia hexandra* and *Pycnus mundtii*. In shallow water shrubs dominate, and towards land *Phragmites mauritanus* replaces *Typha domingensis*.

Marsh Vegetation: This is the vegetation beyond the swamp where water depth is between 20cm and 1m. The dominant species is *Cyperus digitatus*. Other conspicuous species are *Echinochloa haploclada*, *Leersia hexandra*, *Vossia cuspidata* (hippo grass), the floating stemmed *Ipomoea aquatica* and *Ludwigia stolonifera*. Plants found everywhere in this zone include *Azolla nilotica*, *Salvinia hastata*, *Pistia stratiotes* and *Ceratophyllum demersum*.

Hygrophilous Grasslands: This is the vegetation towards dry land and has sub-zoning which depends on the water depth in the rainy season (seasonally flooded). The vegetation is dominated by grasses whose composition is related to the degree of disturbance by grazing animals. In shallow waters, the vegetation is dominated by *Sporobolus robustus*. In water areas, the dominant species is *Echinochloa borumensis* and *E. Haplacada*, *E. Sporobolous consimilis* is also present. Swards of *Cynodon dactylon*, *Eragrostis aspera* and *Eleusine indica* found towards drier land are indicative of typically disturbed areas perhaps from heavy grazing. In patches which are protected from grazing, there are clumps of palms (*Hyphaene ventricosa*) and the main grasses are *Hermarthria altissima*, *Setaria phragmitoides* and *Vetiveria nigratans*.

3.3.6 Major Problems associated with Deforestation

Field investigations conducted from 18 to 21 November 2011 and 12 to 16 February 2012 established the following major environmental and social impacts on the vegetation in the Shire River Basin.

3.3.6.1 Encroachment, Agricultural Expansion and Human Settlement

Based on information obtained during consultations with officials of the forestry Department and National Parks and Wildlife in Liwonde and Lengwe National Parks, encroachment in form of opening gardens (Figure 3.3) is a serious threat in Mangochi Forest Reserve, Liwonde National Park, Machinga, Tsamba, Michiru, Masambanjati Forest Reserves and Lengwe National Park (particularly in its new extension area). A human settlement of close to 600 households was reported inside the extension area of Lengwe National Park.

With the increasing human population, coupled with worsening poverty, marginal areas such as hilly slopes, rocky areas, marshes etc., originally left for natural vegetation to flourish, are being cleared for cultivation and settlement. The effect of agricultural expansion and human settlement on the vegetation was reported by people consulted and could be observed when driving through the Basin. The Shire Highlands, Thyolo escarpment, Elephant and Ndindi marshes in the Lower Shire River Basin have been particularly affected. Deforestation and cultivation on marginal lands and hill slopes (without appropriate soil conservation techniques) particularly for subsistence farming are significant factors accelerating land degradation and soil erosion. Intense cultivation was observed on the Shire Highlands of the Middle Shire River Basin (Figure 3.4 and 3.5).



Figure 3.3: clearing of *Ptercarpus angolensis* trees for extending maize garden in Mangochi Forest Reserve.



Figure 3.4: Cultivation on Hillsides in the Middle Shire River Basin
Water, Waste & Environment Consultants



Figure 3.5: Cultivation and settlements on Hillsides in the Shire Highlands

In the Upper Shire the Mangochi Forest Reserve, the Palm Forests and other forests are constantly being invaded by surrounding communities for forest products. Despite government's efforts to allocate the surrounding areas, including the Ndengu Hills to the people to sustainably manage and benefit from its products, deforestation and cultivation is taking place on the hill slopes, resulting in erosion of soil that is carried away downhill. The Ndengu Hills (Fig. 3.6) were allocated to the people in T/A. Jalasi's area so that communities could harvest mushrooms, practice bee-keeping and access fuel wood under controlled conditions. Under this communal ownership arrangement, members of the community were not allowed to cultivate within the forest boundaries. Unfortunately, the hill slopes were quickly scarred due to deforestation and cultivation. This attracted Community Based Organisations and Non-Governmental Organisations to come and assist in reforestation. By February 2012 signs of deteriorating conditions in the once biodiversity-rich forest were clearly evident, as people were now cultivating on the slopes of the hill.



Fig. 3.6: A Forest Reserve entrusted to community management, in T. A. Jalasi, Mangochi District

In the Mangochi Forest Reserve further south, it is evident that partly due to population pressure some families have decided to relocate to new areas close to the reserve, in search of new farm lands and settlement areas. Living in proximity to the rich biodiversity of the reserve, people are often seen ferrying logs of indigenous wood for sale in Namwera or Mangochi. Reasons for this contravention of the Forest Act are not necessarily due to ignorance of its existence and provisions. The communities in the neighbourhood appreciate the importance and benefits of the forests, which the people of Chiganga Village, in Group Village Headman Balakasi, T/A Jalasi mention to be as follows:

- Assisting in the formation of rain-bearing systems;
- Source of food such as mushrooms;
- Economically essential for bee-keeping enterprises;
- Source of timber and fuel wood;
- Useful habitats for a diversity of flora and fauna;
- Sources of medicinal plants.

When asked about the main challenges they face from residing near the forest reserve, they responded that topping the list is restrictions to cultivation, followed by conflicts with elephants and hyenas that take away their domesticated animals; and monkeys that destroy their crops. Further conversations with the people of this village revealed that the main challenge facing them is poverty and the quest for more land for the rapidly growing population. Poverty has also had an impact on the food and nutritional needs of the people. In times of severe food shortages, they have often resorted to wild roots locally known as *Mpama*, which is cooked and served to the family members (see Plate 3.7).



Fig. 3.7: Mpama used for food in periods of scarcity

Opening up new fields (which they say need no fertiliser at least for a decade) leads to the removal of trees to cultivate for food and income. In the process of land clearing a bicycle load of fuel wood will be harvested to fetch about MK3, 000 (about US\$18). The loss of forests through deforestation can be attributed to population pressure and poverty (Fig. 3.8). These challenges, facing rural communities, are not specific to the Upper Shire alone but also apply to the Middle and Lower Shire River Basins.



Fig. 3.8: New settlement on the periphery of Mangochi Forest Reserve

In the absence of suitable interventions which can improve the lives of these rural communities, efforts to curb land degradation are only likely to be in vain. The people live in an environment where land holdings are less than a hectare per family, access to clean water is difficult, health facilities are scarce and household incomes are meagre.

The communities in this part of Mangochi District, for instance, indicated that they would be happy if their basic needs were provided and this would deter them from encroaching in otherwise fragile environments as well as forest reserves. These basic needs include but are not limited to small to medium-sized dams to provide water for irrigation, by developing the water resources of the Mpitapasi, Nangama and/or Pombwe rivers which are perennial; good access roads; health facilities; and schools.

The basic reasoning behind their requirements is that firstly, they will not rely on rain-fed agriculture but concentrate on farming which they are willing to do throughout the year. They will therefore be able to have adequate food on a relatively small piece of land. Secondly, they need a good road infrastructure to market centres to sell their produce. Thirdly, living in areas which are completely without clinics and dispensaries gives them no other option than to depend on and exploit medicinal plants in the forest reserves. Lastly, they cannot afford to send their young siblings to schools, located far away from their homesteads, if they have to go through treacherous forests.

3.3.6.2 Unsustainable Tree Harvesting for Firewood and Charcoal

Demand for firewood and charcoal is exerting pressure on forest and woodland resources (Fig 3.9). According to Malawi Biomass Energy Strategy (2009) the main source of energy for people in urban centres is 43% charcoal and 42 % firewood. 96% of the rural population depends entirely on firewood. However with the persistent intermittent power ESCOM supply, demand for charcoal, as source of energy in urban centres is likely to surpass the reported 43%. Increasing poverty both in rural and urban populations throughout the Shire River Basin is likely to worsen loss of forest and biodiversity. The removal of trees also means loss of endangered tree species of Malawi such as *Percopsis angolensis*, *Terminalia sericea* (Naphini), *Colophospermum mopane* (Tsanya), *Pterocarpus angolensis* etc. which are preferred for charcoal and firewood.



Figure 3.9: Collected firewood for domestic use and for sale at Mangochi Town

3.3.6.3 Pit Sawing

From consultation with rural communities and government officials in the districts visited, pit sawing is increasing in all the protected areas including Mangochi, Tsamba, Thambani, Masenjere forest reserves as well as in Liwonde and Lengwe national Parks and Mwabvi wildlife Reserve. The main reason for the increase in pit sawing was reported to be high demand for timber for construction in both urban and rural areas throughout the Basin. Tree species reported to be harvested for timber production include *Pterocapus angolensis* (Mlombwa), *Pericopsis angolensis* (Muwanga), *Alfezelia quanzensis* (msambamfumu, ngongomwa), *Adina microcephala* (ng'wenya, chonya, and mungwina), etc.

3.4 Wildlife in the Upper Shire River Basin

Notwithstanding the high rural human population, the Upper Shire River Basin still supports significant populations of the country's wildlife species. However, most of these wildlife species are concentrated Liwonde National Park. They include the re-introduced populations of critically-endangered Black Rhino (*Diceroa bicornia*). The Park also supports a significant population of the endangered African Elephant (*Loxodonta Africana*) which are estimated to be 800, and regarded as the highest population in the country. These elephants maintain trans-frontier migration cycles from Liwonde national Park to the Niassa province in Mozambique, via Mangochi Forest Reserve and forest areas on customary village land. Other notable wildlife species found in the Liwonde National Park include Bush Buck (*Tragelaphus scriptus*), Impala (*Aepycerros melampus*), Greater Kudu (*Tragelaphus strepsicereros*), Sable Antelope, Roan Antelope, Eland, Buffalo, Zebra, common Duicker, Yellow Baboons and Warthog. The Upper Shire River Basin is also harbours hippos and crocodiles mainly along the Shire River and Lake Malombe. According to 2008 Hippo and crocodile population estimates (Bhima et al., 2008), there are about 1089 hippos and close to 654 crocodiles in the Upper Shire River. Figures 3.10 (a) and (b) provide populations trend of wildlife species in Liwonde National Park from 2004 – 2009.

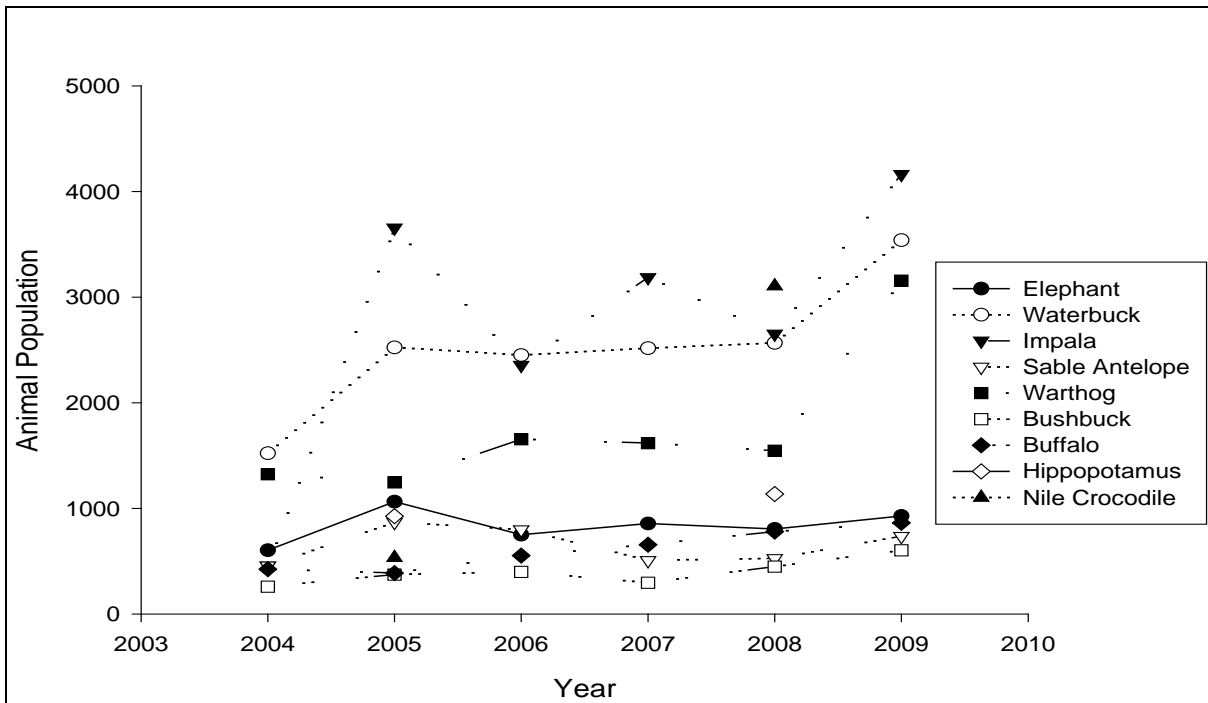


Figure 3.10 (a)

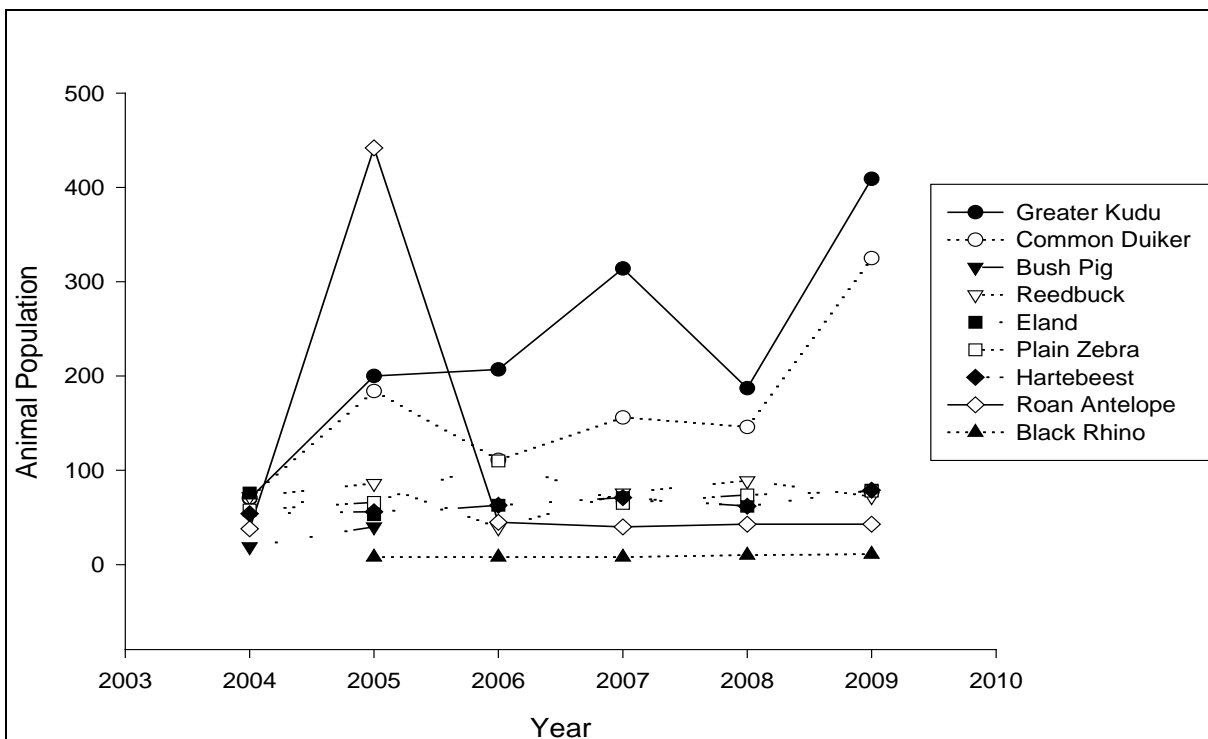


Figure 3.10 (b)

Figure 3.10 (a) and (b) Wildlife Population Trends in Liwonde National park and Surrounding Areas from 2004 to 2009

Source: Lengwe National Park Ground Counts Reports

3.4.1 Bird Species

About 406 of the country's 651 bird species have been recorded in the Liwonde National Park. Some of the common bird species in the park and some parts of the Upper Shire River Basin include the African Fish Eagle (*Haleanctetus vocifer*), Blue waxbill, Red-billed quelea, White-browed sparrowweaver, Pork-tailed drongo, African paradise-flycatcher, Red-billed hornbill, Grey loerie (Go-away-

bird) helmeted guinea fowl, Bateleur, Marital eagle, Burchell's (White-browed) coucal, Hamerkop and White-breasted cormorant, etc.

3.4.2 Migratory Birds Recorded In Liwonde National Park in the Upper Shire River

Migratory birds recorded in Liwonde National Park, in the Upper Shire River Basin include Long toed plover, Sooty tern, White winged tern, Antarctic tern, Long tailed skua, Lesser spotted eagle, steppe buzzard, Lesser kestrel, Western red footed kestrel, European cuckoo, Lesser cuckoo, European nightjar, House martin, European golden bee-eater, Angola pitta, European golden oriole, European wheat eater, River warbler, Great reed warbler, Spotted flycatcher and Little bitten

3.5 Wildlife in the Middle Shire River Basin

Due to the absence of wildlife protected areas within the Middle Shire River basin, no records of wildlife are available. However, according to reports obtained from National Park and wildlife officials consulted at both Liwonde and Lengwe National Parks, the Middle Shire River has hippos and crocodiles. The main reason for failure to have proper population estimates of wildlife species has been due to navigation challenges posed by the cataracts on the Shire River

3.6 Wildlife in the Lower Shire River Basin

Most of the wildlife such as mammals found in the Lower Shire River Basin are confined to protected areas (Lengwe National Park, Majete Wildlife and to some extent Mwabvi Wildlife Reserve).

Lengwe national Park was originally established to conserve the northernmost population of Nyala Antelope in a sporadic range, which extends from Natal in South Africa, through eastern Zimbabwe and central Mozambique, to the southern end of Malawi. The park is home to other wild mammal species such as Buffalo (*Syncerus caffer*), Impala (*Aepyceros melampus*), Kudu (*Tragelaphus strepsiceros*), Warthog (*Phacochoerus africanus*), Bush buck (*Tragelaphus scriptus*), Common Duiker (*Sylvicapra grimmia*), Bushpig (*Potamochoerus larvatus*), Livingstoni Suni (*Neotragus moschatus*), Reedbuck (*Redunca arundinum*), Grysbok (*Raphicerus sharpei*), Hyena (*Crocuta crocuta*), Leopard (*Panthera pardus*), Baboon (*Papio cynocephalus ursinus*), Blue Monkey (*Cercopithecus albogularis*), Velvet Monkey (*Cercopithecus pygerythrus*), Slender Mongoose (*Galerella sanguinea*), Banded Mongoose (*Mungos mungo*), Large Grey Mongoose (*Herpestes ichneumon*), Civet (*Civettictis civetta*), Serval (*Leptailurus serval*), Pangolin (*Manis temminckii*), Sun Squirrel (*Heliosciurus mutabilis*), Red Bush Squirrel (*Paraxerus palliatus*), Tree Squirrel (*Paraxerus cepapi*), Thick-tailed Bush baby (*Galago crassicaudatus*), Lesser Bush baby (*Galago moholi*), Scrub Hare (*Lepus saxatilis*), Smith's Red Rock Rabbit (*Pronolagus rupestris*).

The rare, endangered and endemic mammal species deserving special conservation attention include Nyala Antelope (*Tragelaphus angasii*), Livingstoni Suni (*Neotragus moschatus*) with a restricted range in Lengwe, elephant shrew (*Rhynchocyon cirnei shirensis* (a subspecies of chequered elephant shrew endemic to Malawi), Nchima monkey (*Cercopithecus albogularis*), and Sable Antelope (*Hippotragus niger*). The Lengwe population may be a subspecies restricted to Malawi and eastern Zambia (Clarke, 1983). The animal numbers are generally declining in the park for most of the animal species due mainly to wire snaring poaching (Figure 3.11).

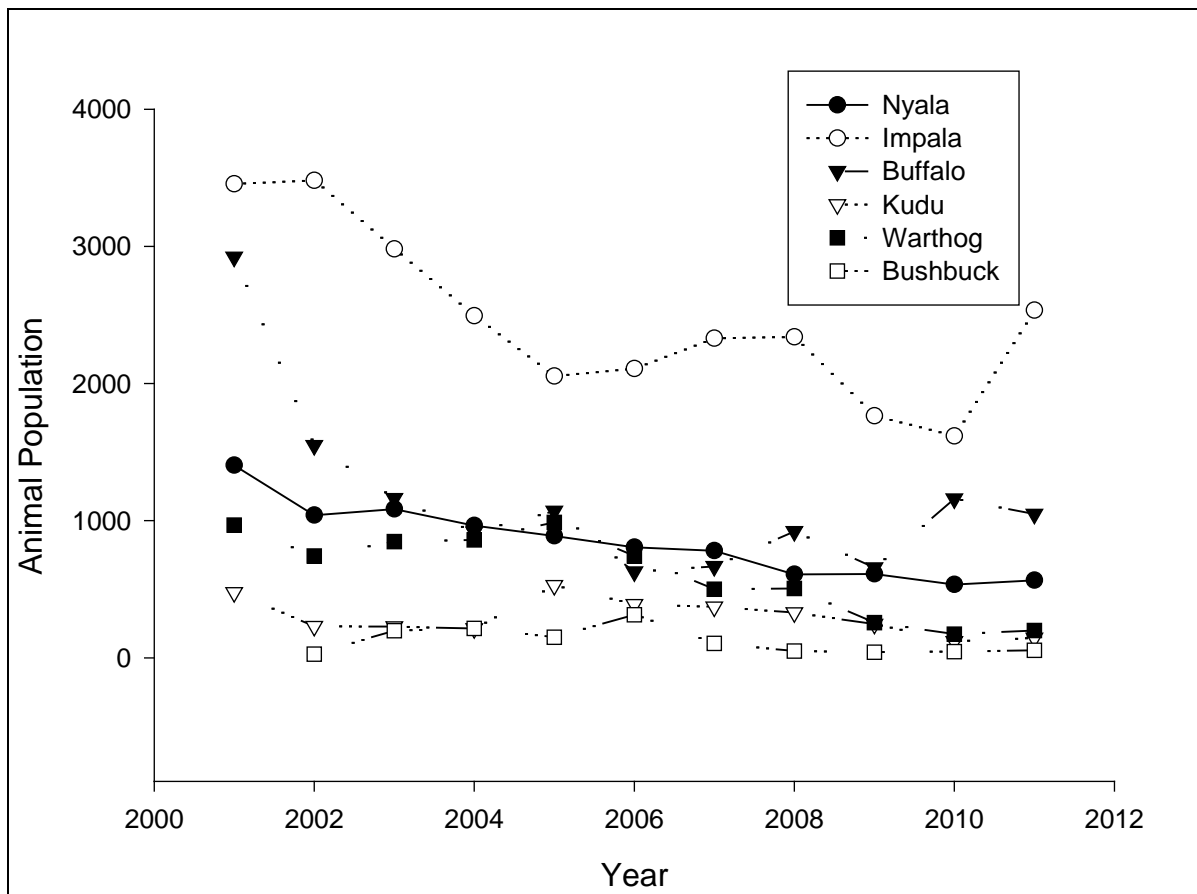


Figure 3.11 Trend of animal populations in Lengwe National Park since 2001
Source: Lengwe National Park Ground Counts Reports

3.6.1 Wildlife of Marshes and the Shire River

The Elephant Marsh and the Shire River itself are major habitats for two large aquatic animal species: the Nile crocodile (*Crocodylus nilotica*) and the hippopotamus (*Hippopotamus amphibious*). Both species occur throughout the Shire River system but are more plentiful in the marshes. According to the crocodile and hippo population estimates conducted by the Department of National Parks and Wildlife (DNPW) in 2008, there are about 934 crocodiles and approximately 932 hippos in the Elephant Marsh, the highest population in Lower Shire. However, comparing with the previous population estimates of the two species, there is a general declining trend of species in the Elephant Marsh and Shire River system especially outside protected areas. The declining trend is attributed to habitat loss and indiscriminate hunting (Bhima *et al.*, 2008).

3.6.2 Birdlife

Bird species found in the marshes are prolific and include many piscivorous species. *Haliaeetus vocifer* hunts the waterways by day while *Scotopelia peli* hunts them by night, both roosting in the peripheral trees. Many of the species mentioned in the national introduction; including cormorants, herons, egrets, storks and ibises feeding on fish, frogs, snails and mussels are present. Piscivorous and insectivorous kingfishers as well as lily-trotters are present. The reed beds are seasonally full of flycatchers and weavers. *Merops nubicus* nests are present in tens, if not hundreds of thousands, in holes in the banks of the Shire River, above Elephant Marsh. With the advent of the dry season and the appearance of islands in the swamp, migrant birds appear; among them ruffs, green shanks and sand pipers, all feeding along the drying margins.

3.6.3 Bird Species in Lengwe National Park

Lengwe National Park is one of the Important Bird Areas (IBAs) in Malawi, listed by Birdlife International under criteria A2 and A3. The bird species that occur in the park currently stands at 361 species (Pile & Bamford, 2010). The forest and thicket communities of Old Lengwe are home to several bird species, some of which are endemic and endangered. The Gorgeous Bush Shrike (*Malaconotos viridis*) considered to be extinct in the 1980s, was rediscovered in the thickets in 2001-2 (Dowsett, 2006) with a population of at least 20-30 pairs as the only one left in Malawi. The thicket area also holds significant populations of several Palaearctic migrants in the summer rains, including small numbers of the endangered Basra Reed Warbler (*Acrocephalus griseldis*).

Majete Wildlife Reserve and the surrounding area lost its entire elephant population over the period 1986 to 1992. The large part of the killing was done by Mozambican refugees, and also by local participation in the process. By early 2003, the reserve had been depleted of most of its wildlife due to poaching and prospects of it recovering seemed remote. It was generally characterized by rampant poaching for animals, logging and charcoal burning. The Government of Malawi entered into a management concession agreement with African Parks Limited to manage the reserve for 25 years, under the Public-Private Partnership model. The concession encompasses rehabilitation of the biodiversity, infrastructure and pursuing community work in and around the reserve. The reserve now supports re-introduced populations of critically-endangered Black Rhino as part of the efforts to restore the ecological integrity of the protected area.

A total of 2,550 animals of 12 different species were reintroduced over a period of eight years from 2003 to 2011. The reserve is home to mammal species such as Elephant (*Loxodonta Africana*), Black Rhino (*Diceros bicornis*), Buffalo (*Syncerus caffer*), Hippopotamus (*Hippopotamus amphibious*), Zebra (*Equus burchellii*), Eland (*Tragelaphus oryx*), Lichtenstein's Hartebeest (*Alcelaphus lichtensteinii*), Sable Antelope (*Hippotragus niger*), Nyala Antelope (*Tragelaphus angasii*), Impala (*Aepyceros melampus*), Waterbuck (*Kobus ellipsiprymnus*), Kudu (*Tragelaphus strepsiceros*), Warthog (*Phacochoerus africanus*), Bushbuck (*Tragelaphus scriptus*), Common Duiker (*Sylvicapra grimmia*), Bushpig (*Potamochoerus larvatus*), Livingstoni Suni (*Neotragus moschatus*), Reedbuck (*Redunca arundinum*), Grysbok (*Raphicerus sharpei*), Hyaena (*Crocuta crocuta*), Leopard (*Panthera pardus*), Crocodile (*Crocodylus nilotica*), Baboon (*Papio cynocephalus ursinus*), Blue Monkey (*Cercopithecus albogularis*), Vervet Monkey (*Cercopithecus pygerythrus*), Slender Mongoose (*Galerella sanguinea*), Banded Mongoose (*Mungos mungo*), Large Grey Mongoose (*Herpestes ichneumon*), Civet (*Civettictis civetta*), Serval (*Leptailurus serval*), Pangolin (*Manis temminckii*), Sun Squirrel (*Heliosciurus mutabilis*), Red Bush Squirrel (*Paraxerus palliatus*), Tree Squirrel (*Paraxerus cepapi*), Thick-tailed Bushbaby (*Galago crassicaudatus*), Lesser Bushbaby (*Galago moholi*), and Scrub Hare (*Lepus saxatilis*). The trend of the animal numbers from the annual counts shows an increase (Table 3.1.).

Table 3.1: Estimated Animal Population of Majete in 2003 before and after Restocking

Species	Population estimate 2003 (before restocking)	Population estimate 2005 (after restocking)	Population estimate 2006	Population estimate 2007	Reintroduced 2003-2009
Elephant	0	-	73	72	215
Buffalo	0	240	328	365	325
Sable	0	125	154	228	299
Waterbuck	25	106	156	232	295
Impala	0	251	289	277	428
Zebra	0	47	110	69	177
Nyala	0	27	36	43	58
Eland	0	29	46	53	78
Warthog	20	91	104	116	158

Species	Population estimate 2003 (before restocking)	Population estimate 2005 (after restocking)	Population estimate 2006	Population estimate 2007	Reintroduced 2003-2009
Hartebeest	0	-	15	31	28
Black Rhino	0	2	2		7
Kudu	25	125	131	145	0
Bushbuck	Present	73	94	78	0
Common Duiker	Present	116	148	136	0
Reedbuck	Present	87	97	91	0
Grysbok	Present	116	114	113	0
Total	70	1435	1897	2049	2068

Method of population estimate based on ground transect count (Sichali 2006 & 2007)

3.6.4 Bird Species in Majete Wildlife Reserve

The reserve has a diversity of bird species with a total of 312 recorded (Dowsett, 2006). It is the only area that harbours some few breeding colonies of rock pratincole (*Glareola nuchalis*) known to exist in Malawi. Of all the National Parks and Wildlife Reserves, the Boulder Chat (*Pinarornis plumosus*) has been recorded only in Majete

3.6.5 Fish Diversity

The cataracts of the Middle Shire River Basin are reputed to act as a total barrier to fish movement, with the result that the fishes above the cataracts belong to Lake Malawi fish fauna and those below to the Zambezi fish fauna. Of the 61 species of fish described from the Lower Shire River, only five: - *Clarias gariepinus*, *C. ngamensis*, *Eutropius depressirostris*, *Marusenius inacrolepidotus* and *Oreochromis mossambicus* are important to the commercial fishery. Of these, the first three, two catfish and a cichlid comprise over 90% of the catch. Species of secondary importance include *Astatotilapia calliptera*, *Hydrocynus vittatus*, *Labeo altivelis* and *L. congoro*. About 30% of the annual catch is consumed locally, while the remaining 70% is preserved for transport by smoking in kilns, or by sun drying. Access to Elephant Marsh is excellent, there being good peripheral roads and a railway. The north end of Ndindi Marsh can now also be reached by an all-weather road and traders come to the marshes to buy fish for markets in the towns. Some account of the fish fauna of the Shire Swamps is given by Hastings (1973) while information concerning the Shire fisheries is contained in Willoughby & Tweddle (1978), Willoughby & Walker (1978) and Tweddle et al. (1978).

3.7 Major Problems Related to Wild Life

3.7.1 Poaching

Poaching of wild animals in protected areas, using weapons such as AK 47 rifles and locally made snare wires, gin traps, muzzle loaders (Figure 3.12) as well as hunting dogs, has led to the decline of wildlife in all the national parks and wildlife reserves in the Basin. High levels of poaching were reported in Liwonde and Lengwe. Poaching is usually done by people from Malawian communities within or neighbouring countries near the protected areas. Poaching is also done by people who live in neighbouring urban centres.



Figure 3.12: Muzzle loader and gin traps used for poaching wildlife in Lengwe National Park

3.7.2 Overfishing and use of Wrong Fishing Gears

Consultations with Fisheries officials in Mangochi, Machinga, Balaka, Mwanza and Chikhwawa as well as fishermen at Lake Malombe and Kamuzu Barrage revealed that fish resources were rapidly declining in the Shire River Basin. As demonstrated in Figure 3.13, total annual catches from Lake Malawi and the Upper Shire River have declined from more than 1,200 tonnes in the early 1980s to the recent levels of around 500 tonnes (FAO, 1993). This is due to a 10-fold decline in Chambo catches, from 900 to less than 100 tonnes. Catches of other species have remained fairly constant, at around 250–400 tonnes (Figure 6.6). Some of the main reasons given were overfishing, use of wrong fishing gears and siltation, among others. It was reported that there are now more fishermen, compared with the numbers 5 years ago, due to increasing demand by the growing population.

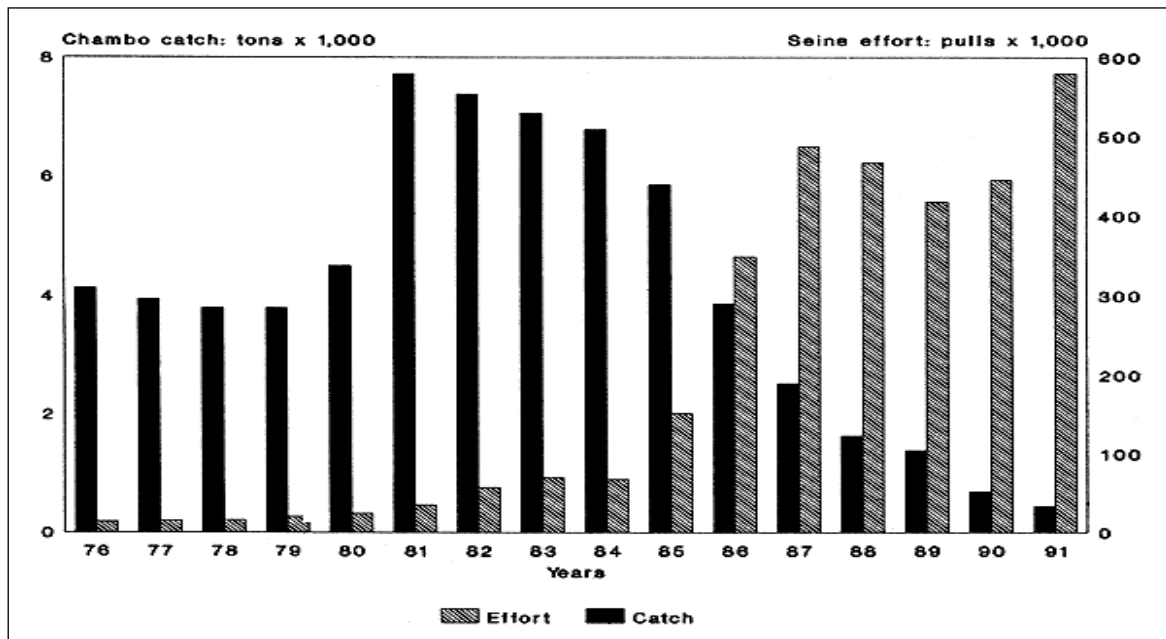


Figure 3.13: Relationship between Chambo catch and effort for 1976–91 on Lake Malombe. Source: FAO (1993)

3.8 Strategies for Improving Biodiversity

3.8.1 Policy, Legal and Institutional Framework

Conservation of the country's forests/woodland and biodiversity is one of the major activities that can contribute to poverty reduction and enhancement of sustainable economic development in the Sire River Basin. One of the priority areas among the thematic components of sustainable economic growth in the Malawi Growth and Development Strategy 2006 (MGDS) is to reduce poverty through sustained economic growth and infrastructure development.

The Departments of National Parks and Wildlife, Forestry and Fisheries are the Government's executive arms mandated through legal instruments (the National Parks and Wildlife Act 1992 revised in 2004, Wildlife Policy of 2000, Forestry Act 1997; and the Fisheries Conservation and Management Act 1997) to protect wildlife, forestry and fisheries resources; and to regulate their sustainable use for the benefit of Malawians. To fulfil their mandate, the departments undertake the functions of protected area management, law enforcement, control of problem animals (by National Parks & Wildlife), community extension and conservation education, research and monitoring through established mechanisms at area level.

The Government's management of wildlife, forestry and fisheries resources; since the establishment of the national parks, wildlife and forest reserves; was based on the 'fences and fines' approach. Communities were not allowed access to wildlife, forestry and fisheries resources. To provide for an enabling environment for involvement of major stakeholders in conservation and management of natural resources in Malawi, the wildlife, forestry and fisheries policies have been reviewed. (Wildlife Policy was reviewed in 2000 to promote collaborative management; and the National Parks and Wildlife Act of 1992 was amended in 2004 to provide for the local communities and the private sector involvement in the conservation and management of biodiversity). The forestry Act (1997) as well as the Fisheries Conservation and Management Act (1997) have some collaborative management principles already included.

Malawi is party and signatory to international conventions and treaties related to biodiversity conservation. The Department of National Parks and Wildlife is the management and scientific authority responsible for implementing the agreements, which include the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), the Ramsar Convention (Convention on Wetlands), the Convention on Biological Diversity (CBD), IUCN-World Conservation Union, International Convention on the Protection of the World's Cultural and Natural Heritage, UNESCO's World Heritage Convention, SADC Protocol on wildlife conservation and law enforcement, and the United Nations Framework Convention on Climate Change (UNFCCC). Plans are under way to designate the Elephant Marsh as a Ramsar site as well as a Community Conservation Area (CCA).

3.8.2 Collaborative Management

The principle of collaborative management provides for sharing of roles and responsibilities with major stakeholders, among them the surrounding communities, community-based organizations (CBOs), the private sector and other stakeholders. Unlike in the past, there is increased involvement of the private sector and local communities in the management of the parks and wildlife reserves. Collaborative management with communities around Liwonde National Park is at an advanced stage of drafting rules and regulations on benefit sharing of resources with the surrounding communities. Standards and guidelines for participatory forestry management (co-management) of 2005, for the Department of Forestry, are already in place for implementation by SRBMP.

3.8.3 Concession Agreements

The Government of Malawi entered into a management concession agreement with African Parks Limited, a private company to manage the Majete Wildlife Reserve for 25 years under the Public-Private Partnership Agreement. The concession encompasses rehabilitation of biodiversity, infrastructure and pursuing community work in and around the reserve. The reserve now supports

re-introduced populations of critically-endangered black rhino, as part of the efforts to restore the ecological integrity of the protected area. A total of 2550 animals of 12 different species were reintroduced over a period of eight years from 2003 to 2011.

In Lengwe National Park, the Government (through the Department of National Parks and Wildlife) signed an ecotourism concession agreement with Jambo Africa, a private company, with the overall objective of establishing a legal framework for a collaborative partnership, with regard to the commercial ecotourism use of the concession area and activity areas in Lengwe National Park. In return, the concessionaire pays fees to the Government for operating the ecotourism business. No concession agreements have been made with the private sector for the management of forestry and fisheries resources in the Shire River Basin.

3.8.4 Community Based Natural Resource Management Initiatives

In line with the wildlife policy on collaborative management and the introduction of Community Based Natural Resource Management (CBNRM) initiatives, a total of 19 and 24 CBOs have been established in villages around Majete Wildlife Reserve and Lengwe National Park respectively. The CBOs are focal points for public awareness, and collaborative forestry and wildlife management activities, with the ultimate goal of improving the socio-economic wellbeing of the local communities bordering the protected areas. Specific roles of the CBOs include acting as liaison groups between Parks authorities and other relevant development partners and chiefs and local communities; coordination of all CBO activities; reporting poaching incidences and any other illegal activities; initiating and/or facilitating developmental projects in their communities; conducting sensitization and awareness campaigns in the local community, on relevant conservation matters; ensuring equitable distribution of benefits and promoting transparency and accountability as well as community policing. The CBNRM initiatives that have been put in place to enhance biodiversity conservation include:

3.8.4.1 Institutional Arrangements for Collaborative Management

The Joint Liaison Committee (JLC) is one example established as a multi-stakeholders technical committee for Majete Wildlife Reserve, to play an advisory role to African Parks Majete (APM) and assist with conflict resolution affecting communities and reserve management. It is comprised of Government Departments such as DNPW, Forestry, Fisheries, Agriculture, Police, the Judiciary, the District Council, NGOs, Private Sector, Traditional Authorities and CBO Representatives among others. In Lengwe National Park, the Lengwe Khumbako Wildlife Conservation Committee was put in place to assist in conflict resolutions.

The Majete Wildlife Reserve Association (MWRA) was formed as an umbrella body of all CBOs to share experiences, knowledge and challenges and receive reports from African Parks Majete and DNPW. The community camp site is run and managed by the MWRA.

3.8.4.2 Community Income Generating Activities

The local communities are involved in various income generating activities to improve their livelihoods through beekeeping, mushroom production, maize milling, guinea fowl keeping, scone baking and arts and crafts, among others around Lengwe and Liwonde National Parks and around most of the forest reserves in the Shire River Basin.

3.8.4.3 Resource Utilization Programme

There are several natural resources, which local communities bordering the protected areas are allowed to harvest on a sustainable basis, based on the approved quota and through the permit system for their livelihoods, food security and poverty reduction in the Shire River Basin.

3.8.4.4 Wildlife School Clubs for Environmental Education and Awareness

There are several wildlife clubs that have been established in primary and secondary schools in most of the districts, within and outside the Shire River Basin, to promote environmental education and awareness to the youth as well as the general public.

3.8.4.5 Law Enforcement

The Departments of National Parks & Wildlife, Forestry and Fisheries are also involved in law enforcement, to ensure that pieces of legislation are abided by.

3.9 Strategies for Improving Land Husbandry

The following land husbandry practices have been promoted in the Shire River Basin, to mitigate impacts of catchment degradation:

- Marker ridges and alignment of ridges are prevalent in the middle and Upper Shire River Basin. However, despite ridging being a good practice for control of soil erosion, the farming community has taken it as a mode of garden preparation and the ridges are not perfect to the contour. Hence, runoff and soil erosion are still significant impacts which must be mitigated.
- *Vetiver* grass hedge-rows- slow down runoff and facilitate deposition of the soil behind the *Vetiver* grass hedge rows. These must be planted.
- Various agro forestry practices are introduced to improve soil fertility and infiltration, thereby reducing run-off. However, these practices need to be reinforced.
- Reforestation on bare hills or fragile areas is being implemented. However, in many cases the resources are not enough, to render this effective, as noted from the Regional Forestry Office in Blantyre
- River bank protection, by planting trees along the rivers and stream banks, must be promoted and supported.
- Conservation agriculture – though a relatively new farming technology, has the potential for protection of cultivated land from being eroded.
- Various rainwater harvesting practices such as swales, mulching infiltration pits, shallow basins etc. can be applied to ensure infiltration of rainfall such that it does not cause erosion and runoff which are responsible for siltation and flooding.

In general good practices are often introduced in the Basin. However, this is usually done too late and little effort is made to support the farming community and agriculture extension officers.

CHAPTER FOUR: SOCIO-ECONOMIC PROFILE

4.1 Population

Malawi as a whole is characterised by high human population densities and strong dependence on subsistence agriculture for food supply. Population in the Shire River Basin is estimated to be around 4.5 million with population densities ranging from 275-3,196 people per square kilometre, for areas around the Shire Highlands. The population size in the basin has been increasing as can be seen in Table 4.1.

District	2008	1998	1987
Ntcheu	471,589	370,800	358,800
Mangochi	797,061	610,200	496,600
Machinga	490,579	369,600	301,800
Balaka	317,324	253,100	213,400
Mwanza	92,947	138,000	121,500
Neno	107,317	**	**
Blantyre	1,001,984	809,400	589,500
Zomba	667,953	546,700	441,600
Chikhwawa	434,648	356,700	316,700
Nsanje	238,103	194,900	204,400
TOTALS	4,619,505	3,649,400	3,044,300

Source: NSO 2006, 2009

** Neno was not a district when 1998 and 1987 censuses were conducted

Out of the ten districts where detailed field investigations were conducted in the basin, Mangochi registered a sharp increase in population, largely because of migration of people under the Community Based Rural Land Development Programme (CBRLDP) (*Kudzigulira Malo* programme), from Thyolo and Mulanje.

Population densities in the Upper Shire range from 70-160 people per square kilometre, while in the Lower Shire, population densities range from 50-70 people per square kilometre (World Bank 2011). Population densities in the basin have been increasing over the years as is the case with the whole country (see Table 4.2).

District	2008	1998	1987
Ntcheu	138	108	105
Mangochi	127	97	79
Machinga	130	98	80
Balaka	145	115	97
Mwanza	40	28	26
Neno	73	56	42
Blantyre Rural	190	172	143
Blantyre City	3,006	2,282	1,514
Zomba Rural	228	215	157
Chikhwawa	91	75	67
Nsanje	123	100	105

Source: NSO 2009

Recent surveys conducted on birth rates in the basin indicate that a woman will give birth to an average of 6.2 children. Mangochi has the highest total fertility rate of 7.0, while Blantyre has the lowest total fertility rate of 4.0 (MDHS, 2010). The annual population growth rate in the basin is estimated at 2.6% (NSO, 2008). The rapid increase in population in the basin is negatively affecting environmental and natural resources management. More land is being cleared for settlements and farming. Cultivation on marginal land, hill slopes, riverbanks and river beds is also on the increase. Table 4.3 provides a summary of demographic characteristics in the basin.

Demographic Characteristic	Population	Population Density	Annual Population Growth	Total Fertility Rate	Infant Mortality	Under-five mortality rates
District						
Ntcheu	471,589	138	2.5	5.3	74	125
Mangochi	797,061	127	2.7	7.0	82	136
Machinga	490,579	130	2.9	6.9	77	125
Balaka	317,324	145	2.3	6.0	66	125
Mwanza	92,947	40	4.1	5.1	63	106
Neno	107,317	73	2.7	5.5	78	118
Zomba Rural	579,639	228	0.6	5.6**	80**	134**
Zomba City	88,314	2,264	3.0			
Blantyre Rural	340,728	190	1.1	4.0**	69**	110**
Blantyre City	661,256	3,006	2.8			
Chikhwawa	434,648	91	2.0	6.7	82	139
Nsanje	238,103	123	2.1	6.2	83	134

Source: NSO 2008 and MDHS 2010

4.2 Land use, Tenure and Administration

The majority of the land in Shire River Basin is used for subsistence agriculture, with most families owning only small pieces of land. Maize, beans, rice, sorghum and millet are grown under subsistence agriculture, supplying households with their annual food requirements. Cotton and tobacco are the main crops for household income. Sugarcane, maize and rice are commercially grown, particularly in the Lower Shire Valley at Nchalo, Kasinthula, Nkhate and other irrigation schemes. Small-scale mining is common in the districts of Ntcheu and Balaka. Gold panning is also practised along the Lisungwi River. Other land use types include settlements (in the form of townships, market centres and villages); roads and road reserves, National Parks, Wildlife Reserves and Forest Reserves.

Land in the Shire River Basin includes public, private and customary land. Customary land is under the control of traditional leaders who are the TAs, Group Village Headman or Village Chief. Allocation of rights to customary land is the responsibility of chiefs who rely on clan and family leaders to identify and allocate pieces of land to individuals and households from land owned by that group. Disputes with respect to land grabbing, encroachment and boundaries are settled by traditional leaders and in extreme cases by the District Commissioner. Over 60% of land in the basin is customary land. In many cases the right of access to land has favoured male rather than female members of the family. This practice, common in Malawi and the Southern Africa Development Community (SADC) region (Chenje, M. 2000), contravenes the Dublin Principles, which encourage participation of women in natural resources management (GWP, 2000).

Public land is owned by the government, on behalf of the entire population. This covers land where government buildings, roads, public institutions, national parks and protected areas are located. Public land can be converted into private land whenever government allocates plots for its citizens to construct structures according to government development plans.

Private land is freehold or leasehold. Usually an individual or corporate entity is granted a leasehold title not exceeding 99 years; and these apply especially to tobacco and sugar plantations as well as other private properties. Freehold land in the basin is mostly owned by religious institutions.

4.3 Inequitable Land Distribution

More than 40% of smallholder farmers cultivate on less than 0.5 hectares. This, coupled with increasing population pressure, has led to overexploitation of the limited natural resource base. The increasing population and conversion of customary land into private land for estate development have reduced land size holding to most ordinary people in the basin. It was established during the field investigations that men generally possess more land than women. This inequality could be attributed to traditional property inheritance rules and land ownership systems which favour men more than women.

Scarcity of land for settlement and farming has increased pressure on public land, spurring encroachment into protected areas (national parks and forest reserves). Protected areas facing encroachment in the basin include Mangochi Forest Reserve, Liwonde National Park, Tsamba Forest Reserve, Lengwe National Park and Mwabvi Wildlife Reserve. To address the problem the government is implementing a project funded by World Bank and the Government, known as Community Based Rural Land Development Programme (*Kudzigulira Malo* programme) by facilitating access to land by the landless. Recently, there has been migration of families from the densely populated areas of Mulanje and Thyolo to some districts of the basin under the programme.

4.4 Economy

The economy of the Shire River Basin is predominantly agricultural based, with about 90% of the people living in the rural areas engaged in agricultural activities. The agricultural activities are largely smallholder farming with exceptions of few large estates and irrigation schemes. Both crop production and livestock development are key agricultural activities in the basin, forming the backbone of the economy and employing over 75% of the population. Fisheries also play an important economic role, in areas close to Lake Malawi, Lake Malombe, Shire River and other rivers within the basin. Fisheries are an important source of protein and they supplement rural income. Tourism also forms an important part of the economy in the basin. Transportation, energy and employment in government and private institutions contribute a substantial percentage to the economy of the basin. A good proportion of the people in the basin are involved in small scale businesses such as operating retail shops.

Poverty is widespread in the Shire River Basin. According to the 2004-05 Integrated Household Survey (IHS) about 50 percent of the people in all the ten districts of the basin are poor, with almost 15 percent ultra-poor. Women comprise almost 60% of the people who are poor in the basin. These people are characterised by the following:

- They do not have food the whole year round or food supply is finished before next harvest
- Children do not go to school because they lack food and basic social amenities;
- They live in round mud houses and rely on piece work and assistance from relatives,
- They do not have beddings and clothes.

The per capital monthly income for all districts of the basin averaged MK50, 000 in 2005, translating into MK139 (\$0.83) per day, which is below the poverty line of \$1 dollar a day. The national average monthly household expenditure is MK93,000; while the average household incomes for the districts in the Basin are: MK36,831 for Mangochi, MK39,679 for Machinga, MK27,269 for Balaka, MK32,359 for Zomba Rural, MK42,530 for Blantyre Rural, MK26,593 for Thyolo, MK16,091 for Mwanza, MK24,125 for Chikhwawa and MK45,136 for Nsanje. The natural resources related sector employs over 50% of the people in the basin (NSO, 2005).

4.5 Agriculture

4.5.1 Main Agricultural Activities

Agriculture in the Shire River Basin occupies 575,350 hectares of arable land. 200,322 hectares is cultivated by smallholder farmers, while the rest is under estates. Agricultural activities in the basin are administered by Machinga, Blantyre and Lower Shire Agricultural Development Divisions (ADDs). These three ADDs in the Southern Region (covering the Shire River Basin) account for 1.47 million ha (41% of the total agricultural area of Malawi). The region also contributes 4.38 million tonnes (35%) of agricultural produce (excluding tea and sugar). Maize, which provides the principal food source for the 4.5 million people living in the Shire River Basin, only appears as 33% of national production but this is proportional to the area and the crop actually takes up over 50% of the cultivated land area.

Maize is the main staple food crop grown in the basin where over 70 % of the area for production of food crops is under maize cultivation. The high production of maize has been attributed to the fertilizer subsidy programme which was introduced in 2005-2006 farming season. However, erratic rains have affected maize production in most areas of the basin. Areas that have been grossly affected by erratic rains include Mangochi, Machinga, Chikhwawa, Nsanje and Lisungwi in Neno. District council officials and local communities indicated that efforts are being made by MWDI, through the ADDs in the basin, to encourage farmers to grow drought resistant crops and venture into irrigation farming.

Sugarcane cultivation is one of the major agricultural activities that generates domestic and export earnings for Malawi. About 186,000 tons of sugar, produced from Shire River Basin in 2009 (61.5% of Malawi's production), contributed revenues of around 16.5 billion Kwacha (110 Million US\$). Two thirds of the sugar grown in Malawi comes from 17,000 hectares in the Lower Shire Valley. The major sugarcane growers include Illovo Sugar Estates and Press Cane Growers. Illovo Sugar Company is the major employer in Lower Shire River Basin, employing about 5, 400 persons, both seasonal and permanent.

Irrigation activities are on the increase in the basin. Throughout the basin small holder farmers are being encouraged to venture into irrigation to supplement rain fed agriculture. The government of Malawi has made irrigation one of the priorities in the Malawi Growth and Development Strategies (MGDS). Out of the ten districts in the Shire River Basin, Chikhwawa has the highest number of smallholder irrigation schemes, using either treadle pumps, motorized pumps (for surface and sprinkler irrigation), stream/river based gravity, canalization, water impoundments or watering cans. Most of these irrigation schemes are located along the perennial rivers of Shire, Livunzu, Nkhate, Mapelera, Mwamphanzi, Nkudzi, Limphangwi, Mwanza, Nkombedzi wa fodya and Nyakamba. The area developed so far for irrigation is 2,223 hectares benefiting 10, 979 farmers. Major crops grown in the schemes include sugarcane, maize, vegetables and beans. However, land is scarce in the basin and as such; suitable areas for agriculture are scarce.

In the Upper and Lower Shire, rain-fed cropping is done on plots of around two hectares. Small intensively cultivated "recession agriculture" (dimba) gardens, using residual moisture on the

terraces or river levees of the floodplain principally occur along the Upper and Lower Shire where some crops can be grown throughout the year. Dimba gardens cover limited areas but provide an extremely important source of nutrition, especially in the dry season. During field investigations, it was established that scarcity of land is forcing most of the communities to open up gardens in riverbanks, marginal lands, steep slopes, protected areas and forest reserves.

4.5.2 Agriculture Related Environmental and Social Problems

4.5.2.1 Low Agricultural Productivity

The Shire River Basin is currently facing significant changes in weather patterns, with severe drought conditions (e.g. the 1991-92 droughts) and extreme flash flooding events (e.g. 2000-01 flash floods), which cause significant damage to crop and livestock production, the environment and rural communities. The main impacts of flooding are loss of life (both human and animals), damage to property and infrastructure (railway, roads and bridges, buildings etc.), impeded drainage of agricultural lands, crop damage and disruption of other important socio-economic and industrial activities. More than half a million people living in the Lower Shire Valley are vulnerable to climatic extremes such as droughts and floods.

It was noted from consultations with District Agriculture Development Officers (DADO) for all the districts in the basin that low agricultural productivity is compounded by environmental degradation, climate change, limited use of improved seed varieties, limited accessibility to agricultural loans, inadequate agricultural extension services, poor cultural practices such as cultivating on steep slopes, making ridges along the contours; low utilization of manures, fertilizers and poor pest management practices. Table 4.4 gives a summary of key factors contributing to low agricultural yields, as determined through consultations with DADOs in the basin. The “tick” in the table indicates that the factor is contributing to low yield while a “cross” means there is insignificant contribution from the factor.

FACTORS	DISTRICTS									
	NU	MH	MHG	BLK	MN	NN	ZA	BT	CK	NE
Inadequate extension services	√	√	√	√	√	√	√	√	√	√
Cultivation of marginal hilly areas without proper control measures	√	√	√	√	√	√	√	x	x	x
Burning of residues and grasses during land preparation	√	√	√	√	√	√	x	x	√	x
Improper ridge making	√	√	√	√	√	√	√	√	√	x
Limited use of fertilizer and improved seeds	√	√	x	x	√	√	x	x	√	x
Cultivation of riverbanks and beds	√	√	√	√	√	√	√	√	√	√

NU: Ntcheu, MH: Mangochi, MHG: Machinga, BLK: Balaka, MN: Mwanza, NN: Neno, ZA: Zomba, BT: Blantyre, CK: Chikhwawa, NE: Nsanje

Agricultural extension is inadequate across the basin. The recommended extension worker: farmer ratio is 1:500 but the average ratio in the basin is 1:2000 which is equal to current national average. Mangochi registered the highest ratio of 1:3617 in and Ntcheu registering the lowest ratio of 1:1275.

Farm mechanization is very low (except for large estates) across the basin. The hand hoe is the predominant farm tool alongside the panga. The number of smallholder farmers using ploughs and

ridgers in the basin is very low. For districts such as Chikhwawa and Nsanje, where rains are very erratic, farm mechanisation would help farmers maximize the short rainy seasons.

4.5.2.2 Use of Chemical Fertilizers, Pesticides and Herbicides

Chemical pesticides are recommended for use as a last resort, after other methods of pesticide control have failed. A number of cultural methods such as crop variety resistance, pest monitoring, scouting and counting, intercropping and crop rotation are also available. Botanical pesticides such as *tephrosia volgelii*, *neem* and *ginger* are also used. Biological methods are also used for control of the large grain borer. However, biological control methods for pests are not commonly used in the Shire River Basin, let alone in Malawi, because they are highly technical, expensive to implement and usually cumbersome in their development.

Integrated pest management encourages the use of cultural and biological and other methods as much as possible, in place of chemical methods. Chemical pesticides should only be used when all methods have failed. A large part of Shire River Basin is suitable for cotton growing. It is therefore anticipated that more pesticides will be used with the promotion of cotton growing in the country

Use of herbicides is on the increase as labour costs are becoming prohibitive in crop production. Herbicides are generally easily biodegradable. Accaricides, for the control of ticks on livestock, are commonly used in the Shire River Basin. However, strategic dipping from November to March reduces the use of accaricides.

Chemicals, pesticides and herbicides may be dangerous to humans, livestock and other animals if swallowed through water. Therefore, due care and control must be exercised when using them. Chemical pesticides and herbicides may also have a negative effect on soils and water quality. The list of approved pesticides is reviewed and updated by the Pesticides Control Board every year and currently more than 300 pesticides, traded in different names, are registered in Malawi (Table 4.5).

No.	Pesticide	No. of Trade Names
1	Insecticide	119
2	Herbicides	105
3	Fungicides	52
4	Fumigant	3
5	Nematicides	6
6	Plant growth/regulators	5
7	Accaricides	4
8	Mosquito repellents	1
9	Rodent	1
10	Buffer	1
11	Adjuvant	1

4.5.2.3 Monitoring of Pesticides Use

Monitoring of pesticides is done by inspectors at the points of sale, and through data for sales, licenses and the list of approved pesticides. Pesticides inspectors make house, points of entry (boarders) and open market inspections. These inspectors are based at Bvumbwe Agricultural Research Station in Blantyre and points of pesticide entry are at the boarders. Sometimes, spot-check inspections are conducted to ensure that pesticides are properly labelled and stored and if not, they are confiscated.

Monitoring of pesticides is not as effective as it should be and there are many illegal pesticides used in the country. Pesticides are illegally imported through informal trade and through the porous borders. Challenges with monitoring of pesticide use include lack of capacity (staff involved in monitoring of pesticides are inadequate). The Pesticides Control Board does not have enough resources to cover the whole country.

4.6 Fisheries

The Upper Shire (including Lake Malombe) has a high production of commercially valuable fish species. Maldeco Fisheries in Mangochi provides the platform for industrial fisheries. Small-scale artisanal fishery is predominantly undertaken in the Lower Shire.

Fishing is a major industry in the country and it requires sustained water availability. Modification of habitats within riverine systems can have disastrous effects on fish as their habitats become destroyed and the fish is unable to spawn. Habitat modification such as removal of vegetation, which leads to erosion and siltation of the habitat sites, occurs as a result of human activities upstream of spawning grounds or within the habitat area itself. Habitats destruction also results from pollution by industries, mines and farmlands. High concentrations of nitrates accelerate growth of aquatic weeds, which cause eutrophication and removal of oxygen from the river systems, making them unsuitable for aquatic fauna including fish. Principal fishery species in the basin are Chambo (Figures 4.1 and 4.2).



Figure 4.1: Chambo (*Oreochromis spp.*)

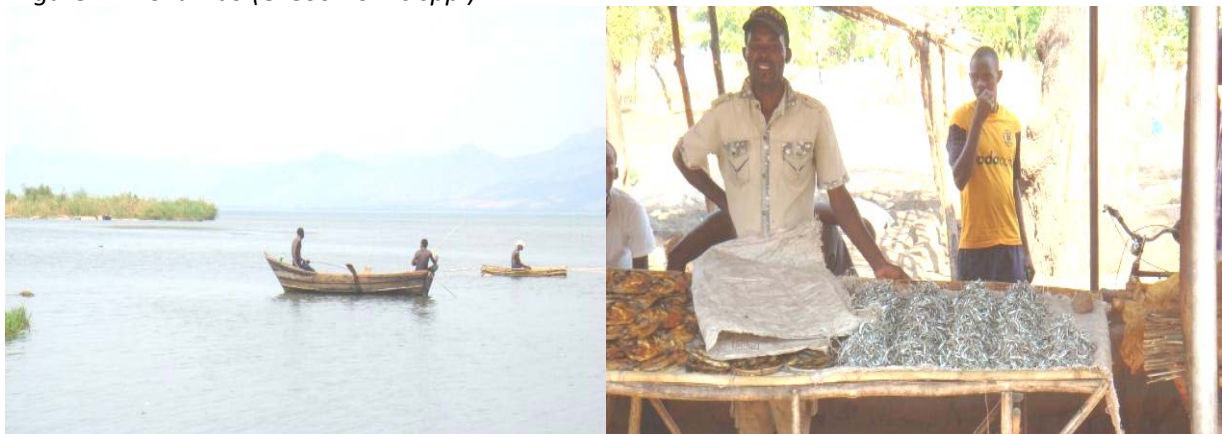


Figure 4.2: Fishing and Fisherman Selling Usipa at Lake Malombe

According to the State of Environment Report (SOER) 2010, the mean total landings for Lake Malombe in recent years (2000-2007) have been reported at 5,202 tonnes per year, which is lower than the 8,000 tonnes per year reported in the late 1990s. Fish landings between 2000 and 2006 indicate that Lake Malombe fishery was dominated by kambuzi fishery but there was a sharp decline in 2007 whilst the chambo fishery showed an increase (Figure 4.3).

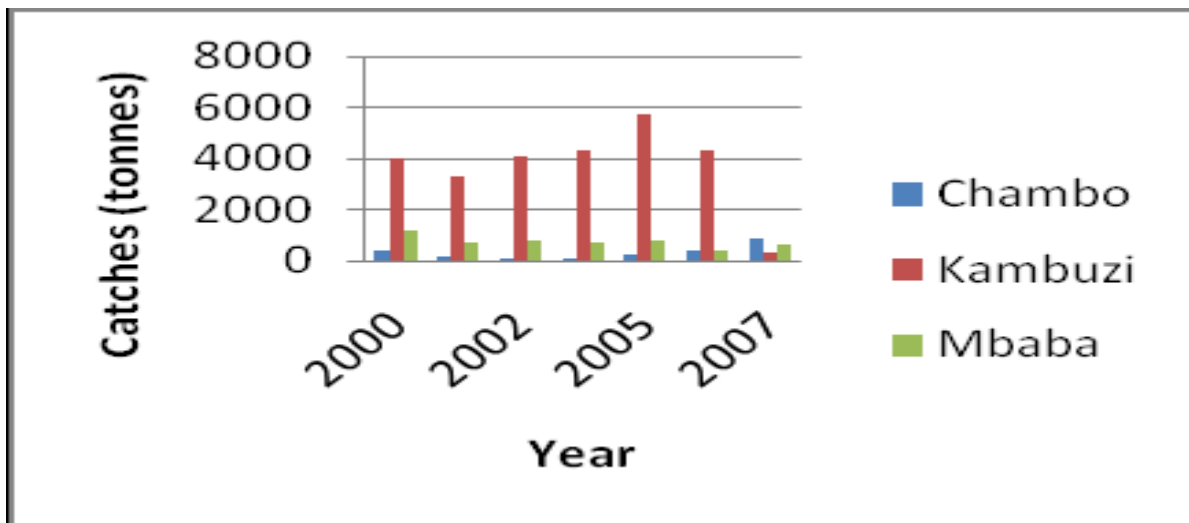


Figure 4.3: Lake Malombe fish catches for Chambo, Kambuzi and Mbaba (2000-2007).
Source: SOER 2010

Chambo used to be the main fishery in the 1970s, increasing to more than 6000 tonnes in 1980. The general decline of the Chambo fishery in Lake Malombe led to over-harvesting of a group of small tilapia locally known as Kambuzi (a collective name for a group of related fishes called *Haplochromines*). As a result, landings of Kambuzi declined to 100 metric tonnes in the early 1990s.

Previously, the Elephant and Ndindi marshes in the lower Shire River Basin supported a vibrant fishery, but this has now declined to the extent that fish has to be imported from Bangula. The decline of fisheries is attributed to damage to fisheries habitat caused by farming up to riverbanks, clearance of once extensive reed beds, and high levels of siltation. Other changes (such as modified hydrological regimes following the closure of the Kapichira Dam) and fertilizer as well as pesticide run-off from upstream farming systems (and the sugar estates immediately upstream of the marshes) may also be playing a role.

Across the Shire River Basin, over-fishing is a major problem, resulting from increased number of fishermen and fishing gears, use of illegal fishing gear, and high demand of fish due to increasing human population growth. Also, high siltation rates and infestation of aquatic weeds lead to reduced fish breeding grounds. Based on information obtained during detailed field investigations with fisheries officials in Mangochi, Machinga, Balaka, Mwanza and Chikhwawa as well as fishermen at Lake Malombe and Kamuzu Barrage on the Shire River, it was clear that fish resources were rapidly declining in the Shire River Basin.

4.7 Livestock

Livestock commonly found in the basin include cattle, goats, pigs, sheep, poultry and rabbits. Most of the livestock are indigenous. These indigenous breeds are adaptable to the harsh weather conditions of the basin and they are disease resistant. Livestock plays a very important role in providing a source of protein (meat and milk), income, manure and draught power for most of the

households in the basin. Consultations with district agricultural officials in the basin indicated that the number of households rearing poultry has been increasing for the past five years. Reduced numbers of cattle for beef and increasing prices of beef, goat meat, pork and mutton has forced most of the households to resort to rearing poultry. Poultry provides both meat and eggs which are relatively a cheaper source of protein.

Cattle, which graze on natural grasslands in the dambos and floodplains, are the most important livestock in the Lower Shire. The population for cattle is slowly increasing in the Lower Shire River Basin. The slow rate of increase is due to frequent outbreaks of disease such as trypanosomiasis and high demand for beef as a result of the growing population in the cities of Blantyre and Lilongwe. Consultations with District Agriculture officials for Chikhwawa indicated that grazing land is scarce because most of land has been used up for settlements. However, the agricultural officials are encouraging farmers to practice stall feeding. Theft was reported to be a major challenge to farmers rearing cattle in the Chikhwawa where there are a number of ranches especially in Traditional Authority Ngabu.

Sheep, goats and pigs have been increasing in the basin although preference by organisations that are distributing animals to farmers, in an effort to increase alternative sources of income, has been cattle.

4.8 Tourism

The basin has a number of tourist attractions both along the main river and in other areas away from the banks of the Shire. Mangochi is one of the major tourist districts in the basin. Major areas of tourist attraction in the district include Lake Malawi, national parks, cultural and historical sites. Lake Malawi is the major tourist attraction feature in the district because of its clear waters, fine sandy beaches and good areas for water sporting activities. Lake Malawi National Park, harbouring more than 2,000 species of fish, is also a major tourist attraction area in the district. Cultural and historical sites in Mangochi include Michesi Iron Age cemetery at Maldeco, rock paintings on Nkhudzi, Chiutsi Hill, Mwala wa Mphini at Cape Maclear, St. Michael's campus at Malindi, Commonwealth cemetery at Mangochi Boma, Lake Malawi and Mpale Cultural Village. Consultations with district council officials indicated that Mangochi has the potential of increasing revenue collection from tourism if these attraction sites are publicised.

Liwonde National Park, which is located in three districts of Mangochi, Machinga and Balaka, is one of the major tourist attraction centres with a variety of wildlife in the basin. The national park hosts private, official and educational visitors. Information from the Liwonde National Parks officials indicates that the park receives an average of 12,000 visitors per year. Patronage and annual revenue have been on the increase since 2005 due to effective publicity, improvement in hospitality and the introduction of new game in the park, as can be noted from Tables 4.4 and 4.5. The park collects revenue from concessions, park entry fees and hire of guides.

Visitor Category	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Private	445	507	259	460	1230	344	366	234	157
Official	803	611	751	1418	596	550	659	641	446
Education	3,550	3,224	5,195	4,188	2,537	3,257	3,818	4,783	5,500
Paying	4,127	5,190	6,455	7,517	8,721	7,773	12,130	7,839	8,499
Total	8,925	9,532	12,660	13,583	13,084	11,924	16,973	13,497	14,602

Source: Liwonde National Park, 2012

	2005/2006	2006/2007	2007/2008	2008/2009	2009/2010
ACTIVITY					
Concessions	8,290,012.19	12,539,583.38	15,014,762.95	18,616,832.47	18,286,388.00
Park entry fees	5,486,289.00	6,245,580.00	6,508,614.92	8,053,373.08	8,920,000.00
Hire of Guides	0.00	0.00	3,640.00	1,400.00	5,320.00
Total Income	14,232,553.69	19,323,923.00	21,887,717.87	27,217,925.55	27,750,708.00

Source: Liwonde National Park, 2012

Mwanza district has various areas of tourist attraction including Majete Wildlife Reserve as a major attraction site. Historical sites relating to early missionaries and others are also attractions for both foreigners and locals.

Chikhwawa district has a number of tourist attraction sites which include Kapichira falls, Madziotentha spring, Diwa spring and Kapichira Hydro-electric Power Station. These sites are close to Majete Wildlife Reserve. The major tourist attraction site is Lengwe National Park and Nyala Park, with its famous Nyala and Majete Wildlife Reserve. Viewing of the meandering Shire River, as one descends the Thyolo – Chikhwawa escarpments at Kamuzu View on the way to Chikhwawa Boma, is also an attraction to tourists.

Nsanje District has one Game Reserve, Mwabvi, which is also a major tourist attraction centre in the Lower Shire. Mwabvi was originally established to protect the black rhinoceros population but the species got extinct in the years 1989-1992. Currently, the game reserve has a large number of impala and kudus. However, the game reserve has problems of poaching, bushfires, habitat loss and encroachment.

Box 3.1: Co-management of natural resources

During field investigations it was established that in areas where co-management of tourist attraction sites is being implemented, local communities have benefited from these sites either through employment, selling of both forest and non-forest based products including firewood, mushrooms and honey. Liwonde National Parks is an example of a protected area where a comprehensive co-management programme has been developed to the extent that a revenue-sharing agreement between the park administration and local communities is being adopted. The revenue-sharing programme came out of the pilot community-based wildlife management project which was set up to help communities to utilise wildlife sustainably, in collaboration with park officials, non-governmental organisations and the private sector. The project period was three years and was funded by Denmark International Development Aid (DANIDA). The project was titled “the Institutionalised Capacity Building of Community Based Wildlife Management for Poverty Reduction”. The overall objective of the project was to increase food security and reduce poverty for the people living in 31 communities on the park’s western border, an area which has very little outside support. Through the project, local communities were introduced to alternative sources of income such as bee keeping, honey production, cultural stay programmes for tourist, mushroom farming, rearing of guinea fowl and paper making from waste paper mixed with elephant dung and banana leaves. Problems of poaching and illegal entry to the park have been reduced through this project as people started looking at wildlife as resources and not pests that destroy their crops. After evaluation of the pilot project, it was established that co-management of natural resources with the local communities should be scaled up into a full programme.

With regards to the co-management activities involving the Departments of Forestry and Fisheries, no clear activities were observed on the ground except collection of firewood, mushrooms and other forestry products which was done by communities surround Mangochi Forest Reserve. However, the Department of Forestry plans to implement co-management activities within the Shire River Basin Management Project as it has already prepared Standards and Guidelines for participatory forestry management in the country (GOM 2005).

4.9 Transport

Movement of people and agricultural products between towns and trading centres is mostly by road transport. All the townships and *bomas* in the basin are well served with public transport, except Neno District, which has limited public transport because of poor road network. National and AXA bus companies operate in the basin as well as countrywide. However, minibuses and pick-ups are the most available modes of road transport in the basin. Minibuses are the fastest and most convenient means of transport. Pedal cycles are a readily available means of transport within most of the townships of the basin. Travel between home and workplaces, home and hospital, home and market and to entertainment centres are commonly on pedal cycles. This mode of transport is predominant in Mangochi, Balaka, Chikhwawa and Nsanje districts. Interviews with business person in pedal cycle transport indicated that it is their main source of livelihood. A survey in the areas where pedal cycle transport is dominant indicated that a single trip costs a minimum of about MK100 and can get as high as MK500 on certain routes. In a day, most of the pedal cycle operators make at least MK1,000 (about US\$3.70) which translate to MK30, 000 (about US\$110.00) per month.

Water transport consists of motorised boats and paddle canoes on Lake Malombe and along the Shire River. The Illala and Mtendere ship vessels, which can be accessed through Mangochi, do not sail on the Shire River. The vessels offer a weekly roundtrip from Mangochi to Karonga on Lake Malawi. Trawlers, boats and canoes are also used for transport in water bodies in the basin though their main purpose is for fishing. The Shire River was once navigable from the Zambezi up to the first cataracts before entry to the Middle Shire. However, due to proliferation of aquatic weeds and changes in channel configuration, only canoes and small paddles boats are able to ply the waters of the Lower Shire, particularly between Nsanje and Chikhwawa.

The Shire River Basin is also serviced by diesel powered passenger and cargo trains, operated by the Central East Africa Railways, from Limbe to Balaka and up to Bilila in Ntcheu; and also connecting to Liwonde on the way to Nayuchi. The passenger train on the route operates 2 days a week (Wednesdays and Fridays) while the cargo train operates according to demand. Rail transport is relatively cheap compared to the other means in the area. However the service is limited by the number of days and also the operating times in a week. The travel schedule does offer people the opportunity to return the same day, if they transact business in the main towns such as Balaka, Liwonde or Blantyre. For people from Nkaya, Utale, Shire North, Namatunu and Gwaza, where there is not any other form of public transport, the train is very attractive more especially for transporting goods on sleep over journeys. The train route from Limbe to Nsanje was not functional at the time of field investigations, although it used to be in the past. Train transport has the potential to be revitalised since there still remains infrastructure connecting the basin to major commercial places in the central and southern Malawi including to Mozambique and Zambia.

Air transport is almost non-functional in the basin as most of the airdromes have been closed and encroached upon. Mangochi and Blantyre have functional air connections although Mangochi can only be reached by light aircraft flights usually by private tourists into Club Makokola. Chileka International Airport is the only reliable and international airport serving the basin.

Overall, the transport system faces challenges in the basin and this is negatively impacting on movement of agricultural produce and commodities. Most of the roads in the basin, especially earth roads, become impassable during the rainy season. Inadequate funding, for most of the district councils, has retarded road maintenance and rehabilitation in the districts of the basin.

4.10 Energy

The main hydropower generating stations for the country's energy needs are in the Shire River Basin are at Nkula, and Tedzani. Other sites such as at Mpatamanga and Kholombidzo, with potential for

power generation, exist in the Middle Shire. The demand for more energy is influenced by the rising population, urbanisation, rural electrification and industry. Growth of sectors of the economy such as agriculture, industry and tourism translate into more demand for energy to pump water. With hydropower ranking very high among Malawi's sources of energy, the sub-basins in the Shire River Basin have to be managed sustainably.

Charcoal production is another form of economic activity in the basin. Discussions with communities and district council officials in the basin indicated that charcoal production is carried out all year round, although it has been observed that from 2009, the demand for charcoal has been increasing due to the frequent electricity blackouts. Prior to 2009 the demand for charcoal has been highest between December and February because of loading shedding by ESCOM. Local communities engaged in charcoal production indicated that charcoal burning is at the moment a quick way of making money because of the high demand. During field investigations it was established that one bag of charcoal sells at a minimum of MK500 in the basin and in Blantyre City the same bag was selling as high as MK1500. It was also noted that natural trees in the Middle Shire River Basin are being more exploited for charcoal production, than in the Upper and Lower Shire. One informant interviewed, right after Thabwa Roadblock in Chikhwawa district, indicated that charcoal production is currently a more profitable business than agriculture. He said there is a ready market and he manages to feed his family and send his children to school from money realised from charcoal production.

The villagers themselves do use charcoal as they consider it a high value product compared with firewood. The main source of energy for the villagers is firewood. Firewood trading is carried out by both men and women; while charcoal trading is regarded as a men's activity. Income from charcoal is used to finance large household purchases such as fertilizers, while small household purchases for soap and salt etc. are usually met from firewood sales.

4.11 Gender Issues

4.11.1 General Observations

Gender refers to socially constructed roles, responsibilities and opportunities associated with men and women, as well as hidden power structures that govern the relationships between them. Inequality between the sexes is not due to biological factors, but is determined by the learnt unequal and inequitable treatment socially accorded to women.

In response to gender inequalities, the use of a 'gender lens' can help people, who implement and benefit from various projects, understand social processes; thereby ensuring that projects consider gendered differences and do not inadvertently perpetuate inequality. Throughout the world, there are gender-specific differences in consumption patterns, lifestyles, access to and control of resources and power, and vulnerability to environmental degradation (UNDP, 2008). According to the UNDP, the concept of gender in development recognizes that men and women often hold different positions and have different responsibilities; and decision-making authorities within the household and in the community play different roles in society, have dissimilar control over use of resources and often have different views and needs.

4.11.2 Gender Issues in the Basin

Assessment of gender issues in the basin revealed that men and women play different roles in the environment and natural resources management. A key feature is that men in most parts of the basin are not as mobile and therefore are often present at home and involved in day-to-day management of the household affairs. In areas around water bodies, most men are fishermen and are often absent from home. It was also established that subsistence farming is undertaken by both men and women, while production of cash crops is mostly done by men. Both men and women were

found to be engaged in casual labour but men dominated most of such activities. Female headed households experience challenges during peak time of agricultural production when labour demand is high. The female headed households had little support and could not afford to hire casual labour to support their agricultural activities.

The investigations also revealed that women have more access to most household assets, but have limited control over these assets, particularly those used in commercial or income generating activities. Income generating activities commonly undertaken by women include selling foodstuffs. A small number of women were engaged in firewood and charcoal selling. Formal employment in the basin was found to be largely dominated by men. To a larger extent, most of the women in the basin were found to be heavily dependent on their husbands for their livelihoods.

The investigations established that women's status is attributed to their participation in low-income activities, low access to resources such as land and capital, higher illiteracy rates compared to men and inadequate health facilities; implying that they become victims of maternal related deaths. In addition, the HIV and AIDS pandemic has had a more devastating impact on women as victims and as carers of HIV and AIDS victims. Many of the widows would have suffered property grabbing and become poorer after the death of a husband. Women are poorly represented in the micro-credit sector and are usually by-passed in a wide range of agricultural services, leading to commoditization of sexual relations as a survival strategy for women, further exposing them to the risk of the HIV infection.

4.11.3 Gender Mainstreaming and Support

During the field investigations, a gender analysis was done to one of the projects in Mwanza, to assess the gender distribution in terms of how women and men benefited from income generating activities. The project in Mwanza aims at providing alternative sources of livelihoods to selected communities in the district. It was observed that 60% of the project beneficiaries were men while the remaining 40% were women. Table 4.6 indicates the gender distribution in selected activities for the sampled project in Mwanza District.

Project Type	TA	Group Village Headman	Men	Women	Total
Briquette Making	STA Govati	Mgwedula	5	5	10
		Kalanga	5	5	10
	TA Nthache	Nthache	8	2	10
		N'gozo	7	3	10
		Kasuza	7	3	10
	TA Kanduku	Mulongolora	4	6	10
		Tulonkhondo	6	4	10
Kanduku		5	5	10	
Sustainable Land Management	STA Govati	Govati	8	2	10
		Kalanga	8	2	10
	TA Nthache	None	-	-	-
TA Kanduku	None	-	-	-	
Citrus Tree Planting	STA Govati	Kalanga	22	8	30
		Govati	6	5	11
	TA Nthache	None	-	-	-
	TA Kanduku	None	-	-	-
Orchard Management	STA Govati	None	-	-	-
	TA Nthache	Nthache	7	6	13
		N'gozo	9	5	14

		Kasuza	9	5	14
	TA Kanduku	Mulongolora	9	6	15
		Tulonghondo	7	8	15
		Kanduku	7	8	15
Vertiver Planting	STA Govati		-	-	-
	TA Nthache	Nthache	5	5	10
	TA Kanduku	Tulonghondo	4	6	10
TOTAL			148	99	247
PERCENTAGE			60	40	100

The above analysis gives a general overview of gender distribution in most community activities requiring the participation of both males and females in the Basin. These findings suggest the need for more integration of a gender perspective that considers the division of labour and sharing of benefits between men and women in development projects so as to equitably distribute work and benefits; and to facilitate equal access to and control of resources and community decision-making.

The findings demonstrate 40% women involvement in the community projects. This is a significant number considering that currently representation of women in parliament and other government organisations is at 23%. However, there is still need and demand to do more in order to accomplish the 50% national requirement for women representation in all community projects, as required by the Ministry of Gender Children and Social Services. The social welfare department and community development office in District Councils should be encouraged to continue including gender mainstreaming in programmes like Local leadership training programme, community-based population Education programme; women in development programme, community based population education which are being implemented in most districts in the basin, Mwanza inclusive (Mwanza District Socio_Economic Profile, 2007). In view of this, the Shire river Basin Management project, will strive to mainstream gender in all its activities, so that it will have women involvement that is equal to their male counterparts.

The finding further suggest improved national policies like those stipulated in the national gender policy 2007-2011 (pending) on implementation of programs which support and empower women.

4.12 Common Diseases

The most common diseases in the Shire River basin include malaria, pneumonia, diarrhoea, cholera and HIV and AIDS.

4.12.1 Malaria

Malaria is by far the most common serious disease and the leading cause of premature death in the Shire River Basin. High incidences of malaria are due to the presence of *Anopheles* mosquitoes, along with a lack of adequate prevention and control measures. Malaria cases are high during the rainy season, due to the many areas of standing water. Consultation with district health officials in the basin indicated that Malaria is the leading cause of morbidity in the basin.

4.12.2 Pneumonia

Pneumonia is one of the common diseases in the basin. The prevalence of HIV and AIDS is contributing to the high incidences of pneumonia-related diseases, especially among children under five.

4.12.3 Diarrhoea

Diarrhoea is one of the major killer diseases of children under five. It is most common during the rainy season when water sources are contaminated. This is a major challenge in the basin where access to potable water is still a problem; forcing people to use rivers and unprotected wells. Flash floods in the Lower Shire lead to water contamination, resulting in high incidences of diarrhoea.

4.12.4 Cholera

Incidences of cholera outbreak are common in the basin, mainly due to lack of safe water and unhygienic food handling practices. During rainy season, risks of cholera outbreak are very high due to contamination of water. Flooding in the Lower Shire also poses risks of cholera outbreaks in the region.

4.12.5 HIV and AIDS

Prevalence of HIV and AIDS is high, especially in the Upper and Lower Shire River basin. Economic activities along Lake Malawi Lake Malombe and along the Shire River are some of the factors contributing to high prevalence rates in some parts of the Shire River Basin. Due to lack of current national official data on HIV prevalence rate per district, the ESA in order to understand what is going on in the districts of the Shire River Basin as far as HIV and AIDS is concerned uses the National HIV prevalence and AIDS estimates report for 2010. However, only two clinics per district were included in this report, as such the district based distribution should be interpreted with caution. These prevalence figures are just indicative of what might be happening in the districts and are not representative of the general population in those districts (Ministry of Health, NAC 2010). The table below indicates prevalence rates in the basin based on Voluntary Counselling and Testing (VCT) services at district level.

District	Prevalence Rate (%)
Mwanza	9.7
Neno	12.5
Mangochi	10.9
Chikhwawa	11.7
Blantyre	17.8
Balaka	11.6
Nsanje	16.3
Machinga	13.4
Zomba	15.51
Ntcheu	11.8
Thyolo	22.4

Common economic activities such as fishing, tourism, and various project activities lead to high mobility of people within and outside the basin. Long distance labor contracts often imply that workers have to leave their families behind for extended periods, prompting them to engage in casual sex. These workers as well as their casual sex partners often have multiple sexual contacts, enhancing the risk of HIV-infection (Bryceson et al 2004; CHGA 2004; Drimie 2002; Epstein 2002; Freudenthal 2001; Garbus 2003; Marcus 1993; Ngwira et al 2001).

4.12.6 HIV and AIDS AND CULTURE

In the context of HIV and AIDS, culture constitutes a significant challenge to intervention due to a complex network of beliefs, values and practices, which promote behaviours that expose individuals, families and communities to HIV infection. Harmful traditional and cultural practices such as:

- *kulowa kufa* (literally translated as entering death) requires that a man must sleep with a woman whose husband or son has just died; or to inheriting the wife of his brother, son or nephew to put to rest the spirit of the deceased;
- *kusansa fumbi* (literary translated as removing dust). This ritual is practiced at the end of initiation ceremonies. Girls are told to identify any anybody to have sex with, to avoid getting pale (*kutuwa*);
- *fisi* (hyena) where if a husband is thought to be impotent, another man is 'requested' to sleep with his wife; and

Kudika (waiting) which involves a couple waiting for six months to resume sex after a child is born to avoid unknown sickness in the home)

These cultural practices are contributing to high HIV and AIDS prevalence rates in Basin Shire River Basin.

4.12.7 IMPACTS OF HIV AND AIDS IN THE SHIRE RIVER BASIN

Discussions with district council officials across the basin indicated that HIV and AIDS have had severe impacts on different levels of communities. Some of these impacts are:

- Loss of productive labour force
- loss of income earners in households
- More time spent on providing home based care for sick relatives than doing productive work
- An increased number of female headed households
- An increased number of orphans and demand for their care and support
- Strain on health services due to a high demand from those living with HIV and AIDS

However, it was worth noting during field investigations that introduction of anti-retroviral therapy, increased sensitization campaigns and encouraging people to go for VCT contribute to prolonging life of people living with HIV and AIDS (PLWA).

4.12.8 HIV and AIDS CHALLENGES

There are a number of challenges of HIV and AIDS that are met in specific districts of the Shire River Basin. These challenges (from the socioeconomic profiles of the districts) are generic and include the following:

- Long distance and high transport costs for PLWA to visit hospitals and clinics to access ARVs;
- Inadequate nutrition supplements;
- Very few NGOs actively involved in implementation of HIV and AIDS programmes;
- Lack of capacity in project formulation and monitoring by CBOs;
- Low participation in HIV and AIDS programme implementation by the faith based community and traditional medicine practioners;
- Inadequate capacities of the District AIDS Coordinating Committee to coordinate HIV and AIDS control and provide support to local civil society partners;
- Lack of human and financial capacity for CBOs to implement HIV and AIDS services and activities;
- Inadequate number of HIV testing counsellors; and
- Lack of HIV testing equipment in health facilities

4.12.9 HIV AND AIDS MAINSTREAMING

HIV and AIDS mainstreaming is targeted to improve understanding of the disease, its effects and how to access treatment and prevention. Programmes implemented in the Basin have been limited to awareness and prevention, which is not a strategic activity in Malawi, considering that universal awareness on HIV and AIDS has already been attained. There is very weak focus on behaviour change, which is the national priority (Cordaid, 2010) amongst program implementing partners in the Basin. According to Cordaid, only one partner had, further than awareness, done comprehensive HIV and AIDS activities in Chikhwawa. There is need therefore to train District Councils in HIV and AIDS mainstreaming concepts so that they can incorporate them in their resource mobilization for community programmes such as voluntary testing and counselling (VCT) services, prevention of mother to child transmission (PMTCT) of the virus, provision of antiretroviral therapy (ART), support of home based care and provision of health services. Implementers of the SRBMP have to be trained to incorporate HIV and AIDS reduction strategies in their programmes. Provision of condoms and information and provision of ART to employees living with AIDS would help mainstream HIV and AIDS in the construction activities. The district councils have the responsibility of coordinating community programmes (VCT services, PMTCT, ART, support of home based care and provision of health services) being implemented through Community Based Organisations (CBOs), Faith Based Organisations, (FBOs), support groups and the private sector. Institutions currently implementing some of these programmes include:

Organization	Areas Of Work			District
	ADVOCACY	TREATMENT, CARE & SUPPORT	IMPACT MITIGATION	
World Vision Malawi (WVM)	√	√	√	Mangochi, Neno Machinga, Zomba, Chikhwawa
Concern Universal (CU)			√	Balaka, Ntcheu
Adventist Development Relief Agency (ADRA)	√			Mangochi, Neno Machinga, Blantyre
Save the Children	√	√	√	Mangochi, Neno Machinga, Zomba Blantyre, Chikhwawa
Action Aid	√	√		Mwanza
Project Hope	√	√		Mwanza
Population Services International	√			Mwanza
Emmanuel International		√	√	Mangochi, Zomba
Catholic Development Commission (CADECOM)	√	√	√	Mangochi, Neno, Zomba
Malawi Carer	√			Mangochi
Self Help Development	√			Mangochi
Family Health International (FHI)	√	√	√	Mangochi
Coalition of Women Living with HIV and AIDS (COWLHA)	√	√	√	Nsanje

Table 4.8 Organisations implementing HIV/AIDS related activities in the basin				
Organization	Areas Of Work			District
National Association for People Living with HIV/AIDS in Malawi (Napham)		√		Machinga, Chikhwawa, Ntcheu
Dignitas		√		Machinga, Zomba
Youth Impact	√			Machinga
YouthNet and Counselling (Yoneco)	√			Zomba, Balaka
Malawi Red Cross			√	Zomba, Blantyre
Malawi AIDS Counselling and Resource Organisation (Macro)	√			Zomba, Blantyre
Centre for human Rights rehabilitation (CHRR)	√			Zomba
Women Legal Resources Centre (Wolerc)	√			Zomba
Bwalo Initiative	√			Zomba
Churches Action in Relief and Development (CARD)	√			Thyolo, Nsanje
Médicines Sans Frontières (MSF)		√		Chikhwawa Thyolo
Maphunziro Foundation	√		√	Balaka
Centre for Human rights and Institute for National Social Initiatives (Chinansi)	√		√	Balaka
Blantyre Synod Health and Development Commission	√		√	Balaka
Catholic Health Commission (CAHECOM)	√		√	Chikhwawa
Adolescent Girls Literacy (AGLIT)	√			Chikhwawa
Patient Welfare Foundation (PAWEM)	√			Chikhwawa
Friends of AIDS support Trust (FAST)	√	√	√	Nsanje
River of Life Evangelical Church (ROLEC)		√	√	Nsanje
Christian Orphan Outreach Mission (COOM)	√			Ntcheu

4.13 Main cultural and Archaeological Resources in the Shire River Basin

According to the Consultation with various stakeholders within the SRB, and also from literature, the main cultural/archaeological resources found in the Basin include the following:

4.13.1 Mbona Cult

Southern Malawi is known for its territorial cult devoted to Mbona. This cult has been thoroughly researched by Matthew Schoffeleers and a few before him using historical and ethnographic data. The Mbona cult is still in existence today, though reduced to its core ritual area around Nsanje Boma. In the not too distant past people would come from lands far into Mozambique in order to give sacrifice at the cult centre Khulubvi. The grove is inhabited by a number of priests and guardians and in the past by a female prophetess by the name of Salima, who is considered Mbona's wife. The sacrifice was aimed to ensure Mbona's mediation with God in the human longing for rain and general fecundity.

There is a wide corpus of myths about the origin of the cult, which generally involve a southerly flight by Mbona after having out-performed the authorities in a rain ceremony which triggered severe accusations of witchcraft. After a long journey, Mbona was beheaded at Ndione and his head was buried close by at Khulubvi where the cult was founded. Schoffeleers has divided the corpus in three main traditions, or streams.

4.13.2 Historical Sites in Lengwe National Park

The area of Lengwe was not always a designated National Park and the cultural history of the park is amazing. Archaeological and historical sites have been found in the park. The sites include the remains of villages abandoned in the park at the time of its creation (1970s). Lengwe is known to have impressive baobab trees and at the base of some of these trees, sacrificial pots dating from the 19th century have been found. In the Lengwe Extension Area, archaeological surveys have been conducted and they reveal iron smelting dated 18th century. The oldest remains in the Park are found at Mbwawala in form of an early Iron Age site dating from the 3-8th century AD. Around Nyala Lodge, some 14-16th century pot shreds associated with the Lundu settlement have been found; and that just outside the park, behind the Paramount Chief Lundu's residence, a sacred grove including a shrine was found at the place where, according to oral history, the first settlement of King Lundu was located. At this location, archaeological excavation however, has revealed 19th century material. On the other side of the current residence of Paramount Chief Lundu, evidence has been found that reveal King Lundu's possible first settlement dating as far back as the 11th century. At the Lundu shrine at Chifhunda Lundu, remains of rain sacrifices in the form of beer sacrifices, white and blue beads and even a human canine, dating from the 19th century have been found. Between the villages of Mphampa and Tomali, on the border of Lengwe, an early Iron Age settlement and a 14-16th century site were found. It is reported that the Tomali gravel pits located at Chomwa stream contain Middle Stone Age deposits of 20,000-100,000 year-old stone tools.

4.14 Proposed Development Projects in the Shire River Basin

The government of Malawi has a number of development projects planned for the Shire River Basin. Although these projects are actively being discussed at the moment, some of them are at the very early stages and in some cases without official written project concepts or proposals. For the SRBMP, it is important to note that development projects in the Basin are likely to continue and that these should also be designed and implemented with environmental sustainability in mind to enhance the developmental ideologies of the SRBMP. Some of the projects planned in the Basin are:

4.14.1 Irrigation Development

Irrigation is one of the technical interventions for alternative rural livelihoods that will be implemented under the SRBMP. Irrigation interventions are expected to gradually decrease dependency on unsustainable exploitation of forest (and wetland) products as sources of income by providing alternative option to secure incomes. It is expected that by the end of the project the value of agriculture related products marketed in the targeted areas will have increased by 15

percent. The SRBMP will finance specifically targeted small to medium scale irrigation schemes on both hills and flatter arable lands to assist farmers in drawing water from various water sources to support agricultural intensification, particularly related to agri-business development. Identification will be vetted by Department of Irrigation, and design and construction will where appropriate be outsourced as applicable to engineering firms and contractors. Irrigation and other infrastructure needs will be identified early in the program to allow successful completion of the schemes with adequate community input (in design, construction and management). Scheme development will include *a priori* market, community and environmental demand assessments, and will support establishment of water user groups/associations for operation and maintenance, as well as establish/strengthen marketing groups as appropriate. The project will be implemented in four districts namely Ntcheu, Zomba, Neno and Blantyre. The project proposes to develop 1670 hectares for smallholder irrigation.

4.14.2 Energy Development Projects

The Department of Energy is planning to implement small to medium scale energy production projects with the possibility to use water hyacinth as a raw material. Other potential initiatives include a thermo power plant using coal, solar applications and promotion of energy efficient cook stove to contribute to reduction in deforestation due to dependence on biomass fuel

4.14.3 The Shire Zambezi Waterway Development Projects

The Shire–Zambezi waterway project entails reopening the Shire and Zambezi rivers for navigation to provide a direct water transport link to landlocked Malawi. The project, which has been embraced by regional groupings, including the New Partnership for Africa’s Development, the Common Market for Eastern and Southern Africa and the Southern African Development Community, will also directly benefit Mozambique and Zambia. The government also wants to invest in the Nsanje airport infrastructure on a ‘build, operate and transfer’ (BOT) basis. In addition, the Nsanje water supply project will involve the identification of water sources and the construction of the associated water-supply intakes, in addition to the rehabilitation, upgrading and extension of the entire water-supply system in Nsanje town to meet the water requirements until 2020

CHAPTER FIVE: RELEVANT LEGISLATION AND THE WORLD BANK POLICIES

5.1 Malawi Legislation and Policies Relevant to SRBMP

Legislation, policies and instruments exist to support environmental management of the Shire River Basin. The Environment Management Act provides the legislative framework for ensuring environmental protection and other sector specific legislation is also available for environmental management of development projects; to avoid or minimize negative impacts on the environment.

5.1.1 The Constitution of the Republic of Malawi, 1995

The present Constitution of the Republic of Malawi came into force in 1995. Section 13 (d) sets a broad framework for sustainable environmental management at various levels in Malawi. Among other issues, it calls for prudent management of the environment and accords future generations their full rights to the environment.

In accordance with the provisions of the constitution, the primary aim of the Shire River Basin Management Project is to implement catchment management measures to restore and improve the environmental integrity of the basin. In addition, all the project activities of the SRBMP will be implemented in an environmentally sustainable manner, through various environmental safeguards including this ESA.

5.1.2 The Malawi Growth and Development Strategy II, 2011-2016

The Malawi Growth and Development Strategy (MGDS) II is the overall functioning medium-term plan for Malawi. Its main objective remains to reduce poverty and achieve the Millennium Development Goals. MGDS-II identifies six broad thematic areas namely: sustainable economic growth, social development, social support and disaster risk management, infrastructure development, improved governance, and cross-cutting issues. Theme number 2 of the MGDS - Social Development - seeks to improve the well-being of Malawians. It contributes to elimination of poverty and plays a key role in raising economic productivity of the country. Its main areas of concern are population, health, education, child development and protection, youth development and nutrition, which encompass HIV and AIDS management.

The SRBMP will implement a series of infrastructure investments that will stimulate economic growth and development for the basin. In implementing its projects to address the challenges in the Basin, the SRBMP will contribute to the goals of MGDS, especially:

- Theme (1) - Sustainable economic growth and in particular sub-theme (1.3) natural resources and environmental management and sub-theme (1.5) rural development;
- Theme (3) - Social support and disaster risk management, including sub-theme (3.2), disaster risk management;
- Theme (4) - Infrastructure development; and
- Theme (6) Cross-cutting issues including sub-theme (6.2) capacity development.

5.1.3 The Malawi Bureau of Standards, MS 539:2002

The Malawi Bureau of Standards MS 539:2002 has set the minimum tolerance of industrial discharge into inland surface waters at nil for insecticides. This requires compliance by the major agricultural investors in the basin. The growing of cash crops in the basin and on the upland areas poses a great risk to the quality of water since the majority of these crops require application of fertilizers and

pesticides. The fertilizers, pesticides and or herbicides may enter the water drainage system through runoff, especially during the rainy seasons.

5.1.4 The National Environmental Action Plan, 2002

The National Environmental Action Plan (NEAP), developed in 1994 and revised in 2002, provides the framework for integrating environmental protection and management in all country development programmes, with the view to achieving sustainable socio-economic development.

Through the SRBMP, catchment management and rehabilitation of degraded lands will be implemented to protect the natural resources base. In addition, improved regulation of flow in the Shire River will complement the environmental protection and management measures needed to achieve sustainable development, as required by the NEAP.

5.1.5 National Environmental Policy, 2004

Based on the findings of the NEAP, a National Environmental Policy (NEP) was developed in 1996 and revised in 2004. The NEP highlights areas of priority, including efficient utilization and management of natural resources and also emphasises the following:

- Promotion of private sector, NGO and community participation to achieve sustainable environmental management; and involvement of local communities in environmental planning (Sub section 2.2 (7));
- Empowering the communities to protect, conserve and sustainably utilize the nation's natural resources (Sub section 2.2 (5));
- Advocating enhancement of public awareness and promotion of public participation; and
- Cooperation with other Governments and relevant international and regional organizations in the management and protection of the environment (Sub section 2.2 (9))

The overall policy goal is the promotion of sustainable social and economic development through sound management of the environment in Malawi. In line with the requirements of the NEP, the SRBMP is integrating environmental management and protection during project planning and implementation. Section 4.1 i) provides the basis for participation of the local communities in the management of natural resources and the environment. Section 2.3d of the NEP recommends effective participation of women in policy, programme and project design and implementation. It also recommends Environmental Impact Assessments that consider biophysical impacts as well as environmental impacts in terms of existing social, health, economic, political and cultural conditions including HIV AND AIDS (Section 4.4 b)

5.1.6 EIA Guidelines, 1997

The EIA Guidelines, published in 1997, outline the process for conducting EIAs to ensure compliance with the EIA process by project developers, as required in the Environment Management Act. The Guidelines provide a list of prescribed projects for which EIA is mandatory and those that may not require an EIA (appendix B). The Guidelines assist in integrating environmental concerns into the project development plans for both the public and private sectors.

The SRBMP activities will be screened to identify project activities to be subjected to EIAs in the proposed project locations. EIAs will be conducted, as appropriate, for the project activities that qualify, by following the process outlined in the Guidelines.

5.1.7 Decentralization Policy, 1998

The Decentralization Policy, developed in 1998, devolves administrative and political authority to the district level, in order to promote popular participation. It assigns certain responsibilities to district councils. One of the key responsibilities is to assist the government in the management and preservation of the environment and natural resources.

This policy is useful for the implementation of the SRBMP, as it supports the creation of different sectoral committees at all levels of the district, to ensure participation of local institutional and community stakeholders.

5.1.8 National Forest Policy, 1996

This policy aims at promoting sustainable contribution of national forests, woodlands and trees towards improvement of the quality of life by conserving the resources for the benefit of the nation and to the satisfaction of diverse and changing needs of the Malawi population. Specifically, the policy aims at:

- A) Contributing towards improving the quality of life in the rural communities and providing a stable local economy, in order to reduce the degenerative impact on the environment that often accompanies poverty (Section 2.2.2) by:
- Promoting graded skill and proven methods for utilizing forest products and introducing value-adding processes to popularise their commercial values;
 - Encouraging the establishment of investment incentives to promote the development of small and medium scale industries in the rural areas and offer employment opportunities to the rural communities;
 - Promoting increased forestry production per unit area of land, and controlled utilization of over-mature trees;
 - Facilitating licensed grazing and access to grazing; and the collection of non-timber forest products; and
 - Encouraging agro forestry to improve land fertility with respect to nitrogen, with minimum need to increase the use of expensive imported nitrogenous fertilizers; and to meet some of the farmers needs for fuel wood and fodder.
- B) Establishing appropriate incentives that will promote community-based conservation and sustainable utilization of the forest resources, as a means of alleviating poverty; and promoting on-farm trees; and fostering the growing of trees by all sections of the communities, in order to achieve sustainable self-sufficiency of wood and forest-derived products (Sub section 2.2.3) through:
- Promotion of communal/individual ownership of forests and forest resources;
 - Promotion of the establishment of nurseries by communities and individuals; and the increase in the diversity of species;
 - Encouragement and enhancement of community and individual marketing of seeds, seedlings and other forest products; and
 - strengthening and maintenance of regular reward system for tree planting and improving the public information system

One of the primary aims of the SRBMP is to ensure that the development and use of forest and water resources meets the needs of the present generation and considers the needs of future generations for all the beneficiaries and stakeholders.

5.1.9 National Parks and Wildlife Policy, 2000

The aim of the National Parks and Wildlife Policy is to ensure proper conservation and management of wildlife resources, to provide for sustainable utilization and equitable access to the resources; and the sharing of benefits arising from the use of the resources for both present and future generations. One of the policy objectives is to ensure adequate protection of ecosystems and their biological diversity, through promotion and adoption of appropriate land management practices that adhere to the principle of sustainable use (Chapter 2 (i)).

The policy recognises the Poverty Alleviation Programme and any efforts that target the eradication of poverty so as to remove poverty driven pressures on protected areas and wildlife reserves (Chapter 2, sub section (ix)). It empowers communities to manage wildlife resources on communal land, to support the management of national parks, wildlife and forest reserves and to be involved at all stages of planning and implementation (Sub section 3.2)

The SRBMP will benefit from the above and other provisions of the Policy since the broad objectives of the project are in line with the Policy provisions.

5.1.10 National Land Policy, 2002

The National Land Policy is the principal policy that guides land management and administration in Malawi. The policy introduces major reforms intended for land planning, use, management and tenure. It provides clear definition of land ownership categories (Section 4), and addresses issues of compensation payment for land (Sub section 4.6).

The policy has provisions for environmental management, urban management of solid and liquid wastes, protection of sensitive areas, agricultural resource conservation and land use, community forests and woodland management. Of particular importance are the requirements in Sub section 9.8.1(b) of the policy, that EIA studies shall be mandatory before any major land development project is carried out; and in Section 9.8.1(c) that development activities in vulnerable ecosystems such as wetlands, wildlife reserves, forest reserves and critical habitats will only be permitted after the appropriate authority has conducted an EIA study and after the appropriate approvals have been granted.

The SRBMP has to adhere to the requirements of this policy to achieve sustainable management and protection of natural resources.

5.1.11 National Water Policy, 2005

The National Water Policy (2005) empowers the minister responsible for water affairs in the country, to put in place sustainable mechanisms to ensure that water is of acceptable quality and is accessible to all Malawians at all times. The policy advocates for an integrated approach to the management of water resources, thereby recognizing the importance of other policies and laws for achieving its goals.

The relevance of this policy to the SRBMP is where the proposed project activities might affect aquatic ecosystems either positively or negatively. If not properly managed, the activities of the SRBMP may lead to the degradation and depletion of water resources, thereby counteracting the principles of the policy. Therefore it will be vital for the ministry responsible for water affairs, as a key stakeholder, to ensure that the project activities are adequately monitored to protect water

resources. In this context, appropriate administrative arrangements have to be in place during and after the project activities to ensure that there is adequate integration between and among stakeholders.

5.1.12 National Irrigation Policy and Development Strategy, 2000

The National Irrigation Policy and Development Strategy provides a clear statement of the government's aspirations for the irrigation sector and highlights the strategy for attaining irrigation objectives. One of the objectives of the Policy is to contribute to poverty alleviation, by targeting smallholder farmers for irrigation development, to enhance farm income (Section 4 (1)). The Policy empowers the government to improve the quality of irrigation education at all levels (Chapter 5)

Components of the SRBMP will improve availability of water for irrigation. The SRBMP also targets to improve livelihoods of people living in the Basin through mini and small-scale irrigation. The National Irrigation Policy will therefore be paramount in guiding the SRBMP in the irrigation activities for which the Department of Irrigation will be consulted from time to time.

5.1.13 National Sanitation Policy, 2000

The National Sanitation Policy provides a framework for development of programmes and initiatives that address sanitation and Hygiene challenges. It provides guidelines for the development of an Investment Strategy that will be supported by development partners under a Sector Wide Approach for Sanitation. The main goal of the NSP is to promote improved sanitation and safe hygiene practices for improved health and socioeconomic development for the people of Malawi (Chapter 2 (4)). The Policy advocates for promotion of improved sanitation and hygiene education in all communities (Section 3.2.3.13). The Policy also recommends delivery of structured health and hygiene education using participatory methods (Section 3.3.3.10).

The Policy recommends that a National Water Resources Authority, that shall have the mandate to give guidance on the use and management of resources, including water, be established as the overall overseer of activities within each basin in the country (Section 9.2). Water utilities, government ministries and in particular, ministries responsible for local government, agriculture, irrigation, natural resources, health, gender, the youth and community services, education, lands, physical planning and human settlements and others such as NGOs, civil society organisations, the private sector and academic institutions shall closely liaise and collaborate with the National Water Resources Authority; in pursuance of strengthening Integrated Water Resources Management within each catchment including the Shire River Basin (sections 9.4 to 9.12).

The SRBMP will have to adhere to the provisions of the NSP to improve sanitation and hygiene by sensitizing communities (e.g. in the Lower Shire) of the negative health and hygiene impacts associated with flooding).

5.1.14 The Environment Management Act, 1996

The Environment Management Act of 1996 requires every person to take all necessary and appropriate measures that promotes the protection and management of the environment and the conservation and sustainable utilization of natural resources. The Act outlines the EIA process to be followed in Malawi and requires that all project developers in both the public and private sectors comply with the process and also prescribes the types and sizes of projects that should be subjected to EIA (Section 24). It defines the powers, functions and duties of the Director of Environmental Affairs (DEA) and the Environmental Affairs Department (EAD), in implementing the EIA process (Sections 25-28).

In the SRBMP, some of the project activities may fall under the list of prescribed projects as determined by the EIA Guidelines. Hence, EIA studies will be conducted for these activities before implementation. Since the project locations and the extent of project activities are not exactly known at this time, an ESMF has been prepared for environmental and social screening and to determine the level of environmental work required for sub-projects.

5.1.15 Water Resources Act, 1969

The Water Resources Act (1969) deals with control, conservation, apportionment and use of the water resources of Malawi. Of relevance to the project is Section 16 of the Act which states that it is an offence for any person to interfere with, alter the flow of, or pollute, or foul any public water.

This Act requires that the programmes and projects under the SRBMP avoid water degradation and depletion when developing and implementing the sub projects.

5.1.16 Forest Act, 1997

The Forest Act (1997) provides guidelines and regulations for the management of indigenous forests on customary and private land, forest reserves and protected forest areas, woodlots and plantation forestry. It also provides for cross-cutting issues including law enforcement and fire management.

Part III, Section 25 deals with co-management of forest reserves and states that the Director of Forestry may enter into agreement with local communities for implementation of the management plan that is mutually acceptable to both parties.

Section 26 says that:

- (1) Where the Minister finds that the protection of soil and water resources, outstanding flora and fauna requires that any area of land be maintained or established as a forest, he may, by order in the Gazette, after consultations with the Minister responsible for land matters, the Minister responsible for agriculture, the Minister responsible for Irrigation and Water Development, the owner or occupier and in case of customary land, the traditional authority, declare such land to be a protected forest area.
- (2) Where the Minister considers that land which requires protection as a forest reserve or protected forest area is liable to serious degradation if not immediately protected, he may declare such land to be a protected forest area for such period not exceeding one year as may be necessary to complete the consultations required by section 22 subsection (I).

Section 27 says that a declaration, made under section 26, shall state the measures required for protection of the areas, the assistance to be provided by the Department of Forestry towards accomplishing such measures and the obligations of the owner, occupier or traditional authority to maintain and protect the forest resources of the area.

Under Section 28:

- (1) The Director of Forestry may recommend to the Minister to revoke or modify, by notice published in the Gazette, a forest reserve or protected forest area with respect to any land and the Minister shall first require a comprehensive environmental impact assessment.
- (2) The Minister may, by notice published in the Gazette, amend such order the purpose of which is to delineate or excise land from a forest reserve or protected forest area, subject to advice from the Board.

- (3) Any environmental impact assessment made pursuant to the provisions of subsection (1), shall investigate the ecological consequences of proposed modification and the report of the assessment shall be submitted to the Minister together with the advice of the Director of Forestry within ninety days of completion of the assessment being made.
- (4) The Minister shall not decide upon a proposal related to revocation or modification of a forest reserve or protected forest area until he is in receipt of the report referred to in subsection (3).

Part V – Customary Land Forest of the Act, Section 29 provides for promotion of participatory forestry on customary land through protection, control and management of trees and forests by the people on customary land, the demarcation and management of village forest areas, ownership of indigenous forest trees, establishment of tree nurseries and regulation of forest produce.

Section 30 gives powers to any village headman, with the advice of the Director of Forestry, to demarcate on unallocated customary land, a village forest area which shall be protected and managed in the prescribed manner, for the benefit of that village community. Section 31 gives provisions under which the Director of Forestry may enter into a forest management agreement with a management authority; and Section 32 gives powers to the Minister to make rules which shall apply to all customary land outside forest reserves and protected areas.

Part VI, Sections 35 to 37, provides for the promotion of tree growing in forest reserves, public land, customary and private land by the Government, non-governmental organizations and the community; while Part VII, Sections 38 to 44 provides for the protection of trees, forest and forest produce against fires, pests and diseases.

Licensing and control for sustainable use of forest land and utilization of forest produce on customary land, public land, forest reserves and protected forest areas is provided for in Part VIII Sections 45 to 54, while Part IX provides for the establishment of the Forest Development and Management Fund to be vested in the Minister and administered in accordance with his directions, subject to the provisions of the Finance and Audit Act.

Part X, Sections 63 to 75, defines the offences against the Act and provides the penalties; and Part XI, Sections 76 to 80 provide for the promotion of the management of cross-border forests and forest resources and implementation of agreed national obligations arising from bilateral, regional and international environmental and other related Conventions to which Malawi is a party.

The SRBMP will comply with and benefit from the provisions of this Act in all areas where the planned project activities will be implemented.

5.1.17 Fisheries Conservation and Management Act, 1997

The Fisheries Conservation and Management Act has provisions for the regulation, conservation and management of the fisheries of Malawi and for matters incidental thereto. It provides for the appointment of the Director of Fisheries and other officers to be responsible for the conservation, management and protection of fish. The Fisheries Advisory Board, established under the provisions of the Act, has the responsibility to advise the Minister on the development, administration and conservation management of fisheries of Malawi.

Part III, Sections 7 to 8 of the Act provides for local community participation in conservation and management of fisheries in Malawi; and states that for proper management of fisheries, the Director may enter into a fisheries management agreement with a fisheries management authority.

Part IV, Sections 10 to 11 requires every owner of a local registrable fishing vessel, who intends to use the vessel for fishing, to apply to the Director for registration in the prescribed manner; and Part V, Sections 12 to 13, prohibits the use of foreign fishing vessels for commercial fishing in the fishing waters, unless the owner or charterer thereof is authorized to fish by a licence granted under Part VI, Sections 14 to 18 of the Act, which details the fishing conditions and controls.

Part VIII, Section 20 to 21 provides the conditions for establishing and operating an aquaculture; requiring a permit to be obtained and the rights to use the waters to be granted by the appropriate authority.

Part XI Sections 22 to 29 provides for the establishment of the Fisheries Fund to be vested in the Minister and subject to this Act, to be administered in accordance with his directions; subject to the provisions of the Finance and Audit Act.

Enforcement of the provisions of the Act and the general powers of fisheries protection officers relating to fishing vessels and fishing practices are provided in Part X, Sections 30 to 40; while applicable offenses are detailed in Part XIII, Sections 52 to 55

Part XII, Sections 46 makes provisions for international co-operation and states that the Minister may, on the recommendation of the Board, enter into fisheries access agreements with other foreign states, providing for allocation of fishing licences to commercial fishermen of such states

The Act identifies issues such as restoration and improvement of spawning grounds impacted by siltation and changing water flow regimes; retention of the unique biodiversity of Shire River Basin and its protection from pollution.

The SRBMP will take these issues into account, through the various safeguard instruments being prepared, to ensure that the project does not adversely affect fish resources. This is critical especially with respect to the project activities in the entire Shire River Basin.

5.1.18 Pesticides Act, 2000

Upon the realisation of the importance of having regulation on the use of pesticides, the Pesticides Act, 2000 for Malawi was accepted by Parliament. This Act enables Malawi to control the import, export, manufacture, distribution, storage, disposal and use of pesticides. Establishment of the Pesticides Control Board was accomplished and the office of the registrar is responsible for enforcement of the law to facilitate the following outputs / results:

- Registration of all marketed pesticides in Malawi; (Section 10 (2))
- Registration of all pesticides according to the crops and the target pests and diseases; (Section 10 (2))
- Documentation of all import permits and licenses for selling and storage of pesticides; (Section 10 (2))
- Conducting stakeholders' workshops to create awareness to the general public on safe usage of pesticides (Section 11 (d))
- Carrying out formulation control in collaboration with the Malawi Bureau of Standards;
- Harmonization of pesticides registration through international bodies such as SEARCH;
- Labelling of pesticides containers according international standards; and
- Carrying out appropriate disposal of obsolete stocks of pesticides.

5.1.19 Local Government Act, 1998

The Local Government Act was enacted to further democratic principles, accountability, transparency and participation of the Malawian people in the decision making and development process. According to the Act, District Councils have the mandate to:

- Promote infrastructure and economic development (Section 6 (c));
- Establish, maintain and manage services for the collection, removal and disposal of solid and liquid waste. (Second Schedule 2 (a)); and
- Compel and regulate the provision, construction, use, maintenance and repair of drains, latrines and receptacles for solid and liquid waste (Second Schedule 2 (b))

The proposed construction works in the SRBMP will generate both solid and liquid waste. Hence there is need for contractors to work with district councils in waste management and disposal; and in other areas, in line with the provisions of the Act.

5.1.20 Energy Laws

The energy laws were passed to establish the Energy Regulatory Authority, to define its functions, duties and powers; and to provide for licensing and other matters related to energy undertakings. The Malawi Energy Regulatory Authority (MERA), under this Act, implements strategies to minimise environmental impact of exploration, production, transportation, storage, supply and use of energy (Section 9 subsection 2(h)). The Energy Regulation Act facilitates enforcement of performance and safety standards for energy exploration, production and distribution.

Component C of the SRBMP aims to address energy shortfalls through upgrading of the Kamuzu barrage and optimising operations to improve critical downstream hydropower generation and to reduce interruptions. Component B aims at sustaining forestation and rural energy interventions to ensure continued supply of alternative biomass resources and fuel. The Energy Regulation Act will play a vital role in the implementation of these project components and in other projects related to energy production.

5.1.21 Occupational Safety, Health and Welfare Act, 1997

The Occupational Safety, Health and Welfare Act has provisions for regulation of the conditions of employment in workplaces; with regard to the safety, health and wellbeing of employees. The Act provide for inspection of plant and machinery, for the prevention of accidents in work places including government establishments and operations as well as building and engineering construction works (Section 5).

The SRBMP will have take the Occupational Safety, Health and Welfare Act into consideration when implementing its various on construction works, infrastructure investments and forest and water management, among others. Workers will have to be provided with appropriate protective clothing, breathing masks and goggles where they are exposure to injurious and offensive substances (Section 58, 59, 60).

5.1.22 The Land Act, 1965

Part (v) of the Land Act provides for acquisition of customary land in the interest of the public. Section 27 (1) of the Act states that “whenever it appears to the minister that any customary land is required for a public purpose, that is to say a purpose which is for the benefit, direct or indirect, of the community as a whole or part of the community, he may declare, by notice under his hand and published in the Gazette, that such land is public land, and thereupon such land shall become public: *provided that this subsection shall not apply to any customary land required for use as a public road*

or for the widening or diversion thereof, but such land shall be acquired for such purpose under or in accordance with the Public Roads Act”.

5.1.23 Town and Country Planning Act, 1988

This Act is administered by the Commissioner for Physical Planning. The Act is very important for managing land use in Malawi. The Act guides regulation of development with respect to location, to ensure compatibility of land use components over a project area. It facilitates protection and sustainable utilization of natural resources through optimal use of land and related service infrastructure.

The Act provides guidelines for physical development planning and development control and has provisions for environmental protection. It prescribes measures for approval of plans for any development. Under Section 40 of the Act, local councils are required to ensure that negative environmental impacts of projects are avoided or mitigated. The planning committees, under the local councils, use this provision as a condition for the granting of development planning permission.

The Town and Country Planning Act will provide guidance to ensure that the SRBMP optimally utilizes and manages land resources and that the proposed development activities are compatible with the land use planning.

5.2 World Bank Safeguard Policies

The proposed Shire River Basin Management Project has triggered eight of the 10 World Bank’s operational safeguard policies as follows:

5.2.1 Environmental Assessment (OP/BP 4.01)

The objective of OP 4.01 is to ensure that World Bank-financed projects are environmentally sound and sustainable, and that decision-making is improved through appropriate analysis of actions and mitigation of their likely environmental impacts. This policy is triggered if a project is likely to have potential adverse environmental impacts and risks in its area of influence.

The World Bank’s classification of projects, with respect to significance of environmental and social impacts is as follows:

(a) Category A: A proposed project is classified as Category A if it is likely to have significant adverse environmental and social impacts that are sensitive, diverse, or unprecedented. These impacts may affect an area broader than the sites or facilities, subject to the physical works. Environmental Assessment (EA) for a Category A project examines its potential negative and positive environmental and social impacts, compares them with those of feasible alternatives (including the "without project" situation), and recommends any measures needed to prevent, minimize, mitigate or compensate for adverse impacts and improve environmental and social performance. For a Category A project, the borrower is responsible for preparing safeguard documents, normally either a framework (ESMF, where the project intervention footprint has not yet been clearly defined; or an ESIA, or a suitably comprehensive or sectoral EA) that includes as necessary, elements such as environmental audits, hazard or risk assessments when the intervention footprint and zone of project influence is known.

(b) Category B: A proposed project is classified as Category B if its potential adverse environmental and social impacts on human populations or environmentally important areas - including wetlands, forests, grasslands, and other natural habitats - are less adverse than those of Category A projects. These impacts are site-specific and easy to deal with; few if any of them are irreversible; and in most

cases appropriate mitigatory measures can be designed more readily than for Category A projects. The scope of EA for the Category B project may vary from project to project but it is narrower than that of Category A project. Like Category A EA, it examines the project's potential negative and positive environmental and social impacts and recommends measures needed to prevent, minimize, mitigate, or compensate for adverse impacts and improve environmental and social performance.

(c) Category C: A proposed project is classified as Category C if it is likely to have minimal or no adverse environmental and social impacts. Beyond screening, no further EA is required for a Category C project.

(d) Category FI: A proposed project is classified as Category FI if it involves investment of Bank funds through a financial intermediary, in subprojects that might result in adverse environmental impacts.

Construction and rehabilitation of infrastructure for the SRBMP is likely to have environmental and social impacts, which require mitigation. Therefore, in line with the Operational Policy, the overall SRBMP is classified as Category A, mainly because of the Kamuzu Barrage upgrading (Component C.1) at Liwonde. The remaining activities to be carried out under the SRBMP are consistent with a Category B classification. Other than the Kamuzu Barrage, the SRBMP is not expected to fund any investments that have been classified as Category A, based on the screening results.

5.2.2 Involuntary Resettlement (OP/BP 4.12)

OP 4.12 applies to all land acquisition and any changes in access to resources due to a sub-project. The policy applies whether or not affected persons must move to another location. The objective of OP 4.12 is to avoid or minimize involuntary resettlement where feasible, by exploring all viable alternative project designs. Where resettlement is unavoidable, OP 4.12 is intended to assist displaced persons in maintaining or improving their living standards. It encourages community participation in planning and implementing resettlement and in providing assistance to affected people. This policy is triggered not only if physical relocation occurs, but also by any taking of land resulting in: (i) relocation or loss of shelter; (ii) loss of assets or access to assets; and (iii) loss of income sources or means of livelihood, whether or not the affected people must move to another location. The Bank's policy requires a full Resettlement Action Plan (RAP) if over 200 people must be relocated or if these people are not physically displaced but lose over 10% of their assets due to the project. If the impact is less than this an Abbreviated Resettlement Action Plan should be prepared instead. The nature and scale of sub-projects, proposed under SRBMP, mean that only minimal displacement is envisaged. Nevertheless, the Environmental and Social Screening Form ESSF in the ESMF provides criteria for determining the need for resettlement. Additionally, a Resettlement Policy Framework with a Process Framework (RPF+ PF) has been prepared for SRBMP to guide on any resettlement related assistance that might be needed.

5.2.3 Natural Habitats (OP/BP 4.04)

This policy recognizes that conservation of natural habitats is essential to safeguard their unique biodiversity and to maintain environmental services and products for human society and for long-term sustainable development. Therefore it supports the protection, management and restoration of natural habitats in its project financing, as well as policy dialogue and economic and sector work. It also supports, and expects a precautionary approach to be applied to natural resources management to ensure opportunities for environmentally sustainable development.

Natural habitats are land and water areas where most of the original native plant and animal species are still present. They comprise many types of terrestrial, freshwater, coastal, and marine ecosystems and they include areas lightly modified by human activities, but retaining their ecological functions and most native species.

This policy is triggered by any project (including any sub-project under a sector investment or financial intermediary) with the potential to cause significant conversion (loss) or degradation of natural habitats, whether directly (through construction) or indirectly (through human activities induced by the project).

Example of some of the existing natural habitats found in the Shire River Basin that might be affected; by the proposed SRBMP include the following:

5.2.3.1 Upper Shire Basin

- Brachystegia wood found in Mangochi Forest Reserve,
- Palm Forest found south of Mangochi Boma
- Floating meadows, lagoons and reed swamps found along the Shire River
- Floodplain grasslands
- Mopane woodland mainly found in Liwonde National Park
- Mixed woodlands dominated by Brachystegia tree species found in rocky hills of Chilole, Nafiulu, and Chinguni in Machinga District
- Riverine semi-deciduous forest/thicket dominated by Acacia tree species

5.2.3.2 Middle Shire River Basin

- Floating meadows, lagoons and reed swamps
- Mixed deciduous woodlands dominated by tree species from the family of *Caesalpinacea-Brachystegia*, *Julbernardia* and *Isoberlinia*
- *Brachystegia* woodlands found in forest reserves such as Tsamba, Thambani Michiru Forest reserves.

5.2.3.3 Lower Shire River Basin

- Mixed deciduous *Brachystegia* woodlands, also known as *Miombo* or savannah woodland found in Majeti Wildlife Reserve, Lengwe National Park, Mwabvi Wildlife Reserve
- *Pterocarpus lucens* or Mpanje Forest woodland found in Lengwe National Park and Mwabvi Wildlife Reserve
- Thicket/forest, dominated by *Acacia* tree species, is mainly found in protected areas (Lengwe National Park, Majeti Wildlife Reserve and Mwabvi Wildlife Reserve) in the Lower Shire Valley
- Woodland savannah
- Grassland savannah dominated by grasses
- Thickets dominated by *Acacia nigrescens*
- Elephant and Ndindi Marshes

Although some of the proposed project activities of the SRBMP may affect natural habitats, the overall objective of the SRBMP is to improve sustainable utilization of natural resources management and promote sustainable development in the basin.

5.2.4 Forests (OP/BP 4.36)

This policy focuses on the management, conservation, and sustainable development of forest ecosystems and their associated resources. It applies to projects that may (i) have impacts on the health and quality of forests; (ii) affect the rights and welfare of people and their level of dependence upon or interaction with forests; or (iii) bring about changes in the management, protection, or utilization of natural forests or plantations, whether they are publicly, privately or

communally owned. The Bank does not support the significant conversion or degradation of critical forest areas or related critical natural habitats.

This policy is triggered by activities and other Bank sponsored interventions, which have the potential to impact significantly upon forested areas. The SRBMP seeks to improve forest conservation and management within selected catchment areas.

5.2.5 Safety of Dams (OP/BP 4.37)

This policy focuses on new and existing dams. In the case of new dams, the policy aims at ensuring that (i) experienced and competent professionals design and supervise construction and (ii) the responsible agency adopts and implements dam safety measures for the dam and associated works. In the case of existing dams, the policy ensures that any dam upon which the performance of the project relies is identified, a dam safety assessment is carried out, and necessary additional dam safety measures and remedial works are implemented. The policy also recommends the preparation of a generic dam safety analysis for small dams.

This policy is triggered if the project involves the construction of a large dam (15 m or higher) or a high hazard dam; if a project is dependent on an existing dam, or a dam under construction. For small dams, generic dam safety measures designed by qualified engineers are usually adequate.

For Component C of the SRBMP, the planning of new dams or rehabilitation of existing dams will need to take into account this policy. Also, the Kamuzu Barrage upgrading will follow this policy, given the barrage's strategic economic importance (even though with a height of approximately 4m which is much less than 15m high).

In the case of the Shire River Basin, it is necessary to consider the following issues that are essential in the design of hydraulic structures such as dams:

- Geology of the area with emphasis on the structure of the underlying material;
- Examination of local seismic activity data to determine the design and size of the dam and material to be used;
- Comprehensive risk assessment in the event of dam failure and what impacts such a failure would have on people, property and the environment;
- Risk reduction plans that would be used to mitigate the impacts of any disaster that would arise from such potential dam failure;
- Provision of local capacity in dealing with disasters;
- The effects of the structure on the local geology as to whether it could trigger localised seismic activities; and
- Impacts on the present and future projects, upstream and downstream of the area.

Cognisance of these issues is important to avoid or reduce the risks that are associated with dams. Careful planning, construction and frequent inspections and maintenance may prevent large-scale losses in terms of human life and property.

5.2.6 Projects on International Waterways (OP/BP 7.50)

Projects on International Waterways may affect the relations between the World Bank and its borrowers, and between riparian states. Therefore, the Bank attaches great importance to the riparian countries' making appropriate agreements or arrangements for the entire waterway or parts thereof, and stands ready to assist in this regard.

In the absence of such agreements or arrangements, the Bank normally urges the beneficiary state to offer to negotiate in good faith with the other riparian states to reach appropriate agreements or arrangements. The Policy lays down detailed procedures for the notification requirement, including the role of the Bank in effecting the notification, the period of reply and the procedures in case there is an objection by one of the riparian countries to the project.

The SRBMP has triggered this policy because (i) the Shire River is a shared water body with Mozambique; (ii) the Shire River is a tributary of the Zambezi River; and (iii) Lake Malawi (headwaters of the Shire River) is shared with Mozambique and Tanzania. Malawi, Tanzania, Mozambique, Namibia, Angola, Zimbabwe, Botswana and Zambia are co-riparian countries of the Zambezi River of which the Shire is a tributary.

5.2.7 Pest Management (OP 4.09)

This policy promotes the use of integrated pest management (IPM) techniques that seek to minimize synthetic pesticide use, as well as safe use, handling, storage, and disposal of pesticides in general.

This policy applies to the SRBMP since certain catchment management and alternative livelihood promotion activities might promote small-scale irrigation or other production systems where pesticides are used. In such special cases, the relevant sub-project investments will include technical assistance to farmers to promote IPM, as well as safer pesticide use where needed. However, the Project will not procure any pesticides. It also does not involve complex pest management issues that would require a separate Pest Management Plan.

5.2.8 Physical Cultural Resources (OP/BP 4.11)

This policy addresses physical cultural resources (objects, sites, structures, groups of structures, and natural features and landscapes) that have archaeological, paleontological, historical, architectural, religious, aesthetic, or other cultural significance. They may be located in urban or rural settings, and may be above or below ground. The procedures to address impacts on physical cultural resources in projects proposed for Bank financing should follow the EA process (see OP 4.01 and EIA regulation). The following projects are subject to the provisions of this policy: (a) any project involving significant excavations, demolition, movement of earth, flooding, or other environmental changes; and (b) any project located in, or in the vicinity of a physical cultural resources site recognized by the borrower. The policy is triggered in that investments may occur in areas that contain archaeological relics, fossils, or other physical cultural resources. Examples of some of cultural/ archaeological sites that might be affected by the proposed Shire River Basin Management Project include Chingwe Hole on Zomba Mountain in the Middle Shire; and in the Lower Shire River Basin are the “Mwala Wa Mpini” in Thyolo District, early iron smelting site in Lengwe national Park, Lundu shrine at Chifhunda Lundu, where remains of rain sacrifices in the form of beer sacrifices, white and blue beads and even a human canine have been found on the outskirts of Lengwe National Park, Mbona shrines (Welling 2005) still in existence at Nsanje Boma etc.

As an integral part of the EA process, the borrower develops a physical cultural resources management plan that includes measures for avoiding or mitigating any adverse impacts on physical cultural resources, provisions for managing chance finds, any necessary measures for strengthening institutional capacity, and a monitoring system to track the progress of these activities.

Some of SRBMP target areas are located, on a small-scale, in or near natural features and landscapes (e.g. archaeological sites). In the event that any such items are uncovered during construction of the Kamuzu Barrage or in other SRBM project-supported civil works, contractors and construction workers would be required to follow the procedures, as specified in the ESIA for the Kamuzu Barrage and the ESMF for the overall project.

5.3 Comparison of the World Bank and the National Environmental Legislation

Both the Malawi legislation on EIA and the World Bank OP 4.01 - Environmental Assessment have provisions for conducting environmental impact assessment studies for projects that are likely to cause adverse environmental impacts.

For the Malawi legislation, there is no provision for environmental and social screening of projects whose activities and locations are not known; while the Bank policy provides for environmental and social screening of proposed projects to determine the extent and type of environmental and social assessment. For this reason, an Environmental and Social Management Framework has been prepared for the SRBMP

The Bank further classifies proposed projects into one of four categories, depending on the type, location, sensitivity, and scale of the project, and the nature and magnitude of its potential environmental and social impacts. For Malawi, projects are classified into the two broad categories of either requiring an EIA or not.

The ESMF, prepared as a separate document, ensures that the gap that exists for the projects whose activities and locations are not known is bridged. Gaps relating to resettlement have been fully covered in the Resettlement Policy Framework for the SRBMP.

CHAPTER SIX: IDENTIFICATION AND ASSESSMENT OF ENVIRONMENTAL AND SOCIAL IMPACTS

6.1 Impact Identification

The Shire River Basin Management Project is likely to induce and generate a wide range of impacts on the physical, biological and socioeconomic environments. Identification of generic environmental and social impacts for the SRBMP was based on both primary and secondary data from the Project Appraisal Document, PAD (2012), detailed Project Description, Terms of Reference and from government documentation and statistics as well as other relevant documents. Secondary data was complemented by field investigations and socioeconomic studies of the project site and surroundings. Field investigations and socioeconomic studies involved the assessment of the environmental and social components such as physical /chemical, biological /ecological, social /cultural, and economic /operational; likely to be impacted.

Based on the activities proposed in the PAD and the comprehensive terms of reference for the project, the approach followed included:

- Analysis of topographical maps to identify the main environmental and social components of: *topography, forest cover, agricultural land, settlements, infrastructure and water resources.*
- Field investigations, focusing particularly on the areas of project influence in the Shire River Basin, to identify critical environmental and social elements to be affected including *social infrastructure, cultural sites, water and sanitation, health, flora and fauna, soils and economy.*
- Public consultation and involvement to facilitate participatory identification of environmental and social impacts and mitigation measures.
- Screening of the anticipated potential generic and significant impacts of the project, in accordance with the project components.

Simple and modified Leopold Matrices, in combination with a consultative approach and professional judgement, were used to identify and evaluate significant generic potential environmental and social impacts of the proposed SRBMP.

6.2 Classification of Impacts according to Project Components

To facilitate systematic impact determination, the project components were used to group the impacts. These project components, as presented in the project description, are also reflected in the environmental management and monitoring plans.

6.3 Determination of Enhancement and Mitigation Measures

To determine enhancement as well as mitigation measures, the baseline information presented in Chapters 2, 3 and 4 was used. This information forms the reference point for the future environmental changes, especially due to project implementation.

Environmental components are all elements that can be affected by the proposed construction and operation of the proposed project activities. Environmental and social impacts are any changes

(adverse or beneficial, positive or negative, whole or partial) in the environmental and social components, resulting from the implementation of the proposed project activities.

Determination of enhancement and mitigation measures was done by examining the environmental impacts and identifying mechanisms to avoid and/or reduce the damage, the activities would cause on the environmental and sociocultural components. Mitigation measures include prevention and control measures to fully or partially reduce the impact or risk of the impact; and remediation measures to repair or restore the environment after any damage is done.

Significant potential generic impacts and their mitigation measures were developed through stakeholder involvement and professional judgment.

6.4 Evaluation of Impacts

The identified potential generic environmental and social impacts were evaluated using the attributes of significance and probability of occurrence, where:

- a) **Probability of occurrence** is an estimate of the likelihood of an impact occurring before mitigation is applied. For the impacts that will definitely occur, a value of +1 or -1 was assigned; and for those that were deemed not likely to occur, a value of 0 (zero) was assigned.
- b) **Significance** is the predicted measure of the importance of a particular impact on the environmental and/or social component under consideration. Values of significance assigned to the impacts ranged from -1 to +4 as follows:
 - A low impact which will result in a small change that is hardly detectable;
 - A moderate impact that is measurable, but does not alter processes;
 - A high impact from which many people or organisms will be lost or affected. Major disruption of settlements, ecosystems or processes will result; and
 - A very high impact from which a community, process or area is completely disrupted or destroyed and all affected organisms will be lost

Impacts with values of 0 were eliminated from the list. Positive impacts were assigned a positive sign and negative impacts were assigned a negative sign and total scores for the two attributes were determined and are presented in Table 6.1.

The evaluation and scoring method is adapted from the Malawi Guidelines for Impact Assessment, 1997, which includes two more attributes of magnitude and duration. However, since the exact nature and location of the proposed project activities are not known, the magnitude and duration of the generic impacts could not be assessed at this stage.

The evaluation of the impacts was guided by careful assessment and professional judgment of the anticipated consequences and by assigning scores to each impact. These scores, as presented in Table 6.1, represent average values of significance and probability of occurrence of the impacts as assessed by subject specialists involved in the consultancy assignment. Table 6.1 also presents the proposed generic enhancement/mitigation measures for the identified impacts.

Table 6.1: Evaluation of environmental impacts				
SUB-COMPONENT	POTENTIAL IMPACT	NATURE OF IMPACT +ve = Positive -ve = Negative	GENERAL SCORE	MITIGATION/ENHANCEMENT MEASURE
COMPONENT A: SHIRE RIVER BASIN PLANNING				
Sub-Components A1-A4: Shire River Basin Planning	Improved water resources information systems, awareness and knowledge base on SRBMP	+Ve	3	Plan for efficient communication channels, with full participation of all stakeholders and plan to train the employees on operation and maintenance of the systems.
	Improved reporting on state of the state of the Shire River Basin	+Ve	3	Plan for efficient maintenance of the information systems to be installed (such as GSM telemetry and traditional gauging stations) in good operating order at all times. Train staff in operation and maintenance skills
	Increased institutional capacity for coordinated management of the Shire River Basin Management Project	+Ve	2	Plan for adequate levels of staffing and adequate institutional resources to be available at all times
COMPONENT B: CATCHMENT MANAGEMENT				
Sub-Component B 1 - 2: Sub-catchment rehabilitation	Reduced water run-off, soil erosion and siltation in the Shire River Basin	+Ve	3	Sustain appropriate soil and water conservation techniques through regular refresher trainings; Sustain structures such as check dams, through regular maintenance; Sustain forestation and rural energy interventions to ensure continued supply of alternative biomass resources and fuel.
	Increased knowledge of applied research and technology for farming systems intensification and efficient technologies (new brick forming machines, small scale solar energy, fuel efficient stoves, eco-sanitation, etc) to reduce fuel wood demand	+Ve	3	Facilitate and disseminate technologies that would be user friendly and acceptable to the communities especially women and children. Include the technology user communities during technology planning and design
	Improved catchment management and protection	+Ve	4	Sustain adequate levels of staffing and resources
	Improved Institutional capacity for catchment	+Ve	4	Conduct regular refresher sensitizations and trainings in

Table 6.1: Evaluation of environmental impacts				
SUB-COMPONENT	POTENTIAL IMPACT	NATURE OF IMPACT +ve = Positive -ve = Negative	GENERAL SCORE	MITIGATION/ENHANCEMENT MEASURE
	planning and monitoring			catchment management and its importance
	Reduced incidences of flash floods	+Ve	4	Sustain forestation and rural energy interventions to ensure continued supply of alternative biomass resources and fuel
	Increase in water table through restoration of forest cover	Ve+	3	Plant as many trees as possible in all degraded areas and promote regeneration and protection of natural vegetation
	Improved consistency in water flows in the Shire River and its tributaries	+Ve	4	Maintain and operate the barrage in line with operating procedures.
	Improved participatory micro-catchment planning for communities, government technical staff, field NGOs and relevant private sector actors through preparation of 28 integrated micro-catchment development plans (MCDPs)	+Ve	4	Consult widely to include and involve all stakeholders and adequately involve women and youth as well as disadvantaged groups to participate in the development of the micro-catchment plans
	Harmonized and quality standard setting in catchment management programs through national guidelines for integrated catchment management	+Ve	3	Consult stakeholders widely during guideline development. Regularly update the guidelines to respond to changing project scope and the environment
	Improved program performance, transparency, accountability and coordination across the Basin due to the monitoring model developed in the program and lesson learning	+Ve	3	Support and supervise the monitoring model and systems to ensure that appropriate targets will be met Identify and remove barriers (such as bureaucracy and political interference) from project implementation to ensure that intended monitoring targets are met without impediment
	Sustainable and productive agriculture from small scale irrigation, and efficient use of water resources, fertilizers, pesticides, herbicides and IPM etc.	+Ve	4	Train stakeholder communities in sustainable agricultural practices and irrigation water management

Table 6.1: Evaluation of environmental impacts				
SUB-COMPONENT	POTENTIAL IMPACT	NATURE OF IMPACT +ve = Positive -ve = Negative	GENERAL SCORE	MITIGATION/ENHANCEMENT MEASURE
	Improved management and rehabilitation of degraded forests on customary and communal lands	+Ve	4	Train communities in forest rehabilitation and management techniques as well as in sustainable use of forest resources
	Restrictions on access to grazing in the protected areas of the catchment	-ve	2	Allocate dedicated areas for grazing and enforce compliance to their utilization
	Removal of vegetation during construction of small scale structures and larger infrastructure investments	-ve	2	Restrict vegetation removal only to areas for construction. Re-vegetate bare areas after construction
	Increased spreading of water related diseases	-ve	2	Design small-scale structures appropriately to avoid water logging and stagnation Cut grass around small earth dams to discourage breeding of mosquitoes
Sub-Components B3 & 4: Sub-catchment rehabilitation, Alternative livelihoods and Ecological management	Increased income-generating activities, with special targeting of women, youth and landless groups	+Ve	4	Sustain empowerment of women, youth and landless groups through regular trainings and sensitization meetings
	Increased revenues from tourism	+Ve	4	Sustain catchment protection, flood attenuation, biodiversity conservation and carbon sequestration.
	Reduced people – park conflicts (park management and animals)	+Ve	4	Sensitize communities on the park rules and regulations and enforce them Implement co-management plans for parks
	Improved forest management in Eastern Escarpment, Tsamba & Mangochi Forest Reserves	+Ve	4	Sensitize communities in the co-management model and regularly review its strategies and implementation procedures in line with lessons learnt on the ground.
	Improved food security, nutrition and household incomes from efficient use of agro-chemicals and IPM	+Ve	4	Promote agricultural diversification with the full participation of smallholder farmers including women, youth and the landless.
	Decreased dependence on unsustainable exploitation of forest resources	+Ve	4	Promote alternative energy sources and support community woodlots
	Increase in value of agriculture related products	+Ve	4	Assist farmers to form cooperatives for price bargaining

Table 6.1: Evaluation of environmental impacts				
SUB-COMPONENT	POTENTIAL IMPACT	NATURE OF IMPACT +ve = Positive -ve = Negative	GENERAL SCORE	MITIGATION/ENHANCEMENT MEASURE
	marketed in the targeted GVs by 15 percent.			and processing of produce into value added products
	Increase in alternative livelihoods through mobilization, sensitization and initial capacity building of common interest groups (CIG) for commercially oriented income-generating activities	+Ve	3	Link CIGs to markets for products of income generating activities.
	Improved sub-catchment level market and access infrastructure	+Ve	3	Train community leaders in community mobilization and task distribution to include women and youth
	Increased access to finance through the investment grants to GVs that have reached a certain level of maturity and savings.	+Ve	4	Design appropriate, transparent and credible mechanisms for determining level of maturity and savings Provide financial management training
	Improved livelihoods from mini and small scale irrigation	+Ve	4	Link farmers to markets for produce and value added products from irrigation.
	Salinization and water logging in irrigation schemes	-Ve	2	Train communities on irrigation water management and efficient application of fertilizers
	Water, soil and air pollution from agrochemicals and pesticides use	-Ve	3	Train communities on safe use, storage and disposal of agrochemicals. Implement IPM
COMPONENT C: WATER RELATED INVESTMENTS				
Sub-Component C 1: Kamuzu Barrage	Improved sustainable use of water resources in the Shire River and its tributaries	+Ve	4	Regularly sensitize communities and water users on water rights and their implications. Monitor water users to comply with water permits
	Reduced potential future water use conflicts	+ve	4	Regularly sensitize communities on water use rights. Monitor water users to comply with water permits
	Improved energy production from existing hydropower stations	+Ve	4	Operate and maintain the barrage according to the recommended operating procedures.
	Improved water availability for hydropower	+Ve	4	Harvest weeds as recommended to facilitate free flow

Table 6.1: Evaluation of environmental impacts				
SUB-COMPONENT	POTENTIAL IMPACT	NATURE OF IMPACT +ve = Positive -ve = Negative	GENERAL SCORE	MITIGATION/ENHANCEMENT MEASURE
	generation, irrigation activities and water supply			of water to the power generation plants
	Improved road safety and traffic flow at the Kamuzu barrage	+ve	2	Provide adequate appropriate traffic warning signs to alert people on the traffic separation at the gates.
	Increased employment opportunities	+Ve	3	Recruit workers from within the project site
	Land acquisition for construction works	-ve	4	Provide adequate compensation to affected persons
	Disruptions to aquatic life and the fishing patterns of local communities due to the construction of temporary coffer dams	-ve	4	Provide for minimum flow in the engineering design as recommended by the Water Resources Department
	Increased risk of drowning for wildlife particularly those of Liwonde National Park	-ve	3	Provide fencing in all areas that pose risk to wildlife drowning
	Disturbance to flow of traffic	-ve	3	Limit number of trucks transporting construction materials during peak traffic periods Providing detours and appropriate traffic signs for vehicles and pedestrians
	Generation of construction waste (rock, soil, and other construction materials)	-ve	2	Dispose all rubble and solid wastes from the site at recommended and approved disposal sites
	Improved weed management and reduced handling costs	+Ve	3	Operate and maintain the boom as recommended
Sub-Component C 2: Improved Flood management	Improved protection of human settlements and infrastructure	+Ve	4	Maintain flood intervention structures regularly and provide early flood warning signs on time and as recommended
	Reduced crop and livestock damage	+Ve	4	Sensitise beneficiaries on the need to protect and care for the flood intervention structures
	Reduced economic losses and damage to property	+Ve	4	
	Improved ecosystem management of the Elephant Marshes	+Ve	3	Drafting of legislation for the protection and management of the Elephant Marsh should be finalised to facilitate protection and maintenance of the buffer capacity

Table 6.1: Evaluation of environmental impacts				
SUB-COMPONENT	POTENTIAL IMPACT	NATURE OF IMPACT +ve = Positive -ve = Negative	GENERAL SCORE	MITIGATION/ENHANCEMENT MEASURE
	Improved sanitation and hygiene	+Ve	2	Sensitise communities on the negative health and hygiene impacts associated with flooding
	Increased employment opportunities during construction of flood intervention structures	+Ve	3	Recruit workers from within the project areas
	Increased generation of both liquid and solid waste from construction works	-ve	3	Provide approved temporary toilets and dispose solid waste in approved sites
	Dust emissions from construction activities	-ve	1	Spray water on dusty construction areas and sites. Provide dust masks to workers exposed to dust and monitor to ensure that they wear them.
	Barriers to animal or human access to rivers where steep embankments are constructed or reinforced for flood protection	-Ve	2	Provide for gentle-sloping river banks at key access points Provide alternative sources of water

6.5 Significant Impacts and their Enhancement /Mitigation Measures

The project activities, proposed for the SRBMP, are generally designed to improve catchment management of the Shire River Basin; and the project is designed with environmental sustainability in mind, for all components and activities. Environmental and social impacts of improved coordination in basin water resources management, watershed management, improved regulation of the Shire River and improved climate resilience and ecosystems are expected to be highly positive overall. Likely environmental and social benefits include improved forest restoration and conservation, reduced soil erosion and land degradation, reduced sedimentation in the Shire River and some of its tributaries; and a reduced risk that the Shire River would run dry during an extended drought.

Environmental and social considerations will be given major attention in Shire River Basin planning, as well as in major civil works, to ensure that adverse environmental and social impacts are minimized and/or adequately mitigated. Component A (Shire River Basin Planning), Component B (Catchment Management) and Component C (Water Related Infrastructure) have very high potential for improving the environmental and social status of the basin. However, some activities under Component B and C could potentially generate adverse environmental or social impacts requiring mitigation.

Field investigations and public consultations conducted from 18 to 21 November 2011 and 12 to 16 February 2012 facilitated identification of potential positive and negative impacts of the proposed project components and activities of the SRBMP. These impacts are presented in the sections that follow. The Kamuzu Barrage upgrading (Subcomponent C1) is assessed in a separate parallel report. Preliminary Environmental and Social Impact Assessment of the Kamuzu Barrage (January 2012); and the impacts have been highlighted in this report and summarized in Annex 6.

6.5.1 Positive Impacts

6.5.1.1 Component A: Shire River Basin Planning

Under this component, the overall positive impacts will be improvement in institutional arrangements and capacity in the areas of environmental and social management and monitoring. Development of decision support systems and training for local expertise is expected to substantially improve the management and monitoring of social and environmental impacts, including consideration for environmental flows in water resources management.

Sub-component A.3 will improve water resources information systems for monitoring water flows and discharges, water quality and sediments and groundwater. This will enhance the management and monitoring of environmental and social impacts, especially in relation to water quality and sediments. Positive impacts generated from activities under Component A include:

6.5.1.1.1 Improved Water Resources Information Systems, Awareness and Knowledge Base on SRBMP

The nature of the impact is positive, highly beneficial and long term. The impact is likely to arise from a wide range of planned project activities that include basin-wide consultative development planning process supported by planning and operational decision support systems, acquiring datasets and training for water resources planning and management, etc.

As enhancement measures, SRBMP should plan to set up efficient communication channels, with full participation of all stakeholders and plan to train the employees.

6.5.1.1.2 Improved Reporting on State of the Shire River Basin

This impact is highly positive and it will improve the overall coordination of the activities of the Shire River Basin.

To enhance the impact, SRBMP should provide for efficient maintenance of the information systems (such as the GSM telemetry and traditional gauging stations to be installed), in good operating order at all times. Staff should be adequately trained in operation and maintenance of the systems.

6.5.1.1.3 Increased Institutional Capacity for Coordinated Management of the Shire River Basin Management Project

A strong institutional capacity with adequate and well trained staff as well as resources is a highly positive impact for the management of the Shire River Basin.

At the planning stage, the SRBMP should propose adequate recommended levels of staffing and adequate institutional resources to be available at all times.

6.5.1.2 Component B: Catchment Management

Interventions under Component B are expected to generate the following positive impacts:

6.5.1.2.1 Reduction in Water Run-off, Soil Erosion and Siltation in the Shire River Basin

The nature of the impact is positive, significant and long term and is likely to occur during the operation phase of the project, as a result of the rehabilitation and restoration of the seriously degraded catchment areas within the Shire River basin.

As enhancement measures, the SRBMP should do the following:

- Sustain appropriate soil conservation techniques through regular refresher trainings;
- Sustain structures such as check dams, through regular maintenance; and
- Sustain forestation and rural energy interventions to ensure continued supply of alternative biomass resources and fuel.

6.5.1.2.2 Increased Knowledge of Applied Research and Technology for Farming System Intensification and Efficient Technologies (New Brick Forming Machines, Small Scale Solar Energy, Fuel Efficient Stoves, Eco-Sanitation, Etc) to Reduce Fuel wood Demand

The nature of the impact is positive, significant and long term and the impact is likely to occur during the planning and implementation of activities under catchment management. The project will support sub-catchment level marketing assessments to identify current and potential product lines and private sector linkages to promote technology transfer.

As enhancement measures, the SRBMP should:

- Facilitate and disseminate technologies that would be user friendly and acceptable to the communities especially women and children; and
- Include the technology user communities during planning and design

6.5.1.2.3 Improved Institutional Capacity for Catchment Planning and Monitoring.

The impact will be beneficial and long term as it aims at building institutional capacity for catchment planning and monitoring, at the Group Village (GV) level, within smaller sub-catchments, through the

Village Development Committees (VDC). Communities will be involved in the planning through the development of village level action plans for micro-catchment planning, management and monitoring.

As enhancement measure, the SRBMP in collaboration with the Department of Land Resources and Conservation should sustain adequate levels of staffing and resources, as well as conduct regular refresher trainings in catchment and its importance.

6.5.1.2.4 Reduced Incidences of Flash Floods

Rehabilitation of several catchments under this project will improve regeneration of vegetation in degraded areas hence minimizing run-off which could eventually result in flash floods in the lower Shire areas. The nature of impact is positive and long term.

As enhancement measure, the SRBMP, in collaboration with the Departments of Forestry, and Land Resources and Conservation should sustain forestation and rural energy interventions to ensure continued supply of alternative biomass resources and fuel.

6.5.1.2.5 Increase in Water Table through Restoration of Forest Cover

The nature of the impact is positive, beneficial and indirect. It is a long term environmental impact likely to occur as a result of restoration of forest cover and planned soil and water conservation interventions.

As part of enhancement measures, trees should be planted in all degraded areas. In addition, regeneration and protection of natural vegetation should be promoted.

6.5.1.2.6 Improved Consistency in Water Flows in the Shire River and its Tributaries

The nature of the impact is positive, indirect and long term. The impact may occur as a result of implementation of the planned rehabilitation and management of degraded catchment areas within the Basin.

As part of enhancement measures, the SRBMP, in collaboration with the MWDI should maintain and operate Kamuzu Barrage in line with operating procedures.

6.5.1.2.7 Improved Participatory Micro-Catchment Planning For Communities, Government Technical Staff, Field NGOs and Relevant Private Sectors to Develop 28 Integrated Micro-Catchment Development Plans (MCDPs)

The impact will be beneficial and long term as it is aimed at improving participation of communities and other stakeholders in development of 28 integrated micro-catchment development plans in selected priority catchments. Communities will be involved in the planning through the development of village level action plans for micro-catchment planning, management and monitoring.

As enhancement measure, consult widely to include and involve all stakeholders and adequately involve women and youth as well as disadvantaged groups to participate in the development of the micro-catchment plans.

6.5.1.2.8 Harmonised and Quality Standard Setting in Catchment Management Programs Through National Guidelines for Integrated Catchment Management

Development and use of harmonised national guidelines for integrated catchment management will result in long term positive impact in managing catchments within the basin. Through harmonization of various guidelines, duplication of efforts will be minimised and implementation of various programmes under catchment management will be more coordinated.

At the planning stage, wide stakeholder consultations should be conducted during guideline development and regular updating of the guidelines should be done to respond to changing project scope and environment.

6.5.1.2.9 Improved Program Performance, Transparency, Accountability and Coordination across the Basin Due to the Monitoring Model Developed in the Program and Lesson Learning

The impact is positive and long term. As mitigation, the SRBMP should:

- Support and supervise the monitoring model and systems to ensure that appropriate targets are met;
- Identify and remove barriers (such as bureaucracy and political interference) from project implementation to ensure that intended monitoring targets are met without impediment

6.5.1.2.10 Sustainable and Productive Agriculture from Small Scale Irrigation and Efficient Use of Water Resources, fertilizers, pesticides, herbicides and IPM etc

The impact is highly beneficial and long term. Soil and water conservation techniques will promote sustainable and productive agriculture and efficient use of water resources will facilitate expansion of irrigation activities within the basin.

To enhance this impact, stakeholder communities should be trained in sustainable agricultural practices and irrigation water management.

6.5.1.2.11 Improved Management and Rehabilitation of Degraded Forest on Customary and Communal Lands

The sub-component is targeting rehabilitation a total of 18,000 ha of degraded forest in communal and customary lands. This will result in improved management of the communal and customary lands.

To enhance this impact, the communities should be trained in forest rehabilitation and management techniques as well as sustainable use of forest resources.

6.5.1.2.12 Increased Income-Generation Activities with Special Targeting of Women, Youth and Landless Groups

The impact is highly beneficial as the project will directly benefit 430,000 people, of which 50 percent will be women, within the basin.

To enhance the impact, SRBMP should sustain empowerment women, youth and landless groups through regular trainings and sensitization meetings.

6.5.1.2.13 Increased Revenues from Tourism

The nature of the impact is positive and highly beneficial. The impact is long term and is likely to occur following improved management of ecosystems in the national parks and wildlife reserves within the Basin. Improved tourism is also likely to increase revenue collection for both the Government and the surrounding communities who collaborate with National Parks & Wildlife in the Management of wildlife in Liwonde and Lengwe national Park

As part of enhancement measures, SRBMP should sustain catchment protection, flood attenuation biodiversity conservation and carbon sequestration.

6.5.1.2.14 Reduced People-Park Conflicts (Park Management and Animals)

The impact is beneficial and long term, and is likely to occur due to investments in sustainable management targeted for Lengwe and Liwonde National Parks, which will promote co-management with local communities.

As enhancement measures, communities should be sensitized on park rules and regulations and the regulations should be enforced. Co-management plans for the parks should also be implemented.

6.5.1.2.15 Improved Forest Management in Eastern Escarpment, Tsamba and Mangochi Forest Reserves

The nature of the impact is positive and long term. The impact is likely to occur due to the rehabilitation of currently heavily degraded catchment areas within the Shire River Basin and also due to the construction of the check dams, gabions and other civil works. community management of natural forests and woodlands on village lands and within the Eastern Escarpment, Tsamba and Mangochi-Namizimu Forest Reserves; and protected areas management investments in and around the Lengwe and Liwonde National Park are likely to contribute significantly to reduction of soil erosion and result in improved land resources management.

As enhancement measures, the communities around these forest reserves should be sensitized on the co-management model. The SRBMP should also review the strategies and implementation procedures in line with lessons learnt on the ground.

6.5.1.2.16 Improved Food Security, Nutrition and Household Income

The nature of impact is positive, highly beneficial and long term. It may occur as a result of implementing alternative livelihoods for communities who currently depend on charcoal production as their main source of household income generation that continue to deplete forest resources and hence the environmental degradation currently rampant in the Shire River Basin.

For enhancement measures, SRBMP should carefully investigate relevant and sustainable alternative livelihoods, with full participation of the affected communities and all stakeholders (Government and NGOs that work in the Basin), through research.

6.5.1.2.17 Decreased Dependence on Unsustainable Exploitation of Forest Resources

The impact is highly positive and long term due to provision of alternative sources of livelihoods and diversified options to secure incomes for communities within the basin. The expanding livelihood options will, in the long term, decrease dependence on unsustainable exploitation of forest and wetland products as sources of income.

As enhancement measure, alternative energy sources should be promoted and support should be provided for establishing community woodlots.

6.5.1.2.18 Increase in Value of Agriculture Related Products Marketed in the Targeted Group Villages by 15 Percent

The nature of the impact is positive and long term as the activities under this sub-component will promote development of specific analysis on community production strengths and opportunities in value chains and identification of bottle necks and quality requirements for selected value chains and development of a strategy to overcome these together with the target communities.

As an enhancement measure, farmers should be assisted in forming cooperatives for price bargaining and processing of produce into value added products.

6.5.1.2.19 Increase in Alternative Livelihoods Through Mobilization, Sensitization and Initial Capacity Building of Common Interest Groups (CIG) for Commercially Oriented Income Generating Activities

The nature of the impact is positive, highly beneficial, long term and wide spread throughout the Shire River Basin and long term. The impact is likely to occur due to a number of planned project activities such as promotion of small-scale business, start-up of alternative livelihoods through support to common interest groups (CIG) for commercially oriented income-generating activities, including capacity building and mentoring to build organisation, technical, financial and business capacities, mini and small scale irrigation and fish farming on both hills and flatter areas within the Shire River Basin.

As an enhancement measure, the SRBMP should link CIGs to markets for products of income generating activities.

6.5.1.2.20 Improved Sub-Catchment Level Market and Access Infrastructure

This impact is highly positive and it will support development of facilities for post-harvest storage and trading at the community level.

To enhance the impact, SRBMP should train community leaders in community mobilization and task distribution to include women and youth.

6.5.1.2.21 Increased Access to Finance Through the Investment Grants to GVs that have reached a certain level of maturity and savings

This impact is highly positive and it will support accessibility of finances to local communities from available investment grants.

To enhance the impact, appropriate, transparent and credible mechanism should be designed for determining level of maturity and savings. Financial management trainings should be provided to GV participating in the program.

6.5.1.2.22 Improved Livelihoods from Mini and Small Scale Irrigation, efficient use of agro-chemicals and introduction of IPM

This impact is highly positive and it will improve the livelihoods of communities from mini and small scale irrigation activities to be established under the project. The project would also support knowledge transfer in efficient and appropriate use of agro-chemicals and IPM.

To enhance the impact, SRBMP should link the farmers to markets for the produce from irrigation.

6.5.1.3 Component C: Water Related Infrastructure

Under sub-component C.1, the upgrading of the Kamuzu Barrage and refurbishment of the existing bridge, construction of a service and road bridge downstream of the barrage; and construction of a floating steel boom upstream of the barrage are expected to generate the following positive impacts:

6.5.1.3.1 Improved Sustainable Use of Water Resources in the Shire River Basin and its Tributaries

The Shire River Basin Planning will improve sustainable use of water resources by regulation water flows, granting water rights, facilitating stakeholder discussion on water resources use and monitoring and evaluation of water resources within the basin.

As an enhancement measure, SRBMP should ensure that affected communities are regularly sensitised on water use rights and their implications. SRBMP should also monitor water users to ensure compliance with water permits.

6.5.1.3.2 Reduced Potential Future Water Use Conflicts

The impact is positive, beneficial and long term. The impact is likely to arise from more coordinated/planned development activities.

As an enhancement measure, SRBMP should ensure that affected communities are properly sensitised on water use rights. Secondly, SRBMP should monitor water users within the basin to comply with water permits.

6.5.1.3.3 Improved Energy Production from Existing Hydropower Stations

The nature of the impact is positive, highly beneficial, long term and wide spread not only throughout the Basin but also the whole country. The project plans to reduce downtime for hydropower generation. The impact is likely to occur due to upgrading of Kamuzu Barrage and rehabilitation of catchments within the basin.

To enhance the impact, the barrage should be operated and maintained according to operating procedures; and weed harvesting at the barrage should be done as recommended, to facilitate free flow of water to the power generation plants.

6.5.1.3.4 Improved Water Availability for Hydropower Generation, Irrigation Activities and Water Supply

The nature of the impact is positive with long term benefits. Upgrading of the Kamuzu Barrage will improve regulation of water flows downstream to meet the needs of various stakeholders. Hydropower generation, water supply, irrigation activities and flood management will be improved by the upgrading of the barrage.

To enhance the impact, the barrage should be operated and maintained according to operating procedures and weed harvesting at the barrage should be done as recommended to facilitate free flow of water to the power generation plants, irrigation schemes and water supply facilities.

6.5.1.3.5 Improved Road Safety and Traffic Circulation at the Current Kamuzu Barrage

The nature of the impact is positive, highly beneficial and long term and it is likely occur during the project operation phase due to the planned physical separation between road traffic and Barrage gate operation.

As enhancement measures, adequate appropriate traffic warning signs should be provided to alert people on the traffic separation at the gates.

6.5.1.3.6 Increased Employment Opportunities

The nature impact is positive, highly beneficial and medium term. It will occur due to implementation of a number of activities under Sub-component C1 relating to the upgrading of Kamuzu Barrage.

As an enhancement measure, SRBMP should recruit workers from within the project site with priority given to women and youth.

6.5.1.3.7 Improved Weed Management and Reduced Handling Cost

The nature of the impact is positive, highly beneficial and long term. The impact will occur during the project operation phase due to implementation of planned activities under Sub-component C1 and those activities under Component B: Catchment management. As an enhancement measure, the boom at the barrage should be operated as recommended.

Under Sub-component C.2: Flood Management, the positive environmental and social impacts will include:

6.5.1.3.8 Improved Protection of Human Settlements and Infrastructures

The nature of the impact is positive, highly beneficial and long term particularly to communities in the Lower Shire valley, who on an annual basis, continually suffer greatly from floods due to catchment degradation of most of the Shire River tributaries such as Mwanza, Mkombedzi wa Fodya and Ruo rivers. The impact is likely to be caused as a result of the planned flood adaption activities such as the construction of flood diversion structures, training of affected communities on flood forecasting and early warning systems, construction of flood stabilisation, provision of communication and transport equipment for Civil Protection Committees, etc.

For enhancement, SRBMP should maintain flood intervention structures regularly and provide early flood warning signs on time and as recommended. In addition, beneficiaries should be sensitized on the need to protect and care for the flood intervention structures.

6.5.1.3.9 Reduced Crop and Livestock Damage.

The nature of the impact is positive, beneficial and long term. The impact is likely to be caused by improved flood management activities outlined in sub-component C2 above. Construction of flood intervention structures and improved ecosystem management of the Elephant marshes will likely reduce crop and livestock damage in communities residing in flood prone areas.

To enhance the impact, all flood intervention structures should be regularly maintained and early flood warning signs should be communicated as recommended. In addition, beneficiaries should be sensitized on the need to care for the flood intervention structures.

6.5.1.3.10 Reduced Economic Losses due to Damaged Property

The nature of the impact is positive, beneficial and long term. The impact is likely to be caused by improved flood management activities outlined in sub-component C2 above. Construction of flood intervention structures and improved ecosystem management of the Elephant marshes will likely reduce economic losses due to damaged property in communities residing in flood prone areas.

To enhance the impact, all flood intervention structures should regularly be maintained and early flood warning signs should be provided as recommended. In addition, beneficiaries should be sensitized on the need to care for the flood intervention structures.

6.5.1.3.11 Improved Management of Ecosystem of Elephant Marshes

The nature of the impact is positive, highly beneficial and long term. It is likely to occur due to the planned flood management activities under the sub-component C2. Improved management of the Elephant Marshes wetlands will complement community preparedness and protective infrastructure investments to form a comprehensive flood resilience program that integrates community

preparedness, physical and ecological infrastructure investments and enhancement of natural-resource dependent livelihoods.

As an enhancement measure, Government through Department of National Parks should finalise drafting of legislation for the protection and management of the Elephant Marsh to support its protection through maintenance of the buffer capacity.

6.5.1.3.12 Improved Sanitation and Hygiene

The impact is moderate and long term. Improved flood management, sanitation and hygiene in the Lower Shire, will be due to reduced incidences of flash floods.

To enhance the impact, communities should be sensitized on the negative health impacts associated with flooding.

6.5.1.3.13 Increased Employment Opportunities during Construction of Flood Intervention Structures

The nature of impact is positive, highly beneficial and medium term. It will occur due to implementation of a number of activities under Sub-component C2, relating to the construction of flood management interventions such flood diversion structures.

As an enhancement measure, SRBMP should target recruiting workers from within the project site.

6.5.2 Negative Impacts

6.5.2.1 Component A: Shire Basin Planning

This component is designed to promote multi-sectoral shared-vision planning approaches to enhance coordinated basin development and management. Therefore, major negative impacts are not expected. There are risks of use of inadequate knowledge base, analysis, and stakeholder consultations that would need to be managed in the planning process. There is also the risk of inadequate consideration of environmental and social information in the planning process. The improvement of the Water Information Systems in sub-component A.3 may have very small-scale land requirements that would need to be addressed.

6.5.2.2 Component B: Catchment Management.

This component will focus on rehabilitating degraded catchments for sustainable natural resources management and livelihoods through integrated and participatory approaches. There are a few negative environmental and social impacts that could possibly arise, including:

6.5.2.2.1 Restrictions on Open-Access to Grazing in the Catchment Areas by Communities

The impact is negative, moderate and only short term. It may occur during the construction phase of the Project. As a mitigation measure, areas for livestock grazing should be allocated to communities and compliance should be enforced to ensure their utilization.

6.5.2.2.2 Removal of Vegetation from Construction Sites

Land preparation for construction activities under component B would result in clearing of vegetation.

To mitigate the impact, vegetation should only be removed in areas targeted for construction and all bare areas should be re-vegetated after construction.

6.5.2.2.3 Generation of Construction Waste (Rocks, Soil and Other Construction Waste)

Construction works and operation activities for Component B (e.g. for the establishment of small-scale and mini irrigation facilities or check dams), are likely to generate wastes.

6.5.2.2.4 Salinization and Water Logging in Irrigation Schemes

The impact is low but long term due to the operations of irrigation schemes established under the component.

To mitigate the impact, communities should be trained on irrigation water management and efficient application of fertilizers.

6.5.2.2.5 Water, Soil and Air Pollution from Agrochemicals and Pesticides Use

With the increase in irrigation activities, pesticides use will also increase resulting in the following potential significant impacts:

- Air contamination through application of pesticides
- Soil and water contamination
- Risk of pesticides poisoning
- Misuse of pesticides

The impact is negative medium term and localised, emanating from excessive application of fertilizers and herbicides in irrigation schemes.

To mitigate the impact, communities should be trained on safe use, storage and disposal of agrochemicals.

6.5.2.2.6 Increased Spread of Water Related Diseases

The impact is negative and long term due to irrigation activities which would result in water stagnation in irrigation areas. Water stagnation would attract breeding of mosquitoes.

To mitigate the impact, small-scale structures should be designed appropriately to avoid water stagnation. In addition, grass around small earth dams should be cut to discourage breeding of mosquitoes.

6.5.2.2.7 Disturbances of the Social Structure and Organisation Network

Implementation of programs targeted to empower women in socio-economic activities in the Basin, without proper gender and cultural consideration, will create chaos and disturbances in the social structure of the communities.

In-depth consultations with relevant organisations in the area and gender mainstreaming can mitigate these impacts.

6.5.2.2.8 Promotion of HIV and AIDS Transmission

The construction works proposed under Component C will demand local as well as migrant labour force. This will create risks in the transmission of HIV and AIDS both for migrant workers who may leave their wives behind and the local worker who may change their lifestyle due to an increase in disposable income.

HIV and AIDS mainstreaming and provision of condoms and information on HIV and AIDS at the construction sites would mitigate the impacts.

6.5.2.3 Component C: Water Related Infrastructure

Kamuzu Barrage Upgrading (Sub-component C.1)

The upgrading of the Kamuzu Barrage at Liwonde is the most environmentally sensitive Project component, and the reason why the overall Project is classified as Category A by the World Bank. A

separate ESIA and associated Environment and Social Management Plan; and a Resettlement Action Plan for the Kamuzu Barrage have been developed and a summary of the observations from this parallel consultancy are as follows:

The most significant environmental and social impacts relate to anticipated changes upstream of the Shire River and Lake Malawi, as well as downstream Shire River flows. In particular, the Kamuzu Barrage upgrading will, at particular times (mainly during dry seasons), enable the levels of the upstream Shire River and Lake Malawi to be raised by up to 40cm higher than is possible with the existing barrage. This would affect the surface area and distribution of certain ecosystems within the upstream Liwonde National Park. In particular river sandbars, sandy river banks, and floodplain grasslands will be affected; with corresponding impacts on certain wildlife species. Although the level of Lake Malawi would still be subject to natural fluctuations (and the Barrage upgrading will not change the minimum and maximum levels of the Lake), the level could at times be up to 40cm higher than is currently the case, implying more land inundated a longer proportion of the time (especially during dry seasons). The flooding of additional land along Lake Malawi, Lake Malombe and the Shire River (upstream of Liwonde) would also affect seasonally cultivated areas and other assets (possibly including some dwellings).

Additional information on the environmental and social impacts of the Kamuzu Barrage upgrading, may be found in the parallel report, *Preliminary Environmental and Social Impact Assessment: Independent Environmental Impact Assessment for the Upgraded Kamuzu Barrage (Government of Malawi, December 2011)* and a list of the negative environmental and social impacts of the Kamuzu Barrage upgrading are provided in annex 6 of the this ESA report.

Downstream of Liwonde, the upgraded barrage will provide opportunities with potentially greater environmental and social impacts than under the more limited river regulation currently possible with the existing barrage. Barrage construction activities at Liwonde will also generate localized environmental and social impacts, including:

6.5.2.3.1 Land Acquisition for the Construction Works

The impact is high and negative as land will be required for construction works on both banks of the Shire River and in areas where people need to relocate to make room for new construction works.

To mitigate the impact, adequate compensation should be provided to affected persons as stipulated in Resettlement Action Plan for the Upgrading of Kamuzu Barrage.

6.5.2.3.2 Disruptions to Aquatic Life and Fishing Patterns of Local Communities Due to the Construction

The impact is high, negative but short term. Changes in water flows and levels during upgrading of the barrage will affect aquatic life and fishing patterns of local communities.

As a mitigation measure, adequate water flows should be maintained during the upgrading, as recommended by Water Resources Department and departments responsible for aquatic life.

6.5.2.3.3 Disturbance to Traffic Flow

The impact is moderate and short term, confined to during upgrading of the barrage. Normal traffic will be disturbed due to road detours and reduced speeds on the construction areas.

To mitigate the impact, number of trucks transporting construction materials should be limited during peak traffic periods. Detours and appropriate traffic signs for vehicles and pedestrians should be provided.

6.5.2.3.4 Increased Spreading of Water Related Diseases

The impact is moderate, long term and confined to areas where small-scale water holding structures such as dams will be constructed.

To mitigate the impact, small-scale structures must be appropriately designed to avoid water logging and stagnation. Maintenance of the structures must include cutting grass around small earth dams to discourage breeding of mosquitoes

6.5.2.3.5 Generation of Construction Waste (Rocks, Soil and Other Construction Materials)

The impact is low and short term. Wastes such as rocks, soil and rubble will be generated from construction works for the barrage.

As a mitigation measure, all solid wastes and rubble should be disposed at recommended and approved sites.

Flood Management (Sub-component C.2)

The proposed flood mitigation civil works in the lower Shire Basin including riverbank stabilization structures, dykes, culverts, flood diversion structures, and new communication and transport equipment are expected to have fairly minor adverse environmental or social impacts, since they are relatively small-scale and localized. Nonetheless, attention will be needed to address a range of environmental and associated social issues, such as ensuring sufficient river access and crossing points for animals (domestic and wild) and people since the embankments tend to be rather steep. The wetland conservation and management activities planned around the Elephant Marshes are expected to be highly positive from an environmental standpoint. From the civil works to be supported, negative impacts could include:

6.5.2.3.6 Increased Generation of both Liquid and Solid Wastes from Construction Works

The impact is low and short term. The construction related works for flood intervention structures (stabilization structures, dykes, culverts, flood diversion structures) under sub-component C2, may generate wastes.

To mitigate the impact, approved temporary toilets should be provided and all solid wastes should be disposed in approved sites.

6.5.2.3.7 Dust Emissions from Construction Activities

The impact is localised and short term, especially during construction of flood intervention structures. Dust will be generated from movement of trucks within the project site.

To mitigate the impact, water should be sprayed on dusty areas of construction. In addition, the contractors should provide dust masks to workers exposed to dust.

6.5.2.3.8 Barriers to Animal or Human Access to Rivers where Steep Embankments are Constructed or Reinforced for Flood Protection

The impact is localised and long term especially during construction and operation of flood intervention structures.

To mitigate the impact, gently-sloping river banks at key access points should be provided and also alternative sources of water should be provided to animals.

6.5.2.3.9

Visual Intrusion on the Landscape

Extraction of soils and quarry for construction related activities will result in open burrow pits which could result creation of ponds; hence becoming visually unattractive.

To mitigate the impact, all burrow pits should be levelled soon after extraction of soils and quarry.

6.5.2.3.10

Loss of Scenic Value From

Burrow pits in areas where soils and quarries have been extracted will result in loss of scenic value in the impacted areas. Discarded equipments will also negatively affect the scenic value of the affected areas.

To mitigate the impact, all areas which have been affected by extraction of soil and quarry should be rehabilitated by planting grass and trees.

6.5.2.3.11

Safety Risks from Abandoned Burrow Pits

Burrow pits could pose safety risks to people and animals in areas where construction related activities have occurred.

To mitigate the impact, the contractors should ensure that abandoned pits are backfilled and in areas where backfilling is not possible, fences should be erected around the pits.

6.5.3 Cumulative Impacts

The SRBMP and the overall longer-term program are intended to improve the management of water and other natural resources within the Shire River Basin. The cumulative impacts of the SRBMP and future follow-up program activities are intended and expected to be highly positive in general. The Strategic Environmental and Social Assessment (SESA) conducted over 2010-2011 developed approaches to promote the consideration of cumulative environmental and social impacts in the development of the Shire River Basin's water resources by examining the close link between people and their environment and natural resources. The investments planned under the SRBMP are closely aligned with the main priorities outlined by the SESA. This includes supporting processes to improve the consideration of cumulative impacts.

Poorly-planned major investments and development through sectoral interventions such as irrigation, hydropower development, water supply, navigation, and industrial development could cause significant cumulative impacts in the form of reducing the performance of existing assets in the Shire Basin. New large upstream consumptive use, pollution, foreclosure of future water uses, or over-commitment of water resources would result in reduced reliability of water supply. Currently, there is little systematic monitoring to understand where various water and watershed-related activities are being financed across projects by the Government and a variety of development partners; and it is difficult to explore synergies and trade-offs across such activities without an appropriate monitoring system, knowledge base, or analytical tools. Investments prepared with poor environmental and social considerations could have significant adverse impacts on the sustainability of the environmental, economic, and social services that the Shire River system provides. This would lead to loss of sight of opportunities to

enhance positive environmental and social benefits. Major new investments could also have associated induced impacts, such as pollution from enhanced agro-chemical use with large-scale irrigation development, or pollution from enhanced industrialization from improved hydropower development that would need to be managed.

The project proposes to strengthen the capacity of the Government of Malawi to better manage cumulative and induced impacts in the Shire Basin. The Basin Planning activities in Component A would support development of a comprehensive basin knowledge base, modelling tools, and stakeholder inputs to examine the cumulative impact of investments. The proposed basin planning approach seeks to move away from the current problematic incremental project-by-project sectoral approach to considering inter-relationships between projects and estimating the cumulative system implications of development across sectors. The monitoring system being supported under Components A and B will set up a framework to provide a systematic tracking of key environmental/natural resources and social parameters in a spatial context across all projects irrespective of financing, using modern remote sensing/earth observation knowledge products and GIS tools combined with bottom-up monitoring. This would help in auditing activities (e.g. “who is doing what activity in which watershed and what the status and impact is”), exploring synergies/trade-offs in a larger systems context, and outlining future investment needs in a more systematic manner.

The SRBMP recognizes the existing stock of infrastructure that depends upon water flows from the Shire River, including the multiple hydropower stations in the middle Shire River, the Walker’s Ferry pump station that provides drinking water to the City of Blantyre, and the existing Illovo sugar cane and other irrigation systems. There are many ways in which the performance of these existing assets is dependent on the cumulative impacts of other activities in the basin system. For example, the project activities of weed clearance and erosion management can have significant positive impacts in the performance of downstream hydropower plants such as Nkula, Tedzani, and Kapichira in terms of reduced maintenance costs, system interruptions, buffer storage, and hence overall power production. As the number of investments in the Shire Basin increases, there will be an increasing degree of complexity in the management of cumulative impacts both related to development and management of the resource base. Proposed project support for building a Shire Basin Institution to improve coordination in planning and management will be critical to address this situation, which will otherwise suffer from the “incremental development creep” that has been a problem till this time. Enhanced awareness of the basin issues and options to enable consensus on decisions and behavioural change is critical across key basin stakeholders (such as government officials, farmers, academia, NGOs, development partners, and the general public).

The development of new investments will also have issues of induced and cumulative impacts. The only major investment that the project is supporting is the Kamuzu Barrage upgrading and it is unlikely that the enhanced Shire River regulation could induce significant additional consumptive water investments in the Basin, as this would reduce the reliability and performance of the existing hydropower assets that the upgrade is primarily intended to enhance. In this regard, any new investments would require their own environmental and social impact studies.

Preparation of new investments (e.g. surveys, pre-feasibility, feasibility, or design studies) supported under sub-component C.3 could have some induced or cumulative impacts depending on the type, location, and scale of investments eventually selected, especially if these prepared investments attract financing and are implemented. The project would support holistic preparation of such investments, including not only the technical studies, but environmental and social impact assessment studies. The SRBMP would not finance the civil works for any large-scale new projects (aside from the Kamuzu Barrage upgrading); any such projects would be subject to the country’s environmental assessment

requirements (see Guidelines for Environmental Impact Assessment (EIA) in Malawi, Government of Malawi, 1997), along with the environmental and social safeguards requirements of any external funding source such as the World Bank.

Catchment management activities in Component B could have some induced and cumulative impacts, for example small-scale check dams or irrigation pilots could be replicated in unsustainable ways in additional inappropriate locations, and both capacity-building and awareness-raising programs will be needed in this regard. Similarly, in flood management activities in sub-component C.2., community-level infrastructure in terms of raised platforms, embankments, etc. can be problematic if inappropriately replicated and capacity-building, good documentation of pilot experiences and awareness-raising will be important.

It is also possible that the SRBMP could set in motion a series of activities that have a more virtuous set of positive cumulative or induced impacts. The fact that this project is part of a longer-term program implies that successful paradigms demonstrated under this project in targeted areas may be significantly scaled-up under future phases. For example, scaling-up of successful watershed interventions could result in improved management of priority catchments in other parts of the Basin and beyond for natural resources and livelihood benefit. Basin planning approaches can be developed for other basins in the country. Positive induced impacts can also be illustrated in the same project. For example, the introduction of real-time hydromet networks as proposed in Component A can induce improved forecasting and early warning systems to flood-affected populations in Nsanje and Chikhwawa, targeted in Component C. Enhancing the knowledge base and capacity in key water and land related institutions can manifest themselves beyond their expected role in the project to more effectively manage their other activities.

6.5.4 Analysis of Alternatives

During project preparation, many different alternatives were considered in terms of project design. With respect to the environmental and social implications, the alternatives considered have included:

1. **Alternatives for the Kamuzu Barrage.** Alternatives considered for the Kamuzu Barrage included (i) alternative designs, including the barrage height; (ii) alternative considerations for barrage operation, including the maximum water level increment to naturally-occurring water levels in lakes Malawi and Malombe and the Shire River upstream of the barrage; (iii) alternative locations along the Shire River for the upgraded barrage; and (iv) leaving the existing Kamuzu Barrage in its current condition, without upgrading. These alternatives are all discussed in the *Preliminary Environmental and Social Assessment for the Kamuzu Barrage* (January 2012).
2. **Alternative Project Sites.** Within the Shire River Basin, alternative sites for project interventions were considered with respect to (i) selection of priority sub-catchments for rehabilitation (the planned sub-catchments are Upper Lisungwi, Upper Wamkulumadzi, Escarpment Upstream of Kapichira Falls, Chingale, and Rivi-Rivi Source); (ii) selection of the natural habitat blocks in the Shire Basin for ecological management (Liwonde and Lengwe National Parks; Eastern Escarpment, Tsamba, and Mangochi Forest Reserves; Elephant Marshes); and (iii) selection of eligible areas for flood management sub-projects under Sub-component C.2 (Chikhwawa and Nsanje Districts and Elephant Marshes). A variety of selection criteria were used, including

which sites provide the best opportunities to promote significant and cost-effective environmental improvements in terms of more sustainable use of forests and woodlands, erosion control, sustainable land management, flood mitigation, and biodiversity conservation.

3. **Alternative Project Interventions.** The types of project interventions selected for SRBMP support closely reflect the priorities noted in the Strategic Environmental and Social Assessment (SESA) for the Shire Basin. However, two types of project interventions recommended by the SESA were considered but not selected for SRBMP support.
 - a. First, charcoal harvesting for cooking fuel and other urban energy uses is a major driver of forest and woodland loss and degradation in the Shire Basin. Effectively addressing the charcoal issue on a broad scale trade will require adequate political will and improved governance. As the first phase project of a longer-term program, the SRBMP will analyze the issue through basin planning studies and dialogue and, under suitable conditions, would pilot the licensing of sustainable charcoal production at a local level under micro-catchment and community forest management activities. However, given the need to build political will for wider action, the Shire Basin Institution is not expected to tackle the charcoal industry as a whole during the first phase project.
 - b. Second, rapid population growth and high rural population densities in Malawi (particularly in the Shire River Basin) contribute importantly to forest loss, land degradation, and other pressures upon natural resources. Unchecked, continued high population growth threatens to undermine efforts to improve the sustainability of natural resource management. However, the main types of interventions that could address this issue—including the provision of reproductive health services, increased education of girls, and urban planning and job creation—are beyond the scope of this natural resource management project.
4. **“No Project” Option.** An option always to be considered is the “no-project” approach. This would imply continued deterioration of the catchment lands, not being able to provide a foundation for the long-term sustainable development and management of the Shire River Basin, continued vulnerability of populations to floods and droughts, continuing poor land productivity, continued loss of biodiversity and inability to benefit from it effectively, major conflicts across water allocations for new investments without an information or analytical basis for such choices, continued degradation of the existing Kamuzu Barrage, and inadequate preparation of important new water resource investments. The project is thus expected to be highly beneficial overall, even though certain environmental and social impacts will require close monitoring and appropriate mitigation measures.

CHAPTER SEVEN: GENERIC ENVIRONMENTAL AND SOCIAL MANAGEMENT AND MONITORING PLANS

7.1 Environmental and Social Management Plan (ESMP)

The purpose of the generic Environmental and Social Management Plan (ESMP) is to ensure that the identified environmental and social impacts for relevant subprojects (i) if negative are adequately mitigated, and (ii) if positive are adequately mainstreamed throughout the project lifecycle. .

For each SRBMP subproject requiring ESIA/ESMP, the ESMP:

- a Lists the potential social and environmental impacts;
- b Provides the mitigation or enhancement measures for each single or cumulative impact;
- c Assigns the responsible institutions to carry out the mitigation or enhancement measures;
- d Proposes dates by which the mitigation measures must be carried out; and
- e Gives an estimate of the cost for implementing the mitigation measures.

For the SRBMP, the ESMPs will have to be designed to suit specific project activities on the respective sites. In this regard, Table 7.1A & 7.1B should be considered as the generic frame to guide the prediction of specific potential impacts of the SRBMP activities. The generic or typical environmental impacts in Table 7.1 were derived from the field investigations, public consultations and professional judgment, with respect to the SRBMP activities; and the list of impacts is by no means exhaustive. The activities of the SRBMP are intended to improve the environmental and socioeconomic conditions of the Shire River Basin. Hence the costs for implementation of the management plan would be included in the project activities and the consultant and well as the contractors will use the EMP to ensure that all the necessary costs to implement the activities are included in the project costs. On the other hand, it is worth noting that most of the activities in the EMP relate to sensitization, training and capacity building. Cost for these activities was submitted to the Consultant preparing the comprehensive capacity building activities for the SRBMP as a separate document.

Once the specific ESMPs have been designed for the SRBMP activities, a certain amount of flexibility should be allowed to optimize its implementation and to take into account any future changes or modifications made on location and the design of the project activities.

Table 7.1A: Generic Environmental and Social Management Plan						
POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	TARGET	RESPONSIBLE INSTITUTION	COST PER YEAR	
1.0 IMPACTS FROM COMPONENT A: SHIRE RIVER BASIN PLANNING						
1.1	Improved water resources information systems, awareness and knowledge base on SRBMP	Set up and maintain efficient communication channels for full participation of all stakeholders	During development of basin planning framework	SRBMP MWDI	Include in the project costs for component A	
1.2	Improved reporting on comprehensive state of the Shire River Basin	Maintain installed information systems such as GSM telemetry and traditional gauging stations in good operating order				
1.3	Increased institutional capacity for coordinated management of the Shire River Basin Management Project	Maintain recommended levels of staffing and adequate resources at all times				
2.0 IMPACTS FROM COMPONENT B: CATCHMENT MANAGEMENT						
2.1	Reduction in run-off water, soil erosion and siltation in the basin	Sustain appropriate soil and water conservation techniques through regular refresher trainings	Annually throughout project life	SRBMP DLRC	Included in the capacity building report	
		Sustain structures such as check dams, through regular maintenance	Annually during project implementation	SRBMP MWDI	From recurrent MWDI budgets through Water Resources Dept.	
		Sustain forestation and rural energy interventions to ensure continued supply of alternative biomass resources and fuel	Annually during implementation	SRBMP Department of Forestry & EAD	From Project Costs under component B	
2.2	Increased knowledge of applied research and technology for farming systems intensification and efficient technologies (new brick forming machines, small scale solar energy, fuel efficient stoves, eco-sanitation, etc) to reduce fuel wood demand	Facilitate and disseminate technologies that would be user friendly and acceptable to the communities especially women and children.	Annually during project implementation	SRBMP	From Project Costs under component B	
		Include the technology user communities during technology planning and design		SRBMP	Not applicable	
2.3	Improved catchment management and protection	Sustain adequate levels of staffing and resources	Annually during implementation	SRBMP	From recurrent budgets for	

Table 7.1A: Generic Environmental and Social Management Plan						
POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	TARGET	RESPONSIBLE INSTITUTION	COST PER YEAR	
		Conduct regular refresher trainings in catchment and its importance		MWDI	responsible institutions	
2.4	Improved Institutional capacity for catchment planning and monitoring			DLR C	Included under capacity building	
2.5	Reduced incidences of flash floods	Sustain forestation and rural energy interventions to ensure continued supply of alternative biomass resources and fuel	Annually during implementation	SRBMP, MWDI District Council DNRDM, DoF	From Project Costs under component B	
2.6	Increase in water table through restoration of forest cover	Plant as many trees as possible in all degraded areas and promote regeneration of natural vegetation	Annually throughout project period	SRBMP Department of Forestry	Included in project costs for component B	
2.7	Improved consistency in water flows in the Shire River and its tributaries	Maintain and operate the barrage in line with operating procedures	Throughout the project life	SRBMP, Water Resources dept	From recurrent MWDI budget	
2.8	Improved participatory micro-catchment planning for communities, government technical staff, field NGOs and relevant private sector actors to develop 28 integrated micro-catchment development plans (MCDPs)	Consult widely to include and involve all stakeholders and adequately involve women and youth as well as disadvantaged groups to participate in the development of the micro-catchment plans	During project planning	SRBMP MWDI	SRBMP to support consultation process	
2.9	Harmonized and quality standard setting in catchment management programs through national guidelines for integrated catchment management	Consult stakeholders widely during guideline development. Regularly update the guidelines to respond to changing project scope and the environment	Before project implementation	SRBMP MWDI	Include in project costs under Component B	
2.10	Improved program performance, transparency, accountability and coordination across the Basin due to the monitoring model developed in the program	Support and supervise the monitoring systems to ensure that targets are met Identify and remove barriers (such as	Annually during project implementation and monitoring	SRBMP MWDI	From recurrent SRBMP and MWDI budgets	

Table 7.1A: Generic Environmental and Social Management Plan						
POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	TARGET	RESPONSIBLE INSTITUTION	COST PER YEAR	
	and lesson learning	bureaucracy and political influence) from project implementation to ensure targets are met without impediments				
2.11	Sustainable and productive agriculture from small scale irrigation, and efficient use of water resources etc.	Train stakeholder communities in sustainable agricultural practices and irrigation water management	Annually during project implementation	SRBMP MAFS	Included in ESMF capacity building Report	
2.12	Improved management and rehabilitation of degraded forests on customary and communal lands	Train communities in forest rehabilitation and management techniques as well as in sustainable use of forest resources	Annually during project implementation	SRBMP DLRC	Included in ESMF capacity building Report	
2.13	Increased income-generating activities, with special targeting of women, youth and landless groups	Sustain empowerment of women, youth and landless groups through regular trainings and sensitization meetings	Annually during project implementation	SRBMP Ministry of Gender	SRBMP through MGCSW budgets	
2.14	Increased revenues from tourism	Sustain catchment protection, flood attenuation, biodiversity conservation and carbon sequestration	Annually during project implementation	SRBMP DNPW	From DNPW recurrent budgets	
2.15	Reduced people – park conflicts (park management and animals)	Sensitize communities on the park rules and regulations and enforce them Implement co-management plans for parks	Quarterly throughout project implementation	DNPW District Council	From DNPW recurrent budgets	
2.16	Improved forest management in Eastern Escarpment, Tsamba & Mangochi Forest Reserves	Sensitize communities in the co-management model and review its strategies and implementation procedures in line with lessons learnt on the ground.	Bi-annually during project implementation	Department of Forestry	From Forestry Dept recurrent budgets	
2.17	Improved food security, nutrition and household incomes	Promote agricultural diversification with the full participation smallholder farmers including women, youth and the landless.	Annually during project implementation	MAFS	From MAFS recurrent budget	
2.18	Decreased dependence on unsustainable exploitation of forest resources	Promote alternative energy sources and support community woodlots	Throughout project life	Department of Energy and EAD	From recurrent DOE and EAD budgets	

Table 7.1A: Generic Environmental and Social Management Plan						
POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	TARGET	RESPONSIBLE INSTITUTION	COST PER YEAR	
2.19	Increase in value of agriculture related products marketed in the targeted GVs by 15 percent.	Assist farmers to form cooperative for price bargaining and processing of produce into value added products	Throughout project life	SRBMP MAFS	From recurrent MAFS budgets	
2.20	Increase in alternative livelihoods through mobilization, sensitization, and initial capacity building of common interest groups (CIG) for commercially oriented income-generating activities	Link CIGs to markets for products of income generating activities.	Throughout project life	SRBMP MAFS MTI	From recurrent MAFS and MTI budgets	
2.21	Improved sub-catchment level market and access infrastructure	Train community leaders in community mobilization and task distribution to include women and youth during construction of market and access infrastructure	Bi-annually throughout project implementation	District Council MGCSW	From SRBMP funds for allocated for training	
2.22	Increased access to finance through the investment grants to GVs that have reached a certain level of maturity and savings.	Design appropriate, transparent and credible mechanisms for determining level of maturity and savings	Annually during project implementation	District Council SRBMP	From SRBMP funds allocated for IGAs	
		Provide financial management training				
2.23	Improved livelihoods from mini and small scale irrigation, efficient use of agro-chemicals and introduction of IPM	Link farmers to markets for produce from irrigation	Annually during project implementation	MAFS Irrigation Dept	From recurrent MAFS budgets	
3.0 IMPACTS FROM COMPONENT C: WATER RELATED INFRASTRUCTURE						
3.1	Improved sustainable use of water resources in the Shire River and its tributaries	Regular sensitization of communities and water users on water rights and their implications.	During project construction, operation and maintenance	SRBMP MWDI	Included in ESMF training under capacity building	
		Monitor water users to comply with water permits			From recurrent MWDI budgets	

Table 7.1A: Generic Environmental and Social Management Plan						
POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	TARGET	RESPONSIBLE INSTITUTION	COST PER YEAR	
3.2	Reduced future potential water use conflicts	Regularly sensitize communities on water use rights Monitor users to comply with water permits	During development of basin planning framework	SRBMP MWDI	Included in ESMF training under capacity building	
3.3	Improved energy production from existing hydropower stations	Operate and maintain the barrage according to the recommended operating procedures.	Quarterly during project implementation	SRBMP MWDI DOE ESCOM		
3.4	Improved water availability for hydropower generation, irrigation, and water supply	Harvest weeds as recommended to facilitate free flow of water to the power generation				
3.5	Improved road safety and traffic flow at the Kamuzu barrage	Provide adequate appropriate traffic warning signs to alert people on the traffic separation at the gates	Quarterly during project construction	SRBMP MTPW NRSC	Contractor to be provided with additional support from NR SC	
3.6	Increased employment opportunities	Recruit workers from within the project site	During project construction	District Council Department of Labour	From project funds	
3.7	Improved weed management and reduced handling cost	Operate and maintain the boom as recommended	During project implementation	SRBMP MWDI	Project costs and recurrent budget from MWDI	
3.8	Improved protection of human settlements and infrastructure	Implement integrated Flood Risk Management Plan (IFRMP) to benefit approximately 40,000 households in the flood-prone areas in terms of better preparedness and reduced vulnerability Maintain flood intervention structures	Annually during project implementation	SRBMP DNRDM	From recurrent budgets for responsible institutions with additional support from SRBMP	

Table 7.1A: Generic Environmental and Social Management Plan						
POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	TARGET	RESPONSIBLE INSTITUTION	COST PER YEAR	
3.9	Reduced crop and livestock damage	regularly and provide early flood warning signs as recommended	Annually during project implementation	SRBMP	From recurrent budgets for responsible institutions	
3.10	Reduced economic losses and damage to property	Sensitise beneficiaries on the need to care for the flood intervention structures		MWDI		
3.11	Improved ecosystem management of the Elephant Marshes	Drafting of legislation for the protection and management of the Elephant Marsh to be finalised	Before project implementation	Department of National Parks and Wildlife	from recurrent budgets for DNPW	
3.12	Improved sanitation and hygiene	Sensitise communities on the negative health impacts associated with flooding	Annually just before the rains	MWDI	SRBMP to support sensitization meetings	
3.13	Increased employment opportunities during construction of flood intervention structures	Recruit workers from within the project areas	Quarterly during construction	Department of Labour DC		

Table 7.1B: Generic Environmental and Social Management Plan					
NEGATIVE IMPACTS					
ITEM No.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED MITIGATION MEASURES	TARGET	INSTITUTION	COST
2.0 IMPACTS FROM COMPONENT B: CATCHMENT MANAGEMENT					
2.1	Restrictions on access to grazing in the protected areas of the catchment	Allocate dedicated areas for grazing and enforce compliance to their utilization	Before project implementation	SRBMP DLRC	Not Applicable
2.2	Removal of vegetation during construction of small scale structures and larger infrastructure investments	Restrict vegetation clearing only in areas for construction	Quarterly during construction	DC Contractors	Not Applicable
		Re-vegetate bare areas after construction	After construction works	Contractors	To be included in costs for component B
2.3	Water soil and air pollution from agrochemicals and pesticides use Poisoning and misuse of pesticides	Train communities on safe use, storage and disposal of agrochemicals and pesticides. Develop and implement IPM	Annually during implementation	Water Resources Dept, PCB MAFS Department of Irrigation	From project funds under component B and capacity building
2.4	Salinization and water logging in irrigation schemes	Train communities on irrigation water management and efficient application of fertilizers			
3.0 IMPACTS FROM COMPONENT C: WATER RELATED INFRASTRUCTURE					
3.1	Land acquisition for construction works	Provide adequate compensation to affected persons	Before construction	SRBMP DC	As specified in RAP
3.2	Disruptions to aquatic life and the fishing patterns of local communities due to the construction of temporary coffer dams	Provide for minimum flow in the engineering design as recommended by the Water Resources Department	During design	SRBMP Water Resources Dept	Not applicable
3.3	Increased spreading of water related diseases	Design small-scale structures appropriately to avoid water logging and stagnation	During planning and design	SRBMP	Include in bills of quantities for
		Cut grass around small earth dams to discourage breeding of mosquitoes	During operation and maintenance	SRBMP Communities	

Table 7.1B: Generic Environmental and Social Management Plan						
NEGATIVE IMPACTS						
ITEM No.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED MITIGATION MEASURES	TARGET	INSTITUTION	COST	
3.4	Disturbances in the social structure and organisation	Conduct consultation with the communities and the workers to sensitize them on the importance of respecting the existing social structures and organization.	During planning and implementation	SRBMP	Not applicable	
3.5	Spreading of HIV and AIDS	Include HIV and AIDS mainstreaming at the construction sites	During planning and implementation	SRBMP Contractors NAC	From capacity building project funds	
3.6	Disturbance to flow of traffic	Limit number of trucks transporting construction materials during peak traffic periods Provide detours and appropriate traffic signs for vehicles and pedestrians	During construction	MTPW Contractors	Include in bills of quantities for contractors	
3.7	Generation of construction waste (rocks, soil, and other construction materials)	Dispose all rubble and solid wastes from the site at recommended dumping sites	During construction	SRBMP DC Contractors	Not applicable	
3.8	Increased generation of both liquid and solid waste from construction works	Provide approved temporary toilets and dispose solid waste in approved sites	During construction	Contractor SRBMP Consultant	Included in bills of quantities for contractors	
3.9	Dust emissions from construction activities	Spray water on dusty areas on construction sites. Provide dust masks to workers exposed to dust	During construction	Contractors Consultant	Include in bills of quantities for contractors	
3.10	Increased risk to drowning of wildlife	Provide fencing in all areas that pose risk to wildlife drowning	During construction	Contractors DNPW	From project funds under component C	
3.11	Barriers to animal or human access to river where steep embankments are constructed or reinforced for flood protection	Provide for gently-sloping river banks at key access points Provide alternative sources of water	During construction	SRBMP DNPW	Not applicable	

7.2 Environmental and Social Monitoring Plan

Environmental and social monitoring has to be carried out during the catchment management, construction and rehabilitation of water related infrastructures, as well as during their operation and maintenance. Table 7.2 gives the proposed monitoring institutions, monitoring indicators, monitoring frequency and the estimated costs for monitoring implementation of the EMP activities of the SRBMP in one district for one year. Costs for monitoring implementation of some of the recommended enhancement and mitigation measures are provided in Table 7.2. For activities which do not have costs, it is assumed that these will be funded as part of normal responsibility of the respective government institutions.

Table 7.2A Generic Environmental and Social Monitoring Plan						
POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	MONITORING INDICATORS	RESPONSIBLE INSTITUTION	FREQUENCY/ PER YESR	COST
1.0 IMPACTS FROM COMPONENT A: SHIRE RIVER BASIN PLANNING						
1.1	Improved water resources information systems and knowledge base on SRBMP	Set up and maintain efficient communication channels with full participation of all stakeholders	Number or size of communication channels set	MWDI	Twice during project planning	
1.2	Improved reporting on comprehensive State of the Shire River Basin	Maintain installed information systems such as GSM telemetry and traditional gauging stations in good operating order	Efficient maintenance programme in place	MWDI	Twice during project planning	
1.3	Increased institutional capacity for coordinated basin management	Recruit and maintain recommended levels of staffing and adequate resources to be sustained at all times	Number of staff employed and value of assets in place	MWDI	Twice during planning	
2.0 IMPACTS FROM COMPONENT B: CATCHMENT MANAGEMENT						
2.1	Reduction in run-off, soil erosion and siltation in the basin	Sustain appropriate soil and water conservation techniques through regular refresher trainings	Amount silt in Shire River and tributaries	Water Resources Dept.	Annually during project implementation	US\$8,000r
		Sustain structures such as check dams, through regular maintenance	Number of structures in good operating status	Water Resources Dept.		
		Sustain forestation and rural energy interventions for continued supply of alternative biomass resources and fuel	Percentage increase in vegetative cover in selected catchments	Forestry Dept. LRCD	Annually during project implementation	
2.2	Increased knowledge of applied research and technology for farming systems intensification and efficient technologies (new brick forming machines, small scale solar energy, fuel efficient stoves, eco-sanitation, etc) to reduce fuel wood demand	Facilitate and disseminate technologies that would be user friendly and acceptable to the communities especially women and children	Percentage of new and efficient technologies adopted	SRBMP EAD Forestry Dept	Annually during project implementation	US\$2,000
		Include the technology user communities during technology planning and design	Number of technology user communities			

Table 7.2A Generic Environmental and Social Monitoring Plan

POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	MONITORING INDICATORS	RESPONSIBLE INSTITUTION	FREQUENCY/ PER YESR	COST
			participating in the planning			
2.3	Improved catchment management and protection	Sustain adequate levels of staffing and resources	Number of staff and resources provided	MWDI	Bi-annually during implementation	Recurrent budgets for MWDI and Capacity Building report
2.4	Improved Institutional capacity for catchment Planning and monitoring	Conduct regular refresher trainings in catchment and its importance				
2.5	Reduced incidences of flash floods	Sustain forestation and rural energy interventions to ensure continued supply of alternative biomass resources and fuel	Percentage hectare rehabilitated	Forestry Dept. EAD	Annually during implementation	Costs from recurrent Forestry Dept budget. \$2000
2.6	Increase in water table through restoration of forest cover	Plant as many trees as possible in all degraded areas and promote regeneration of natural vegetation	Percent area rehabilitated out of the proposed 133,000 ha	Forestry Dept. Land Resources & Conservation Dept.	Annually during implementation	Recurrent budgets of responsible institutions Included in 2.5
2.7	Improved consistency in water flows in the Shire River and its tributaries	Maintain and operate the barrage in line with operating procedures	Amount of water flows recorded at Kamuzu Barrage	MWDI	Monthly during implementation	Recurrent budgets for MWDI. N/A
2.8	Improved participatory micro-catchment planning for communities, government technical staff, field NGOs and relevant private sector actors to develop 28 integrated micro-catchment development	Consult widely to include all stakeholders and adequately involve women and children as well as disadvantaged groups	Number of MCDPs developed out of the 28 in consultation with all stakeholders	MWDI District Council NGOs CSOs	Quarterly during implementation	US\$6000per year

Table 7.2A Generic Environmental and Social Monitoring Plan

POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	MONITORING INDICATORS	RESPONSIBLE INSTITUTION	FREQUENCY/ PER YESR	COST
	plans (MCDPs)					
2.9	Harmonized and quality standard setting in catchment management programs through national guidelines for integrated catchment management	Consult stakeholders widely during guideline development. Regularly update the guidelines to respond to changing project scope and the environment	Number of consultations conducted during guidelines updating	SRBMP Land Resources & Conservation Dept.	Annually during project implementation	\$2000
2.10	Improved program performance, transparency and accountability in the program and lesson learning and coordination across the Basin due to developed monitoring model	Support and supervise the monitoring model and systems to ensure that appropriate targets will be met Identify and remove barriers (such as bureaucracy and political interference) from project implementation to ensure that intended monitoring targets are met without impediment	Percentage of performance targets being met	MWDI	Annually during project implementation	N/A
2.11	Sustainable and productive agriculture from small scale irrigation, and efficient use of water resources etc.	Train stakeholder communities in sustainable agricultural practices and irrigation water management	Percent of area under sustainable agricultural practices	Irrigation Dept. Land Resources & Conservation Dept	Annually during implementation	\$8,000
2.12	Improved management and rehabilitation of degraded forests on customary and communal lands	Train communities in forest rehabilitation and management techniques as well as in sustainable use of forest resources	Number of trainings conducted Number of farmers using sustainable agricultural practices and irrigation water management	Forestry Dept. Land Resources & Conservation Dept.	Annually	\$2000

Table 7.2A Generic Environmental and Social Monitoring Plan						
POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	MONITORING INDICATORS	RESPONSIBLE INSTITUTION	FREQUENCY/ PER YESR	COST
2.13	Increased income-generating activities, with special targeting of women, youth and landless groups	Sustain empowerment of women, youth and landless groups through regular trainings and sensitization meetings	Percentage of women and youth benefiting from IGAs	Ministry of Youth, Ministry of Gender, DC	Quarterly throughout implementation	US\$1,000
2.14	Increased revenues from tourism	Sustain catchment protection, flood attenuation, biodiversity conservation and carbon sequestration programmes	Percentage increase in tourism revenues Percent of catchment protection work completed in protected areas	DNPW, Land Resources & Conservation Dept.	Monthly during project implementation	US\$8,000
2.15	Reduced people – park conflicts (park management and animals)	Sensitize communities on the park rules and regulations and enforce them Implement co-management plans for parks	Percent change in people-park conflicts	DNPW	Quarterly during implementation	Included in 2.14
2.16	Improved forest management in Eastern Escarpment, Tsamba & Mangochi Forest Reserves	Sensitize communities in the co-management model and review its strategies and implementation procedures in line with lessons learnt on the ground.	Number of village co-management contracts in place	Forestry Dept.	Bi-annually during implementation	US\$2000
2.17	Improved food security, nutrition and household incomes	Promote agricultural diversification with the full participation smallholder farmers including women, youth and the landless	Percentage of farmers practicing diversification	MAFS, Department of Irrigation, Ministry of Gender Ministry of Youth	Annually during project implementation	

Table 7.2A Generic Environmental and Social Monitoring Plan						
POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	MONITORING INDICATORS	RESPONSIBLE INSTITUTION	FREQUENCY/ PER YESR	COST
2.18	Decreased dependence on unsustainable exploitation of forest resources	Promote alternative energy sources and support community woodlots	Percentage of communities using alternative energy sources and number of community woodlots established	Department of Energy Forestry Dept.	Bi-annually during project implementation	US\$2000
2.19	Increase in value of agriculture related products marketed in the targeted GVs by 15 percent	Assist farmers to form cooperative for price bargaining and processing of produce into value added products	Percent increase in marketed value added products in GVs	District Council ADC	Annually during project implementation	US\$3,000
2.20	Increase in alternative livelihoods through mobilization, sensitization, and initial capacity building of common interest groups (CIG) for commercially oriented income-generating activities	Link CIGs to markets for products of income generating activities.	Number of CIGs established out of the 360 CIGs planned to be established in 480 villages	District Council	Quarterly throughout project implementation Included in 2.19	
2.21	Improved sub-catchment level market and access infrastructure	Train community leaders in community mobilization and task distribution to include women and youth during construction of market and access infrastructure	Number of people and women participating in sub-catchment infrastructure work	District Council	Annually during project implementation Included in 2.19	
2.22	Increased access to finance through the investment grants to GVs that have reached a certain level of maturity and savings	Design appropriate, transparent and credible mechanisms for determining level of maturity and savings	Number accessing finance in each GV out of the 430,000 households	District Council	Annually during project implementation	Costs included in 2.19
		Provide financial management training	Number of beneficiaries trained			
2.23	Improved livelihoods from mini and small scale irrigation	Link farmers to markets for produce from irrigation	Percentage increase in farmers linked to produce markets	District Council, MWDI	Annually during implementation	Costs included in 2.19

Table 7.2A Generic Environmental and Social Monitoring Plan						
POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	MONITORING INDICATORS	RESPONSIBLE INSTITUTION	FREQUENCY/ PER YESR	COST
3.0 IMPACTS FROM COMPONENT C: WATER RELATED INFRASTRUCTURE						
3.1	Improved sustainable use of water resources in the Shire River and its tributaries	Regular sensitization of communities and water users on water rights and their implications.	Number of sensitizations conducted	Water Resources Board SRBMP	Annually during project implementation	
		Monitor water users to comply with water permits	Number of complaints against water availability			
3.2	Reduced future potential water use conflicts	Regularly sensitize communities on water use rights Monitor water users to comply with water permits				N/A
3.3	Improved energy production from existing hydropower stations	Operate and maintain the barrage according to the recommended operating procedures. Harvest weeds as recommended to facilitate free flow of water to the power generation plants	Percentage decrease in downtime for hydropower stations	MWDI ESCOM	Monthly during construction	
3.4	Improved water availability for hydropower generation, irrigation, and water supply		Water availability to users in the basin	MWDI ESCOM	Monthly during the project life	N/A
3.5	Improved road safety and traffic flow at the Kamuzu barrage	Provide adequate appropriate traffic warning signs to alert people on the traffic separation at the gates	Number of accidents	SRBMP RTD	Monthly during construction	
3.6	Increased employment opportunities	Recruit workers from within the project site	Number of project beneficiaries employed during upgrading of Kamuzu Barrage	Ministry of Labour MWDI	Quarterly during construction	\$2000

Table 7.2A Generic Environmental and Social Monitoring Plan

POSITIVE IMPACTS						
ITEM NO.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	PROPOSED ENHANCEMENT MEASURES	MONITORING INDICATORS	RESPONSIBLE INSTITUTION	FREQUENCY/ PER YESR	COST
3.7	Improved weed management and reduced handling cost	Operate and maintain the boom as recommended	Percent change in unit cost of weed removal	SRBMP ESCOM	Throughout the project	N/A
3.8	Improved protection of human settlements and infrastructure	Implement integrated Flood Risk Management Plan (IFRMP) to benefit approximately 40,000 households in the flood-prone areas in terms of better preparedness and reduced vulnerability.	Number of households in flood prone areas re-classified to lower risk	DODMA District Council	Annually	N/A
3.9	Reduced crop and livestock damage	Maintain flood intervention structures regularly and provide early flood warning signs as recommended.	Number of infrastructures constructed and maintained	DODMA District Council	Annually during project	\$3000
3.10	Reduced economic losses and damage to property	Sensitise beneficiaries on the need to care for the flood intervention structures	Number of households in flood prone areas re-classified to lower risk	DODMA District Council		
3.11	Improved ecosystem management of the Elephant Marshes	Drafting of legislation for the protection and management of the Elephant Marsh should be finalised to support its protection through maintenance of the buffer capacity	Percentage of land under ecosystem management	DNPW	Before project implementation	N/A
3.12	Improved sanitation and hygiene	Sensitise communities on the negative health impacts associated with flooding	Number of improved sanitary facilities being used	MWDI MoH District Council	Throughout operation period	\$2000
3.13	Increased employment opportunities during construction of flood intervention structures	Recruit workers from within the project areas	Number of workers recruited from project area	Ministry of Labour	Throughout operation	Covered in 3.6

Table 7.2B Generic Environmental and Social Monitoring Plan						
NEGATIVE IMPACTS						
ITEM No.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	Proposed CONTROL / MITIGATION MEASURES AND	MONITORING INDICATORS	RESPONSIBLE INSTITUTION	FREQUENCY and cost	
2.0 IMPACTS FROM COMPONENT B: CATCHMENT MANAGEMENT						
2.1	Restrictions on access to grazing in the protected areas of the catchment	Allocate dedicated areas for grazing and enforce compliance to their utilization	Percentage decrease in open grazing area	District Council SRBMP	Annually	Covered in 2.16
2.2	Removal of vegetation during construction of small scale structures and larger infrastructure investments	Restrict vegetation removal only areas for construction	Percent area cleared of vegetation	District Council, SRBMP	Quarterly throughout construction	US\$2,000.00
		Re-vegetate bare areas after construction	Area revegetated	Contractors	Covered in 2.2	
2.3	Water, soil and air pollution from agrochemicals and pesticides use Poisoning and misuse of pesticides	Train communities on safe use, storage and disposal of agrochemicals and pesticides. Develop and implement IPM	Water and soil quality around the irrigation schemes	Department of Water Resources PCB	Quarterly	\$4000
			Number of cases			
2.4	Salinization and water logging in irrigation schemes	Train communities on irrigation water management and efficient application of fertilizers	Percentage of land under good water management	Department of Irrigation Department of Water Resources	Annually	\$2000
3.0 IMPACTS FROM COMPONENT C: WATER RELATED INFRASTRUCTURE						
3.1	Land acquisition for construction works	Provide adequate compensation to affected persons	Number of complaints on compensation	MLHUD District Council	As specified in RAP	\$1000
3.2	Disruptions to aquatic life and the fishing patterns of local communities due to the	Provide for minimum flow in the engineering design as recommended by	Volume of water flows in the rivers	Department of Water Resources	Monthly	

Table 7.2B Generic Environmental and Social Monitoring Plan						
NEGATIVE IMPACTS						
ITEM No.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	Proposed CONTROL / MITIGATION MEASURES AND	MONITORING INDICATORS	RESPONSIBLE INSTITUTION	FREQUENCY and cost	
	construction of temporary coffer dams	the Water Resources Department	of the Shire River Basin		\$3000	
3.3	Increased spreading of water related diseases	Design small-scale structures appropriately to avoid water logging and stagnation. Cut grass around small earth dams to discourage breeding of mosquitoes	Number of water related diseases Number of malaria cases	MoH SRBMP MWDI	Annually	\$2000
3.4	Disturbances in the social structure and organisation	Conduct consultation with the communities and the workers to sensitize them on the importance of respecting the existing social structures and organization.	Number of complaints on social disturbances from the communities	District Council NRSC	Weekly during construction	N/A
3.5	Spreading of HIV and AIDS	Include HIV and AIDS mainstreaming at the construction sites	Increase in the spread of HIV and AIDS	SRBMP NAC	Annually	US\$2000
3.6	Disturbance to flow of traffic	Limit number of trucks transporting construction materials during peak traffic periods Providing detours and appropriate traffic signs for vehicles and pedestrians	Number of complaints on traffic flow	District Council NRSC	Weekly during construction	
3.7	Generation of construction waste (rocks, earth, and other construction materials)	Dispose all rubble and solid wastes from the site at recommended dumping sites	Percent waste disposed in approved places	District Council	Monthly during construction	Covered in 3.12
3.8	Dust emissions from construction activities	Establish a frequent watering program to keep bare dirt surfaces and roads in	Number of complaints on	Consultant, SRBMP	Daily during construction	

Table 7.2B Generic Environmental and Social Monitoring Plan					
NEGATIVE IMPACTS					
ITEM No.	POTENTIAL ENVIRONMENTAL/ SOCIAL IMPACT	Proposed CONTROL / MITIGATION MEASURES AND	MONITORING INDICATORS	RESPONSIBLE INSTITUTION	FREQUENCY and cost
		construction areas from generating dust	dust		N/A
3.9	Increased risk to drowning of wildlife	Provide fencing in all areas that pose risk to wildlife drowning	Percentage change in wildlife drowning cases	Department of National Parks and Wildlife	Weekly during construction N/A
3.10	Barriers to animal or human access to river where steep embankments are constructed or reinforced for flood protection	Provide for gently-sloping river banks at key access points Provide alternative sources of water	Number of accidents on potentially dangerous areas	SRBMP Consultant	Twice annually N/A

Table 7.3: Summary Costs for Environmental and Social Monitoring Plan

Impact enhancement/ Mitigation measure	Cost (US\$)
Sustain structures such as check dams, through regular maintenance	8,000
Facilitate and disseminate technologies that would be user friendly and acceptable to the communities especially women and children Include the technology user communities during technology planning and design	2,000
Sustain forestation and rural energy interventions to ensure continued supply of alternative biomass resources and fuel	2,000
Consult widely to include all stakeholders and adequately involve women and children as well as disadvantaged groups	6,000
Consult stakeholders widely during guideline development. Regularly update the guidelines to respond to changing project scope and the environment	2,000
Train stakeholder communities in sustainable agricultural practices and irrigation water management	8,000
Train communities in forest rehabilitation and management techniques as well as in sustainable use of forest resources	2,000
Sustain empowerment of women, youth and landless groups through regular trainings and sensitization meetings	1,000
Sustain catchment protection, flood attenuation, biodiversity conservation and carbon sequestration programmes	8,000
Sensitize communities in the co-management model and review its strategies and implementation procedures in line with lessons learnt on the ground	2,000
Promote alternative energy sources and support community woodlots	2,000
Assist farmers to form cooperative for price bargaining and processing of produce into value added products	3,000
Recruit workers from within the project site	2,000
Implement integrated Flood Risk Management Plan (IFRMP) to benefit approximately 40,000 households in the flood-prone areas in terms of better preparedness and reduced vulnerability.	3,000
Sensitise beneficiaries on the need to care for the flood intervention structures	2,000
Restrict vegetation removal only areas for construction	2,000
Train communities on safe use, storage and disposal of agrochemicals and pesticides. Develop and implement IPM	4,000
Train communities on irrigation water management and efficient application of fertilizers	2,000
Provide adequate compensation to affected persons	1,000
Provide for minimum flow in the engineering design as recommended by the Water Resources Department	3,000
Design small-scale structures appropriately to avoid water logging and stagnation. Cut grass around small earth dams to discourage breeding of mosquitoes	2,000
Include HIV and AIDS mainstreaming at the construction sites	2,000
TOTAL	69,000

CHAPTER EIGHT: INSTITUTIONAL ARRANGEMENT FOR IMPLEMENTATION OF SHIRE RIVER BASIN MANAGEMENT PROJECT.

8.1 Key project implementing institutions

The project will be coordinated by a multi-sector Technical Team (MSTT) that has been formed and is located in Ministry of Water Development and Irrigation. The technical team will be led by a Project Coordinator who will be reporting directly to the Principal Secretary.

Key government institutions in the implementation of the project include the:

- Department of Water Resources;
- Department of Irrigation;
- Department of Land Resources Conservation;
- Department of Forestry;
- Department of Surveys and the National Spatial Data Centre;
- Department of Climate Change and Meteorological Services;
- Department of National Relief and Disaster Management;
- Department of National Parks and Wildlife;
- Environmental Affairs Department; and
- Department of Energy.

Table 8.1 provides roles and responsibilities of the various institutions for the Shire River Basin Management Project.

Table 8.1: Institutional Roles and Responsibilities for Implementation of the SRBMP			
	PROJECT COMPONENTS		
INSTITUTION	COMPONENT A	COMPONENT B	COMPONENT C
Technical Team	<ul style="list-style-type: none"> • Overall project management, M&E and fiduciary support to departments • Hatch Shire River Basin planning institution • Facilitate Interdepartmental cooperation 	<ul style="list-style-type: none"> • Implementation of project planning and activities • Monitoring & Evaluation • Facilitate Interdepartmental cooperation 	<ul style="list-style-type: none"> • Implementation of prioritized activities • Fiduciary oversight Kamuzu Barrage • Monitoring & Evaluation • Facilitate Interdepartmental cooperation
Water Resources Department	<ul style="list-style-type: none"> • Coordinate sustainable water resources development and management related activities • Knowledge base development • Develop Water Resources Information System • DSS planning • DSS real-time 	<ul style="list-style-type: none"> • Hydrological analysis • Small dam design • Support operationalization of Zomba centre of excellence for Land and water management 	<ul style="list-style-type: none"> • Facilitate optimization and implementation of a new operational regime for the upgraded Kamuzu Barrage • Kamuzu Barrage upgrading • Dam Safety Panel • Supervise community level early warning and infrastructure (incl. hiring service provider) • Facilitate design, costing, and construction of small-scale water resources infrastructure • Implementation of Flood Forecasting and Early Warning System Development and Operation Control
Shire River Basin Institution	<ul style="list-style-type: none"> • Hydrological / flood forecasting 	<ul style="list-style-type: none"> • Catchment stakeholder meetings 	<ul style="list-style-type: none"> • Analysis and facilitating of prioritization and preparation of new investments
Department of Irrigation	<ul style="list-style-type: none"> • Irrigation planning as part of basin planning through knowledge base 	<ul style="list-style-type: none"> • Support development of irrigation within catchment approach, including support to WUAs • Support to national 	<ul style="list-style-type: none"> • New irrigation investment preparation • Support prioritization next set of catchments for phase 2

Table 8.1: Institutional Roles and Responsibilities for Implementation of the SRBMP			
	PROJECT COMPONENTS		
INSTITUTION	COMPONENT A	COMPONENT B	COMPONENT C
		guidelines <ul style="list-style-type: none"> • Support operationalization of Zomba Centre of Excellence for Land and water management 	
Department of Land Resource Conservation	<ul style="list-style-type: none"> • Catchment mgmt planning as part of basin planning through knowledge base 	<ul style="list-style-type: none"> • Lead preparation and implementation of sub catchment and micro-watershed plans • Catchment M&E planning • Development of national guidelines • Set up and operationalize Zomba Centre of Excellence for Land and water management 	<ul style="list-style-type: none"> • Support Ruo investment studies • Prioritize next set of catchments for phase 2
Department of Forestry, and National Herbarium and Botanical Gardens	<ul style="list-style-type: none"> • Interfacing forestry strategic plans with Shire River Basin Plans • Improve forestry knowledge base • Support to national herbarium/NFRI 	<ul style="list-style-type: none"> • Support co-management of Forest Reserves • Promote agro forestry/ woodlots in catchment management • Support to national guidelines 	<ul style="list-style-type: none"> • Prioritize further forestry activities for phase 2
National Spatial Data Centre	<ul style="list-style-type: none"> • Coordinate development of Spatial knowledge base/products • Facilitate coordinated procurement of satellite imagery • Facilitate spatial data sharing across institutions and in the public domain (online) • Support development of hydromet visualization portal 	<ul style="list-style-type: none"> • Support catchment management /M&E with mapping and spatial analysis. • Develop catchment thematic maps/Atlas 	<ul style="list-style-type: none"> • Support flood management with mapping and spatial analysis • Support LiDAR and other surveys • Mapping/spatial analysis to support investment preparation • Develop flood area atlas

Table 8.1: Institutional Roles and Responsibilities for Implementation of the SRBMP			
	PROJECT COMPONENTS		
INSTITUTION	COMPONENT A	COMPONENT B	COMPONENT C
	<ul style="list-style-type: none"> Developing Shire River Basin Atlas 		
Department of Climate Change and Meteorological Services	<ul style="list-style-type: none"> Improve hydromet network (include radar) Make real-time data available in public domain visualization portal. Improve weather forecasting and linkage with hydrological/flood forecasting integration of climate change/variability analysis in basin planning Drought management planning as part of Basin Planning 	<ul style="list-style-type: none"> Support M&E/catchment planning by tailor-made meteorological observations 	<ul style="list-style-type: none"> Support flood last mile connectivity for disaster management Support preparation of new investments.
Department of National Relief and Disaster Risk Management	<ul style="list-style-type: none"> Implement the relevant policies and various guidelines for effective management of disaster risks in the basin Support Flood Forecasting and Early Warning System development and operational control Support flood mapping and information for basin knowledge base Contribute to other activities in the SRBMP, including knowledge base development and ecosystem-related activities in coordination with other relevant parties. 		<ul style="list-style-type: none"> Support supervision of community based investment Support supervision and communication on flood early warning Strengthen response capacity and operational control Support preparation of new investments on Ruo.
Department of National Parks and Wildlife	<ul style="list-style-type: none"> Biodiversity assessments to support basin knowledge base Contribute to other activities in the SRBMP, including knowledge base development and ecosystem-related activities, in coordination with other relevant Parties 	<ul style="list-style-type: none"> Improved Protected Area management in Lengwe, Liwonde Hire long term TA 	<ul style="list-style-type: none"> Improved community based ecosystem mgmt in Elephant Marshes
Environmental Affairs Department	<ul style="list-style-type: none"> State of Environment Reporting as Basin knowledge base Provide technical input into relevant sections of the Shire River Basin Plan and thematic areas 	<ul style="list-style-type: none"> Review EIA and implementation of ESMP for catchment sub-projects Coordinate the rehabilitation 	<ul style="list-style-type: none"> Review EIA and implementation of ESMP Review ToR and ESIA for new investments

Table 8.1: Institutional Roles and Responsibilities for Implementation of the SRBMP			
	PROJECT COMPONENTS		
INSTITUTION	COMPONENT A	COMPONENT B	COMPONENT C
	<ul style="list-style-type: none"> including biodiversity and ecosystem management • Participate in the preparation of the State of the Shire Basin Report and knowledge base and facilitate their dissemination • Provide input in the identification of critical natural habitats and biodiversity hotspots within the Basin and participate in their management • Enhance use of the Shire knowledge base developed as baseline information for projects in the Basin 	<ul style="list-style-type: none"> and restoration of degraded areas and habitats in the Shire River Basin • Participate in monitoring and evaluation of the environmental and social performance of the SRBMP 	<ul style="list-style-type: none"> • Participate in monitoring and evaluation of the environmental and social performance of the SRBMP
Department of Energy	<ul style="list-style-type: none"> • Support basin knowledge base with energy planning inputs • Support dialogue on long term sustainable weed and barrage operation and maintenance • Implement the relevant policies and various guidelines for effective management of energy resources to support sustainable energy resources development and management in the basin • Contribute to other activities in the SRBMP, including knowledge base development and ecosystem-related activities related activities, in coordination with other relevant parties 	<ul style="list-style-type: none"> • Advise on Catchment energy aspects (e.g. pico-hydro, solar, improved cook stoves) 	<ul style="list-style-type: none"> • Support preparation and analysis for new investments • Facilitate optimization and implementation of a new operational regime for the upgraded Kamuzu Barrage
Non-Governmental Organisations and Civil Society Groups	<ul style="list-style-type: none"> • Advocacy and community mobilization 	<ul style="list-style-type: none"> • Support on sustainable use of natural resources • Support on Forestation programmes 	<ul style="list-style-type: none"> • Support on Climate Change resilience programmes

CHAPTER NINE: EXIT STRATEGY

The primary goal of any development project is to improve the socio-economic wellbeing of the people and the natural resource base on which they depend for the very existence of their lives. Every project such as the SRBMP will have several phases including the inception, planning, implementation and management and maintenance phases. During the first two phases, usually the beneficiaries of the project are seldom involved and only participate during the latter phases. This is an anomaly that also needs to be addressed. During implementation up to the time when outputs and outcomes are likely to be realized, performance indicators will show whether or not there are diversions on the expected results of the project as outlined at the inception stage. The benefits accruing at the end of the project will depend on the integration of a number of factors including financial outlays at every stage of the development process, equipment, human resources, frequency and adequacy of monitoring and evaluation of the performance indicators and others which may include political interventions.

An exit strategy can be prepared at any early stage of the development process: either during the time of inception, planning or early during implementation. Many projects particularly in southern Africa have rarely had any exit strategies to the extent that beneficiaries have envisaged continued dependence on the implementing and executing agencies; more so because they have not been brought on board within the activities of the project at an early stage. The central focus of an exit strategy ought to be human capital development including establishment and/or strengthening of the institutional arrangements and policy which also has to be enforced and adhered to.

While it is expected that the SRBMP will be associated with many positive impacts, this would entail numerous demographic, environmental and economic dynamics which would blindfold resource managers from executing their work professionally. This is why the immediate establishment of the National Water Resources Authority ought to be an overriding priority within government to play a major part in the allocation, management and use of natural resources within the Shire River Basin. The Authority would, during the time of project implementation, be tasked with capacity building within the various sub-catchments of the Shire River Basin; and take control of policy implementation, enforcement and demonstrate transparency in resource conservation, use and management.

Capacity building in how to set goals, mobilize resources in the form of inputs, implement activities left behind by the project, monitor and evaluate performance and ensure that each project within the basin is sustainable will also be required for communities within the various sub-basins of the Shire River Basin. Sustainability depends on total ownership of the project and acceptance by beneficiaries of the benefits that are expected to accrue. This is why, the intended beneficiaries ought to be involved as early as possible during this project so that they fully participate and learn the required skills during every stage of the project. This ESA therefore recommends the following:

- ❖ The National Water Resources Authority (NWRA) should be established as a matter of urgency;
- ❖ Each major sub-basin should have an arm of the NWRA;
- ❖ Staff of the NWRA should be involved in all aspects of project planning and implementation;
- ❖ Training, knowledge and skills development should be extended to staff of the NWRA, the Water Department and other sectors that will be involved with the activities of the project;
- ❖ Traditional leaders including Members of Parliament should receive some form of capacity building and made aware of the benefits of IWRM;

- ❖ As much as possible and of crucial significance, beneficiaries that will directly be involved with the project activities should be trained to take over the operations of the various projects upon the exit of the government and its development partners;
- ❖ To facilitate financing mechanisms of the various projects within the basin and depending on the type and scale of the projects, government will have to recommend to the beneficiaries, the creation of a revolving fund for project sustainability;
- ❖ A public/private sector cost and benefits-sharing scheme should also be introduced where the private sector engages in a development project within the basin to assist government provide adequate financial outlays to its people.

During the period of exit from implementation of the core activities of the project in the Shire River Basin, the establishment of monitoring and evaluation units for various projects would be ideal and these units must have concrete performance indicators which should show minimum divergence from intended goals. These indicators must apply to all sectors of the economy.

CHAPTER TEN: CONCLUSIONS AND RECOMMENDATIONS

This Environmental and Social Assessment has been prepared to provide the baseline information and existing environmental problems of the SRBMP. Generic potential impacts of the proposed SRBMP activities have also been predicted, to assist the sub-project implementers and other stakeholders to identify project specific impacts and determine mitigation measures for sustainable implementation of the SRBMP.

Catchments in the Shire River basin are rated severely degraded except for two catchments located to the west of the Lower Shire. This represents gross catchment modification. Severe loss of vegetation, natural habitats and biodiversity and ecosystems has occurred; and the existing severe environmental problems in the basin include but not limited to deforestation, soil erosion, siltation, land degradation, and sedimentation.

The catchment is grossly cultivated and management of the cultivated land is poor. Modification of the catchment is accelerated by high population and land pressures which lead to cultivation in fragile areas, steep slopes and non-arable land. The catchment is also infested with weeds.

Overall, continuing degradation of the catchment is negatively impacting on water resources, aquatic life, hydro – electric power generation and water transport. Although programmes of land management are promoted, these are inadequate.

“Appropriate land use” means using land according to what it is suitable for. Unfortunately, there are no appropriate land use practices in the Shire River Basin, as areas such as hilly and rocky areas as well as river banks, which should not have been cultivated, are now used for agricultural purposes. Areas which should have been left for forest use are now used for settlements or are badly encroached.

The SRBMP, designed to help restore the environmental and socioeconomic integrity of the basin, will provide opportunities for the communities and other key stakeholders to sustainably manage and benefit from the natural resource base in an environmentally acceptable and coordinated manner.

The ESA has identified the following generic positive environmental impacts from the proposed SRBMP activities:

- Improved reporting on comprehensive State of the Shire River Basin;
- Improved information systems and knowledge base on Shire River Basin Management Project;
- Reduction in run-off, soil erosion and siltation;
- Increased institutional capacity for coordinated management of Shire River Basin;
- Improved sustainable use of water resources in the Shire River Basin;
- Improved catchment management and protection;
- Improved consistency in water flows in the basin;
- Improved protection of human settlements and infrastructure through a set of adaptation measures including flood zone demarcation;
- Sustainable and productive agriculture from small scale irrigation and efficient use of water resources;
- Improved income generation at household level within the basin;
- Improved power generation at hydro power stations in the Shire River Basin;
- Improved forest management in Eastern Escarpment, Tsamba and Mangochi Forest Reserve;

- Increased economic development within the Shire River Basin.
- Improved livelihoods through enhanced food security, nutrition and availability of disposable income;
- Decreased dependence on unsustainable exploitation of forest resources;
- Improved water availability for hydropower generation, irrigation activities and water supply;
- Improved weed management and reduced handlings costs; and
- Improved ecosystem management of the Elephant Marshes.

The generic negative environmental and social impacts of the project activities, in the absence of adequate mitigation measures, could include:

- Land acquisition on both banks of the Shire River and in areas where people need to relocate to make room for new construction works;
- Disruptions to aquatic life and the fishing patterns of local communities due to the construction of temporary coffer dams during to upgrading of the Kamuzu Barrage;
- Removal of vegetation from construction sites;
- Changes in water flows and levels during the upgrading of Kamuzu Barrage (addressed in a separate Environmental and Social Impact Assessment);
- Water pollution from uncontrolled agro-chemical use and pesticides use;
- Blockage of river access and crossing points for animals (domestic and wild) and people where steep embankments are constructed or reinforced for flood protection; and
- Water logging and stagnation in irrigation schemes.

During the assessment, it was noted that the generic negative impacts will be localised, site specific and easy to manage, and provisions for mitigating the identified negative impacts have been presented in ESMF, RPF, PF and a separate ESIA report which has been prepared for Upgrading of Kamuzu Barrage.

In implementing the ESMF it should be noted that there will be different sources of social and environmental impacts arising from existing and new project activities, apart from SRBMP project activities. It is also to be appreciated that the project sites are dynamic and, therefore, prone to environmental and social impacts that may be generated from activities of other future development projects. These activities may impact on the project locations for the SRBMP. It is expected therefore that any other existing and new project activities will have their own environmental and social management plans. In the same way it is hoped that the Environmental Affairs Department and other relevant line ministries will ensure that human activities that lead to environmental problems are properly managed and monitored through enforcement of relevant administrative and legal provisions.

Successful implementation of the ESMF (a separate document) will depend, to a large extent, on the involvement and participation of local communities and the local institutions. It is therefore recommended that these stakeholders should be involved, as early as possible, in the design as well as implementation of the project and the ESMF. The stakeholders should adopt and adapt the screening process, checklists and the EMP in the ESMF to suit local conditions. It is further recommended that the ESMF should be referred to prior to any project activity of the SRBMP.

Specifically, it is recommended that:

- In the Shire River Basin, only areas suitable for agriculture, as recommended by specialist, should be opened. Non-arable land should be left for forestry or grazing while river banks should be left free of any activity for the natural vegetation to regenerate. This would help

reduce the drying of rivers and streams; and reduced siltation and soil erosion through reduced runoff. It would protect earth roads and bridges from damage. Implementation of appropriate land use practices in rural communities is increasingly becoming problematic due to population growth, land pressure and poverty.

- The Screening Process in the ESMF should be used for each project activity to determine potentially significant adverse environmental impacts and the level of environmental work to ensure that the negative impacts are properly mitigated;
- Environmental awareness and education for key stakeholders and affected communities should be an integral part of ESMF implementation;
- City/Town/District and local community structures should be adequately trained to implement the screening process, to develop and implement appropriate Environmental Management and Monitoring Plans;
- The EMPs and environmental monitoring plans prepared on the basis of the ESMF should be regularly updated to respond to changing local conditions and should incorporate lessons learned from implementing various components of the project activities;
- The City/Town/District Councils should be assisted to develop appropriate information management systems to support the environmental management process;
- The Councils should be assisted with the necessary resources and equipment to be able to produce the screening documentation such as checklists and environmental management and monitoring forms;
- The Environmental District Officer should be empowered to adequately administer the ESMF and should be given the necessary support and resources to ensure effective implementation.

Based on the findings of ESA, it is recommended that the project should proceed since it will, in the short and long term, generate significant environmental and social benefits to the communities and stakeholders of the Shire River Basin as well as the country.

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Annex 1. Terms of Reference

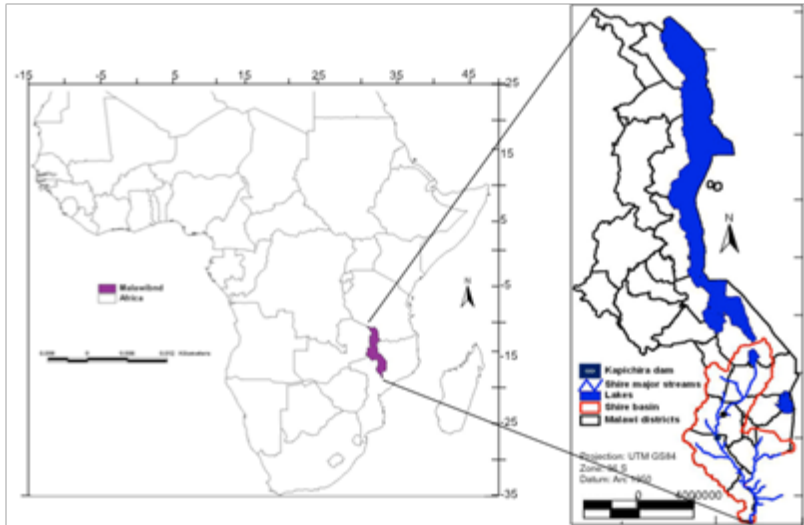
Malawi Shire River Basin Management Project

Terms of Reference for an Environmental and Social Assessment

Introduction and Project Context

1. The Government of Malawi has received a Project Preparation Advance on the proceeds of a credit from the International Development Agency (IDA – World Bank Group) to finance the preparation of the Shire River Basin Development Project. The World Bank is assisting the Government of Malawi in the preparation of a Shire River Basin Management Project as part of a longer term Program. The program is a flagship World Bank financed activity for Malawi given the importance of the Shire River Basin for economic growth and poverty alleviation.
2. The overall Program Development Objective is to make significant progress in achieving socially, environmentally and economically sustainable development in the Shire River Basin. The project development objective of the Shire River Basin Management Program would be to develop a strategic planning and development framework for the entire Shire River Basin (defined from outflow of the lake to the border at Nsanje) and support targeted investments to improve land and water resources management and livelihoods in the Basin.
3. The Program investments will be designed to support the GoM's economic growth and sustainable development plans for the basin. The Program will address the interlinked challenges of poverty and a deteriorating natural resource base in the Shire River Basin to halt the process of environmental degradation and improve the productive potential of natural resources. The Program will promote integrated climate resilient investment planning in the basin, including institutional capacity building to plan and monitor changes in land use patterns at a basin level. The first project in the Program will support strategic planning and implementation of large-scale infrastructure investments; adoption of sustainable land, forest and water management practices to reduce land degradation in production landscapes and improve the productivity and incomes of smallholder farmers in priority catchments; and improved flood management in the Lower Shire. The first Project is expected to involve a World Bank investment of about US\$ 100m and be implemented over five and a half years. The Project is organized in three components (of about equal costs) as described below:

Component A: Shire Basin Planning intends to *lay the foundation for more integrated investment planning and system operations for the Shire Basin*. It would finance development of a modern integrated Shire Basin knowledge base and analytical tools, as well as well-planned structured stakeholder consultation processes, in order to facilitate investment and systems operation planning. This component is critically required to move from the current fragmented



approach to investments and systems operation, to a more coordinated and holistic approach based on a shared (but evolving) vision for the development and management of the Shire Basin. It will support institutional coordination mechanisms for basin planning and management for the basin's socio-economic development and environmental sustainability. It is organized in four sub-components:

- **Sub-component A.1: Develop a Shire Basin Plan**, through (i) preparing an inter-sectoral Shire River Basin Plan, including basin planning and decision support systems, acquiring datasets (satellite imagery etc.), and training for water resources planning and management; and (ii) strengthening an inter-sectoral Shire Basin coordination and management institution.
- **Sub-component A.2: Build institutional capacity for coordinated basin management**, will strengthen the different line agencies involved in Shire basin management to more effectively play their different roles, in particular: (i) Ministry of Irrigation and Water Development (in particular, the Department of Water Resources, Department of Irrigation, and the Water Resources Board); (ii) Ministry of Agriculture and Food Security (Department of Land Resources Conservation); (iii) Ministry of Natural Resources, Environment and Energy (Department of Forestry, Department of Climate Change and Meteorological Services); (iv) Ministry of Lands, Housing and Urban Development (particularly Department of Surveys and the National Spatial Data Centre); and (v) Department of Disaster Management Affairs (DODMA).
- **Sub-component A.3: Improve water resources information systems**, focused on: (i) water resources information system, to monitor water flows and discharges, water quality and sediment loads, as well as groundwater, using real time low-cost modern communications such as GSM telemetry, complete with operational control systems; and (ii) Flood Early Warning Systems, including hydrological/hydraulic flood modelling and forecasting, as well as community level early warning systems. These information systems would also be used to refine and update the Integrated Flood Risk Management Plan for the Shire Basin being prepared by DODMA with Bank/GFDRR support.
- **Sub-component A.4: Program management, monitoring and evaluation**, to ensure efficient and timely delivery of project resources in accordance with the project's objectives. A multi-sector Technical Team has been formed and located in MIWD, led by a Project Coordinator who reports directly to the Permanent Secretary (PS). The project will provide funding for professional and support staff to strengthen the Technical Team (initially facilitated by the National Water Development Program PMU) and facilitate its operations, including procurement, financial management, environmental and social safeguards specialists, an institutions specialist, GIS and modelling experts, economist and water resources planner, as well as a diverse range of short term expertise and annual external audits, as well as training and communications. M&E support will be provided for baseline, 6-monthly, mid-term, and end-of-project reporting.

Component B: Catchment Management intends to *rehabilitate degraded catchments for sustainable natural resource management and livelihoods through an integrated, participatory approach*. Development of community-based natural resource management systems is a long-term process that requires sufficient time to build the necessary capacity and ownership and is suitable for the programmatic approach proposed for the project. There would be three stages at the local micro-catchment level: (i) building conditions for micro-catchment rehabilitation and alternative livelihood development, including community sensitization, social mobilization and capacity building to ensure ownership and a strong foundation for subsequent interventions; (ii) implementation of micro-catchment development plans and alternative rural livelihoods; (iii) continuing financial and technical support for catchment rehabilitation and livelihood activities and longer-term community support.

- **Sub-component B.1: Build institutional capacity for sub-catchment planning and monitoring** with five sets of activities: (i) strategic planning and facilitation (including development of a comprehensive Monitoring & Evaluation System, guidance documents/field manuals, etc.); (ii) participatory micro-catchment planning at the Group Village level to develop integrated plans covering approximately 3,000 hectares each; and (iii) implementation support to provide technical service to government and communities at the national and field level.
- **Sub-component B.2: Rehabilitate targeted sub-catchments**, would finance interventions identified in micro-catchment plans prepared under sub-component B.1, including: (i) soil and water conservation for more sustainable and productive agriculture; (ii) forestry and rural energy interventions to restore forest cover and reduce firewood consumption within the sub-catchments; (iii) water regulation control to support community infrastructure; (iv) small-scale/mini irrigation facilities to assist farmers in drawing water from small storage structures to support agriculture/agri-business; and (v) appropriate rural infrastructure in each sub-catchment based on initial strategic assessments.
- **Sub-component B.3: Support alternative rural livelihoods** would support demand and market driven income-generating activities, with special targeting of women, youth and landless groups, to gradually decrease dependency on forest products as sources of income. This includes: (i) development and start-up of alternative livelihoods to support identification, mobilization, sensitization, and initial capacity building of common interest groups (CIG) for commercially oriented income-generating activities; (ii) capacity building and mentoring to build organizational, technical, financial and business capacities, and linkages with the private sector; and (iii) improving access to rural finance through community small-grants and linkages with existing credit schemes.

Component C: Water Related Infrastructure intends to *mitigate risks posed by droughts and floods and to prepare priority water investments*. The component would build on the basin planning carried out under Component A, and also on ongoing strategic water resources planning by the MoIWD. The component is organized in three sub-components:

- **Sub-component C.1: Kamuzu Barrage** would support the construction and construction supervision of the Kamuzu Barrage upgrade at Liwonde (to improve control of Lake Malawi water level), coupled with optimization and implementation of a new operational regime for the barrage. This central piece of water resources infrastructure for Malawi is currently being finalized with a detailed design and independent Environmental Impact Assessment under the Second National Water Development Project II implemented by MoIWD.
- **Sub-component C.2: Flood Management** in the Lower Shire in collaboration with other initiatives, to support the implementation of the Integrated Flood Risk Management Plan for the Lower Shire (see Component A): (i) community level adaptation support to the design and construction of adaptation measures, such as flood demarcation, elevated platforms, shelters and safe havens; communication and transport equipment for Civil Protection Committees, and connectivity to the Flood Early Warning Systems; and (ii) priority flood mitigation interventions, such as river bank stabilization, dykes, culverts, flood diversion structures etc.
- **Sub-component C.3: Preparation of New Water Investments** within the Shire basin would include feasibility and design studies for additional water related infrastructure works. There is ample scope and need to further develop the Basin's resources for different economic sectors, such as: agriculture in general and irrigation agriculture in particular, aquaculture, urban and rural water supply, hydropower, transport and disaster resilience. Special attention could be given to the design of a set of measures for flood mitigation in the Ruo River, the notoriously forceful flooding tributary to the Lower Shire.

Environmental and Social Context

4. **Existing Environmental and Social Problems:** The Shire River basin is currently facing a number of environmental and social problems induced by human factors. Major ones include conversion of catchments to other land uses, deforestation, soil erosion, proliferation of weeds and invasive species, declining capacity for agricultural productivity, expansion of settlements, declining incomes and livelihoods and others.
5. **Expected Environmental Impacts:** The project is being designed with environmental sustainability in mind for all components and activities. The environmental impacts of watershed management (Component B) are expected to be highly positive overall; likely environmental benefits include improved forest conservation and restoration, reduced soil erosion and land degradation, reduced sedimentation in the Shire River and some of its tributaries, and a reduced risk that the Shire River would run dry during an extended drought. Environmental considerations will be given major attention in Shire River Basin planning, as well as major civil works, to ensure that any adverse environmental impacts are minimized and adequately mitigated.
6. **Social Development Issues:** The project design will reflect social safeguards and sustainability. Preparatory activities will include consideration of these issues as part of an Environmental and Social Assessment and Management Framework and a Resettlement Policy Framework. Stakeholder involvement is proposed throughout the project and the preparation will support studies for stakeholder identification at various levels. This will build on work by various CSOs/NGOs especially related to catchment management and related livelihood enhancement and capacity-building activities.
7. **Environmental and Social Safeguards Reports.** The following World Bank Safeguard Policies apply to this project: Environmental Assessment OP 4.01, Natural Habitats OP 4.04 and Forests OP 4.36, Pest Management OP 4.09, Physical Cultural Resources OP 4.11, Involuntary Resettlement OP 4.12, Safety of Dams OP 4.37, and International Waterways OP 7.50. To ensure that the project is designed so as to comply fully with these policies, the following safeguards-related instruments will be developed during project preparation. Each of these reports will need to be completed (at least as good-quality drafts) and publicly disclosed in advance of project appraisal and (except for the Riparian Notification Letter) at least 120 days before formal project approval by the World Bank's Board of Executive Directors.
 - a) A **Strategic Environmental and Social Assessment (SESA) of the Shire River Basin** is substantially complete, with a Second Draft provided in August 2010 and now under review. The SESA is intended to assess the environmental, social, economic, and institutional implications of development policies, plans, and programs for the Shire River Basin.
 - b) An **Independent Environmental Impact Assessment (EIA) of the Kamuzu Barrage Upgrading** (including a social assessment and Resettlement Plan) is currently in the procurement process, with agreed terms of reference. An Independent EIA is sought, bearing in mind that a preliminary EIA was completed in 2003 as part of the Feasibility Study (*The Integrated Water Resources Development Plan for Lake Malawi and Shire River System "Lake Malawi Level Control"—Stage 2, Final Feasibility Report, Volume II, Part C—EIA of Upgraded Liwonde Barrage*, Norconsult).
 - c) An **Environmental and Social Assessment (ESA) of the Shire River Basin Management Project** will provide an overview of the expected environmental and social impacts of the overall project. The ESA will include an Environmental and Social Management Framework (ESMF), indicating the corresponding mitigation and enhancement measures for each type of environmental and social impact identified (whether negative or positive). This ESA will serve as a companion volume to the Independent EIA of the Kamuzu Barrage Upgrading (part of Component C).

- d) A **Resettlement Policy Framework** for the overall project will (i) incorporate the Resettlement Plan that will be produced under the Independent EIA of the Kamuzu Barrage Upgrading and (ii) specify the criteria and procedures to be followed if other components of the project (besides the Kamuzu Barrage work) would lead to involuntary physical relocation, or the loss of assets or livelihoods, among people in the project area.
- e) Given that the Shire is part of the Zambezi basin and given the nature of activities proposed under the project, there is a need to send a **Riparian Notification Letter** to the governments of all the other Zambezi River Basin countries (Mozambique, Tanzania, Angola, Botswana, Namibia, Zambia, and Zimbabwe). The mission advised the Department of Finance on the requirement for such a routine notification and request for official comments as per the Bank operational policy on Projects in International Waterways. It was also noted that the Bank could undertake such a notification as in the case of the earlier National Water Development Project.

Objective of This Study

8. The objective of this study is to undertake an Environmental and Social Assessment (ESA) of the Shire River Basin Management Project. This assessment would analyze the environmental and social implications of the proposed project activities (with the exception of the Kamuzu Barrage upgrading that is being handled by a separate study) and develop an Environmental and Social Management Framework for project activities. The ESA is intended to help prevent, minimize, or mitigate any adverse environmental and social impacts, while enhancing the positive impacts of the project. A Resettlement Policy Framework will also be prepared to guide the compensation and resettlement process of any activities that might lead to displacement of people. An analysis of project activities would be undertaken to examine these aspects and this would also draw upon other studies and the existing experience from implementation of similar activities through relevant government and NGO/CSO programs.

Study Scope

9. The following paragraphs are intended to define the scope of the ESA:

- **ESA to include ESMF and RPF.** In addition to the diagnostic sections describing the existing situation and potential environmental and social impacts (positive or negative) of proposed project activities, the ESA report should include (as a chapter or concise separate volume) an Environmental and Social Management Framework (ESMF). The ESMF would essentially function as an Environmental Management Plan (EMP), but is called an ESMF (i) to allow for adaptive changes in specific project interventions (especially under Component B) and (ii) to explicitly acknowledge the social aspects. The ESMF should outline mitigation and enhancement measures for all components, including from the Kamuzu Barrage Independent EIA. The ESMF should be written in a concise, operational style, so that (following negotiations between Government and the World Bank) it can serve as a legally binding document referenced in the project's Financing Agreement. In addition to recommending specific actions for mitigating the potential adverse environmental or social impacts—and enhancing the positive impacts—the ESMF should include (i) an implementation schedule (in sync with other project activities); (ii) institutional responsibilities for implementation; (iii) a budget for investment and recurrent costs; and (iv) suggested source(s) of funding for the recurrent costs. The ESA would also include a comprehensive social assessment related to the project area and activities and undertake stakeholder identification and consultations in this regard. Areas of environmental and social capacity building and a framework for monitoring and evaluation would be developed. A Resettlement Policy Framework (RPF) would also be developed for the project as some of the project activities could involve some involuntary resettlement. Findings of the Strategic Environmental and Social Assessment will likely have direct and indirect influence on the outcomes of the ESA. The consultant should therefore critically analyze the findings and recommendations of

the SESA and integrate them in relevant section of the ESA as part of the impact mitigation and enhancement process.

- **Basic Content of ESA, ESMF, and RPF.** The ESA report should provide the types of information—where specifically relevant to this project—indicated in OP 4.01, Annex B, “Content of an Environmental Assessment Report for a Category A Project”. In the case of environmental and social impacts related to the Kamuzu Barrage upgrading, the ESA should briefly summarize the key findings of the Independent EIA, which will serve as a companion volume to the ESA report. Similarly, the ESMF report should outline the types of activities—where relevant to this project—indicated in OP 4.01, Annex C, “Environmental Management Plan”. The work should also build on good practice examples in existing projects in Malawi and similar projects elsewhere. The work of the Millennium Challenge Corporation (MCA in Malawi) on environmental and social aspects should be particularly useful in this regard. Other triggered policies should be analyzed, investigated and reported in specific chapters of the ESA and mitigation measures should be part of the ESMF.

Consistency with World Bank Safeguard Policies and Malawian Legal Requirements: The consultant should ensure that the preparation of the ESA, ESMF and RPF is consistent with the World Bank Environmental and Social Safeguard Policies. A total of eight safeguards are triggered by this project and therefore due consideration must be given towards the requirements for each of these policies ensuring that their conditions are met. The ESA, ESMF and RPF will also have to be consistent with the provisions of the Environment Management Act (EMA), 1996 and the requirements of the Malawi Environmental Impact Assessment Guidelines (1997). Section 24 of the EMA specifies the types and sizes of projects that require an environmental impact assessment (EIA) before they can be implemented. A prescribed list of projects (Gazetted under the EMA, 1996) for which EIA is mandatory is provided in the Malawi Environmental Impact Assessment Guidelines, 1997. The Act further outlines the EIA process to be followed in Malawi; and requires that all project developers in both the public and private sectors comply with the process. The Act under section 26 (3) further requires that no licensing authority issue any license for a project for which an EIA is mandatory unless the Director of Environmental Affairs (DEA) has given consent in writing; on the basis of a satisfactory EIA or non-requirement of an EIA. In light of these requirements, Kamuzu Barrage Upgrading will require a separate Independent EIA to provide specific information needed for approval by the Environmental Affairs Department (EAD). For the multiple, small-scale civil works expected under Component B, the ESA should attempt to include whatever environmental information is required by EAD. To the maximum extent feasible, the proposed civil works in each sub-catchment—when precisely defined—should be submitted to EAD as a single package to minimize transaction costs. The basic information that first needs to be submitted to EAD is a Project Brief; based on the content of this document, EAD determines whether the project (or any component thereof) requires (i) a full Environmental Impact Assessment; (ii) only an Environmental Management Plan; or (iii) no further action. Further details are in the Government’s *Guidelines for Environmental Impact Assessment* (1997), along with more recent, sector-specific guidelines related to water development (available from EAD).

Key Tasks

10. The Consultant will undertake the following tasks as part of this assignment:

Task 1. Understand the Project Area and Activities: Discuss scope of project activities with Client, related agencies, and the World Bank to better understand the types of investments, especially physical interventions that are envisaged as part of the project. Also examine spatial and other information available for the proposed project intervention locations for each activity to understand the social and environmental setting and determine potential impact areas of concern for each type of activity. Undertake field visits (including to potential project activity

areas such as the Middle Shire for watershed management activities) and stakeholder consultations in this regard.

Task 2. Analyze alternative project planning scenarios and approaches:

Examine different project scenarios and implementation approaches and determine the best alternatives in order to secure benefits, minimize negative impacts and reduce overall project costs. Alternatives may be analyzed both at project and component level depending on the available options.

Task 3. Analyze Environmental and Social Implications of Proposed Project Activities:

Determine the environmental and social implications of the proposed project activities. These will include implications on natural habitats and biodiversity, water quality, public health, dam safety (for check dams), resettlement and economic rehabilitation (e.g. related to any land acquisition), invasive species, etc. The ESA would also assess any riparian implications of project activities as per the World Bank Safeguard Policy OP 7.50 Projects on International Waterways. Positive implications of the project should also be analyzed where possible.

Task 4. Develop an Environmental and Social Management Framework (ESMF) and Resettlement Policy Framework (RPF) for the Project: This will include measures by each kind of activity to maximize the environmental and social benefits of the activities, as well as minimize and mitigate any adverse impacts. In particular, attention will be paid to the following aspects:

- **Water Release Operating Rules.** The ESMF should describe how interim and longer-term water release operating rules from dams and barrages in the Shire Basin would seek to optimize between different water-dependent objectives, including hydropower generation, drinking water supply, irrigation, ports and river transport, and environmental flows. (For the Kamuzu Barrage, this information should become available from the forthcoming Independent EIA.) **Environmental flows** considerations can include (i) simulating natural seasonal variation in river flows (within defined limits) to promote successful fish reproduction, riverine forest regeneration, flood-recession agriculture, dry-season river sandbar habitat for rare birds, etc.; (ii) maintaining minimum dry-season flows (a major objective of the Kamuzu Barrage, since historically the Shire River has occasionally run dry); (iii) avoiding strong daily fluctuations in the flow of larger rivers (resulting from uncompensated peaking power water releases); and (iv) avoiding sudden major drops in river flows (to prevent fish stranding).
- **Impacts on Natural Habitats and Biodiversity.** The project (Component B) is expected to affect natural forests in a positive manner by promoting their conservation and sustainable use within selected sub-catchments of the Shire Basin; to the extent feasible, the ESA should identify the main forest areas within each sub-catchment that would likely benefit from Component B activities. The ESA should also identify any potential adverse impacts on natural habitats or species of conservation concern, from project-supported civil works or changes in water releases from hydraulic infrastructure. In the case of the Kamuzu Barrage upgrading, the ESA report should summarize (from the detailed Independent EIA) the impacts of an expected increase in flooding within the upstream Liwonde National Park, in terms of changes in floodplain vegetation as well as damage to park trails and other infrastructure. The ESMF should specify compensatory mitigation measures for any significant damage to protected areas and other natural habitats, consistent with the requirements of World Bank policies (Natural Habitats OP 4.04 and Forests OP 4.36) as well as Malawian law. The ESMF should indicate the types of biodiversity-related monitoring that the project would support, such as of how endemic fish species in Lake Malawi respond to the modest increase in average lake levels resulting from the Kamuzu Barrage upgrading. The ESMF should also provide guidance (such as that in Chapter 9, pages 311-312 of the

World Bank's 2008 *Forests Sourcebook*) for how any project-supported planning studies (such as the Shire Basin Flood and Drought Management Master Plan, or pre-investment studies of proposed new water infrastructure) or information systems (such as the Shire Basin Atlas) would include key information on existing and proposed protected areas and other sites of high conservation value (known as Critical Natural Habitats in OP 4.04).

- **Invasive Species and Weed Proliferation.** The ESA should indicate if any project activities (particularly under Component 2) could lead to proliferation of weeds and spread of alien invasive species. The ESA should also examine the impact of weeds and invasive species on broader economic activities along the Shire River including the water treatment and hydro-power generation, agriculture, transport systems and facilities, water abstraction, settlements and other activities. The ESMF should specify any needed mitigation measures (such as prohibitions on stocking of non-native fish).
- **Pest Management.** Since Component B is likely to involve investments in improved agricultural practices, some project-supported activities might trigger the Bank's Pest Management OP 4.09—specifically, if the project would (i) procure pesticides or pesticide application equipment (whether with Bank-provided or counterpart funds) or (ii) maintain or expand pest management practices that are risky from an environmental or human health standpoint. The ESMF should indicate—as needed—the means by which (i) any project-supported pesticide procurement would solicit the Bank's prior no-objection; (ii) the project would promote the safe storage, handling, and disposal of pesticides; and (iii) the project would promote integrated pest management (IPM) wherever feasible. Some of the alternative livelihoods development (Component B) might involve market development and other promotion of organic crops, produced without the use of synthetic compounds.
- **Cumulative Environmental Impacts.** The ESA should address whether, under Component 2, certain types of small-scale civil works could have specific, cumulative adverse environmental impacts, even though (i) their individual adverse environmental impact is too small to be considered significant and (ii) their overall cumulative environmental impact might well be highly positive. As an example, numerous small-scale dams within a particular catchment (i) might not have a significant adverse impact on an individual basis and (ii) could have important cumulative benefits, such as downstream sediment reduction. However, they might have a cumulative adverse impact by blocking the access of migratory fish to all or most of their available tributaries. The ESMF should recommend feasible mitigation measures for any such cumulative adverse impacts.
- **Social, Gender, and Resettlement Issues:** The ESA will also determine ways to improve broad-based livelihood improvement through project activities, improve participation and empowerment of women, as well as minimize and mitigate involuntary resettlement requirements. **A Resettlement Policy Framework (RPF) has to be developed in this regard as a separate document.** The RPF would elucidate the need for such a framework, the types, scale and extent of potential losses of assets, existing implementation arrangements and capacity for implementing resettlement safeguard measures, estimated extent of resettlement project-affected persons (PAPs) and budget implications for implementing the RPF, existing grievance redress mechanisms on which the PAPs could rely, and the monitoring and evaluation (M&E) system to be put in place to support RPF implementation. Impact of HIV and AIDS and other communicable diseases on vulnerable segments of the society should also be examined and their mitigation included in the ESMF.
- **Environmental and Social Rules for Contractors.** For the small civil works to be carried out under Component B (Watershed Management), the ESMF should include a list of generic environmental and social requirements for contractors to follow. Some will be site-specific, such as legal and environmentally appropriate sites for obtaining rocks, sand, or other

construction material and for depositing construction wastes. Other such rules involve generic standards for good behaviour by construction workers, such as prohibitions on hunting, unauthorized burning of vegetation, firearms possession (except by security personnel), or inappropriate interactions with local people. Contractors should also be asked to indicate specific measures they will take during construction to prevent HIV-AIDS transmission by the work force. The ESMF should verify that environmental and social rules for contractors—including specific financial or other penalties for non-compliance—will be referenced in all relevant bidding documents and contracts. The Independent EIA of the Kamuzu Barrage Upgrading is expected to include environmental and social rules of conduct, as well as detailed environment-related technical specifications, that the main civil works contractor (and any sub-contractors) would need to follow.

- **Institutional Strengthening and Capacity Building.** The ESMF should describe the main ways in which the project would strengthen the environmental and social management capacity of river basin authorities and institutions involved with water resources management, particularly in the Shire Basin. This would need to be mainstreamed into project capacity-building activities in all components.
- **Institutional Arrangements for Implementation of the ESA:** The ESMF should clarify the institutional roles and responsibilities including synergy and interaction of activities for effective implementation of the ESA recommendations and mitigation plans.
- **Monitoring and Evaluation Framework.** The ESMF would also describe the monitoring and evaluation indicators and the approach to its monitoring (e.g. by whom, when, how frequently, how reported, and how used for decision making). This will include formulation of reporting formats for critical environmental and social parameters to be monitored, in order to monitor the overall implementation of the ESMF and to take adaptive management actions as needed.

Task 5. Stakeholder Consultation: The Consultant will organize stakeholder meetings at appropriate levels (with the help of the Government of Malawi implementing agencies) to discuss the ESA, ESMF and RPF at various stages (Inception, interim, and final). Inputs from the meetings will be well documented. In particular, the ESA should include an Annex which indicates the (i) consultation modalities used; (ii) date and venue of each consultation event; (iii) which stakeholder organizations and interest groups were invited; (iv) which ones participated; and (v) the main issues raised and recommendations offered, along with whether and how these are reflected in the ESA report. At appropriate consultation events, the Consultant will make presentations with suitable photographs, etc. to indicate good and poor practices (e.g. in watershed management).

Deliverables and Schedule

11. The Consultant will be responsible for the following deliverables:

Output	Description	Timing (months after contract signing)
Inception Report	<ul style="list-style-type: none"> • Description of primary project activities to be analyzed • Description of the environmental and social baseline and key issues in proposed investment and possible impact locations • Scoping and screening of key environmental and social issues 	1 month (report and presentation)

Output	Description	Timing (months after contract signing)
	<ul style="list-style-type: none"> • Relevant institutional and policy context • Proposed detailed outline of ESA, ESMF, and RPF 	
Interim Report	As described in Tasks 3&4: <ul style="list-style-type: none"> • Draft of ESA • Draft of ESMF • Draft of RPF 	3 months (report and presentation)
Final Report	As described in Tasks 3&4: <ul style="list-style-type: none"> • Final ESA • Final ESMF • Final RPF 	5 months (report and presentation)
Data Repository	<ul style="list-style-type: none"> • Satellite images, software and other data procured or sourced under the Consultancy 	Before end of contract

Facilities to be provided by Client:

The Client will facilitate access to key information available with various government agencies. They will also facilitate the Consultant's access to relevant staff in various agencies, help arrange field visits, and organize stakeholder workshops for carrying out of this assignment. They will also facilitate making copies of the reports and their distribution. They will also provide feedback on the outputs within a reasonable timeframe (10 days after presentation).

Reporting Arrangements

Reporting to the Director of Water Resources and Director of Environmental Affairs through the Coordinating Office

Duration

The duration of this consultancy would be 6 months.

Profile and Qualification

The consulting firm should have the following expertise: The Team Leader should be an Environmental and Social Impact Assessment Expert with a minimum qualification of a Masters Degree in Environmental Sciences and having at least 10 years experience in similar work. The other expertise in the team would be as follows:

1. Hydrologist with a Masters degree and having 5 years experience.
2. Water Quality Management Specialist with a Masters degree and having 5 years experience.
3. Land Husbandry/Catchment Management Specialist with a Masters degree and having 5 years experience.
4. Forestry/Biodiversity Specialist with a Masters Degree and having 5 years experience
5. Social Development Specialist with at least 5 years experience in resettlement, gender, and stakeholder consultation.

Annex 2. Questionnaire

QUESTIONNAIRE ON THE ENVIRONMENTAL AND SOCIAL ASSESSMENT OF THE SHIRE RIVER BASIN

(To be addressed to the senior member of a household)

A: Bio-data:

1. Village:T.A.....District.....
2. Head of Household: Name:
3. Male.....Female.....
4. Size of household:
5. Have always been here since.....Migrated from
6. Reason for migration.....
7. Satisfaction of this place: (a) Very happy (b) Happy (c) Satisfactory (d) Not happy
8. Reasons for answer given in (7) above:

Household income:

Agricultural	Approximate Annual Income (MK)	Non-agricultural	Approximate Annual Income (MK)

B. Climate and drainage

9. Are you happy with the rainfall regime in this area: Yes No
If not, state why not:
10. Do you experience flooding in this area? Yes No
If yes, what do you think is the main reason?
- 11a. From your reason above, what do you ought to be done?
- 11b. What has been or is being done to contain this challenge?
- 12a. Do you know about climate change?
- 12b. If yes what does it mean?
- 13a. Are there any problems related to climate change?
- 13b. Which are these problems
- 13c. How are you coming up with these problems?
.....
- 13d. How are you prepared for climate change
- 14a. Name of river.....
- 14b. What is the status of the flow regime of the nearby river?
- 14c. What in your view, do you think is the main reason for your observation?
- 14d. Then, what do you think ought to be done?
- 14e. If present conditions of water availability persist, what decision are you going to take?

C. Water supply and sanitation:

15. Source of water supply	Lake	River	Borehole	Dugout well	Gravity-fed
16. Water quality	Excellent	Good	Satisfactory	Poor	
17. Sanitation	Water-borne		VIP	Pit latrine	

D. Agriculture:

18a. (**Approximately**) How many Hectares/Acres do you possess?

18b. What crops do you grow?

18c. To which crops do you apply chemical fertilisers.....

18d. If you did not apply the fertiliser would you get adequate yields?

18e. If not, why not?

18f. Do you use other forms of fertilisation?

18g. Is the method in (4b) above sustainable? Y No

19a. What form of agriculture do you use? Rain-fed Irrigation Both

19b. If you use irrigation, what system do you employ?

 Canal Treadle pump Drip Sprinkler Other

(Specify).....

20a. Do you have dams for irrigation.....

20b. Is the water enough for irrigation

21a. Do you have a water right for the abstraction? Yes No

21b. If not, why not?.....

I/we have yet to apply H already applied Did not know we need one

E. Invasive Weeds

22. Do you know any invasive weeds in your area

23a. Are you aware of invasive weeds in your area

23b. If yes mention them

23c. Where are they found

24a. Do they give any problems in your daily livelihoods

24b. What is the name of the aquatic weed in this area?

25. How long has this weed been here?

26. Where did it originate?

27. What problems does it cause?

28. Is it useful and if yes, what do you use it for?

29a. After that use what do you observe in the following year or two?

29b. How can it be contained?

30. Is soil erosion a problem in this area and if yes why?

F. Catchment Condition

31a. Area there programmes to rehabilitate the sub catchments

31.b If yes mention them

- 32. Who is implementing these programmes /activities
- 33a. Do you think the problems in the catchment will be solved with the existing activities
- 33b. If yes how do you think the problem should be tackled
- 34. Who should initiate the change (government, villages or NGOs)

G. Soil Erosion

- 35. What problems do you have with regard to soils
- 36. Why do you construct ridges every year
- 337. Are there other practices other than ridges?
- 38. Mention them if yes
- 39. Who tells you about practices for soil conservation
- 40. How many practices for reducing soils erosion do you know
- 41. Which practices are best for soil conservation
- 42. Which ones do use in your fields

H. Forests and Woodlands

- 43. How much do you value natural forests and woodlands and why?
- 44. What benefits if any have you had from forests?
- 45. Are you satisfied with the current land cover and if not why not?
- 46. What efforts are being taken to conserve natural forests?
- 47. In your view, are these efforts adequate and if not, why not and what should be done?
- 48. There are no trees in the hilly areas – what are the reasons?
- 49. For how long have been no trees in the hills
- 50. You are cultivating in the hills which is not good. Explain the problem
- 51. Do you have enough yields from cultivating in the hills
- 52. How do you get food if it is not enough?
- 53. How do you get enough yields if it is yes
- 54. Can you tell us what you use for cooking (mbaula, three stones or fuel paraffin) – explain the reason why you are using one of them
- 55. Is charcoal sold in this area – where does it come from?
- 56. Who makes it (people in the village, from out the village or foresters).....

I. Fisheries and aquaculture

- 57. What are the pressing issues affecting fisheries in this area?
- 58. What are the main fish species found within the water bodies?
- 59. What are the common fishing methods used?
- 60. Are fish stocks adequate, increasing or decreasing and why?
- 61. What traditional methods if any, were used to conserve fish in water bodies?
- 62. What is your view regarding aquaculture development if it were to be established in this area?

J. Wildlife Resources

- 63. How do you get animal protein in this area?
- 64. If through hunting, what animals do you hunt?
- 65. What is currently the common species of animals in the area?
- 66. Which animals are rare and why, in your view?

K. Social and economic needs

67. Please list in order of priority development projects you would require in this area:

- (i).....
- (ii).....

68. What developments have been established in this area and did the people ask for them?

No.	Type of development project	Yes	No
1.			
2.			
3.			

L. Development plans

- 69. Have you ever participated in the development plans of your area
- 70. How to you come up with them explain
- 71. Who facilities them (public, private or news officials)
- 72. How many development plans have you implemented in your area
- 73. What is the role of GVH in development plans

M. Existing Problems in the area

- 74. What are the most serious problems in your area
- 75. How are they caused
- 76. How do you then tackle them if they are present
- 77. Which is the most serious problem in the area?
- 78. What efforts are authorities making to address the challenges you are facing in this area?

Annex 3. Checklist

FOREST/WOODLANDS AND BIODIVERSITY CHECKLIST TO GUIDE KEY INFORMANT INTERVIEWS AND FOCUS GROUP DISCUSSION

A. PLANT (FORESTRY RESOURCES) FOUND IN THE SHIRE RIVER BASIN

- Names of common forest and other plant species and their distribution
- Names of man-introduced forest tree and other plant species
- Value of the forests/woodlands to animal species
- Names of endangered forest tree and other plant species (location, distribution and general status)
- Plant specimen of scientific or aesthetic interest
- Problems facing the forest/woodlands and other plant species
- Management measures (including examples of community based management systems) being undertaken by to address the problems facing forests/woodlands
- Adequacy of the measures undertaken to address forests/woodlands
- Challenges facing the management of forests/woodlands
- Suggested was of overcoming such challenges
- Potential Benefits and significant impacts likely to be brought about as a results of the proposed Shire River basin rehabilitation Project onto the forests/woodlands
- Suggested measures to enhance /mitigate impacts likely to be brought about by the project's implementation

B ANIMAL (BIODIVERSITY) FOUND IN THE SHIRE RIVER BASIN

- Common species of Wild mammal, fish and birds and their current status
- Names of man-introduced exotic species of biodiversity (wild mammals, fish and fowl and their current status
- Names of endangered species (location, distribution and status)
- Names of migratory species (Wild mammals, fish or birds) and their current status
- Names of commercially valued species (wild mammals, birds and fish) and their status
- Measures being undertaken by various stakeholders (including communities) to address the problems facing biodiversity
- Adequacy of the measures being undertaken various stakeholders (including communities) to address problems facing the management of biodiversity
- Challenges facing the management of biodiversity
- Suggested ways of overcoming such challenges of biodiversity management
- Potential Benefits and significant impacts likely to be brought about by the proposed Shire River basin rehabilitation Project onto the management of biodiversity
- Suggested measures to enhance /mitigate impacts likely to be brought about by the Shire River Basin Rehabilitation project onto the biodiversity.

Annex 4. List of Stakeholders Consulted during Preparation of ESA

No.	Name	Position	Institution	Date
NTCHEU DISTRICT				
1.	Mr. L. Mjumira	Director of Planning and Development	Ntcheu District Council	09/02/12
2.	Mr. Chigwenembe	Director of Public Works	Ntcheu District Council	09/02/12
3.	Mr. K. Kamoyo	Land Resources Conservation Officer	Ntcheu District Council	09/02/12
4.	Mr. M. Gondwe	District Forestry Officer	Ntcheu District Council	09/02/12
5.	Mrs. M. Kamoyo	Environmental District Officer	Ntcheu District Council	09/02/12
6.	Mr. G. Maloni	Assistant District Agriculture Development Officer	Ntcheu District Council	09/02/12
7.	Mr. C. Kachokamanja	Crops Officer	Ntcheu District Council	09/02/12
8.	Mr. Makwangawala	Traditional Authority	Ntcheu	09/02/12
9.	Mr. T. Bokosi	Farmer	Ntcheu	09/02/12
10.	Mai Enelesi	Farmer	Ntcheu	09/02/12
11.	Mr. G Billiati	Farmer	Ntcheu	09/02/12
12.	Mr. V. Kwananji	Farmer	Ntcheu	09/02/12
MANGOCHI DISTRICT				
13.	Mr. Mughogho	Director of Planning and Development	Mangochi District Council	13/02/12
14.	Mr. L. Mlaviwa	District Forestry Officer	Mangochi District Council	13/02/12
15.	Mr. H. Pondeponde	Acting District Water Officer	Mangochi District Council	13/02/12
16.	Mr. R. Namwada	Assistant District Forestry Officer	Mangochi District Council	13/02/12
17.	Mr. D. Mfunya	Senior Forester	Mangochi District Council	13/02/12
18.	Mrs. M. Kamanga	Crop Protection Officer	Mangochi District Council	13/02/12
19.	Peter L. Banda	Assistant Statistician	Fisheries Department, Mangochi	13/02/12
20.	Mr. E. Kapalamula	Villager	Kandulu Village, T. A. Jalasi	13/02/12
21.	Asongwe Issa	Villager	Chiganga Village, T.A. Jalasi	13/02/12
22.	Chitambi Binuli	Villager	Chiganga Village, T.A. Jalasi	13/02/12
23.	Alick Phiri	Villager	Chiganga Village, T. A Jalasi	13/02/12
24.	Silinava Jackson	Villager	Chiganga Village, T.A. Jalasi	13/02/12
25.	GV Chiganga	Traditional Leader	T. A. Jalasi	13/02/12
26.	Village Headman Mr. Makupo	Traditional Leader	T. A. Jalasi	13/02/12
27.	Mr. B. Jalasi	Farmer	Samama Irrigation Scheme	18/11/11
28.	Mr. Mtochi	Farmer	Samama Irrigation Scheme	18/11/11
29.	Mrs. E. Mangulenje	Villager	Samama Village	18/11/11
30.	Mr. F. Nganire	Villager	Samama Village	18/11/11
31.	Mr. Y. Tobias	Fisherman	Lake Malombe	18/11/11
32.	Mr. Mwamadi	Fisherman	Lake Malombe	18/11/11

No.	Name	Position	Institution	Date
33.	Mr. Y. Gavisoni	Fisherman	Lake Malombe	18/11/11
MACHINGA DISTRICT				
34.	Mr. W. Gausi	Director of Planning and Development	Machinga District Council	13/02/12
35.	Mr. Kawejere	Chief Lands Resources Officer	Machinga ADD	13/02/12
36.	Mr. Mtafya	Assistant District Forestry Officer	Machinga District Council	13/02/12
37.	Mr. J. Kasusweni	District Fisheries Officer	Machinga District Council	13/02/12
38.	Mr. S. Nyanyali	Division Manager	Liwonde National Park	14/02/12
39.	Mr. B. Msikuwanga	Head of Research	Liwonde National Park	14/02/12
40.	Mr. S. Meja	District Water Officer	Machinga District Council	14/02/12
41.	Mr. S. Chaula	DECK Technician	ESCOM (Liwonde)	14/02/12
42.	Mr. J. Chatepa	Marine Technician	ESCOM (Liwonde)	14/02/12
43.	Mr. W. Longwe	Marine Technician	ESCOM (Liwonde)	14/02/12
44.	Mr. E. Makuzula	Marine Technician	ESCOM (Liwonde)	14/02/12
45.	Mr. J. Pemba	Sewerage Attendant	Liwonde Town Council	19/11/11
46.	Mr. N. Govala	Sewerage Attendant	Liwonde Town Council	19/11/11
	T/A Sitola	Traditional Leader	Machinga District Council	24/06/12
47.	Group Village Headman Kaudzu (TA Sitola)	Traditional Leader	Machinga District Council	24/06/12
48.	Village Headman Diyere (TA Sitola)	Traditional Leader	Machinga District Council	24/06/12
49.	Village Head Sailesi (TA Sitola)	Traditional Leader	Machinga District Council	24/06/12
50.	Group Village Headman Chabwera	Traditional Leader	Machinga District Council	24/06/12
51.	Mrs. F. Bauleni	Villager	Liwonde	19/11/11
52.	Mrs. V. Tomotiyo	Villager	Liwonde	19/11/11
53.	Mr. Gausi	Director of Planning and Development	Machinga District Council	19/11/11
54.	Mr. Kawejere	Chief Land Resources Conservation Officer	Machinga ADD	19/11/11
55.	S. Chaula W. Longwe E. Makudzula	Marine Technician	ESCOM (Liwonde)	19/11/11
56.	Mr. Chigowo	Chief Land Resources Conservation Officer	Blantyre ADD	19/11/11
57.	Mr. Simba	Land Resources Conservation Officer	Blantyre ADD	19/11/11
58.	Rasheed Takur	Managing Director	Hippo View Lodge 01914434	27/11/2012
59.	Mrs. Muyaya	Managing Director	Liwonde Holiday Resort 0999246096	

MWANZA DISTRICT				
60.	Mr. Gwedemula	District Commissioner	Mwanza District Council	15/02/12
61.	Mr. E. Thamba Phiri	District Water Officer	Mwanza District Council	15/02/12
62.	Mr. S. Kananji	Assistant District Forestry Officer	Mwanza District Council	15/02/12
63.	Mr. C. Likongwe	District Fisheries Officer	Mwanza District Council	15/02/12
64.	Mr. E Kalitsiro	Assistant Land Resources Conservation Officer		15/02/12
65.	Mr. M. Nyongo	Farmer	T.A. Nthache	15/02/12
66.	Mr. B. Semu	Farmer	T.A. Nthache	15/02/12
67.	Mrs. K. Mateyo	Villager	T.A. Nthache	15/02/12
68.	Mrs. M. Sailoni	Villager	STA Govati	15/02/12
69.	Mrs. D. Chimkota	Villager	STA Govati	15/02/12
70.	Mrs. M. Mandalasi	Villager	STA Govati	15/02/12
71.	Mr. F. Dulamoyo	Farmer	T.A. Kanduku	15/02/12
72.	Mr. K. Zuze	Farmer	T.A. Kanduku	15/02/12
73.	Mrs. A. Jere	Farmer	T.A. Kanduku	15/02/12
NENO DISTRICT				
74.	Mr. W.M. Kuseli	District Water Officer	Neno District Council	15/02/12
75.	Mr. D. Itimu	Environmental District Officer/District Fisheries Officer	Neno District Council	15/02/12
76.	Mr. J. Mando	Assistant District Water Officer	Neno District Council	15/02/12
77.	Mr. L. Sipolo	Assistant District Water Officer	Neno District Council	15/02/12
78.	Mr. Kampeza			
79.	Mr. E. Ngwangwa	District Forestry Officer	Neno District Council	15/02/12
80.	T.A. Dambe	Traditional Leader	Neno District Council	20/06/12
81.	G.V.H Chikalema	Traditional Leader	Neno District Council	20/06/12
82.	GV.H. Chakulemba	Traditional Leader	Neno District Council	20/06/12
83.	G.V.H. Mposadala	Traditional Leader	Neno District Council	20/06/12
84.	G.V.H Soka	Traditional Leader	Neno District Council	20/06/12
85.	G.V.H Kumbwani	Traditional Leader	Neno District Council	20/06/12
86.	T/A Tchekutcheku	Traditional Leader	Neno District Council	21/06/12
87.	G.V.H. Kalupsya	Traditional Leader	Neno District Council	21/06/12
88.	G.V.H. Donda	Traditional Leader	Neno District Council	21/06/12
89.	V.H. Mpatat	Traditional Leader	Neno District Council	21/06/12
90.	V.H. Wilson	Traditional Leader	Neno District Council	21/06/12
91.	V.H. Hiwa	Traditional Leader	Neno District Council	21/06/12
BLANTYRE DISTRICT				
92.	Ms. M. Lakioni	Assistant Environmental Officer	Blantyre Water Board	15/02/12
93.				
94.	Mr. Chigowo	Chief Land Resources	Blantyre ADD	15/02/12

		Officer		
95.	Mr. M. Simba	Land Resources Conservation Officer	Blantyre District Council	15/02/12
96.	Mr. G. Kanyerere	District Forestry Officer	Blantyre District Council	15/02/12
97.	Mr. A. Simenti	Lab Assistant	Soche Sewerage Treatment Plant	15/02/12
98.	Mr. Jackson	Lab Assistant	Soche Sewerage Treatment Plant	15/02/12
99.	Mr. Bizi	Labourer	Soche Treatment Sewerage Plant	15/02/12
100.	Mr. Kumalireni	Labourer	Soche Sewerage Treatment Plant	15/02/12
101.	Mr. E. Kapeya	Registrar of Pesticides	Bvumbwe Agriculture Research Station	15/02/12
102.	Mr. Kayira	Station Manager	ESCOM, Nkula hydropower station	15/02/12
103.	Mr. Banda		ESCOM (Nkula)	19/11/11
104.	Mr. G. Khobwe		BWB (Walkers Ferry)	19/11/11
105.	Village Headman Whayo (T/A Kapeni)	Traditional Leader	Blantyre District Council	23/06/12
106.	Group Village Headman Manjombe (T/A Kapeni)	Traditional Leader	Blantyre District Council	23/06/12
107.	Village Headman Chimwayi (T/A Kapeni)	Traditional Leader	Blantyre District Council	23/06/12
108.	Village Headman Moses Maluwa	Traditional Leader	Blantyre District Council	23/06/12
CHIKHWAWA DISTRICT				
109.	Mr. K. Harawa	Director of Planning and Development	Chikhwawa District Council	16/02/12
110.	Mr. N. Dakamau	Assistant Director of Planning and Development	Chikhwawa District Council	16/02/12
111.	Mrs. R. Kaira	Assistant District Community Development Officer	Chikhwawa District Council	16/02/12
112.	Mr. A. Dickson	Land Resources Conservation Officer	Chikhwawa District Council	16/02/12
113.	Mr. Kamngadaza	District Forestry Officer	Chikhwawa District Council	16/02/12
114.	Mr. E. Mchilikizo	District Water Development Officer	Chikhwawa District Council	16/02/12
115.	Mr. G. Kauta		Evangelical Association Of Malawi	16/02/12
116.	Mr. Beleu	Group Village Headman	T.A. Maseya, Chikhwawa	16/02/12
117.	Mr. W. O. Mgoola	Division Manager	Lengwe National Park	16/02/12

118.	Mr. P. Moyo	Assistant Parks and Wildlife Officer	Lengwe National Parks	16/02/12
119.	Mr. B. Sakala	Education and Extension Officer	Lengwe National Park	16/02/12
120.	Mr. T. Manda	Assistant Human Resources Manager	Lengwe National Park	16/02/12
121.	Mr. C. Mbewe	Senior Parks and Wildlife Officer	Lengwe National Park	16/02/12
122.	Mr. J.C. Mabeti	Research Officer	Lengwe National Park	16/02/12
123.	Mr. W. Thomas	Villager	Tomali Village	16/02/12
124.	Group Village Headman Tomali	Traditional Leader	Tomali Village	16/02/12
125.	Steven Jasi	Villager	Tomali Village	16/02/12
126.	Estere Jasi	Villager	Tomali Village	16/02/12
127.	Soda Bire	Villager	Tomali Village	16/02/12
128.	Jake Lakeni	Villager	Tomali Village	16/02/12
129.	Chimwemwe Sinota	Villager	Tomali Village	16/02/12
130.	Mrs. K. Malunga	Farmer	Nkhate Irrigation Scheme	21/11/11
131.	Mrs. L. Selemani	Farmer	Nkhate Irrigation Scheme	21/11/11
132.	Mrs. V. Chikuse	Villager		21/11/11
133.	Mr. Kawere	Villager		21/11/11
134.	Mr. Hanifi	Villager		21/11/11
135.	Thole	Conservation Officer	Ngabu ADD Cell: +2650999318237	20-11-2012
NSANJE DISTRICT				
136.	Mr. T. Jakisoni	Villager		21/11/11
137.	Mr. G. Viola	Villager		21/11/11
138.	Mr. N. Msulira	Villager		21/11/11
LILONGWE DISTRICT				
139.	Mr. E. Musopole		Evangelical Association of Malawi	22/02/12
140.	Peaches Phiri	Deputy Director	Water Resources Board 0888931212	27/11/2012
141.	Mr. W. P. Chipeta	Chief Water Resources Development Officer	Ministry of Water Development and Irrigation	22/02/12
142.	Mrs. R.C. Kachuma	Water Resources Management Specialist	National Water Development Programme	22/02/12
143.	Mr. D. Kambuku	Senior Hydrogeologist	Ministry of Water Development and Irrigation	22/02/12
144.	Mr. Ngauma	Deputy Director for Crops Department	Ministry of Water Development and Irrigation	23/03/12
145.	Mr. Tibu	Senior Land Resources Conservation Officer	Ministry of Water Development and Irrigation	23/03/12
146.	Mr. G.J. Munthari	Chief Cartographer		23/02/12

147.	Mr. Nyirenda	Chairman	Technical Sub-Committee on Pesticides	23/02/12
148.	Mr. G. Mamba	Director of Irrigation	Department of Irrigation	15/11/11
149.	Mr Sukasuka		Department of Energy	0884276816
150.	Mr. Kibu	Director of Land Resources and Conservation	Ministry of Water Development and Irrigation	
151.	Mr. Nyandule	Controller of Agricultural Services	Ministry of Water Development and Irrigation	15/11/11
152.	Mr. Humprey Mdyetseni	Deputy Director Of Planning	Department of Nutrition and HIV AND AIDS	5/11/12
153.	Effie Kaminyoghe	HIV Team Leader	Catholic Relief Services	6/11/12
154.	Ms Antonia Powell	Head of Health and HIV Unit	Catholic Relief Services	6/11/12
155.	Tatha Phiri	Executive Secretary	Civil Society Agriculture Network 01775540	27/11/2012
156.	Mr Macleoud Mwale	Principal Statistician/M& E Officer/GIS Specialist	Ministry of Health	9/11/12
157.	Dr. Blackson Matatiyo	Research Officer	National AIDS Commission	19/11/12
158.	Mr Kazima	Assistant Director of Gender Affairs	Department of Gender	12/11/12
159.	Steven Iphani	Capacity Building Officer	Coalition for Women Living with HIV 0888596920 and AIDS 0888596920	27/11/2012
160.	Moffat Mzama Manase	Fishery Analyst	Department of Fisheries Office: +26501788511 Mobile: +2650991438774 E-mail: moffatmanase@yahoo.com	23-11-2012
161.	Dr. S. Steve J. Donda	Deputy Director of Fisheries	Department of Fisheries Office: +2650789387 Home: +26501716585 Fax: +26501788712 Cell:+2650999950035 E-mail: stevedonda@gmail.com	
162.	John Paul	Projects Manager to Building resilience in Climate Change	Total Land Care 0991260163	23-11-2012
163.	John Mlava	Lecturer	University of Malawi Bunda College of Agriculture Cell: +265888875900	15-11-2012

ZOMBA DISTRICT

164.	T/A Mlumbe	Traditional Leader	Zomba District Council	24/06/12
165.	Village Headman Mlumbe (TA Mlumbe)	Traditional Leader	Zomba District Council	24/06/12
166.	Village Headman Kebulo Ilule (TA Mlumbe)	Traditional Leader	Zomba District Council	24/06/12
167.	Village Headman Herbert Chizinda (TA Mlumbe)	Traditional Leader	Zomba District Council	24/06/12
MULANJE AND THYOLO DISTRICT				
168.	Mr. Bodole	Director of Public Works	Thyolo District Council 0888 897 092	
169.	Mr. David Nangoma	Programme Officer for Biodiversity Conservation, Research and Monitoring	Mulanje Mountain Conservation Trust 0111 466 282	
170.	Mr. Utule	District Water Supervisor	Mulanje District 0888 676 836	
171.	Mr. G. Kansadwa	Group Manager	Esparanza Tea Estate – Eastern Produce 0999 958 246	
172.	Mr. Chafuli	Group Manager	Small Holder Tea Company and Chitakale Tea Plantations 0888892381	
173.	Mr. M. Munthali	Administrative Manager	Tea Research Foundation 0111 4672995	19-11-2012

Annex 5. Comments by Some Stakeholders Consulted during Preparation of ESA

Name, position and Institution	Issue/comment	How the issue/comments have been incorporated into the report
Mr. L. Mjumira, Director of Planning and Development and Mrs. M. Kamoyo, Environmental District Officer (Ntcheu District Council)	There is serious environmental degradation in Tsangano EPA where deforestation is increasing at faster rate because of charcoal production and cultivation on marginal lands	Comment noted and Tsangano is part of the catchment under SRBMP that will be rehabilitated
Mr. L. Mlaviwa, District Forestry Officer (Mangochi District Council)	The project will assist the Department of Forestry in dealing with encroachers and illegal settlers in Mangochi Forest Reserve which is under great threat due to opening.	Discussed in Section 3.3.6
Mr. E. Kapalamula, Villager (Kandulu Village, T. A. Jalasi, Mangochi)	The proposed project is a welcome development as it will provide the local communities with alternative income generating activities which are rare in the area.	Noted the comment and is part of positive impacts of the project in Sub-components B3 & 4
Mr. Kawejere Chief Lands Resources Officer (Machinga ADD)	The project should include capacity building training programmes for local communities on sustainable land resources management.	Noted and the comment has been included as part of mitigation measure in ESMP
Mrs. K. Mateyo, Villager (Nthache Village, T.A. Nthache in Mwanza)	The proposed project is a welcome development as it would provide small dams for irrigation activities.	Positive impact of the proposed project and has been described in section 6.1.3
Mr. K. Harawa, Director of Planning and Development (Chikhwawa District Council)	There is need for the project to include NGOs in implementation of project activities	Comment included in Table 8.1 on Institutional roles and responsibilities
Mr. S. Chaula, DECK Technician (ESCOM-Liwonde)	The project is a very good initiative because it will reduce invasive aquatic weeds, especially the water hyacinth, which affects the hydropower station at Nkula, Kapichira and Tedzani. ESCOM is spending a lot of money in harvesting weeds at Liwonde Barrage as well as at hydropower stations.	The comment was confirmed during the site visit and has been incorporated in section 5.5.12
Mr. Kayira	The upgraded Barrage will help to ensure adequate minimum flows in the Shire River, for more reliable generation of	

Name, position and Institution	Issue/comment	How the issue/comments have been incorporated into the report
	hydropower from existing facilities. This will have a positive effect on local, regional and national economies. The Catchment management initiatives proposed under the SRBMP will help reduce the silt loads and debris that are contributing to the frequent load shedding and power outages.	
Mr. E. Ngwangwa, District Forestry Officer (Neno District Council)	The SRBMP is a very welcome project as forests in the district under assault from charcoal producers. The high demand of charcoal in the City of Blantyre exacerbated by frequent electricity blackouts are promoting charcoal production in the district. The proposed project will help the council in rehabilitating degraded catchments in the district.	Comments included in section 3.3.6 on environmental problems in the basin.
Mr. Mughogho, Director of Planning and Development (Mangochi District Council)	To ensure that implementation of the project is smooth and government achieves objectives of the project, capacity building trainings should be provided to district council staff.	This is part of enhancement measures described in ESMP in chapter seven
Mr. N. Dakamau, Assistant Director of Planning and Development (Chikhwawa District Council)	If the project is implemented then it will reduce reliance on forest resources for charcoal production and income generation. Creation of job opportunities for local people during catchment management will be a welcome development as this will reduce poverty amongst local people.	Positive impacts of the proposed project and have been incorporated in section 6.1.2
Mrs. R. Kaira, Assistant District Community Development Officer (Chikhwawa District Council)	The issues of gender and HIV AND AIDS should be included in the implementation of the project	Trainings will be provided through during implementation as indicated in ESMP in chapter seven.
Mr. A. Dickson, Land Resources Conservation Officer (Chikhwawa District Council)	The project is a welcome development in the district and the basin as a whole. The district will benefit a lot from the project as rehabilitation of catchment in the basin will reduce issues of flooding and siltation of the rivers in the basin.	This is part of the positive impacts of the project described in section 6.1.2 and 6.1.3
Mr. Kamngadaza, District Forestry Officer (Chikhwawa District Council)	The project if implemented would greatly reduce the pressure being experienced by forests in the district. However, monitoring activities should be scaled up to ensure smooth implementation of the project.	Comments noted and positive impacts of the project and monitoring plan has been prepared for the project as indicated in section 7.1
Dr Montfort Mwanyambo	The project will benefit the country in many positive ways There is need to update the botanical database in the area	Comments noted, part of 7.3.1.2.12 and

Name, position and Institution	Issue/comment	How the issue/comments have been incorporated into the report
(Scientific Officer National Herbarium and Botanical Gardens (NHBG), Zomba)	and all species that are likely to be endangered due to developments should be conserved by among other ways employing ex-situ techniques. Already species under threat from bush fires and unsustainable firewood collection and charcoal production in the area.	7.3.1.2.16
Associate Professor Dr J.J. Namangale, Director of Natural Resources and Environmental Centre (NAREC), Chancellor College, University of Malawi, Zomba	The project area is under threat from unsustainable fuel wood products harvesting, siltation, and water quality degradation. There is need for increased stake holder participation to arrest further degradation and also to ensure that any proposed projects in the area incorporates sustainable natural resource management.	Noted, and this is part of 7.3.1.2.12 and 7.3.1.2.16
Associate Professor Dr S. Sajidu, Dean faculty of Science, Chancellor College, University of Malawi, Zomba	There is need for a more organised water quality monitoring in the area to address data gaps and include more parameters in order to come up with a comprehensive water management programme in the area.	Noted and issues discussed in Chapters 6 and 8.
Dr Montfort Mwanyambo (Scientific Officer National Herbarium and Botanical Gardens (NHBG), Zomba)	The project will benefit the country in many positive ways There is need to update the botanical database in the area and all species that are likely to be endangered due to developments should be conserved by among other ways employing ex-situ techniques. Already species under threat from bush fires and unsustainable firewood collection and charcoal production in the area.	Comments noted, part of 7.3.1.2.12 and 7.3.1.2.16
Mr. Beleu, Group Village Headman (Beleu, Chikhwawa)	Flooding is greatly affecting people in the village and the coming in of the project will save lives in the district.	Noted and is part of section 5.5.11
Mr Humphrey Mdyetseni, Deputy Director of Planning (Department of Nutrition and HIV	The Department does not have specific information on HIV AND AIDS issues in the basin-we will give you the information that we have on HIV AND AIDS National Action Framework, National AIDS Commission Annual Report (2010-2011) National HIV and AIDS strategic Plan (2011-2016) and HIV and AIDS Workplace Policy Guidelines. If you need specific	The information that we got from Department of Nutrition and HIV AND AIDS dealt with the country as a whole and not Shire river basin or

Name, position and Institution	Issue/comment	How the issue/comments have been incorporated into the report
AND AIDS)	information on HIV AND AIDS in the basin consult NAC, UNFPA, UNAIDS, MANELERA, WVI, CADECOM, WALA AND CRS but i would recommend that you consult CRS first because they work all over the basin in issues of HIV AND AIDS	individual districts in the basin therefore we found lacking to address issues in the document.
Mrs Effie Kamunyoghe, HIV Team Leader (CRS)	Catholic Relief Services deals with improving livelihoods in the rural communities in some of the districts in the basin, of course there are components of Nutrition and HIV AND AIDS but they are dealt with as part of the livelihood programs. I cannot give you any reports now but you should contact Ms Antonia Powell who is responsible in the distribution of reports to donors.	Ms Powell was Consulted through e-mail but she never responded the e-mails.
Mr Macleod Mwale, Principal Statistician/M& E Officer/GIS Specialist (Ministry of Health)	The Country for now does not have the current HIV prevalence rates by district. We are still working on it and producing reports. Consult Mr Blackson Matatiyo at NAC, he should have the rates by age, by sex and by economic activity	The report incorporated the HIV prevalence rates from the 2010 National HIV prevalence and AIDS estimates report
Mr Blackson Matatiyo	We are still working with NSO to produce the HIV prevalence rates for the nation but the data is not official as of now. Therefore, i am uncomfortable to release unofficial data to be used in official reports. However, i can provide you with data from the 2010 National HIV prevalence and AIDS estimates.	We incorporated Mr Matatiyo's comments in the report when describing HIV/AIDS situation in the basin.
Mr Kazima, Assistant Director of Gender Affairs (Department of Gender)	Our Department does not deal with Gender per individual districts; rather issues that are dealt with are generic. I would advise you to send me your report so that i can comment where ever appropriate. Those issues you are asking me of should have been dealt with when you were doing the survey in the individual districts.	We failed to incorporate Mr Kazima's comments since we couldn't arrange for a face to face interview with him because he had pressing work commitments in Uganda.
Name, position and Institution	Issue/comment	How the issue/comments have been incorporated into the report
Mr. Bodole, Director of Public Works, Thyolo District Council 0888 897 092	<ul style="list-style-type: none"> • Deforestation in Thyolo is a big problem because if charcoal making by the people from Thyolo and Chikhwawa. This problem is rampant in the customary land. Most of the private land is conserved through tree planting and protected by estates. • Land and soil degradation is so rampant in the customary land areas due to unsustainable agricultural management practices. Land and soil degradation is perpetuated by acute shortage of land in Thyolo. • Nswazi River is heavily silted due to unsustainable land 	<ul style="list-style-type: none"> • The problems stated here are the focus of the SRBMP and have been mentioned in the project description as well as in the main report

Name, position and Institution	Issue/comment	How the issue/comments have been incorporated into the report
	<p>management practices in the customary land areas. The water board installed their water intake in Nswazi River as a result the water board experiences problems to manage the water intake and to efficiently provide water to its beneficiaries.</p> <ul style="list-style-type: none"> • Chemical pollution is reported to happen in rivers that pass through estates. Chemical pollution results from use and application of lime, chemical fertilizers and herbicides in tea plantations. • Public cash transfer programme through the local development fund engages people in the district in the tree planting exercises as a measure of dealing with deforestation in the area. • Thyolo District Council helps in sensitisation and awareness campaigns on issues concerning deforestation, soil erosion, land degradation and water pollution through chemicals in the district. • There are district development plans in place for the district that mainly focus on district catchment protection. These development plans are developed with the involvement of local communities. 	
<p>Mr. David Nangoma, Mulanje Mountain Conservation Trust, Programme Officer for Biodiversity Conservation, Research and Monitoring</p> <p>0111 466 282</p>	<ul style="list-style-type: none"> • There is a big problem of invasive alien plants in most of the river catchment on Mulanje Mountain. Some of the invasive alien species include <i>P. patula</i> on Chambe Basin and Bracken fern. These suppresses the growth of indigenous forests on the mountain • There is an increase in illegal cutting down of trees on Mulanje Mountain, especially at the sources of major river, for timber, firewood and poles. This is resulting in soil erosion on the mountain and heavy siltation in rivers. • There is a problem of fires on Mulanje Mountain which is contributing to the rapid loss of indigenous vegetation. This also results in soil erosion and siltation of rivers 	<ul style="list-style-type: none"> • Invasive alien weeds and deforestation have been mentioned in the report as some of the existing baseline situation
<p>Mr. Utule, Mulanje District Water Supervisor</p> <p>0888 676 836</p>	<ul style="list-style-type: none"> • Generally, status of water flow in many rivers in FROM Mulanje Mountain is good. However, the flow is sometimes affected by the persistent drought that occurs in the area. • Some of the rivers are heavily silted from deforestation on Mulanje Mountain. However, some rivers are not silted since their water sources are protected by the water department since they constructed their water intakes and normally conduct monitoring of any illegal activities 	<ul style="list-style-type: none"> •

Name, position and Institution	Issue/comment	How the issue/comments have been incorporated into the report
	<p>around the intakes.</p> <ul style="list-style-type: none"> • Some rivers that passes through estates are polluted from chemicals fertilizers. • There is no collaboration between the district water office and the estate owners to reduce water resources degradation through chemical pollution. • There is always reluctance from the surrounding communities to volunteer themselves in water conservation by planting trees. • District water office in conjunction with ministry of agriculture encourages communities farming close to rivers to practice sustainable agriculture to conserve soil and reduce erosion. People are also sensitized on the issue of cultivation along river banks especially within the 10m of the buffer zone • The water office in collaboration with forestry department and MMCT encourages people in the area to plant more trees along the rivers especially around river sources on Mulanje Mountain. However, often times they experience a problem of lack of seedlings. 	
<p>Mr. G. Kansadwa, Group Manager, Esparanza Tea Estate – Eastern Produce 0999 958 246</p>	<ul style="list-style-type: none"> • There is minimal erosion on tea fields since there is permanent crop cover. • Changes in climate are affecting tea industry in Mulanje. Climate change brings some conditions such as erratic rainfall and drought in the area. Climate change is caused by deforestation and other human related activities. • The area sometimes faces acute water shortages due to several reasons which include careless cutting down of trees on Mulanje Mountain which is causing depletion of underground water resources. • The estate is planning to construct a water reservoir for the factory to overcome the problem of water shortages. • The estate taps water from Likhubula River for overhead irrigation for almost 50hectares of land. They also tap water from other mountain rivers such as Chitakale and Nakhulo for tea factory purposes • They use chemical fertilizers such as D-compound for mature tea crops, sulphate of ammonia in the tea nursery and Malawi Tea Mix which is applied using an air craft. • Water samples for water quality testing are collected 2 times a year by Malawi Bureau of Standards. • Partners with rainforest alliance to conserve and project trees from degradation. • The estate company has no particular plans with regard to replacement of tree cover and preventing the soil from 	<ul style="list-style-type: none"> • Effects of climate change in the basin have been elaborated and the project has this as one of the main objectives in the sustainable management of the Basin

Name, position and Institution	Issue/comment	How the issue/comments have been incorporated into the report
<p>Mr. Chafuli, Group Manager, Small Holder Tea Company and Chitakale Tea Plantations. 0888892381</p>	<p>erosion.</p> <ul style="list-style-type: none"> • There is no use of irrigation at STECO but Chitakale Tea Plantations. • There are soil erosion and loss of soil fertility problem. • Sometimes the area experiences erratic rainfall and droughts. STECO sells inputs to farmers, who are usually, outgrowers. • STECO relies mostly on Chitakale River which also forms the boundary of the estate. • Status of Chitakale River is good because of permanent tree cover. The river is currently dry because of persistent drought. • The tea estate uses urea fertilizer and round-up for weeds once a year. • There is a problem of weeds where there are some unplanted areas in the estate. • Engages in tree planting especially Blue gum which is fast growing species. • Works in collaboration with tea research foundation 	<ul style="list-style-type: none"> • Soil erosion, loss of soil fertility, erratic rainfall and persistent droughts are some of the baseline conditions mentioned in the report. SRBMP proposes to address of these problems
<p>Mr. M. Munthali, Administrative Manager for Tea Research Foundation 0111 4672995</p>	<ul style="list-style-type: none"> • There is a tripartite agreement between, Tea Research Foundation, local communities and MMCT on management of the forest. • Advocate for good agricultural practices to the tea estates in Mulanje. • Provides a handbook for suitable chemicals and their uses to the tea estates in Mulanje. • Provides improved tea crop varieties to tea estates in Mulanje 	<ul style="list-style-type: none"> • Co-management of forests and good agricultural practices are part of the focus areas of the SRBMP
<p>Mr. L. Msunga, Monitoring and Evaluation Coordinator, Concern Universal 0999 237 283</p> <p>Mr. A. Mailosi, Cross-Cutting Issues Coordinator, Concern Universal 0999 267 186</p>	<ul style="list-style-type: none"> • There is rampant soil, water and forestry degradation due to heavy dependence on these resources within the Shire River Basin especially in the project areas. Concern Universal focuses on conservation practices on selected catchments within the Shire River Basin. They work with farmers particularly in Chikhwawa at Kasinthula to adopt sustainable water conservation measures such as planting vertiver, construction of contour ridges and check dams where there is deep gullies and use of organic manure in their planting fields. • The organisation also encourages the use of inorganic fertilizers in sugarcane plantations at Kasinthula. A combination of the use of organic manure and inorganic fertilizers such as CAN and Urea is also encouraged in maize fields on small scale maize fields depending on the type of soils and nutrient deficiency levels in the soils. 	<ul style="list-style-type: none"> • The activities of Concern Universal and other NGOs are in line with the project objectives of the SRBMP

Name, position and Institution	Issue/comment	How the issue/comments have been incorporated into the report
	<ul style="list-style-type: none"> • They encourage participating farmers to use herbicides to eliminate weeds in their planting fields. • Unsustainable use of agricultural chemicals such as fertilizers and herbicides by some farmers are causing chemical pollution to the soils and in nearby rivers in the project areas. However, soils tests and analysis are done for fields of participating farmers in various project areas and advisory services are provided for proper use of agricultural chemicals to participating famers. • Deforestation is a major problem in many of the project areas within the Shire River Basin. Therefore the organisation encourages reforestation activities in the project areas by facilitating the sourcing out of tree seedling and planting of trees in the project areas. • Concern Universal work with various companies and organisations such as Kasinthula Cane Growers Limited within the Shire River Catchment in development of environmental management plans to management natural resources in the area. The organisation sometimes provides seedlings to farmers and organisation to plant trees within their programme areas. • Embarked on a Mobilise Project Works with Mulanje Mountain Conservation Trust that aims at fostering conservation of natural resources on Mulanje Mountain. • In Balaka, Concern Universal embarked on a project that encourages communities to use energy saving stoves to reduce dependency on fuel wood to reverse deforestation in the area. • The organisation assists in building capacity in irrigation scheduling and management in Chikhwawa, Ntcheu and Dedza. 	

Annex 6. Selected Photos Captured During Consultations



TA Dambe making his contributions during the meeting



Participants at TA Dambe



Consultative meeting at T.A Tchekutcheku



From Right: VH Whayo, VH Chimwayi, VH Maluwa in Blantyre

Annex 8. List of ESA Consultancy Team

Name	Kent Kafatia (Team Leader)
Expertise	Environmental and Social Assessment
Professional Qualifications,	MSc. in Water and Waste Engineering BSc. Chemical Engineering (Environmental) BSc. in Engineering Diploma in Water and Environment Management Certificate in Water and Environmental Management
Roles and Experience	<p>Mr. Kafatia was responsible for coordinating the whole environmental and social impact assessment, ensuring that outputs are delivered according to the Terms of Reference and on time; planning and liaising with Client and providing quality assurance and document control.</p> <p>Mr. Kafatia has more than 25 year's practical experience in water, wastewater and environment management. He has carried out consultancy work and lead consultancy teams on assignments for the Governments of Malawi, Mozambique, Tanzania, Kenya and Rwanda. On most of these assignments, has been directly engaged by the World Bank or has been engaged by the respective governments on World Bank and African Development Bank (AfDB) supported projects. He has worked as a Team Leader on a variety of environmental projects in Malawi and internationally.</p>
Name	Elton Laisi (Hydrologist)
Expertise	Hydrology, Earth Science and Economics
Professional Qualifications	Bachelor of Science Post Graduate Diploma in Hydrology
Roles and Experience	<p>Mr. Laisi was responsible for collection of data on hydrology, including but not limited to data on geology, topography, rainfall, evaporation, fisheries and aquaculture development. He also assessed current impacts on water resources; as well as potential impacts by the proposed priority water investments. He analyzed community's perceptions on the proposed interventions and he will look at environmental and social impacts related to energy, transportation, water use as well as impacts related to floods and droughts.</p> <p>He has undertaken various assignments in a number of countries in Central, Eastern, Western and Southern Africa. He possesses wide knowledge on the water resources of Malawi, having been in the public sector for 20 years and Controller of the department responsible for water resources and supply in Malawi. His several missions in other African countries have made him an expert on environmental issues in Africa.</p>
Name	Edwin Chiwona (Forestry and Biodiversity Expert)
Expertise	Biology, Conservation and Utilisation of Plant Genetic Resources,
Professional Qualification	PhD in On-Farm Conservation (Finalising) MSc in Conservation and Utilisation of Plant Genetic Diversity Bachelor of Science majoring in Biology and Chemistry

Roles and Experience Mr. Chiwona was responsible for assessing the current state of biological resources (flora and fauna including fisheries and aquatic life). He assessed impacts on biological resources by the proposed project; propose mitigation/enhancement measures for each impact identified, and use the information for preparation of the ESA and ESMF.

Mr. Chiwona has vast experience in environmental management including preparation of environmental and social impact assessments, environmental and social management frameworks and environmental auditing. He has carried out consultancy work for the Government of Malawi and has also been directly engaged in World Bank supported projects. Currently, he is a senior Lecturer at Bunda College of Agriculture.

Name Nyami Jaffu Mulenga (Land Husbandry/Catchment Management Specialist)

Expertise Natural Resources Research and Land Evaluation, Agriculture

Professional Qualification MSc. in Natural Resources Research and Land Valuation
Bachelor of Science in Agriculture

Roles and Experience Mr. Mulenga was responsible for identifying and assessing current environmental and social impacts on land resources. He determined potential environmental and social impacts of the proposed project on land resources and designed appropriate mitigation and enhancement measures in relation to land and soil conservation.

Mr. Mulenga is an expert in Land Resources Conservation with over 30 years of working experience in soil conservation, agro-forestry, land use planning, land conservation and natural resources management with wide practical knowledge in these areas. He has served as the Director of Land Resources Conservation in Malawi, responsible for advising the Ministry of Agriculture on issues related to land management, soil conservation, soil fertility improvement and agro-forestry as related to food security. He has worked with government, non – governmental organizations and community based organization, particularly the rural communities of Malawi, in soil conservation with emphasis on catchment conservation, land use planning, agro-forestry, rainwater harvesting, land resources surveys and forestation.

Name Bizalieli Daimon Kambewa (Social Development Specialist)

Expertise Rural Development and Extension, Agriculture, Animal Science

Professional Experience PhD in Social Science (Rural Development and Extension)

Roles and Responsibilities MSc. in Animal Science
BSc. in Agriculture

Mr. Kambewa was responsible for assessing impacts of existing, gender, socioeconomic and cultural practices on the environment. He assessed and analyzed potential socioeconomic impacts of the proposed project activities and determined their mitigation measures.

He has vast knowledge in social science especially working with rural communities. He has contributed to knowledge on the role of governance mechanisms and tenure systems in the management of land and natural resources. He has unveiled the importance of society, culture, local knowledge, and customary (traditional) or local institutions and practices in the

management of challenges such as HIV and AIDS, climate change and poverty to rural development and natural resources management.

Name	Jonas Mwatseteza (Water Quality Management Specialist)
Expertise	Analytical Chemistry
Professional Experience	PhD in Chemistry MSc. in Chemistry B. Ed, Science (Hons) B. Ed, Science
Roles and Experience	<p>Mr. Mwatseteza was responsible for conducting baseline assessments on key strategic points to determine impacts on water quality. He assessed potential impacts on water quality by the proposed project; and developed appropriate mitigation and enhancement measures for the ESA and ESMF.</p> <p>Mr. Mwatseteza is a Senior Lecturer teaching both undergraduate and postgraduate students in Analytical Chemistry and Environmental Chemistry, in the Department of Chemistry, Faculty of Science at Chancellor College, University of Malawi. He also carries out training on special topics in Chemistry as and when needed by various industries, public and private institutions. He is one of the pioneering researchers to apply micro-dialysis sampling for the analysis of metals in environmental samples. He serves as a technical expert in several committees with Ministry of Irrigation and Water Development, Department of Environmental Affairs, and Ministry of Health. He has experience in conducting environmental impact assessments and environmental auditing.</p>

Name	Robert Matengula
Expertise	Environmental and Social Impact Assessment Specialist
Professional Experience	MSc. in Environmental Management BA. In Humanities Dip. In Social and Development Studies
Roles and Experience	<p>Mr. Matengula was responsible for assessing impacts on the environment. He assessed and analyzed potential environmental and socioeconomic impacts of the proposed project activities and determined their mitigation measures.</p> <p>Mr. Matengula was responsible for site investigation, preparing the report, literature review. He identified and assessed all potential environmental and social impacts of the project. He prepared enhancement and mitigation measures for the identified impacts. He was also responsible for preparing environmental and social management plan (ESMP).</p> <p>His extensive experience in conducting environmental and social impact assessments provided the required expertise for this project environmental impact assessment.</p>