Document of

The World Bank

FOR OFFICIAL USE ONLY

Report No: ICR00004750

IMPLEMENTATION COMPLETION AND RESULTS REPORT

(IDA-51250/IDA-H7750/TF-12921/TF-12920)

ON A CREDIT IN THE AMOUNT OF SDR 60.6 MILLION
(US$93.75 MILLION EQUIVALENT)

AND A

IDA GRANT
IN THE AMOUNT OF SDR 20.2 MILLION
(US$31.25 MILLION EQUIVALENT)

AND A

GRANT FROM THE
GLOBAL ENVIRONMENT FACILITY TRUST FUND
IN THE AMOUNT OF US$5.08 MILLION

AND A

GRANT FROM THE
LEAST DEVELOPED COUNTRIES FUND
IN THE AMOUNT OF US$1.5 MILLION

TO THE
REPUBLIC OF MALAWI

FOR THE

Malawi: Shire River Basin Management Program (Phase-I) Project
June 3, 2019

Water Global Practice
Africa Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective {May 16, 2019})

Currency Unit =	MKW
725 MKW =	US$1
1 US$ =	SDR 0.720856

FISCAL YEAR
July 1 - June 30

Regional Vice President:	Hafez M. H. Ghanem
Country Director:	Bella Deborah Mary Bird
Senior Global Practice Director:	Jennifer J. Sara
Practice Manager:	Catherine Signe Tovey
Task Team Leader(s):	Josses Mugabi
ICR Main Contributor:	Javier Zuleta

ABBREVIATIONS AND ACRONYMS

ADC	Area Development Committee
AEC	Area Executive Committee
AIP	Area Intervention Plan
ARL	Automatic Rainfall Logger
AWS	Automatic Weather Stations
CBO	Community Based Organization
CECF	Catchment Environmental Conservation Fund
CIG	Common Interest Group
CMP	Catchment Management Plan
CPC	Civil Protection Committee
DoCCMS	Department of Climate Change and Meteorological Services
DDF	District Development Fund
DoDMA	Department of Disaster and Management Affairs
DoF	Department of Forestry
DFO	District Forestry Office(r)
DoNPW	Department of National Parks and Wildlife
DQA	Data Quality Analysis
EAD	Environmental Affairs Department
EGENCO	Electricity Generation Company Limited
EMP	Environmental Management Plan
ESCOM	Electricity Supply Corporation of Malawi
ESMP	Environmental and Social Management Plans
ESIA	Environmental and Social Impact Assessment
FFEWS	Flood Forecasting and Early Warning System
FFS	Farmer Field School
FGD	Focus Group Discussions
FRM	Flood Risk Management
GEF	Global Environmental Facility
GEO	Global Environmental Objective
GRM	Grievance Redress Mechanism
GVH	Group Village Headman
ICR	Implementation Completion Report
IDA	International Development Association
IFRMP	Integrated Flood Risk Management Plan
IGA	Income Generating Activity
IP	Implementing Partner
IPC	Internal Procurement Committee
ISP	Implementation Service Provider
ISP-CM	Implementation Service Provider for Catchment Management
ISP-FRM	Implementation Service Provider for Flood Risk Management
LDCF	Least Developed Countries Fund
LFMB	Local Forest Management Board
METT	Management Effectiveness Tracking Tools
M&E	Monitoring and Evaluation

MGDS	Malawi Growth and Development Strategy
MoAIWD	Ministry of Agriculture, Irrigation and Water Development
MOU	Memorandum of Understanding
MRA	Malawi Revenue Authority
NRI	Non-Regret Interventions
NSDC	National Spatial Data Centre
NWRA	National Water Resources Authority
ODSS	Operational Decision Support System
PAD	Project Appraisal Document
PDO	Program/Project Development Objective
PIC	Project Implementation Committee
PIP	Project Implementation Plan
PSC	Project Steering Committee
PTC	Project Technical Committee
RAP	Resettlement Action Plan
RPF	Resettlement Policy Framework
SCMP	Sub-Catchment Management Plan
SFAP	Strategic Forest Area Plan
SLA	Sustainable Livelihoods Analysis
SLWM	Sustainable Land and Water Management
SRBA	Shire River Basin Agency
SRBMP	Shire River Basin Management Program
TT	Technical Team
VDC	Village Development Committee
VFA	Village Forest Area
VFAP	Village Flood Action Plan
VLAP	Village Level Action Plan

TABLE OF CONTENTS

DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P117617	Malawi: Shire River Basin Management Program (Phase-I) Project
Country	**Financing Instrument**
Malawi	Investment Project Financing
Original EA Category	**Revised EA Category**
Full Assessment (A)	Full Assessment (A)

Related Projects

Relationship	Project	Approval	Product Line
Supplement	P127866-Shire River Basin Management Program (GEF)	14-Jun-2012	Global Environment Project

Organizations

Borrower	Implementing Agency
Ministry of Finance	Ministry of Agriculture, Irrigation and Water Development

Project Development Objective (PDO)

Original PDO

The overall Program Development Objective of the Shire River Basin Management Program is to generate sustainable social, economic and environmental benefits by effectively and collaboratively planning, developing and managing the Shire River Basin's natural resources. The program would support the Government's Shire basin Policy Letter , and would have a duration of 12-15 years. The first phase project – the Shire River Basin Management Program (Phase-I) Project (SRBMP) – would establish coordinated inter-sectoral development planning and coordination mechanisms, undertake the most urgent water related infrastructure investments, prepare additional infrastructure investments, and develop up-scalable systems and methods to rehabilitate sub-catchments and protect existing natural forests, wetlands and biodiversity. Future phases would consolidate Basin planning and development mechanisms and institutions, undertake further infrastructure investments, and up-scale catchment rehabilitation for sustainable natural resource management and livelihoods.

The Project Development Objective (PDO) of the SRBMP is to develop a Shire River Basin planning framework and improve land and water management for ecosystem and livelihood benefits in target areas.

The project would:(a) strengthen the institutionalcapacities and mechanisms for Shire Basin monitoring, planning, management and decision support systems; (b) invest in water related infrastructure that sustainably improves water resources management and development; (c) reduce erosion in priority catchments andsedimentation and flooding downstream, while enhancing environmental services, agricultural productivity and improving livelihoods;(d) improve flood management in the Lower Shire and provide community level adaptatin and mitigation support; and (e) protect and enhance ecological services in the Basin.

FINANCING

		Original Amount (US$)	Revised Amount (US$)	Actual Disbursed (US$)
World Bank Financing				
P117617	IDA-51250	93,750,000	93,750,000	84,709,295
P117617	IDA-H7750	31,250,000	31,250,000	30,595,122
P127866	TF-12921	1,500,000	1,500,000	1,500,000
P127866	TF-12920	5,078,000	5,078,000	5,078,000
Total		**131,578,000**	**131,578,000**	**121,882,417**
Non-World Bank Financing				
Borrower/Recipient		11,300,000	0	0
Total		**11,300,000**	**0**	**0**
Total Project Cost		**142,878,000**	**131,578,000**	**121,882,416**

KEY DATES

Project	Approval	Effectiveness	MTR Review	Original Closing	Actual Closing
P117617	14-Jun-2012	07-Sep-2012	19-Oct-2015	31-Jan-2018	31-Jan-2019

RESTRUCTURING AND/OR ADDITIONAL FINANCING

Date(s)	Amount Disbursed (US$M)	Key Revisions
17-Aug-2017	87.50	Change in Results Framework Change in Loan Closing Date(s) Reallocation between Disbursement Categories Change in Legal Covenants

KEY RATINGS

Outcome	Bank Performance	M&E Quality
Satisfactory	Satisfactory	Substantial

RATINGS OF PROJECT PERFORMANCE IN ISRs

No.	Date ISR Archived	DO Rating	IP Rating	Actual Disbursements (US$M)
01	09-Mar-2013	Satisfactory	Moderately Satisfactory	4.35
02	24-Aug-2013	Moderately Satisfactory	Moderately Unsatisfactory	5.61
03	18-Jan-2014	Moderately Satisfactory	Moderately Satisfactory	8.68
04	10-Sep-2014	Moderately Satisfactory	Moderately Satisfactory	19.99
05	13-Jan-2015	Moderately Satisfactory	Moderately Satisfactory	37.92
06	24-Jun-2015	Satisfactory	Moderately Satisfactory	42.86
07	18-Dec-2015	Satisfactory	Moderately Satisfactory	46.03
08	27-Jun-2016	Moderately Satisfactory	Moderately Satisfactory	58.60
09	28-Dec-2016	Moderately Satisfactory	Moderately Satisfactory	67.73
10	15-Jun-2017	Moderately Satisfactory	Moderately Unsatisfactory	74.70
11	19-Oct-2017	Satisfactory	Moderately Satisfactory	97.14
12	25-May-2018	Satisfactory	Moderately Satisfactory	106.96
13	31-Jan-2019	Satisfactory	Satisfactory	115.30

SECTORS AND THEMES

Sectors

Major Sector/Sector	(%)
Agriculture, Fishing and Forestry	**27**
Irrigation and Drainage	4
Other Agriculture, Fishing and Forestry	23
Water, Sanitation and Waste Management	**69**
Public Administration - Water, Sanitation and Waste Management	19
Other Water Supply, Sanitation and Waste Management	50

Industry, Trade and Services	**4**
Other Industry, Trade and Services	4

Themes

Major Theme/ Theme (Level 2)/ Theme (Level 3)	(%)
Private Sector Development	**100**
Jobs	100
Human Development and Gender	**3**
Gender	3
Urban and Rural Development	**6**
Rural Development	6
Rural Markets	3
Rural Non-farm Income Generation	3
Environment and Natural Resource Management	**192**
Climate change	100
Mitigation	31
Adaptation	69
Environmental Health and Pollution Management	12
Air quality management	4
Water Pollution	4
Soil Pollution	4
Water Resource Management	80
Water Institutions, Policies and Reform	80

ADM STAFF

Role	At Approval	At ICR
Regional Vice President:	Makhtar Diop	Hafez M. H. Ghanem
Country Director:	Kundhavi Kadiresan	Bella Deborah Mary Bird

Senior Global Practice Director:	Jamal Saghir	Jennifer J. Sara
Practice Manager:	Idah Z. Pswarayi-Riddihough	Catherine Signe Tovey
Task Team Leader(s):	Nagaraja Rao Harshadeep	Josses Mugabi
ICR Contributing Author:		Javier Zuleta

I. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

A. CONTEXT AT APPRAISAL

1. **Country and Sector Context**. In 2012, Malawi's population was estimated at 13.5 million, of which 85 percent resided in rural areas. Approximately 71 percent of the population lived in poverty. Gross National Income (GNI) per capita was at US$290, and Malawi ranked 171 out of 187 countries on the United Nations Human Development Index. Agriculture was (and is still) the lifeblood of Malawi's economy, contributing about 40 percent of GDP and over 90 percent of total export earnings in 2012. However, most of the population were engaged in smallholder, low-productivity rain-fed agriculture which regularly suffers from weather shocks (floods and droughts), limiting overall growth and poverty reduction.

2. The second Malawi Growth and Development Strategy (MGDS-II, 2011-2016) identified, among others, infrastructure development, agriculture, energy, water and natural resources management as priority areas for stimulating economic growth and reducing poverty. At the time of project appraisal, water remained a key development priority for Malawi. While the availability of water resources in Malawi on the aggregate was considered satisfactory, per capita water availability was declining at a rapid rate due to population growth, and the country was predicted to become water scarce by 2025. Further, Malawi's water resources were increasingly under threat from severe catchment degradation. The Government of Malawi (GoM)'s Water Resources Investment Strategy (WRIS, 2011) identified poor catchment conditions and deteriorating water quality as significant risks to water resources and associated infrastructure (dams, hydropower plants, irrigation systems), and recommended investments in catchment management in strategically important watersheds. Thus, improving the management of water resources was and is still a top priority for the government.

3. The Lake Malawi-Shire River hydrological system[1] (referred to as the Shire River Basin) remained the country's single most important natural resource system, supporting various sectors of the economy (energy, agriculture, industry, navigation, and water supply and sanitation). However, decisions on development and management of the water resources of the Shire River Basin were often taken on an ad-hoc and uncoordinated basis. While the level of Lake Malawi has varied significantly over time, there was concern that future lake level changes could cause serious social and economic disruption to Malawi, especially if the outflow into the Shire River was reduced. Hydropower plants on the Shire River produced more than 98 percent of Malawi's electricity, and reliability of power generation partly depends on the careful regulation of flows in the Shire River and water levels in Lake Malawi. The Kamuzu barrage (constructed in 1965) was used to regulate water levels in the Shire River to ensure sustainable water flow for hydro power generation irrigation, water supply and other uses. At appraisal, the structural stability of the barrage was in danger due to a serious unattended erosion process affecting the foundation, with its regulatory capacity constrained due to the poor conditions of the manually operated gates, and by the lack of real time information to operate the dam efficiently, particularly during emergencies. At the time of the identification of the project, with more intense climate variability due to climate change, there were growing concerns that the existing Kamuzu Barrage would not provide enough buffering capacity to ensure continuous water flows.

4. The Shire River Basin had also become a hotspot of catchment degradation and siltation of river beds, reservoirs and floodplain wetlands, which affected irrigation canals, fisheries and hydropower generation. Hydropower plants were often unable to meet peak demand, partly due to low flows and sediments in the river

[1] Shire River is the only outlet from Lake Malawi.

caused by degradation of catchments upstream of the plants. Given the economic and social importance of the Basin for national growth and development, it was critical to address the root causes of the deteriorating environment and natural resources base in the basin to ensure sustainable growth and poverty reduction.

5. In this context, GoM conceived a long-term, multi-sectoral investment program and an enabling institutional framework to effectively and sustainably develop and use the Shire River Basin's resources, to address the Basin's evolving challenges, and to maximize its potential for the benefit of Malawi. The Shire River Basin Management Program Phase- I Project (P117617) was the first project to support GoM's long term vision for the Basin. The project was consistent with the Bank Group Country Assistance Strategy (2011-2016) for Malawi, and Malawi's Growth and Development Strategy (2011-2016), both of which recognized water infrastructure and improved management of water resources as critical to economic growth.

6. **Theory of change**. The project aimed to achieve two outcomes: (i) develop a Shire River Basin planning framework; and (ii) improve land and water management for ecosystem and livelihood benefits in target areas. These would jointly contribute to longer-term outcomes, such as reduced rural poverty, reduction in soil erosion, increase in hydropower generation from the Shire basin and increase in persons with access to improved flood management. According to the project design, development of a Shire River Basin planning framework would be achieved by strengthening the institutional capacities, information and knowledge base, and decision support systems to facilitate integrated, collaborative planning and management of the basin's natural resources. Similarly, improved land and water and management would be achieved by (i) rehabilitating priority catchments based on participatory catchment management plans that integrated both catchment restoration and livelihoods improvement; (ii) improving ecological management of protected areas (national parks and forest reserves) which constitute a large proportion of the basin's landscape; (iii) investing in water management infrastructure (i.e. rehabilitation and upgrade of Kamuzu barrage); and (iv) investing in flood management infrastructure in the lower Shire, as well as community level adaptation and mitigation support. Details of the project's theory of change are provided in Annex 6.

7. **Project development objectives.** The project development objective (PDO) as stated in the financing agreement was *to develop a Shire River Basin Planning framework to improve land and water management for ecosystem and livelihood benefit*s.

8. **Key expected outcomes and outcome indicators.** The PDO statement captures two separate outcomes against which project performance will be assessed. These are:

- *PDO 1- Develop Shire River Basin planning framework*. The original project result framework in the PAD included one indicator to assess this outcome. The indicator was formulated as follows: Shire River Basin Plan developed by multi-sectoral Shire Basin Institution.
- *PDO 2 - Improve land and water management for ecosystem and livelihood benefit*s. The original results framework in the PAD included four indicators to assess this outcome: (i) vegetation cover change as a percentage of baseline in selected catchments (increase by 10 percent); (ii) downtime for hydropower stations on the Shire River (reduced by eight percent); (iii) households in targeted flood prone areas reclassified to lower flood risk (20,000 households); and (iv) direct project beneficiaries (400,000) of which 50 percent are female.

9. **Components.** The project had three components contributing to the PDO. A summary of the activities financed under each component is provided in the following paragraphs.

10. **Component A: Shire Basin Planning (Cost at appraisal US$41.6 million, at completion US$42.1 million).** This component laid the foundation for more integrated investment planning and management of the Shire Basin's natural resources through four sub-components: A1. Development of a Shire Basin Planning Framework*:* support the development of (i) *Knowledge base for the Shire Basin*, including developing a Shire River Basin Atlas, studies and spatial analysis products; (ii) *Decision Support System (DSS) for basin planning*; (iii) *Development of a Shire River Basin Plan*; *(iv) Shire Basin Institution*: setting up a multi-sectoral Shire Basin institution to support long-term planning and management to be created under existing water legislation and policies[2], but effective development would require further legislative reforms. A2. Building institutional capacity for coordinated basin management: provide support to ministries and agencies involved in land and water resources development. Support included technical assistance, infrastructure and incremental operational costs for coordinated basin planning and management. A3. Improve Water Resources Information Systems: supporting i) *Modernization of Monitoring Network*, including installation of 30 meteorological and hydrologic monitoring stations. ii) *Development of Operational Decision Support System (ODSS)*: Defined as an integrated hydromet data platform associated with a *Flood Early Warning System* conceived as an end-to-end short-term weather and flood forecasting system and, at seasonal level, a drought warning and monitoring system. A4. Program Management, Monitoring and Evaluation: support the operations and smooth functioning of the multi-sector Technical Team (TT) that was established to manage the project.

11. **Component B: Catchment Management (at appraisal US$45.0 million, at completion US$26.10 million**). This component was to initiate the rehabilitation and management improvement of priority catchments and protected areas for reduced erosion and improved livelihoods through an integrated and participatory approach. Activities were organized in three sub-components as follows: B1. Institutional capacity for catchment planning and monitoring: support community-based natural resource planning and management, social mobilization and training in four priority catchments covering 133,000 ha. B2. Rehabilitate targeted catchments: support communities to implement soil and water conservation activities including rehabilitation of degraded community forests, targeting an area of 33,000 ha. B3. Support Alternative Rural Livelihoods: support income-generating activities, commercially oriented alternative livelihoods initiatives; finance district level infrastructure including markets places, feeder roads, bridges to access to markets; and provision of livelihood grants. B4: Improve Ecological Management: would support: (i) implementation of infrastructure and management plans in Lengwe and Liwonde National Parks; (ii) implement community forest co-management in forest reserves; and (iii) support zoning, patrolling and monitoring.

12. **Component C: Water Related Infrastructure (at appraisal US$59.0 million, at completion US$52.9 million).** This component would finance infrastructure to improve the regulation of Shire River flows and strengthen climate resilience as follows: C1. Upgrade of Kamuzu Barrage: support the rehabilitation and upgrade of the Barrage, including installation of new gates (14), erosion protection works, upgrading of the weed collection system, construction of a new bridge, instrumentation and automation of operations. C2. Improve Flood Management: support implementation of flood risk management plans for the lower Shire through: (i) flood mitigation interventions: river bank stabilization, dykes, culverts, flood diversion structures etc.; (ii) community awareness raising and planning; (iii) community level support to the implementation of adaptation measures, (iv) support to Civil Protection Committees; and (v) planning and pilot investments in ecological flood mitigation and climate resilient livelihoods in the Elephant Marshes. C3. Prepare Priority Water Investments: finances preparation of feasibility and design studies for water-related infrastructure works identified in the Shire River Basin Plan.

[2] National Water Policy (2005) and Water Resources Act (1969)

B. SIGNIFICANT CHANGES DURING IMPLEMENTATION

13. **Changes to PDO and outcome indicators/targets.** During implementation some changes were made to PDO outcome indicators in a Level 2 project restructuring (August 2017) in line with the recommendations of the October 2015 mid-term review. Two of the original PDO indicators (vegetation cover change in selected catchments and downtime for hydropower stations on the Shire River) were dropped. One indicator (average management effectiveness score for 8 targeted protected areas/forest reserves) originally placed at the intermediate level was elevated to the PDO level, and a new indicator (improved operation of the upgraded Kamuzu barrage with adequate institutional arrangements) was introduced at the PDO level. In addition, the end target value for one of the PDO indicators (households in target areas reclassified to lower flood risk) was reduced drastically from 20,000 to 2,780 households. At the level of intermediate results, three indicators were dropped; seven new indicators were introduced and the end targets for two indicators were adjusted. There were also minor adjustments to the definitions of four indicators to make them more specific. (see Annex 7)

14. **Other changes.** As part of the August 2017 project restructuring, the project closing date was extended by 12 months from January 31, 2018 to January 31, 2019. The restructuring also involved reallocation of resources between expenditure categories. Within the IDA grant, a total of SDR1,066,546 was reallocated from Category 2 and 4 to Category 1. This amount represented the balance of funds not utilized under Category 4 (project preparation advance) and balances that were unlikely to be utilized under Category 2. Similarly, within the IDA credit, the unutilized amount of SDR 3,900,000 at the time was reallocated from Category 2 to Category 1 (SDR 2,400,000) and Category 3 (SDR 1,500,000).

15. **Rationale for changes and their implications for the original theory of change**. Changes were made to the results framework to improve the logical connection between project activities, outputs and outcomes. Some indicators were dropped either because they were not measurable due to lack of requisite data or were not directly attributable to the project interventions. Others were dropped because they were evaluated at mid-term review as unachievable within the remaining project period. Extension of the project by 12 months was done primarily to allow for full completion of the Kamuzu barrage rehabilitation – an important infrastructure investment that was critical to achieving the project objectives. Reallocation was done to address the over/under expenditure in some categories, and to ensure that activities that were critical to achieving the project objectives remained sufficiently funded.

II. OUTCOME

A. RELEVANCE OF PDOs

16. **Assessment of relevance of PDOs**. The PDO remains highly relevant to Malawi's development trajectory and is consistent with the World Bank's new Country Partnership Framework (CPF) which is currently under preparation[3]. The CPF focuses on four themes which emerged from the Malawi Systematic Country Diagnostic (SCD)[4]. These are: (i) human capital; (ii) governance and macroeconomy; (iii) energy and infrastructure; and (iv) environment and rural resilience. The project's outcomes related to improved land and water management contribute directly to the environment and rural resilience theme, as well as the energy and infrastructure themes of the CPF. Project interventions on sustainable land management practices and protection of forests

[3] P165153 - Malawi Country Partnership Framework covering from 07-2018 to 06-2022 to be delivered in FY20 (November 2019)
[4] Malawi Systematic Country Diagnostic: *Breaking the Cycle of Low Growth and Slow Poverty Reduction* (December 2018)

and woodlands are important for a healthy watershed that delivers ecosystem services and livelihood benefits. The SCD also emphasizes the urgency of protecting critical watersheds and securing water resources for existing and proposed hydropower plants on the Shire River as well as Malawi's largest irrigation scheme currently under implementation as part of the Shire Valley Transformation Project.

17. The project also remains relevant to GoM's priorities as laid out in the Malawi Growth and Development Strategy (MGDS III) 2017-2022. The objective of the strategy is to move Malawi to a productive, competitive and resilient nation through sustainable agriculture and economic growth, energy, industrial and infrastructure development while addressing water, climate change, environmental management and population challenges.

18. **Rating for relevance of PDOs.** Considering the above, the relevance of PDOs is rated **High**.

B. ACHIEVEMENT OF PDOs (EFFICACY)

19. **Assessment of achievement of the PDOs**. The project fully achieved its development objectives of developing a Shire River Basin planning framework and improving land and water management for ecosystem and livelihood benefits. Below is an assessment of each outcome.

20. **PDO 1: Develop Shire River Basin planning framework.** The development of the Shire River Basin planning framework has been fully achieved. The Shire River Basin Plan was completed and adopted by GoM in June 2017. The planning process followed a well-structured stakeholder participation process supported by state-of-the art decision-support tools. The project succeeded in changing the fragmented approach to investments prevailing at appraisal, to a more coordinated and holistic approach based on a shared diagnosis and vision for sustainable development of the Shire River Basin. This was achieved in several ways. First, the project supported the development of a large knowledge base for the Shire Basin that included the *Shire River Basin Atlas*; *State of the Shire Basin Report*, spatial analysis products and 16 sector and thematic studies[5]. These products were used in the development of the basin plan. The planning process was facilitated by a *Decision Support System* for basin planning, developed as a tool for analyzing management scenarios and trade-offs among future investment.

21. Secondly, the project invested in modernizing water resources information systems and financed various natural resources studies to improve the knowledge and information base for planning. The monitoring network of the basin has been revamped to produce real-time hydro-meteorological information for improved planning, operational decision support and flood forecasting. The project financed the installation of 100 hydromet monitoring stations, consisting of 75 automated weather and rainfall stations managed by the Department of Climate Change and Meteorological Service (DCCMS) and 25 river flow gauging stations managed by the Department of Water Resources (DWR). However, at the time of preparing the ICR, 44 hydromet stations were transmitting data in real time (the target set at appraisal was 30 hydromet stations transmitting data in real time).

22. Thirdly, the project helped to strengthen collaboration and coordination between different government agencies involved in Shire River Basin management. A multi-sectoral, multi-agency Technical Team (TT) established by the Ministry of Agriculture, Irrigation and Water Development (MoAIWD) led the preparation of the Shire Basin Plan supported by consultants financed under the project. The project also improved the institutional capacity and coordination mechanisms of 15 agencies involved in land and water management in the Shire River Basin. This included training, technical assistance, upgrading and refurbishment of buildings,

[5] Most of the knowledge products (including the Shire Basin Plan) can be downloaded from the website http://www.shirebasin.mw/.

equipment, surveys, digitation of archives, vehicles, bikes and incremental operational costs. Various training and capacity building activities have been undertaken to enhance capacity for coordinated basin planning and management. In total, 51 capacity building activities (comprising long term training courses, short courses, workshops, conferences and study tours) have been undertaken, with a total of 162 participants. That included two Master of Sciences degrees obtained overseas, one on weather and hydrological modelling and another on GIS and digital mapping.

23. Finally, the project supported various stakeholder engagement activities and knowledge services which enabled MoAIWD to restart dialogue and initiate implementation of the institutional framework for water resources management. At appraisal, the PAD proposed to support establishment of a Shire Basin Institution in line with the National Water Policy of 2005 that recognized the river basin as the management unit for water resources management. However, during project implementation, with the passing of the Water Resources Act in 2013, the institutional framework evolved towards creation of a National Water Resource Authority (NWRA) rather than separate basin institutions. Under this new legal context, the project focused on supporting the establishment of NWRA. The project supported technical assistance, stakeholder engagement and convening services, building on the efforts of previous projects[6]. The sustained engagement resulted in the appointment of the Governing Board for NWRA in November 2018. This appointment was an important milestone in operationalizing the Water Resources Act of 2013. With the NWRA board now in place, there is finally a sustainable institutional mechanism in place to facilitate multisectoral long-term planning and management of Malawi's water resources, including in the Shire Basin. MoAIWD is fast-tracking the remaining steps (appointment of Executive Director) and other transition steps needed to enable NWRA start its work by end of 2019. The project also financed the construction and equipping of a modern office building for NWRA's regional office in Blantyre responsible for the Shire Basin. Overall, the project succeeded in developing a planning framework for the Shire River basin, as well as the necessary institutional mechanisms for coordinated development and management of the basin's resources.

24. **PDO 2: Improve land and water management for ecosystem and livelihood benefits.** Consistent with the ICR guidelines, assessment of achievement of this objective was based on both the original set of outcome indicators before restructuring and the new indicators after restructuring. The indicators were generally appropriate to measure achievement of this outcome. However, to provide a more complete assessment, the ICR team used additional information obtained from recent remote-sensed measurements in the targeted catchments in the Shire River basin. Specifically, remote-sensed data was obtained on land use change, as well as changes in Normalized Difference Vegetation Index (NDVI)[7] and Land Surface Water Index (LSWI)[8] – the two most commonly used indices for monitoring vegetation. Details are provided in Annex 7.

25. *Land management.* With respect to land management, remote-sensed data shows that 56 percent of the land area rehabilitated under the project has registered a change in land use categorized as positive[9] during the period 2012-2018 (see Annex 7). Similarly, NDVI in the target catchments has increased by 33 percent while LSWI has increased by 66.7 percent during the same period. For the national parks and forest reserves that

[6] Preparatory studies for establishment of NWRA were financed under the Second National Water Development Project which closed in October 2015. The same project also financed the acquisition of office space in Lilongwe and start-up equipment, including logistical support (vehicles).

[7] NDVI uses the visible and near-infrared bands of the electromagnetic spectrum to analyze remote sensing measurements (based on satellite imagery data) to determine the extent to which a target contains live green vegetation

[8] LSWI uses the shortwave infrared and near-infrared bands of the electromagnetic spectrum to analyze remote sensing measurements (based on satellite imagery data) to determine the amount of water in vegetation and soil.

[9] A land use change was classified as positive, it fell in any of these categories: from agricultural land to forest; from shrubland to forest/plantation forest, from marshland to forest/plantation forest and built areas to forest

benefited from improved management measures supported by the project, NDVI has increased by 19.67% during the period 2018-2018.

26. Further, operation data from Malawi's Electricity Generation Company (ENGECO) shows that the percentage downtime of hydropower plants on the Shire River due to silt and sediments has reduced from 8 percent (2009 baseline) to 5.3 percent (in 2015) and to zero percent in 2018 and 2019 (see Annex 7 for details). However, during the same period downtime due to lack of water increased from 2.1 percent (2015) to 14.3 percent (2018) due to the restriction of water releases associated with the water saving policy introduced by MoAIWD in 2017 to recover water levels in lake Malawi. This suggests that changes in downtime of hydropower plants cannot be reasonably attributed to the project activities. However, the changes registered in land use, NDVI and LSWI can be reasonably attributed to the project interventions under Component B (catchment management), given that there was no other major catchment restoration program in the target areas.

27. The project successfully developed scalable systems and methods to rehabilitate catchments and protect existing natural forests, wetlands and biodiversity in the Shire River Basin. National catchment management guidelines were developed and adopted at the national level and currently used by various stakeholders. Various plans at catchment (4), sub-catchment (17) and micro-catchment/village level (305) were developed to guide implementation of community-based land and water management interventions in four priority catchments of upper Lisungwi, upper Wamkulumadzi, Kapichira and Chingale, covering a total area of 129,000 ha (about 5 percent of the basin land area). These priority catchments were selected because of their high levels of degradation resulting in high sediment load in the Shire River, upstream of the hydropower plants.

28. Out of the total area targeted, about 35,385 ha (27 percent of the targeted catchment area, and 1.3 percent of the basin land area) has been rehabilitated, including 10,173 ha of previously degraded community forests which have been regenerated. This was achieved through implementation of 305 participatory watershed management plans (Village-Level Action Plans or VLAPs) that typically included: (i) soil and water conservation measures such as gully reclamation, marker ridges and contour cultivation on steep slopes, as well as conservation agriculture practices such as zero tilling and mulching; (ii) stream and water control, including check dams and vegetative protection measures on 4,166 km of water courses, significantly exceeding the target of 992 kms within the VLAP areas; (iii) rehabilitation of degraded community forests, including improved forest protection to allow natural regeneration to flourish, fill-in planting where needed, and spacing where trees might be overcrowded.

29. Consistent with global best practice on watershed management, the project adopted a livelihoods approach to catchment management by integrating livelihood-enhancing activities - i.e. establishment 80 farmer field schools, provision of enterprise micro-loans for alternative (non-farm) livelihoods, community environmental conservation grants, rural infrastructure for market access (80km of feeder roads, 11 bridges and 13 market centers). The total value of enterprise development grants managed by targeted Group Villages (GVs) reached 620.5 million Malawian Kwacha at project closure. A total of 366 Common Interest Groups (CIGs) were formed, trained and provided with low-interest micro loans (up to US$2,500 each) as start-up capital for various non-farm enterprises. The most common enterprises included goat rearing, piggery, fish mongering, grocery shops etc. In some of the communities, the small initial grants provided have doubled in size as borrowers paid back small loans with interest. Beneficiary data obtained from project M&E database suggest that 446,650 people (compared to a project target of 400,000) directly benefited from the project's improved land and ecological management, as well as various livelihood enhancing activities linked to these interventions. About 50 percent of the beneficiaries were women. Overall, there is evidence that the livelihoods approach helped to increase farmer adoption of sustainable land and water management practices. At project

close, about 77 percent of households within the targeted catchments were reported to be engaged in sustainable land and water management practices, compared to a baseline of 15 percent.

30. The project also invested in improving the management of national parks, forest reserves and protected areas and wildlife in Shire River Basin affected by illegal encroachment, pouching and deforestation. Protected areas constitute a large portion of the landscape in the Shire river basin and play a key role in protecting ecosystem services. Incremental GEF support strengthened management and provided critical infrastructure in Lengwe and Liwonde National Parks to increase their long-term revenue. In forest reserves, GEF funding supported community forest co-management in the Neno Eastern Escarpment and Tsamba Forest Reserves in Neno district, which complemented the IDA-funded investments as part of an integrated landscape management approach; zoning, patrolling and monitoring of the Mangochi Forest Reserve adjacent to the Liwonde National Park, in recognition of the key importance of these forests as a wildlife corridor. In terms of results, the Management Effectiveness Tracker Tool (METT) [10] – a GEF tool used to score changes in protected area management effectiveness – was a part of the M&E system applied to all targeted natural habitat sites under the project. At appraisal, METT score was 39 and the target at completion was 65. The results of the assessment conducted in March 2019 showed that for all national parks and reserves, the project achieved a METT score of 70 (compared to a target of 65). This implies that protected areas and forest reserves within the Shire River Basin are now better managed (see Annex 7 for details).

31. Overall, available evidence suggests that project interventions under Component B contributed to improving land management in the Shire River Basin, resulting in noticeable changes in land use and in key vegetation indices. In the addition, the increase in METT scores for national parks and forest reserves suggests that project interventions contributed to improving the management of protected areas in the Shire Basin.

32. *Water management.* With respect to water management, the project's investments in modernizing water resources information and decision-support systems, and the upgrading of critical water management infrastructure contributed to improved water resources management and allocation at basin level. The most prominent intervention was the rehabilitation and upgrading of Kamuzu Barrage which increased the regulated level of lake Malawi by 40cm, thereby increasing inter-seasonal storage capacity of the lake. The rehabilitation included the replacement and automation of the 14 gates, downstream and upstream erosion protection, upgrading of the weed collection and handling system, construction of a new separate bridge and walkways to improve safety and to ease traffic flow during gate maintenance operations.

33. In addition, water managers have been equipped with information and tools to manage competitive water demands for hydropower, water supply, irrigation and environment, while at the same time mitigating risks of recurrent floods and droughts in Middle and Lower Shire districts. A network of 100 hydromet monitoring stations (75 meteorological and 25 hydrological) across the basin has been revamped to improve hydro-meteorological information for improved planning, operational decision support and flood forecasting. Modern hydromet equipment and associated software have been installed to enable access to hydromet data in near real time. An improved operational decision support tool for Kamuzu Barrage has been developed and is currently in use. The Kamuzu Barrage Operation and Management Model (KABOM) analyzes short, medium- and long-term strategies for releasing water from the lake during normal operations and under emergencies, based on real-time hydromet observations in 17 sites. MoAIWD has signed a Memorandum of Understanding

[10] The METT scoring system developed by the World Wildlife Fund (WWF)-World Bank Forest Alliance programme published in 2001 has been adopted by the Global Environment Facility (GEF). The methodology is a rapid assessment based on a scorecard questionnaire for stakeholders and managers that includes all six elements of management: context, planning, inputs, process, outputs and outcomes. *Management Effectiveness Tracking Tool Reporting Progress at Protected Area Sites: Second Edition. World bank/WWF July 2007.*

with EGENCO for sharing the operation and maintenance duties at the barrage. However, MoAIWD retains control of the water releases in line with the barrage operating rules agreed with all stakeholders and codified in KABOM.

34. A gradual recovery of the water levels in Lake Malawi has been observed since July 2018, the first time in 10 years. The use of real-time information by trained operators able to make decisions based on pre-agreed operating rules (with minimum bureaucratic or political interference), has enabled MoAIWD to implement, since July 2016, a rigorous water saving policy that has stopped the decline of Lake Malawi's water level. In addition, a more efficient, timely and flexible operation of the gates and the increased flood control pool created by the project in Lake Malawi enabled the Kamuzu barrage operators to moderate extreme flood peaks during the recent Idai cyclone (March 8-14, 2019).

35. Flood risk in lower Shire has been reduced through better water management and construction of flood protection infrastructure at five sites in the flood prone districts of Chikwawa and Nsanje. A total of 3,155 households in targeted flood prone areas have been reclassified to a lower flood risk[11], compared to the project's revised target of 2,780 households. While the project's M&E framework focused on tracking households protected from floods through structural measures, there is evidence that the project has contributed to increasing flood resilience in the entire basin. An operational decision support system (ODSS) for flood and drought forecasting has been developed which makes use of near real-time hydromet data to calculate (every six hours) weather and rainfall forecasts using GPM-COSMO (with an increased resolution from a grid of 45km to a new of 7km). The rainfall predictions are fed into a rainfall-runoff forecast suite of models to calculate levels and flows in 25 sub-catchments and location along the Shire River up to the confluence with Zambezi with a lead time of 72 hours.

36. The ODSS is currently issuing automated alerts and warnings via SMS to stakeholders including Village Heads in the flood prone area of Lower Shire and to Kamuzu barrage operators. The ODSS is jointly operated by the DCCMS and the DWR, and there is an institutionalized process of operating and issuing alerts by the Department of Disaster Management Affairs (DoDMA). The warning system was utilized during the recent Cyclone Idai (March 8-14, 2019) with positive impacts. Based on rainfall and flood forecasts in 25 sub catchments, as well as real-time data on the evolution of the cyclone, the operators of Kamuzu barrage reduced the discharges from 200 to 40 m^3/s for two days. This reduction in the release from the lake created sufficient space in the Shire River channel and Elephant Marshes to attenuate the impact of floods coming from tributaries. That operation was possible because of the improved coordination between three departments (DWR, DCCMS and DoDMA), supported by better information and improved infrastructure (e.g. automatically control of barrage gates in all weather conditions). Recent assessments by DoDMA shows that the impact of floods from Cyclone Idai (in terms of reported deaths and damages) was much less compared to the 2015 floods[12].

37. The project also supported the preparation of six area intervention plans (AIPs) covering all flood prone areas in the Shire. The AIPs have identified a total of 34 different flood management interventions (dykes, flood proof roads, river bank strengthening, evacuation centres, etc.) estimated at a cost of US$12.5 million. Together, the AIPs cover a population of approximately 187,136 people and provide a solid basis for future investments in flood risk mitigation in the lower Shire. Detailed designs were completed for some of the interventions. At the community level, a total of 22 Village Flood Action Plans (VFAPs) were prepared. The

[11] Classification was based on 2D flood modelling. Households were classified to lower flood risk if the flood modelling showed that they would be protected by a flood management structure supported by the project.

[12] For more details about the comparison between 2015 and 2019 floods see in Annex 5 Table A5.5

VFAPs identified about 32 labor-intensive works (i.e. sandbagging, tree planting, cleaning culverts, and opening storm water channels) across the area covered by the AIPs. Finally, the project also supported preparation of community-based flood risk management guidelines which have been adopted by the government.

38. Reduction of flood risks generated by the Lower Shire river and the management of flash floods generated in tributaries entailed considerable planning and coordination with local communities. A detailed community mapping exercise in all the districts established a baseline map of community assets/critical infrastructure, individual households, etc., for the flood prone areas. Detailed aerial photography of the baseline and a lidar survey, with a resolution of 0.18 mts, covering 542,000 hectares (2017) is extensively used by the government in planning flood infrastructure and disaster relief and emergency management. The project helped to strengthen the existing community-based flood early warning system through provision of flood early warning equipment to 45 targeted communities in the two districts. At the community level, village committees were equipped with mobiles, megaphones, inundation maps and training on emergency management.

39. Finally, the project supported activities to enhance the hydrological function of Elephant Marshes in absorbing floodwaters as a key element of the nature-based strategy for flood risk management in the Shire. The project provided technical assistance for studies on the hydrological, ecological and resource-use characteristics of the 1,200km^2 Elephant Marshes as a basis for establishing participatory management planning, and piloting community resource management activities. The Marshes occupy a significant proportion of the lower Shire floodplain, and are important for their biodiversity, and for their potential for supporting enhanced climate-resilient livelihoods such as fisheries and tourism. The project also invested in boat facilities to support research, management and patrolling of the Marshes. This has contributed to the conservation of these areas that are critical for climate resilience in the Lower Shire. One of the most impressive results was the implementation of the Elephant Marshes Management Plan, which led to the designation of the Elephant Marshes as a wetland of international importance under the Ramsar convention.

40. Overall, the information available at the time of preparing this ICR suggests the project contributed to improving water management in the Shire River Basin, resulting in improved water availability for production, ecosystem and livelihoods benefits and reduced flood risks.

41. **Justification for rating for overall efficacy**. Considering the above, overall efficacy of the project is rated **Substantial.** The project fully achieved its twin objectives of developing a Shire River Basin planning framework and improving land and water management. The project has achieved and, in some cases, exceeded its PDO indicators and targets, and there is a strong and clear indication that results recorded can be attributed to project interventions.

C. EFFICIENCY

42. **Assessment of efficiency**. The project directly or indirectly impacted several sectors of the Malawian economy including agriculture, energy, irrigation, transport, tourism, water supply and sanitation, and small and medium enterprises. The project outputs had effects on human capital, natural resources (including wildlife, forest, soils, water, wetlands, and ecosystems), strengthened water and related institutions, and attenuated the effects of the recent catastrophic floods. The upgraded Kamuzu Barrage and associated decision support systems substantially improved operational decisions and enabled the recovery of water levels in Lake Malawi. These effects were transmitted to the overall economy of the basin and the country through multiple pathways. The economic analysis conducted at appraisal anticipated strong economic viability of the project, with economic rate of returns (EIRR) ranging between 15.8-48.6 percent for individual components but

did not provide an analysis for the overall project. The ex-post analysis conducted at closing attempted to follow the original analysis as closely as possible. The results are summarized in Table 1 below. Details of the analysis are provided in Annex 4.

Table 1. Results of the economic cost benefit analysis

Components	At ICR			At Appraisal		
	NPV (US$ M)	IRR (%)	B/C Ratio	NPV (US$ M)	IRR (%)	B/C Ratio
B. Catchment Management	7.1	25.9%	1.46	5.95	15.76%	1.24
C1. Kamuzu Barrage Upgrade	53.2	37.0%	7.3	24.5-177.0	15.8%-48.6%	NA
C2. Flood Risk Management	0.25	12.9%	1.07	1.8	16.8%	NA
Overall Project	**21.0**	**15.8%**	**1.32**	**NA**	NA	NA

43. The ex-post economic analysis shows that the project resources were efficiently deployed to generate significant benefits with an overall EIRR of 15.8 percent. In addition, a cost-effectiveness analysis of catchment management interventions shows that catchment management interventions were delivered at competitive costs compared to similar projects in other countries in Eastern and Southern Africa. Final expenditures for Sub-components B1, B2, and B3 were US$ 19.5 million. Sub-component B2 treated approximately 35,000 ha through sustainable land management practices and forestry conservation with total expenditures of US$7.3 million. However, watershed programs using an integrated approach such as the one adopted in this project, need to apply a combined cost reflecting planning, field interventions, and livelihood activities. Based only on this 35,000 ha and the overall sub-component cost of US$19.5 million, the average cost for the integrated catchment activities in this sub-component was US$557 per ha. Based on the total area of the four catchments of 129,500 ha, the average cost was US$150 per ha. In comparison, overall average cost of the Ethiopia Resilient Landscape and Livelihood project (P163383) for 170,000 ha in area was US$588 per ha. With the Lake Victoria Environmental Management Project – Phase II (P100406) the overall average cost was US$916 per ha. For the Burundi Landscape Restoration Project (P160613), the overall average cost was US$1,437 per ha, although this project included terracing, which is a high cost intervention.

44. Finally, the project delivered a variety of products from technical assistance, equipment, training and studies to large transformational infrastructure and information systems. The capacity of the counterparts to evaluate and monitor a wide range of processes and activities in many locations in parallel was inadequate. More than 31 consultancies (16 large) required a sizable supervision effort from the multi-sectoral Technical Team (TT), beneficiary departments and local governments. The risk of delays in the preparation and approval of designs, consultancy reports and completion of works, properly identified at appraisal, was mitigated to a great extent by hiring consultant firms to assist various departments and the TT. Notwithstanding these efforts, at MTR, Government and TT agreed on concentrating the available budget and time to critical and essential activities directly linked to the PDOs. The restructuring of the project with one-year extension and reallocation of funds to key activities allowed the TT to finalize successfully the completion of Kamuzu Barrage with relatively small changes to final costs, which did not affect efficiency.

45. **Rating for efficiency.** Considering the above, the efficiency of the project is rated **Substantial.**

D. JUSTIFICATION OF OVERALL OUTCOME RATING

46. The overall Outcome rating has been derived based on the combined assessments of Relevance, Efficacy and Efficiency as presented above. Given the changes to some of the outcome indicators and targets introduced by the August 2017 project restructuring, a split rating methodology has been applied to rate the overall outcomes of the project.

47. The efficacy rating without restructuring was based on the four original outcome indicators and targets – i.e. (i) Shire River Basin Plan developed by multi-sectoral Shire Basin Institution; (ii) vegetation cover change as a percentage of baseline in selected catchments; (iii) downtime for hydropower stations on the Shire River; and (iv) households in targeted areas reclassified to lower flood risk. These four indicators were assessed in terms of what was achieved at the end of the project relative to the originally envisioned targets, even though the first three indicators were dropped or refined while the last one had a reduced target value. Based on the assessment presented above, the efficacy of the project without restructuring is rated Substantial. Most of the original indicators and targets were achieved, except the indicator on households reclassified to lower flood risk which registered a modest achievement.

48. The efficacy rating with restructuring was based on the final set of indicators and targets – i.e. (i) Shire Basin plan adopted; (ii) improved operation of the upgraded Kamuzu barrage with adequate institutional arrangements; (iii) average management effectiveness score for 8 targeted protected areas/forest reserves; and (iv) households in targeted areas reclassified to lower flood risk. The post-restructuring evaluation was based on the achievement of these new indicators (and in the case of the last indicator, the revised target value) from restructuring until the end of the project. Based on data and information available on the revised PDO indicators at project closure, the project fully achieved, and in some cases, exceeded its revised PDO indicator targets. The efficacy rating with restructuring is therefore rated High.

49. Details of the split evaluation are provided in Table 2 below. Based on this evaluation, the overall outcome of the project is rated as **Satisfactory**.

Table 2 – Overall Outcome Rating

	Without Restructuring	**With Restructuring**
Relevance Rating	**High**	
Efficacy Rating	**Substantial**	**High**
PDO 1	Substantial	High
PDO 2	Substantial	High
Efficiency Rating	**Substantial**	
Outcome Rating	Satisfactory	Highly Satisfactory
Numerical value*	5	6
Disbursement	US$93.00 million	US$28.89 million
% Disbursement	76.30%	23.70%
Weighted value	3.815	1.422
Overall Outcome Rating	**5.23**	
	Satisfactory	

*Overall Outcome is rated on a 6-point scale: Highly Unsatisfactory (1); Unsatisfactory (2); Moderately Unsatisfactory (3); Moderately Satisfactory (4); Satisfactory (5); Highly Satisfactory (6)

E. OTHER OUTCOMES AND IMPACTS (IF ANY)

50. **Gender.** The project had a strong focus on and succeeded in ensuring balanced gender representation across its activities. Out of a total of 446,650 project beneficiaries, about 50 percent were women. Gender disaggregated indictors in the project's M&E database showed that women reached high levels of access to project financed activities, catchment management, farmer field schools, livelihood grants and other income generating activities. However, data on capacity building activities implemented at the national level showed that these activities benefited mostly men (75 percent). This may be due to gaps in women's representation in decision-making roles in the water sector in general.

51. **Institutional strengthening.** Collaboration and coordination between different government agencies involved in Shire River Basin management improved continuously during implementation. Various training and capacity building activities were undertaken to enhance capacity for coordinated basin planning and management. In total, 51 capacity building activities (comprising long term training courses, short courses, workshops, conferences and study tours) were undertaken, with a total of 162 participants. The project also supported various stakeholder engagement activities and knowledge services which enabled MoAIWD to restart the dialogue and initiate implementation of the institutional framework for water resources management as laid out in the Water Resources Act 2013. The sustained engagement during the project resulted in the appointment of the Board for the NWRA in November 2018.

52. **Poverty reduction and shared prosperity.** Project activities under component B (catchment) targeted small holder farmers in the poorest region of Malawi, where rural poverty rates are above 80 percent. There is no rigorous evaluation of poverty impacts from the project. However, household socio-economic surveys carried out in the project areas in 2014 and 2017 showed positive movement in some indictors (e.g. average annual cash income from sale of crops). However, the changes cannot be attributed to the project interventions because such changes were also observed in the non-project areas. That said, recent studies[13] show a strong correlation between areas with highly degraded land and those with a high incidence of poverty, implying that increasing levels of land degradation may be contributing to the poverty of millions of Malawians. A project such as this would therefore be expected to contribute to poverty reduction over the long term.

53. There is evidence that the livelihood interventions supported under the project have had some impact on poverty reduction. For instance, in some of the communities visited during the ICR mission, the small CECF funds provided as an incentive to engage in catchment management have grown from the initial grant of MK1.1 million, as borrowers paid back small loans with interest, to between MK1.5 million and MK 2.8 million. Field visits over the implementing period and during the recent ICR mission confirmed that these small loans were used for school fees, unexpected medical costs, farm inputs, and for small business development. One good example was a family that used the loan of MK250,000 (just under US$350) to buy goats. Profits from the goat operation allowed the loan to be fully repaid, a new house built, fertilizer purchased, and trees planted in fields for agro-forestry.

[13] World Bank (2018). Malawi Country Environmental Analysis. October 2018 (under preparation)

III. KEY FACTORS THAT AFFECTED IMPLEMENTATION AND OUTCOME

A. KEY FACTORS DURING PREPARATION

54. **Complex project design.** The project scope was complex, combining large infrastructure (Kamuzu barrage) with a mix of knowledge activities and small community-level investments in 305 VLAP areas. This scope translated into 31 consultancy contracts and 52 works contracts all together. While this is expected for a large multi-sectoral undertaking, it was the first time MoAIWD had engaged in such a complex operation. The multi-sectoral technical team (TT) established to manage the project was understaffed and unprepared for the task. The risk assessment at appraisal rightly assessed the capacity risks as high. However, some of the mitigation measures (hiring of additional professional technical and project management staff to support the TT) were not implemented. Consequently, the TT struggled to manage the multitude of activities leading to delays in project implementation.

55. **Government commitment to a multi-sectoral approach.** There was clear Government commitment to a collaborative long-term vision and enabling institutional environment for a multi-sectoral approach to effectively and sustainability develop and use the basin resources. This was reflected in a letter of policy sent to the World Bank on January 18, 2012. The project design recognized and reflected the importance of multidisciplinary teams and participatory approaches. A strong involvement of stakeholders was key for ensuring the needed levels of ownership and uptake among the communities of project beneficiaries. Early investment in capacity building, both at beneficiary level and at implementing agency level was integrated into the project design. The project design philosophy emphasized a bottom-up approach in the identification of the environmental and/or natural resources management challenges, and agreement on the actions that must be implemented to address these challenges, as well as the investments required. This due process fostered community ownership of the plans that were developed and will potentially enhance sustainability, provided resources are availed for continued implementation of identified interventions.

56. **Results framework.** The project had a well-designed results framework, with indicators that were aligned with the project objectives. However, for some of the indicators (biophysical and ecological), the systems for data collection were not in place and the project design did not include capacity building for biophysical and ecological monitoring and impact evaluation. At project mid-term review, it was agreed that the project would finance installation of sediment monitoring stations at key points in watercourses in selected catchments. The stations were installed, but no measurements were carried out.

57. **Farmer/community incentives to engage in catchment restoration activities**. Reversing catchment degradation is largely in the hands of smallholder farmers and their communities. However, farmer incentives to engage in sustainable land and water management practices was not assessed during project preparation. Given that the project objective was to improve land and water management for ecosystem and livelihood benefits and given that benefits only accrue if farmers adopt new practices introduced by the project, it was necessary to understand farmer/community incentives to adopt new practices and include measures in the project design to increase adoption rates. The issue was examined at MTR and a financial incentive (Community Environmental Conservation Fund) was introduced. CECF is a community incentive scheme that integrates a range of landscape restoration activities – such as forest restoration and conservation agriculture – within a program of benefits shared at the community level. The scheme provided fixed payments of US$1,500 to communities in exchange for satisfactory performance on their watershed management plan. The incentive helped increase adoption rate although a rigorous evaluation of its impact has not been done.

58. **Implementation readiness.** At appraisal, the project's flagship infrastructure investment (Kamuzu barrage) had feasibility studies and detailed designs ready. However, the rest of the project investments (particularly catchment management) were not ready for implementation, as they depended on participatory planning processes which only commenced two years after the project became effective. The project was therefore slow in committing resources. That said, some background studies were done to close knowledge gaps at the time of project preparation, including erosion modelling to identify priority catchment areas for intervention.

B. KEY FACTORS DURING IMPLEMENTATION

59. Several factors affected project implementation. Some are subject to the control of government, while others are not. The key factors are summarized in the following paragraphs.

60. **Multi-sectoral coordination and engagement**. The multi-sectoral TT approach enhanced capacity and/or team building amongst members while fostering inter-sectoral sharing of ideas and expertise. The model was consistent with the multi-sectoral nature of the project and helped to build capacity of the TT members involved and enhanced understanding of the interlinked challenges from other sectors. For many of the participating departments, the TT members who were working on this project have become important resource persons in their respective departments on issues of integrated watershed management. There were minimal changes in the composition of the TT and its leadership, thus ensuring continuity.

61. **Strong partnership.** The World Bank team and TT worked closed together to solve implementing challenges as they arose. Regular joint review meetings were held (outside the standard mission schedules) to review progress, identify challenges and opportunities, agree actions to address bottlenecks, adapt to new circumstances or take advantage of new opportunities. This adaptive approach to project management continued throughout the implementation period.

62. **Delays in operationalization of NWRA.** Project resources earmarked to support the operationalization of NWRA could not be fully utilized due to delays in establishing NWRA's basic corporate governance structure. For most of the project period, there was no formally established and sustainable institutional mechanism to facilitate multi-sectoral, long-term planning and management of the Shire Basin. The TT provided the multi-sectoral coordination support needed for the preparation of the Shire Basin Plan. Attempts to establish a prototype Shire River Basin Agency (SRBA) before the NWRA was set up failed as the SRBA had no legal backing and no budget. The delayed establishment of NWRA created considerable policy uncertainty and delayed decision-making in the management of water resources in the Shire Basin and in the country.

63. **Contract management challenges**. Weaknesses in contract management led to time extension of contracts and in some cases cost overruns. Further, due to the capacity and time constraints within the TT, there was inadequate supervision and oversight of the 31 consultants engaged under the project. On average, about 80 percent of consultancy contracts were delayed. Consultants were in many cases not followed-up on each aspect that they ought to have delivered. There were also instances of delayed client feedback on reports produced by consultants which also delayed subsequent tasks under these contracts, and in some cases compromised the quality of the products. These challenges were compounded by inadequate due diligence at the time of developing the terms of reference for some of the consultancies.

64. **Community facilitation model for catchment rehabilitation.** Extension staff at the district level are at the frontline of GoM's fight against catchment degradation. However, the district extension service remained severely underfunded, understaffed and in most cases, extension workers lacked the requisite capacity and

incentives to perform. At project preparation, the client and Bank team considered two implementation models. One would route project funds through District Councils who would deploy their line staff and field extension officers to support communities to implement field activities. This model was not selected because of weak capacity and staffing in the Councils at that time, and fiduciary concerns. The second model, which was selected, used an Implementation Service Provider (ISP) through a service contract to support communities and facilitate field activities. Funds for small-scale field works flowed directly to communities through appropriate field-level institutions (Project Implementation Committees). District Council line and extension staff received modest financing to their consolidated account for operating costs needed to sustain travel to the field and allowances. The funding level to Councils gradually increased to support scaling up of their work so that when the ISP started to scale down in the months before closure of the project (January 2018), they could then continue to work with communities. The implementation model was not perfect; there was ongoing tension between the ISP and Councils over funding and coordination. A memorandum of understanding signed between the TT, ISP and all five participating Councils, was helpful in clarifying roles and responsibilities, but did not fully alleviate this issue.

65. **Exchange losses.** The project suffered exchange losses due to fluctuations between the US$ and the SDR soon after the signing of the Financing Agreement. The aggregate loss was estimated at US$9.7 million as of October 2018. This resulted in reduction of scope for certain activities. However, activities that were critical to achieving the project objectives remained sufficiently funded.

IV. BANK PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME

A. QUALITY OF MONITORING AND EVALUATION (M&E)

66. **M&E design.** The project had a well-designed results framework, with indicators that were aligned with the project objectives. A comprehensive monitoring and evaluation (M&E) system and tools were developed and used to monitor and track progress on project activities and results. The system provided vital information on progress of activities, progress on expenditures, contract management, project results and impacts on the beneficiaries. However, the M&E system relied heavily on consultants and was not integrated with the participating departments and districts.

67. **M&E implementation**. A consulting firm was contracted to carry out M&E functions on behalf of the TT during most of the project period until January 2018. Thereafter, an individual consultant was engaged to provide M&E support up to project close. The monitoring of progress across all project components was detailed and timely. Comprehensive quarterly input-output reports, process and quality monitoring reports were prepared throughout the implementation period and shared with stakeholders, including the Bank. Period beneficiary reports were also prepared during project – but only up to 2017. There were no beneficiary reports per se prepared during the last year of the project[14]. The methodology used for indicator definitions and data collection was generally robust and consistent. The M&E system allowed for spatial data analysis and visualization to measure impacts, particularly of catchment rehabilitation activities. However, the complexity of the project, involving many activities and multiple institutions (supported by different consultants), at national and local levels, posed challenges to the flow of quality and timely information. In addition, although

[14] The Government prepared an internal *Project Completion Report* in December 2018 that included a comprehensive consultation to asses beneficiary's perception and satisfaction with output of project. This rapid evaluation was supported by *Key Informant Interviews* and a qualitative data gathered from10 *Focus Groups Discussions* held in 5 districts (Blantyre, Zomba, Machinga, Neno and Ntcheu)

the M&E design included a provision for biophysical monitoring at sub-catchment level, this activity was not done due to delays in installing the biophysical monitoring stations and capacity constraints within DWR to manage these stations.

68. **M&E utilization.** The information generated by the project's M&E system was routinely used for operational decisions throughout project implementation. It was also readily available for review and action during World Bank missions. Process and quality monitoring reports were routinely prepared, and findings used to adjust implementation processes. For instance, several adjustments were made to the implementation model for the catchment management component based on the findings of the process monitoring reports.

69. **Justification of the overall rating of M&E quality.** Considering the above, the quality of M&E is rated **Substantial.** The M&E system as designed and implemented was generally robust to assess the achievement of the objectives and test the links in the result chain. However, there were some weaknesses in a few areas as discussed above.

B. ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE

70. **Environmental and social compliance.** This was a Category A project, as one of the key investments (Kamuzu barrage) was anticipated to have significant adverse impacts that are sensitive, diverse, or unprecedented, or that affect an area broader than the sites or facilities subject to physical works. The project triggered the following safeguard policies: Environmental Assessment (OP/BP 4.01); Natural Habitats (OP/BP 4.04); Forests (OP/BP 4.36); Pest Management (OP 4.09); Physical Cultural Resources (OP/BP 4.11); Involuntary Resettlement (OP/BP 4.12), Safety of Dams (OP/BP 4.37); and Projects on International Waterways (OP/BP 7.50). The project complied with all applicable environmental and social safeguard policies of the World Bank. Annex 8 provides details on how the project complied with each policy.

71. The borrower ensured that the required capacity for the management of safeguards was in place for the entire life of the project and safeguards instruments were prepared and implemented to completion for all subprojects. Sub-project specific safeguard instruments were prepared and cleared prior to start of works. There was only one case (construction of SRBA office building) where a contractor was instructed to start works prior to approval of the ESIA by the Bank. However, this was promptly resolved by suspending works temporarily until the ESIA was reviewed and cleared. Safeguards issues for Kamuzu barrage – the largest infrastructure investment under the project – were generally well managed. All grievances were amicably resolved except one grievance by a lodge owner which is currently in court. Overall, the project has delivered environmentally positive outcomes, including the restoration of degraded lands and streams, improved management of natural as well as planted forests, more effective management of certain protected areas, and specific plans for conserving the Elephant Marsh.

72. **Fiduciary compliance.** Financial management (FM) compliance was consistently rated satisfactory during project implementation. The project used consultative budgeting processes leading to detailed activity-based budgeting, which guided implementation on an annual basis. However, the annual plans and budgets were generally optimistic, leading to excessive funds in the Designated Account (DA) for most of the implementation period. With respect to internal controls, the project had an FM manual detailing policies and procedures in using proceeds of financing. The internal controls have generally been good demonstrated by only few observations of control and accountability in both external and internal audits. However, few districts experienced problems in use of project funds and in one case leading to qualification of project audited accounts and in other cases leading to delays in implementation of planned projects. At the community level,

the project engaged Accounts Assistants to assist communities in financial management. Most of the communities maintained proper books of accounts and were able to report on use of funds supported by appropriate documentation.

73. The funds flow arrangements worked well, and the project had more than adequate funds throughout the implementation period. IDA disbursement totaled US$115.3.8 million against the original funding of US$125 million. The difference of US$9.7 million represents realized exchange losses due to the SDR/ Dollar exchange rate fluctuation. The full GEF funding of (US$6.6 million) was also disbursed. The bank reconciliations were timely and clean, without long outstanding reconciling items. However, some bank accounts in districts were not timely reconciled. The project used a computerized accounting package for transaction processing and reporting. The project is current on all reporting requirements for both interim financial reports and audited financial statements. The audited accounts have carried clean audit opinions except for 2017 when the accounts were qualified due to misuse of funds (MK17 million) by Zomba District Council. The funds have since been replaced and used appropriately.

74. The project generally followed the procurement procedures as stipulated in the procurement guidelines, PAD, financing agreement and project implementation manual. The project had a dedicated procurement team comprising a procurement specialist and two assistants. The project meticulously used STEP for all procurement transactions, even though it was only introduced in the middle of project implementation period. There was adequate oversight from the MoAIWD's Internal Procurement Committee which assisted to fast-track procurement processes with due regard to agreed procedures, and as such during the project implementation, there was no declaration of any mis-procurement. That said, the TT struggled to manage the large number of contracts under the project, leading to excessive extensions and in some cases cost overruns.

C. BANK PERFORMANCE

75. **Quality at entry.** Project design benefited from a large multidisciplinary team of Bank staff (31) and consultants (8), as well as technical support from FAO staff (3). The project design recognized and reflected the importance of multidisciplinary teams and participatory approaches. The project was aligned with GoM and Bank priorities at the time, anchored in a sound theory of change and informed by lessons learned from previous projects in Malawi and elsewhere. Project implementation arrangements were clear, and risks were adequately assessed, and mitigation measures identified. However, there were a few shortcomings which affected quality at entry. First, the project scope was necessarily broad and ambitious, but in some areas was beyond the existing government's capacity levels. Second, at appraisal, most of the project investments were not ready for implementation, despite the long project preparation period (28 months from concept to approval). Third, although the project had a well-designed results framework, with indicators that were aligned with the project objectives, for some of the indicators (biophysical and ecological), the systems for data collection were not in place and the project design did not include capacity building for biophysical and ecological monitoring and impact evaluation.

76. **Quality of supervision.** Bank supervision missions were regular and well resourced, with adequate expertise to assess progress and provide implementation support on all project activities, including the specific aspects related to implementation of environmental and social safeguards. There were minimal changes in task team leadership during project implementation (only one change at project mid-term review), thus ensuring continuity of client relationships which are critical for a successful partnership. The task team prepared detailed, well-written aide memoires and flagged issues candidly for management and government attention. A thorough project mid-term review was conducted, and this resulted in several recommendations

and adaptations to improve project implementation performance (e.g. introduction of CECF, farmer field schools etc.). Implementation status reports (ISRs) and mission aide-memoires provided candid and accurate assessments of the project implementation progress and of the issues requiring attention at the time. For instance, after four years of project implementation, about 30 percent of project resources remained uncommitted. The Bank mission of July 11-22,2016 candidly flagged this issue and supported the TT in preparing a detailed action plan to commit the resources within six months. The Bank team also remained focused on the institutional issues. Three missions (January 2017, August 2017 and April 2018) prominently flagged the importance of operationalizing the institutional framework for water resources management. The Bank team actively engaged MoAIWD and other relevant government entities on this reform. The sustained Bank engagement resulted in the appointment of the Governing Board for the National Water Resources Authority (NWRA) in November 2018. Overall, Bank's technical support and partnership was generally appreciated by stakeholders. A stakeholder survey conducted by the project M&E consultant at project close revealed that 82 percent of respondents were satisfied with the Bank's support during project implementation.

77. **Justification of overall rating of Bank performance.** Considering the above, Bank performance is rated **Satisfactory.** There were minor shortcomings in quality at entry, but supervision was effective and adaptive to client needs.

D. RISK TO DEVELOPMENT OUTCOME

78. The risk that development outcomes achieved will not be maintained is **moderate.** The project succeeded in putting in place satisfactory arrangements to ensure sustainability. For instance, the project established and equipped many community level structures that took part in the planning processes for activities at that level. These structures are still active even after project close. Field visits conducted by the ICR team in December 2018 and February 2019 showed that in all VLAP areas, District Council field staff had continued to provide some level of effort to support communities with ongoing soil and water conservation activities. At the same time, it was evident that in the VLAPs visited, tree nurseries were still functional, protection and expansion of community forests was continuing, work to repair small gullies was occurring, and many farmers were undertaking small-scale soil and water conservation activities on their lands such as planting vetiver grass and strengthening contours on slopes.

79. At the central level, the project facilitated the operationalization of the NWRA, which is expected to strengthen multi-sector planning and management of water resources and provide continued support to watershed management institutions at community level. However, MoAIWD needs to fast-track the remaining steps (appointment of Executive Director, opening accounts etc.) and other transition steps needed to enable NWRA start its work. GoM remains committed to reversing the rate of catchment degradation and improve water and energy security, agricultural productivity and livelihoods, and has recently launched its landscape restoration strategy which was partly informed by the experience from this project. A follow-on operation (Malawi Resilient Productive Landscapes Project, P167860) is currently under preparation to consolidate the gains from SRBMP and scale up the interventions in other river basins.

V. LESSONS AND RECOMMENDATIONS

80. SRBMP was the first integrated river basin management project in Malawi, targeting a river basin of critical importance to the economy, with a combination of investments in infrastructure, institutions and information, and watershed management. The project demonstrated new and innovative approaches for

integrated catchment management, encompassing planning from catchment to village levels with community participation, capacity and institution building, soil and water conservation interventions, sustainable forestry and protected areas management and developing alternative livelihoods. Several lessons can be drawn from the project experience to inform future similar projects in Malawi and elsewhere. The most significant lessons and recommendations are summarized in the following paragraphs.

81. **Reversing watershed degradation requires significant investment in strengthening institutional capacities at all levels.** The project demonstrated that it is possible to restore degraded landscapes through an integrated package of interventions involving land and water management, forestry management and livelihood support. However, this required significant investment in capacity building and facilitation at the central, district and local levels. Given that watershed management is a long-term process, any future investment should also consider strengthening financing mechanisms for watershed management to reduce reliance on short duration projects.

82. **A community-led landscape approach to watershed restoration can achieve results at scale and help build resilience at basin scale**. Managing natural resources in an integrated way across different land uses and connecting them at the basin level provides the basis for addressing trade-offs and enhancing people's livelihoods and resilience to climate change. The project demonstrated a scalable, community-based approach to addressing the alarming levels of land and forest degradation that is threatening Malawi's water resources and showed that it is possible to achieve results within the project lifetime. The achievements of the project helped to inform GoM's national forest and landscape restoration strategy published in July 2017 that aims to restore 4.5 million ha of degraded landscapes by 2030.

83. **Improving water resources management requires a combination of investments in institutions, information and infrastructure.** The project demonstrated what can be achieved in terms of enhancing water security with an integrated package of investments in critical water infrastructure, institutions and information systems. The project's investments in upgrading Kamuzu barrage and water management tools (ODSS, KABOM, real-time hydromet) and training staff in the use of these tools, led to an increase in the amount of water available for productive use, while at the same time protecting people from the destructive impacts of water (floods).

84. **Choices about project design and scope should consider the capacity of implementing agencies.** While river basin management projects are inherently complex, projects should be structured to match the capacity of implementing entities, and any measures agreed to mitigate capacity constraints should be translated into appropriate covenants in the financing agreement.

85. **Inter-agency collaboration on multi-sectoral projects requires strong government commitment and deliberate design choices**. The project broke new ground in inter-agency collaboration partly because of clear government commitment expressed in a Letter of Policy to the Bank prior to appraisal, followed by the establishment of a multi-agency, multi-sector technical team drawn from all relevant ministries and departments to manage project preparation and implementation. Given that water is the integrating factor in river basin management projects, the choice of MoAIWD as the lead ministry was appropriate. In addition, the project was appraised at a time when Government policy was not in favor of stand-alone Project Implementation Units (PIU) for delivery of projects. This policy therefore presented an opportunity to design implementation arrangements that fostered long-term institutional capacity of key land and water related institutions to perform their core mandate.

ANNEX 1. RESULTS FRAMEWORK AND KEY OUTPUTS

A. RESULTS INDICATORS

A.1 PDO Indicators

Objective/Outcome: Develop Shire River Basin planning framework

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Shire Basin Plan adopted	Yes/No	N 01-Nov-2012	Y 31-Jan-2018	Y 17-Aug-2017	Y 27-Apr-2018

Comments (achievements against targets):

Objective/Outcome: Improve land and water management for ecosystem and livelihood benefits

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Improved operation of the upgraded Kamuzu barrage with adequate institutional arrangements	Yes/No	N 14-Jun-2012	Y 04-Dec-2018	Y 17-Aug-2017	Y 04-Dec-2018

Comments (achievements against targets):

Target achieved. Kamuzu barrage upgraded and regulated level of lake Malawi increased by 40cm, thereby increasing inter-seasonal storage capacity of the lake. An improved operational decision support tool - Kamuzu Barrage Operation and Management Model (KABOM) - has been developed and is currently in use. KABOM analyzes short, medium- and long-term strategies for releasing water from the lake during normal operations and under emergencies, based on real-time hydromet observations in 17 sites. MoAIWD has signed a Memorandum of Understanding with the Electricity Generating Company (EGENCO) for sharing the operation and maintenance duties at the barrage. However, MoAIWD retains control of the water releases in line with the barrage operating rules agreed with all stakeholders and codified in KABOM.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Average management effectiveness score for targeted protected areas	Number	39.00 14-Jun-2012	65.00 31-Jan-2018		73.00 04-Dec-2018

Comments (achievements against targets):

Target exceeded.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Direct project beneficiaries	Number	0.00 01-Nov-2012	400000.00 31-Jan-2018		446650.00 27-Apr-2018
Female beneficiaries	Percentage	0.00	50.00		50.00

Comments (achievements against targets):
Target exceeded

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Households in targeted areas re-classified to lower risk	Number	0.00 01-Nov-2012	20000.00 31-Jan-2018	2780.00 17-Aug-2017	3155.00 04-Dec-2018

Comments (achievements against targets):
Revised target exceeded

A.2 Intermediate Results Indicators

Component: Shire Basin Planning

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Hydromet stations with accessible data in real time	Number	0.00 01-Nov-2012	30.00 31-Jan-2018		44.00 27-Apr-2018

Comments (achievements against targets):
Target exceeded

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Shire River Basin Institution Established	Yes/No	N 14-Jun-2012	Y 31-Jan-2018		Y 08-Nov-2018

Comments (achievements against targets):
In line with the Water Resources Act of 2013, the National Water Resources Authority (NWRA) has been established to manage Malawi's water resources, including in the Shire River Basin.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Functional geodatabase developed	Yes/No	N 14-Jun-2012	Y 31-Jan-2018		Y 04-Dec-2018

Comments (achievements against targets):
Geospatial database developed and in use

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Shire basin planning tools developed	Yes/No	N 01-Nov-2012	Y 31-Jan-2018	Y 17-Aug-2017	Y 02-Jun-2017

Comments (achievements against targets):
Basin planning tools developed and used in the preparing basin plan

Component: Catchment Management

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Length of river bank protection (vegetative) undertaken	Kilometers	0.00 14-Jun-2012	992.00 31-Jan-2018		4166.00 27-Apr-2018

Comments (achievements against targets):
Target exceeded

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Number of Village-Level Action	Number	0.00	305.00		305.00

Plans (VLAPs) approved		14-Jun-2012	31-Jan-2018		14-Aug-2017

Comments (achievements against targets):
Target achieved

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Area under sustainable land and water management (ha)	Hectare(Ha)	0.00 14-Jun-2012	24460.00 31-Jan-2018		25212.00 27-Apr-2018

Comments (achievements against targets):
Target exceeded

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Total value of livelihood investment grants managed by targeted Group Villages (GVs) in Million Malawi Kwacha	Number	0.00 01-Nov-2012	220.00 31-Jan-2018		620.50 04-Dec-2018

Comments (achievements against targets):

Target exceeded

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Proportion of households within targeted sub-catchments engaged in sustainable land and water management	Percentage	15.00 01-Nov-2012	75.00 31-Jan-2018		77.00 27-Apr-2018

Comments (achievements against targets):
Target exceeded

Component: Water related infrastructure

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Community-based flood early warning system is established	Yes/No	N 30-Jun-2017	Y 31-Jan-2018		Y 27-Apr-2018

Comments (achievements against targets):
Flood early warning system established and operational

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Budgeted management plan established for Elephant Marshes	Yes/No	N 01-Nov-2012	Y 31-Jan-2018		Y 27-Apr-2018

Comments (achievements against targets):
Budgeted management plan for elephant marsh prepared and adopted

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
New water investment plans prepared to pre/feasibility stage	Number	0.00 01-Nov-2012	4.00 31-Jan-2018	3.00 17-Aug-2017	2.00 04-Dec-2018

Comments (achievements against targets):
Revised target not achieved due to budget constraints

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion

GV with improved community flood management infrastructure	Number	0.00 01-Nov-2012	40.00 31-Jan-2018	29.00 17-Aug-2017	28.00 04-Dec-2018

Comments (achievements against targets):
Revised target not fully achieved due to budget constraints.

Indicator Name	Unit of Measure	Baseline	Original Target	Formally Revised Target	Actual Achieved at Completion
Kamuzu Barrage upgraded	Yes/No	N 01-Nov-2012	Y 31-Jan-2018		Y 04-Dec-2018

Comments (achievements against targets):
Kamuzu barrage upgraded and is now operational.

A. KEY OUTPUTS BY COMPONENT

Objective/Outcome 1: Develop Shire River Basin planning framework	
Outcome Indicators	1.Shire basin plan adopted
Intermediate Results Indicators	1. Shire basin planning tools developed 2. Shire River Basin institution established 3. Hydromet stations with accessible data in near real time 4. A functional geodatabase developed
Key Outputs by Component (linked to the achievement of the Objective/Outcome 1)	1.Knowledge base and planning decision support tools 2.Basin plan adopted 3.National Water Resources Authority (NWRA) established 4.25 hydrological stations, 41 automatic weather stations and 31 rain water gauging stations 5. A functional geodatabase developed
Objective/Outcome 2: Improve land and water management for ecosystem and livelihood benefits	
Outcome Indicators	1. Average Management Effectiveness (METT) Scores for 6 targeted protected areas/forest reserves 2. Households in target areas re-classified to lower flood risk 3. Improved operation of the upgraded Kamuzu barrage with adequate institutional arrangements 4. Direct project beneficiaries, of which female (%)
Intermediate Results Indicators	1. Proportion of households within targeted sub-catchments engaged in sustainable land and water management 2. Number of Village Level Action Plans (VLAPs) approved 3. Area under sustainable land and water management in targeted micro-catchments (VLAP areas) 4. Length of riverbank protection undertaken

	5. Number of Common-Interest Groups (CIGs) established and operational 6. Total value of livelihood investment grants managed by targeted Group Villages (GVs) 7. Kamuzu barrage upgraded 8. Number of GVs with improved community flood management infrastructure 9. Community-based flood early warning system established 10. Preparation studies for water-related infrastructure 11. Budgeted management plan established for Elephant Marshes
Key Outputs by Component (linked to the achievement of the Objective/Outcome 2)	1.77 percent of households within targeted sub-catchments engaged in sustainable land and water management 2. 305 VLAPs prepared and approved 3. 25,212 ha under sustainable land and water management 4. 4,166km of river banks protected 5. MK 620.5 million of livelihood grants managed by GVs 6. Kamuzu barrage upgraded 7. 28 GVs with improved community flood management infrastructure 8. Community-based flood early warning system established 9. Budgeted management plan for Elephant Marshes adopted.

ANNEX 2. BANK LENDING AND IMPLEMENTATION SUPPORT/SUPERVISION

A. TASK TEAM MEMBERS

Name	Role
Preparation	
Nagaraja Rao Harshadeep	Team Leader
Pieter Waalewijn	Co-Team Leader
Cary Anne Cadman	Senior Forestry Specialist
Grant Milne	Senior Natural Resources Management Specialist
Stephen Ling	Natural Resources Management Specialist
George Ledec	Lead Ecologist
Cheikh Sagna	Sr. Social Development Specialist
Marjorie Mpundu	Senior Legal Counsel
Luis Schwarz	Senior Finance Officer Finance
Frauke Jungbluth	Senior Rural Development Economist
Hardwick Tchale	Sr. Agricultural Economist
Stephen Mhone	Procurement Specialist
Trust Chimaliro	Financial Management Specialist
Francis Mkandawire	Financial Management Specialist
Dalitso Kafuwa	Natural Resources Management Specialist
Francis Nkoka	Disaster Risk Management Specialist
Zeria Banda	Communications Officer
Rimma Dankova	Disaster Risk Reduction Specialist
Alessandro Palmieri	Lead Dam Specialist
Ademola Braimoh	Sr. National Resources Management Specialist
Almudena Mateos	Operations officer
Reto Thoenen	Energy Specialist
Petros Akililu	Institutional Development Specialist
Gayatri Kanungo	Environmental Specialist

Hrishikesh Patel	GIS Specialist
Jayne Kwengwere	Program Assistant
Grace Chilambo	Team Assistant
Supervision/ICR	
Josses Mugabi	Task Team Leader(s)
Anthony Aggrey Msendema, Steven Maclean Mhone	Procurement Specialist(s)
Trust Chamukuwa Chimaliro	Financial Management Specialist
George Campos Ledec	Environmental Specialist
Minerva S. Espinosa-Apurada	Team Member
Grant Milne	Team Member
Esther Angellah Lozo	Team Member
Guoping Zhang	Team Member
Nigel Ross Hughes	Team Member
Javier Zuleta	Team Member
Ntambuzeni Zeria Banda	Team Member
Time Hapana Fatch	Team Member
Odete Duarte Muximpua	Team Member
Francis Samson Nkoka	Team Member
Zione Edith Kansinde	Team Member
Tamara Juvenile Mwafongo	Team Member
Violette Mwikali Wambua	Social Specialist

A. STAFF TIME AND COST

Stage of Project Cycle	Staff Time and Cost	
	No. of staff weeks	US$ (including travel and consultant costs)
Preparation		
FY10	31.672	317,097.66
FY11	40.104	371,079.48
FY12	99.316	485,211.98
FY13	0	-16,787.40
Total	**171.09**	**1,156,601.72**
Supervision/ICR		
FY13	120.111	950,276.73
FY14	53.136	331,997.92
FY15	29.062	158,184.14
FY16	33.643	169,507.38
FY17	35.478	184,804.60
FY18	52.902	282,916.01
FY19	41.516	303,992.11
Total	**365.85**	**2,381,678.89**

ANNEX 3. PROJECT COST BY COMPONENT

Components	Amount at Approval (US$M)	Actual at Project Closing (US$M)	Percentage of Approval (US$M)
SHIRE BASIN PLANNING	41.6	42.1	101%
CATCHMENT MANAGEMENT	45.0	26.1	58%
WATER-RELATED INFRASTRUCTURE	59.0	52.9	90%
Total	**145.6**	**121.10**	**83%**

ANNEX 4. DESCRIPTION OF PROJECTS COMPONENTS

Components. The project had three components contributing to the PDO. A summary of the activities financed under each component is provided in the following paragraphs.

1. **Component A: Shire Basin Planning (Cost at appraisal US$41.6 million, at completion US$42.1 million).** This component laid the foundation for more integrated investment planning and management of the Shire Basin's natural resources. Activities were organized in four sub-components

A1. Development of a Shire Planning Framework*:* support the development of (i) *Knowledge base for the Shire Basin* ,including developing a Shire River Basin Atlas, a Shire State of the Basin Report, and other spatial analysis products; and sector studies at basin and national level; (ii) *Decision Support System (DSS) for basin planning:* as a tool for analyzing management scenarios and trade-offs among future investment; (iii) *Development of a Shire River Basin Plan:* supported by the Planning DSS and multisector stakeholder participation, defined development policies for the basin and priority investments; *(iv) Shire Basin institutions*: The project should support the setting up and operationalization of a multi-sectoral Shire Basin institution to support long-term planning and management of the Shire Basin to be created under existing water legislation and policies[15], but effective development would require further legislative reforms. As such, it would be a prototype organization, developed as a sub organ of a national water resources management system, which would also be supported under this Component.

A2. Building institutional capacity for coordinated basin management: provide support to ministries and agencies involved in the planning and management of land and water resources in the Shire River Basin. Support included technical assistance, training, renovation of offices buildings, equipment, vehicles and incremental operational costs to enhance capacity for coordinated basin planning and management.

A3. Improve Water Resources Information Systems: support modernization of the water resources monitoring systems and developed an operational decision support system. i) *Modernization of Monitoring Network*, including installation of 30 meteorological and hydrologic monitoring stations. ii) *Development of Operational Decision Support System (ODSS)*: Defined as an integrated hydromet data visualization platform of weather, hydrologic, and flood forecasting and warning information. One of the components of the Operational DSS would be *Flood Early Warning System* conceived as an end-to-end weather and floods forecasting system that, based on real-time data, calculate high resolution weather and rainfall forecast to be used to manage floods and to alert potentially affected people, local governments and operators of water infrastructure. At seasonal level ODSS would support also drought warning and monitoring systems for communities at risk and disaster management related agencies.

A4. Program Management, Monitoring and Evaluation: support the operations and smooth functioning of the multi-sector Technical Team (TT) that established to manage the project.

2. **Component B: Catchment Management (at appraisal US$45.0 million, at completion US$26.10 million**). This component aim was to initiate the rehabilitation and management improvement of priority catchments and protected areas for reduced erosion and improved livelihoods through an integrated and participatory approach. Given the longer-term nature of catchment management interventions, this

[15] National Water Policy (2005) and Water Resources Act (1969)

component sought to institutionalize an approach and show early results that could be scaled up and consolidated in subsequent phases of the project. Activities were organized in three sub-components as follows:

B1. Institutional capacity for catchment planning and monitoring: support development of community-based natural resource planning and management system that included social mobilization and training to build the necessary capacity and ownership in four priority catchments. Project support development of a catchment planning framework from large scale (around 26,000-41,000 ha) down to village level (less than 500 ha). Broad catchment and sub-catchment management plans covered 133,000 ha across the four priority catchments. The planning should cover, sub- catchments and village-level action plan. The project should also support the development of national policies and guidelines, to be officially adopted by the GoM.

B2. Rehabilitate targeted catchments: support communities to engage in a range of soil and water conservation activities to improve land and water management at village level for sustainable land management, including rehabilitation of degraded community forests, targeting an area to be treated of 33,000 has. The sub-component would support improved water management through smaller-scale structures built by community members that might include stream and water control structures, including check dams and small earthen dams. At sub-catchment and/or catchment level, larger infrastructure investments such as upgrading feeder roads, culverts and small bridges would be supported. Capacities should be built in communities and District Councils (line departments, field extension staff, etc.) to continue this work beyond project closure.

B3. Support Alternative Rural Livelihoods: support demand and market driven income-generating activities to gradually decrease dependency on low performance agriculture and unsustainable harvesting of forest products as sources of income. This include: (i) area-specific market demand and value chain transaction support studies; agricultural fairs aimed at identification of and linkages with markets; (ii) development and start-up of commercially oriented alternative livelihoods initiatives of common interest groups (CIG), (iv) finance district level infrastructure including markets places, feeder roads, bridges to access to markets; and (v) provision of livelihood grants.

B4: Improve Ecological Management. this subcomponent strengthen management of large natural habitat within the Shire Basin, including: (i) selected infrastructure and capacity building investments and management plans in Lengwe and Liwonde National Parks to increase their long-term revenue flows; (ii) implement of community forest co-management in the Neno Eastern Escarpment and Tsamba Forest Reserves in Neno district; and (iii) support zoning, patrolling and monitoring of the Mangochi Forest Reserve adjacent to the Liwonde National Park.

3. **Component C: Water Related Infrastructure (at appraisal US$59.0 million, at completion US$52.9 million).** This component finance new investments to enable improved regulation of Shire River flows and strengthen climate resilience. Activities were organized in three sub-components as follows:

C1. Upgrade of Kamuzu Barrage: support the rehabilitation and upgrade of the Barrage, including installation of new gates (14no), downstream and upstream erosion protection, upgrading of the weed collection and handling system, construction new bridge and walkways, instrumentation and automation of operations. The project would also support preparation of dam safety management plans, development and use of new and improved barrage operating rules supported by an operational DSS, and training of barrage

operators. The upgrading would extend the operational life of the barrage and supported its key functions to (i) regulate water flows downstream to meet the needs related to hydropower, irrigation, water supply, flood management, and environment, (ii) regulate water levels upstream to help improve climate resilience and meet environmental and socio-economic sustainability by increasing regulatory range by 40 cm; (iii) improve weed management to reduce interruptions in hydropower installations downstream, and (iv) improve traffic circulation on the major corridor in Malawi and safety by separating road traffic from the gates. The improved water resources information system and operational DSS should be used to optimize barrage operations in real-time.

C2. Improve Flood Management. support implementation of the integrated flood risk management plan for the lower Shire, focusing on both structural and non-structure measures, as well as community -level adaptation and support. Support include (i) construction of 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, and training on the use of 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; (vi) participatory management to enhance environmental services (particularly flood attenuation), livelihoods and biodiversity.

C3. Prepare Priority Water Investments finance preparation of feasibility and design studies for water related infrastructure works identified in the Shire River Basin Plan.

ANNEX 5. EFFICIENCY ANALYSIS

Background

1. The implementation of the Shire River Basin Development Project directly or indirectly impacted several sectors of the Malawian economy including agriculture, energy, irrigation, transport, tourism, water supply and sanitation, and small and medium enterprises. The project outputs had also profound effects on human capital, natural resources (including wildlife, forest, soils, water, wetlands, and ecosystems), and relevant Malawian institutions, and attenuated the effects of the recent catastrophic floods. The upgraded Kamuzu Barrage and associated decision support systems substantially improved operational decisions and enabled the recovery of water levels in Lake Malawi. These effects were transmitted to the overall economy of the basin and the country through multiple pathways. The impacts could be positive or negative, expected or unanticipated, on-site or off-site, short/medium or long-term (see the theory of change).

2. Hence, demonstrating or capturing the overall benefits and costs of a project such as this in few indicators is challenging. Some of the benefits and costs, even though real, are difficult to quantify and value. In this analysis, such benefits and costs are described qualitatively. While for those aspects of the project for which the costs and benefits are readily quantifiable, an economic cost benefit analysis was performed.

Methodology and Key Assumptions

3. The project activities were organized into three main components and eleven-subcomponents (see Table A5.1).

Table A5.1: Description of main and sub-project components

Main and sub-project components	Remarks
Component A: Shire Basin Planning	
A1: Development of Shire Basin Planning Framework	The data/information generated, and the Shire River Basin Plan were used to: prepare pipeline projects, prepare district development plans, National Water Resources Authority and Shire River Basin Agency established for efficient water resources management at National and local level. Thus, the benefits are generic and not restricted to specific to the project area.
A2: Build Institutional Capacity for Coordinated Basin Management	Improvement of institutional capacity through training development of new management tools, renovation of infrastructure and provision of equipment and data to 15 key institutions enabled reforms and better overall WRM. But benefits are generic (with impact nationwide not restricted to project area) and difficult to quantify in the short term.
A3: Improve Water Resources Information	The benefits are generic (with hydromet and data management instruments with nationwide impact not restricted to project area) and difficult to quantify
A4: Program Management, Monitoring, and Evaluation	Relevant for the implementation of the overall project components. Thus, the costs for this sub-component are used in the cost benefit analysis of the overall project.

Component B: Catchment Management	
B1: Institutional Capacity for Catchment Planning and Monitoring	Identified micro-catchment interventions, which were subsequently implemented in Components B2 and B3. The sub-Component also developed integrated national catchment management guidelines-the benefits of which are of national nature.
B2: Rehabilitate Targeted Catchments	The interventions include: capacity building at watershed and village level, design of strategy for implementing watershed management by communities, design and testing of soil and water management practices to reduce soil erosion and enable sustainable and productive agriculture, forestry, and provision of credits to access inputs.
B3: Support Alternative Rural Livelihoods	Introduced market driven income generating activities, enhancement of agriculture productivity through training and capacity building in Farmers Field Schools. Development of 13 new market centers, construction of 11 new bridges and upgraded 80 km of rural roads.
B4: Ecological Management	Interventions were implemented to strengthen management of national parks and other protected areas. The key interventions implemented include: design of business development plans for each national park, construction of range camps, water holes, conference centers, tourism promotion, promotion of alternative livelihood strategies, community-based forest management, etc.
Component C: Water Related Infrastructure	
C1: Upgrading Kamuzu Barrage	Involved renovation of infrastructure and enhancement of operation of the barrage to contain depletion of Lake Malawi improving water security and productivity. Increase of regulation capacity in 40 cm and implementation of decision support system based on real-time hydromet data and accurate rainfall-runoff and flows forecast reduced risks of floods and droughts and enabled improvement of hydropower productivity
C2: Flood Risk Management	Implement community level flood mitigation and adaptation measures. Institutionalization of National Guidelines for Community Based Flood Risk Management and Early Warning and Flood Forecast System.
C3: Water Related Studies	Supported the preparation of new water related investments within the Shire basin such as feasibility and design studies for priority infrastructure works.

4. To the extent possible, the cost benefit analysis approach adopted at appraisal stage was followed. First, cost benefit analysis was performed separately for components B, C1, and C2. The analysis was not done for components A and C3 because the benefits apply at scale higher than the project area or the benefits are not readily quantifiable. Finally, a consolidated cost benefit analysis was done to assess the overall efficiency of the project. It must be noted that at appraisal stage the cost benefit analysis was not done for the overall project.

Key Assumptions

5. The assumptions made in the economic cost benefit analysis are summarized in Table A5.2.

Table A5.2. Summary of key assumptions made in the economic analysis

No	Parameters	At appraisal	At ICR
1	Power outage for the three power stations on the Shire River*	44000 MWh per year	44000 MWh per year
2	Average financial tariff charged by ESCOM	0.05 US$/kwh	0.05 US$/kwh
3	Average Economic Tariff (Energy Replacement)	0.25 USD/kWh	0.25 USD/kWh
4	Conversion Factor	0.9 - 0.95	0.9 - 0.95
5	Conversion factor for labor	0.75	0.75
6	Opportunity Cost of family labor-Financial	200 MK/person-day	200 MK/person-day
7	Opportunity Cost of family labor-Economic	150 MK/person-day	150 MK/person-day
8	ESCOM Annual Dredging Costs*	500,000 USD	500,000 USD
9	Blantyre Annual Water Treatment Costs*	425,000 USD	425,000 USD
10	ESCOM Annual Machinery/ Equipment Maintenance Costs*	480,000 USD	480,000 USD
11	Period of Analysis	25 years	25 years
12	Annual O&M costs	0.23 million USD /year	0.23 million USD/year
13	Discount Rate	12%	12%
14	Cost of Kamuzu Barrage Upgrade**	75%	75%

*These environment costs are estimated to be constant over time in the "without-project" scenario, while they will be gradually reduced by the factor of one percent reduction after project intervention, increasing to 3 percent reduction in year 15 and five percent reduction in year 25, in the "with-project" scenario. The environmental benefits provided by project interventions will thus be in the form of avoided future costs.
**The cost for the Kamuzu Barrage was scaled down to reflect the hydropower generation aspect.

Assessment of Benefits

Component B: Catchment Management

6. A total of 322 village and sub-catchment level watershed management plans were developed and implemented covering over 25,212 hectares of land. The specific land and water management practices adopted include marker ridges, box ridges, conservation agriculture, soil fertility improvement technologies, tree nurseries, forestry, and river/stream bank rehabilitation. The adopted conservation agriculture, soil fertility improvement practices, and planting of fruit trees in homesteads significantly increased crop productivity and farm income.

7. In addition, a total of 80 Farmer Field Schools were established benefiting a total of 2,160 farmers of which 1657 were women and 503 were men. On average 78% of these trainees have adopted the recommended agronomic and crop protection technologies increasing their income by about 38.4%. The total benefits of FFS activities were estimated to be US$ 603,611 per annum**.** About 581 million MK

was invested under the Common Interest Groups (GIGs) scheme to develop various production and livelihood activities (Table A5.3). These crop production and livelihood activities generated a net benefit equivalent to US$937,402 per annum and boosted the income of participating farmers, particularly women.

8. In addition, the project developed 13 market centers and built or rehabilitated 80 km of rural roads and built 11 new bridges, the benefits of which were not quantified and included in the analysis. The omission of these benefits may underestimate the efficiency of the project.

Table A5.3. Financial support to alternative rural livelihoods

Livelihood Activities	Investment Cost (MK)
Rainfed Maize Farming	15,952,250.0
Irrigated Maize Farming	16,129,260.0
Goat Farming	179,094,640.0
Poultry Farming	6,822,840.0
Pig Farming	31,417,000.0
Potato Farming	120,335,500.0
Fish Farming	5,618,900.0
Rice farming	1,824,000.0
Horticulture	2,883,000.0
Other livelihood activities	201,542,100.0
Total	581,619,490.0

Component C: Water Related Infrastructure.

9. **Kamuzu barrage.** Kamuzu Barrage was constructed in 1965 to regulate outflows from lake Malawi in Liwonde and mitigate the effect of extreme floods and droughts mainly on hydro-electric power generation at three hydro power plants, which normally satisfy 95% of the country's power demands. Poor maintenance, obsolescence of equipment, absence of real time hydrological information, and poor operational decisions, compromised the proper functioning of the Barrage-resulting in faster than anticipated depletion of the lake water level. To address these problems, the barrage was renovated, upgraded, and its operation model was automated and modernized.

10. At appraisal stage, the cost-benefit analysis was based on comparison of six alternative options of lake level (i.e., 475.52masl and 475.72masl), water releases (i.e., 260m^3/s, 300m^3/s and 340m^3/s), and energy outputs for with and without barrage upgrade scenarios. At appraisal, the without project scenario assumed lake level of 475.32masl and water releases at the barrage of 300 m^3/sec. The scenarios considered and key assumptions at ICR stage analysis are summarized in Table A5.4.

Table A5.4. Assumed annual average additional energy production (GWh) at appraisal

Highest Regulated Water Level (masl)	Energy output (GWh)	Key assumptions	Incremental energy benefits ('000 US$)
No Project	1983.7 (yearly total)	-	-
475.32	+39.3	Expected to be realized right after the completion of the project lasting for five years	9,825
475.52	+ 76.7	Expected to be realized after five years post project completion and lasting for ten years	19,175
475.72	+112.7	Expected to be realized sixteen years post project completion	28,175

11. During 2015 and 2016, the water level declined at rates of 40 to 20cm per year and modeling results predicted that following this trend by late 2019 or early 2020, the lake would be reaching 471.5 masl level, which means no water outflow from Lake Malawi and by implication no energy production[16]. Consequently, the developed Kamuzu Barrage Operation Model was used to formulate water saving policy, which adjusts water discharge levels to the predicted water levels in the lake. For instance, for lake level below 473.5 masl, the release was determined to be 135 m3/s, which is about half of the 300m3/s assumed for without project scenario at appraisal stage. In conclusion, the use of Kamuzu Barrage operation model and other management instruments provided by SRBMP have proved to be extremely useful and effective in initiating a recovery of the storage in lake Malawi, limiting situations of overexploitation of the resource and avoiding the risk of a potential cessation of flows in Shire predicted by late 2019 with great benefits for the energy sector in the long run.

12. If the hydrological conditions continue yielding the same level of free water that the system had at the beginning of the period analyzed, Kamuzu barrage management could start to increase releases from the barrage to 180-220 m3/s to meet the demand of the hydropower plants (i.e., the 2014 level). This will reduce downtime of the HPP due to low flows to Zero, increase the utilization rate of the HPP utilization from the current 60% to 80-90%.

13. **Flood Risk Management**: the flood risk management interventions had multifaceted benefits due to the peculiarly flood prone situation of the project area. The interventions reduced loss of human, livestock and wildlife, protected schools and minimized disruption in school attendance, reduced negative health impacts, reduced damages to private and public properties, reduced disruption to transport services and businesses, reduced crop losses, etc. (see table A5.5). These benefits are confirmed by comparison of the impacts of flood events pre- and post- project implementation. Malawi experienced devasting floods in 2015[17] (before project completion) and in 2019[18] (post project completion). These flood events directly affected 15 districts of which two (Nsange and Chikawawa) were in the project area.

[16] If this scenario is used as a base or reference in the cost benefit analysis, the net benefits of the Kamuzu barrage upgrade would have been substantially higher

[17] Government of Malawi (2015). Malawi 2015 Floods Post Disaster Needs Assessment (PDNA)

[18] Government of Malawi (2019). Malawi 2019 Floods Post Disaster Needs Assessment (PDNA)

14. The benefits of flood interventions were estimated to be the probability[19] weighted damage loss difference between the 2019 and 2015 flood events in Shire basin. The 2015 and 2019 floods were assumed to be a one-in-50year events. Thus, the annualized damages and losses avoided is calculated to be about US$1.1 million.

Table A5.5. Comparison of floods impact in 2015 and 2019

Flood impacts	**2015-Floods**	**2019-Floods**	**Difference**
Number of people affected	1,101,364	975,600	125,764
Number of people displaced	230,000	90,000	140,000
Number of people killed	106	60	46
Number of people missing	172	NA	NA
Number of people injured	NA	672	NA
Total damage and loss (Million USD)	335	220.2	114.8
Estimated cost of recovery and reconstruction (Million USD)	494	368.3	125.7

Costs

15. The project costs by components are summarized in Table A5.6.

Table A5.6: Project Costs by component and Year

Component	**Costs (US$ million)**
Component A – Shire Basin Planning	42.1
Component B – Catchment Management	26.1
Component C – Water-Related Infrastructure	52.9
Total	**121.1**

Results of Economic Cost Benefit Analysis

16. The results of the economic cost benefit analysis are summarized in Table A5.7. The ICR stage results are better than the appraisal stage results. However, at appraisal analysis was not done for the overall project.

Table A5.7. Summary Results of the economic cost benefit analysis

Components	**At ICR**			**At Appraisal**		
	NPV (US$ M)	IRR (%)	B/C Ratio	NPV (US$ M)	IRR (%)	B/C Ratio
B. Catchment Management	7.1	25.9%	1.46	5.95	15.76%	1.24
C1. Kamuzu Barrage Upgrade	53.2	37.0%	7.3	24.5-177.0	15.8%-48.6%	NA
C2. Flood Risk Management	0.25	12.9%	1.07	1.8	16.8%	NA
Overall Project	**21.0**	**15.8%**	**1.32**	**NA**	NA	NA

[19] The probabilities are equal to the assumed flood return periods

Sensitivity Analysis

17. The sensitivity analysis indicates that the values of the efficiency indicators are quite robust to unfavorable changes in all the parameters considered (See table A5.8).

Table A5.8. Sensitivity Analysis

Standard sensitivity tests		**EIRR**	**NPV 12% (million USD)**
Ref. case		15.76%	21.0
Costs +	10%	14.4%	14.4
Costs +	20%	13.2%	7.8
Costs +	30%	12.2%	1.2
Income +	10%	17.2%	29.7
Income +	20%	18.4%	38.4
Income +	30%	19.9%	37.1
Income -	-10%	14.3%	12.3
Income -	-20%	12.7%	3.6
Income -	-30%	9.9%	-11.7
Income delayed by 1 year		13.7%	10.0
Income delayed by 2 years		12.0%	0.002
Costs + 10% & Benefit-10%		13.0%	5.7
Costs + 20% & Benefit-20%		10.4%	-9.6

ANNEX 6. BORROWER, CO-FINANCIER AND OTHER PARTNER/STAKEHOLDER COMMENTS

Note submitted by Sydney Kamtukule, Project Director of Shire River Basin Management Project June 12 2019

Government of Malawi

The Government of Malawi being the borrower and Co-Financier has the following comments on the Designing, Planning and Implementation of the Project:

i. The assessment of the Bank's technical support during both, the design of the Project and during the implementation period, was viewed as having been useful and satisfactory. In particular, key informants emphasized that World Bank officials had been very helpful in guiding the government towards an integrated approach to addressing the interlinked challenges in the Basin at design stage. The World Bank provided the much needed support from the designing, planning to implementation of the Project activities. During the Support Missions the Bank provided valuable technical and expert support including quality control checks among many others areas. Therefore the Bank contributed very positively to a large extent in as far Project Implementation was concerned.

   However, there were some instances when the Bank had taken too long to provide feedback on submissions for "no objections" and these delays led to corresponding delays to engage the service providers;

ii. The Project was generally very complex and this was a huge challenge to effectively and efficiently manage to the required expectations of many. However, the multi-sectoral nature of the Project activities under each one of the Components were relevant to adequately respond to the interlinked challenges facing the country at large and the Shire Basin in particular. This design approach therefore led to an overly combination of planning interventions, feasibility studies, software interventions and hardware infrastructural interventions, a combination that compromised the delivery timeliness of interventions to some extent. As such there were significant cases of under-budgeting for most of the activities which led to unwanted deferment of their execution and/or scaling down of the scope of the interventions;

iii. The implementation model that involved the TT members from participating technical departments was very relevant as it helped to draw vital technical expertise from all participating departments. The model also enhanced capacity building and fostered program ownership and sharing of technical information across the various inter-related sub-sectors. The setup required that the TT would be spending almost 80% of the time on the Project. The requirement for TT Members to dedicate 80% of their time on Project work while 20% on their departmental work was not practical and therefore could not be

attained for almost all TT members apart from those from the lead implementing Department of Water Resources which had almost 100% of the time on the Project;

iv. The TT faced some challenges in general management of the contracts as most of them lacked requisite professional contract management skills. The involvement of consultants and the associated need for contract management therefore would have worked much better if capacity building in contract management for the TT prior to commencement of these works was provided. Otherwise, contract management became a big challenge, resulting in contracts delivery delays and/or suboptimal delivery of the contracts. As such the individual consultants engaged to support the TT at the Project Secretariat were helpful in providing the requisite support in especially in Fiduciary Management and reporting on implementation progress;

There have been a number of lessons learnt from implementation of the first phase Project of the Shire River Basin Management Program. The following are some of the lessons learnt:

i. The consultative process of developing the Shire Basin Planning framework helped to enrich the framework with an integrated knowledge base including 17 sectoral and thematic reports that will be useful in facilitating a focused approach towards implementation of the Shire Basin Plan interventions by the various sectors;
ii. The involvement of the Shire Basin forum which drew membership from relevant organizations such as ESCOM and Water Boards, the academia, research institutions, the private sector institutions and civil society organizations provided a useful forum for technical feedback on the interim and final products from the Shire Basin planning process;
iii. The inclusion of key institutional and policy changes such as the establishment of a multi-sectoral Shire Basin planning institution as one of the key covenants of the Project compromised the performance rating of corresponding activities even though final decisions were expected to be taken by government authorities beyond the Ministry;
iv. The inclusion of the capacity enhancing interventions such as short and long term training for some officers within the targeted participating departments, procurement of vehicles and office equipment, amongst others, provided a useful catalyst for smooth implementation of Project activities due to reduced resource constraints;
v. Inappropriate sequencing of interlinked activities, without careful critical path analysis, led to delays in the delivery of outputs that were dependent on full implementation of other activities such as those on hydromet, ODSS and FFEWS development and deployment;
vi. Inclusion of the local community members in the catchment planning and identification of interventions enhances ownership and potential sustainability of the interventions beyond the Project lifespan;
vii. The integrated approach to catchment management used under the Project helps to stimulate community participation in Project activities because of the associated incentives, such as small monetary grants other than focusing only on the hard work associated with the implementation of sustainable land and water management interventions;

viii. The lengthy planning processes that precede the start of physical implementation of activities such as those under catchment, flood risk and ecological management, leads to considerable frustration amongst some beneficiary community members who expect to start participating in the implementation process soon after the sensitization campaigns;

ix. The strategy of front-loading implementation of some activities under the Non-Regret Interventions (NRIs) helps to sustain the interest of community members in the Project;

x. The establishment of the Catchment Environmental Conservation Fund (CECF) to provide incentives to community members involved in implementation of catchment management interventions significantly helps to increase participation numbers amongst the targeted beneficiaries;

xi. The introduction of the Farmer Field Schools (FFS) approach to promotion of sustainable land and water management significantly enhances the uptake of the technologies being promoted;

xii. The provision of start-up grants and capacity building towards establishment of income generating business enterprises is very useful in empowering the beneficiary community members, most of whom tend to acquire livelihoods improving assets through proceeds of these business loans. Therefore there is need to ensure timely disbursement and start of the business enterprises by the Common Interest Groups (CIGs) for them to be nurtured into fully functioning business groups;

xiii. Large infrastructural contracts for related interventions are better managed when they are executed by one contractor. The separation of the contractors for the civil and mechanical works at the Kamuzu Barrage led to several challenges as delays by one contractor tend to affect the other and vice versa, with significant associated quandaries on who takes the financial responsibility for some delayed works. It is important to carry out a thorough due diligence about the make-up of expert needs for supervising consultants right from the ToRs development stage to avoid unwarranted expenditures on experts that may not be really useful; and

xiv. Feasibility studies included in the Project design ought to have been those that are already identified.

The Government recommends the following at Project Design and Implementation Stages:

i. The implementation model using TT must be encouraged because it fosters capacity building and sharing of technical information and expertise on interlinked challenges. However, the model must be improved by engaging one or two individual consultants with Project management skills, to support the Coordination Unit with the implementation process in order to enhance implementation efficiency, including improved contract management, and reduce pressure on the TT members who are faced with more pressure of work even in their respective departments;

ii. It is important to be focused on a few clear and realistic and activities that are clearly aimed at attaining tangible results other than mixing too many of the software interventions that may otherwise be easily implemented with locally generated resources under the government budget. Therefore it is imperative to seriously

consider including those only activities which are ready for implementation other than those that may require further lengthy planning processes and/or studies before actual implementation;

iii. There is need to adopt market-based costing approach for all activities to be implemented under any other successor Project/s other than using unrealistic estimates that end up compromising the ability of the Government to implement those activities;

iv. Involvement of professional individual consultants in fiduciary management at the Project Secretariat should be maintained in order to enhance compliance with the relevant fiduciary management practices and regulations;

v. District Councils should be engaged right from the start of the projects planning in order to ensure ownership and enhance the potential for sustainability; and

vi. The ISP model must be dropped because of the unwarranted antagonisms that such a model brought to the District Councils leading to compromising ownership and sustainability issues. Instead of the ISP there should be consideration of employing local full-time individual Project officers to be attached to all participating districts with a view to improving the implementation coordination and management functions at that level.

The following are some comments and recommendations related to Activity Implementation:

i. It is imperative to include in the successor Project only those institutional and/or policy reforms that have been thoroughly considered within government and agreed upon to avoid undue implementation delays and compromising performance ratings once the Project commences;

ii. There is need to consider including technical support in GIS in the subsequent phases of the Program or any other successor projects to further enhance capacity of government departments and officials charged with such responsibility as had been the case under the first phase Project;

iii. The bio-physical monitoring stations should be operationalized by rolling out the tasks of collecting and processing bio-physical monitoring data from these stations which provide the basis for future analysis of any sustained impacts of the catchment management interventions;

iv. Inter-dependent Project activities should be carefully sequenced in a manner that allows seamless implementation of activities that are designed to utilize inputs from other activities within the same Project;

v. There is need for continued support for the ODSS to avoid undue disruption to the operation and maintenance of the system;

vi. It is imperative to ensure that catchment management activities are included in the subsequent phases of the SRBMP or indeed any successor Project to the SRBMP-1 Project to ensure that the 25,212 hectares of land that has been reached out with SLWM interventions are sustained;

vii. It is imperative that for similar future Projects, proper communication channels between the service providers and District level staff are well established and District Council personnel are adequately involved in activity implementation, monitoring and

reporting arrangements in order to enhance transparency, accountability and eventual ownership;

viii. The District Councils need to firm up the financing arrangements for the operation and maintenance of the newly constructed market facilities to ensure longevity of the facilities;

ix. It is important to localize the procurement of animals such as goats that are intended to the distributed to beneficiary communities under the pass-on programs to reduce mortality of the distributed animals due to changes in weather conditions;

x. It is important to standardize incentive structures within the delivery modalities of Project activities in order to avoid undue reluctance by community members in Project activities with perceived low incentives especially when other Projects offer some cash payments to participants;

xi. Beneficiaries of the flood early warning equipment ought to be extensively trained in use of each piece of equipment received and their collective use to enhance information sharing efficacy as intended;

xii. Extra financing is needed to support the implementation of key interventions identified in the AIPs and VFAPs, particularly those in the flood hotspot areas such as safe havens and escape routes should be constructed;

xiii. There is need to urgently solicit financing for the construction of some more flood protection structures in the Lower Shire and other parts of the country; and

xiv. Under flood risk management, there is need to seriously consider the option of multi-purpose damming of water upstream of the flooded areas to deal with the problem of flooding in the Lower Shire.

Below are some areas that need to be paid special attention as experienced during implementation of the project:

i. The Project Implementation also suffered greatly due to garnishing of Project Account by the Malawi Revenues Authority on funds that were already committed thereby leading the Project to some financial shortfalls and challenges to honour some payments;

ii. The Bureaucratic setup in the Government affected some implementation of some project activities as some decisions had to be made at higher levels beyond that of the Project Technical Team;

iii. Continued changes of Government Officials at both the Project Technical Committee and Project Steering Committee affected smooth implementation and delivery by Project in some cases. For example some decisions took long to be taken as the Committee members due to these changes; and

iv. There were some inconsistences coming from the World Bank team mainly due to frequent changes in Mission staff who usually shared conflicting expert advice to the Project Team. Minimizing staff changes is good in order to enhance proper understanding and continuity.

ANNEX 7. CHANGES IN PDO OUTCOME AND INTERMEDIATE INDICATORS

PROJECT DEVELOPMENT OBJECTIVE (PDO)

1. **Loan Agreement PDO:** The objective of the Project is to *develop a Shire River Basin Planning framework to improve land and water management for ecosystem and livelihood benefit*s.

2. **Project Appraisal Document (PAD) PDO:** to *develop Shire River Basin planning framework to improve land and water management for ecosystem and livelihood benefits in target areas.* The project would: (a) strengthen the institutional capacities and mechanisms for Shire Basin monitoring, planning, management and decision support systems; (b) invest in water related infrastructure that sustainably improves water resources management and development; (c) reduce erosion in priority catchments and sedimentation and flooding downstream, while enhancing environmental services, agricultural productivity and improving livelihoods; (d) improve flood management in the Lower Shire and provide community level adaptation and mitigation support; and (e) protect and enhance ecological services in the Basin

DETAILS OF CHANGES

Table A7.1 Changes in PDO Outcome Indicators

Original PDO Outcome Indicators (PAD)		Approved Changes (through Formal Restructuring)		
PDO Indicators	**Targets**	**PDO Indicators**	**Targets**	**Achievements**
Shire Basin Plan developed by multi-sectoral Shire Basin Institution	Y	**Revised** to "Shire Basin Plan adopted" **Rationale:** Work on the basin plan started before the multi-sectoral shire basin institution was established	Y	Y
Vegetation cover change as a percentage of baseline in selected catchments	+10%	**Dropped** Evaluated at mid-term review as unachievable under the project. **Change in land use**: Remote-sensed data shows that 56 percent of the land area rehabilitated under the project has registered a change in land use categorized as positive[20] between 2012 and 2018 **Changes in vegetation indices:** the impact of three main interventions (afforestation, forest regeneration and soil & water conservation) were evaluated measuring changes in vegetation indices like Land & Surface Water Index (LSWI) and Normalized Differential Vegetation Index (NDVI). Comparing between 2014 (baseline) and 2018 **NDVI** **LSWI**	n/a	56% 29.65% 66.70%

[20] A land use change was classified as positive, it fell in any of these categories: from agricultural land to forest; from shrubland to forest/plantation forest, from marshland to forest/plantation forest and built areas to forest

Original PDO Outcome Indicators (PAD)		Approved Changes (through Formal Restructuring)		
PDO Indicators	**Targets**	**PDO Indicators**	**Targets**	**Achievements**
Downtime for hydropower stations on the Shire river.	7.2% (-10%)	**Dropped** Catchment management measures were long-term in nature, may not have an impact in reducing and downtime of HPP during the project period. At ICR confirmed the indicator not attributable to projects activities. The reduction % of downtime due to sediments measured from 2015 to 2018		0%
Average management effectiveness score for 8 targeted protected areas/forest reserves[21]	65%	**New** measure of changes in management effectiveness in protected area because of various GEF-funded activities. This Indicator was elevated from intermediate level to PDO level as an outcome	65%	70%
Improved operation of the upgraded Kamuzu barrage with adequate institutional arrangements	Y	**New**. This Indicator was elevated from intermediate level to PDO level as an outcome	Y	Y
Households in targeted areas re-classified to lower risks	20000	**Revised Target.** Targeted number of households to be reclassified to lower risk of flooding was reduced according to resources available at MTR/Restructuring	2780	3155
Direct project beneficiaries of which female (%)	400000	**No change**	400,000	446,650

[21] This indicator is measured using the Management Effectiveness Tracker Tool (METT) is a GEF tool that uses a basket of indicators to score changes in protected area management effectiveness. This is a required M&E tool for all GEF funded biodiversity programs and will continue to be applied to all targeted natural habitat sites under the program.

Table A7.2 Evolution of Pre- and Post -Restructuring Indicators, Targets, and Achievements

PRE-RESTRUCTURING INFORMATION FROM PAD		POST-RESTRUCTURING CHANGES (2017)		
Component A Shire basin planning				
Intermediate Result Indicators	**Targets**	**PDO Indicators**	**Targets**	**Achievements**
Progress on Shire Basin knowledge base and decision support systems development, including ecological aspects	Y	**Revised** to "Shire basin planning tools developed". Planning tools include: spatial knowledge base, decision-support systems, water quality database, state of the base report, thematic and sector reports.	**Y**	**Achieved** All planning tools delivered and used in the planning process. Shire River Basin Plan adopted
Shire basin institution established	Y	**New.** New indicator. *Shire basin institution* means an organization/agency set up within the laws of Malawi to support and coordinate long term planning and management of the Shire basin. The institution will be considered established if (i) it is set up within an existing or new law; (ii) has adequate and qualified staff; and (iii) has an annual operational budget that is fully funded	**Y**	**Achieved**
Hydromet stations with accessible data in real time	30	**No Change**	30	**Achieved - 100.** Weather and rainfall station under the DCCMS (75) and hydrometric gauges under the WRD (25).
Functional geodatabase developed	Y	**New indicator.** A functional geodatabase means hard-copy and electronic spatial database and web-based tools such as the MASDAP portal	Y	**Achieved.** hard-copy and electronic spatial database and web-based tools available at MASDAP portal
Average warning time for flood forecast information to reach targeted communities for improved preparedness	24hs	**Dropped at restructuring** because of delays Installation of hydromet stations is now in advanced stages after several delays and limited time for testing and calibration and concerns about institutionalization of the early warning system.	24 hs	**Achieved - 72hs.**The Flood Early Warning System has been completed and is operational as part of the ODSS issuing alert and warnings every 6 hours with forecast for next 12, 24, 72 hours and seasonal stochastic forecast for next 3 to 12 months
Component B- Catchment management				
Annual average sediment load from selected sub-catchments compared to control catchments reduced	0.9 ratio	**Dropped at restructuring.** Systems to collect data was not in place. Establishment of a bio-physical monitoring network was delayed. Also, given the long-term nature of catchment management interventions, it is unlikely that the project will have a measurable impact on sediment loads	n.a.	**Not achieved.** The bio-physical monitoring network is delayed. Also, given the long-term nature of catchment management interventions, it is unlikely that the project will have a measurable impact on sediment loads
Proportion of households within targeted sub-catchments engaged in	75%	No change	75%	**Achieved – 77%.**

sustainable land and water management				
Length of river bank protection undertaken (km)	n.a	**New indicator s**tream and water control, including check dams and vegetative protection measures on water courses.	992km	**Achieved - 4,166 km:** exceeding the target of 992 kms within the VLAP areas
Area under sustainable land and water management (ha)	n.a	**New indicator** to track outputs related to sustainable land and water management activities	24,460 has	**Achieved - 25,212 ha**
Number of Village Action Plans (VLAPs) approved	n.a.	**New indicator** to track outputs from capacity building activities on catchment management planning at the village level	305	**Achieved - 305 VLAP prepared and implemented**
Total value of livelihood investment grants managed by targeted Group Villages (GVs)	220,000 Million MKW	No change	220,000 Million MKW	**Achieved - 620,500 Million MKW**
Percentage increase in total value of agriculture related products marketed from targeted GVs.	25%	**Dropped.** Difficult to measure and depends on many (other) factors beyond the control of the Project, such as rainfall and market prices	n.a	**Not achieved**
Number of Common Interest Groups (CIG) established	n.a.	**New indicator** to track outputs from activities related to alternative livelihoods	279	**Achieved – 366 CIG established**
Average Management Effectiveness scores for 6 targeted protected areas/forest reserves.		Indicator elevated to PDO level		
Component C - Water-related infrastructure				
Kamuzu barrage upgraded and operational with improved management.	Y	**Revised** to "Kamuzu barrage upgraded" to focus only on the output (upgraded barrage). A new indicator (at the PDO level) relating to improved operation and management has been introduced	Y	**Achieved**
GV with improved community flood management infrastructure	40	Target reduced to a realistic level due to budget constraints	29	**Achieved - 28**
Community-based flood early warning system is established.	n.a.	**New indicator** introduced to track progress on establishment of a community-based early warning system in selected flood hotspot areas. This system does not depend on the flood forecasting model	Y	**Achieved**
New water investment projects and plans prepared to pre/feasibility stage	4	**Target reduced** to a realistic level due to budget constraints	3	**Partially achieved – 2 studies prepared**
Budgeted management plan established for Elephant Marshes	Y	No Change	Y	**Achieved**

Annexure 7.3- Detailed description of the assessment of changes in land use and status of vegetation in four sub-catchments and in national parks and forest reserves in Shire basin

Changes in land use between 2012 and 2018 in Shire River Basin

1. In the four sub catchment targeted under the project, for a selected Village Level Action Plans (VLAP), in which the project implemented interventions changes among six types of land use were investigated. Remote-sensed data shows that 56 percent of the land area rehabilitated under the project has registered a **change in land use** categorized as positive[22] between 2012 and 2018 (see Table 1)

Table 1- Change in land use between 2012 and 2018

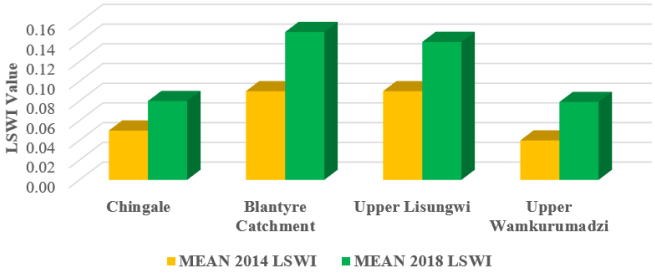
Sub-catchment	No. VLAPs	Change in Land use between 2012 and 2018			
		Negative	No change	Positive	Total
Kapichira	20	818	4,088	4,230	9,135
Chingale	19	341	5,272	2,458	8,070
Upper Lisungwi	15	177	2,204	5,328	7,709
Upper Wamkulumadzi	17	39	1,742	6,699	8,480
Total ha		1,375	13,305	18,715	33,395
Total %		**4%**	**40%**	**56%**	**100%**

Source: Mukherjee, C. (2019)

Changes in vegetation indices between 2014 and 2018 in Shire River Basin

2. In the four sub catchment targeted, the impact of three main interventions (afforestation, forest regeneration and soil & water conservation) influencing vegetation were evaluated using two of the most popular vegetation indices used for monitoring vegetation: Normalized Difference Vegetation Index (NDVI)[23] and Land Surface Water Index (LSWI)[24] to compare the situation at project completion (2018) against baseline set in 2014

Subcatchment	LSWI (+66.7%)	
	2014	2018
Kapichira	0.09	0.15
Chingale	0.05	0.08
Upper Lisungwi	0.09	0.14
Upper Wamkulumadzi	0.04	0.08
Average	0.07	0.11



3. The NDVI is a measure of vigor (greenness/health) of vegetation indicating the health of vegetation while LSWI is a measure of liquid water molecule in vegetation canopies that interact with the solar radiation. LSWI can detect moisture content of the vegetation enabling the user to identify young plantation and irrigated crops and

[22] A land use change was classified as positive, it fell in any of these categories: from agricultural land to forest; from shrubland to forest/plantation forest, from marshland to forest/plantation forest and built areas to forest

[23] NDVI uses the visible and near-infrared bands of the electromagnetic spectrum to analyze remote sensing measurements (based on satellite imagery data) to determine the extent to which a target contains live green vegetation

[24] LSWI uses the shortwave infrared and near-infrared bands of the electromagnetic spectrum to analyze remote sensing measurements (based on satellite imagery data) to determine the amount of water in vegetation and soil.

is clearly able to discern the increase in soil and vegetation liquid water content therefore it is used to evaluate the interventions like forest plantation, irrigated agriculture, soil and water conservation etc. The NDVI in the target catchments has increased by 33 percent while LSWI has increased by 66.7 percent during the same period (Figure 1).

Sub-Catchment	NDVI (33%)	
	2014	2018
Kapichira	0.35	0.52
Chingale	0.42	0.56
Upper Lisungwi	0.40	0.54
Upper Wamkulumadzi	0.55	0.67
Average	0.43	0.57

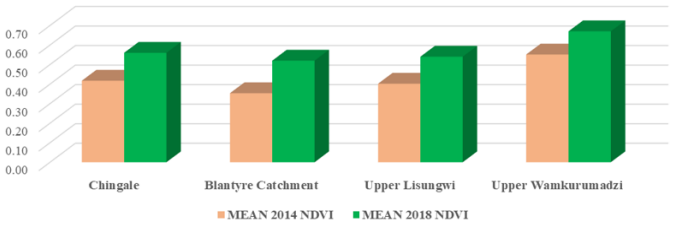


Figure 1: Changes in NDVI and LSWI between 2012 and 2018 in the target catchments
(Source: Mukherjee, C. (2019)

Changes in vegetation index, between 2012 and 2018, in national parks and forest reserves in Shire basin

4. The project also invested in improving the management of national parks, forest reserves and protected areas and wildlife in Shire River Basin affected by illegal encroachment, pouching and deforestation. Protected areas constitute a large portion of the landscape in the Shire river basin and play a key role in protecting ecosystem services. Incremental GEF support strengthened management and provided infrastructure in Lengwe and Liwonde National Parks to increase their long-term revenue. In forest reserves, GEF funding supported community forest co-management in the Neno Eastern Escarpment and Tsamba Forest Reserves in Neno district, which complemented the IDA-funded investments as part of an integrated landscape management approach; zoning, patrolling and monitoring of the Mangochi Forest Reserve adjacent to the Liwonde National Park, in recognition of the key importance of these forests as a wildlife corridor.

Table 2 – Evolution NDVI in National parks and reserves between 2012 and 2018

Type	Name	NDVI 2012	NDVI 2018	Variation	change %
National Park	Liwonde National Park	0.35	0.38	0.03	8.57%
Forest Reserve	Liwonde Forest Reserve	0.45	0.52	0.07	15.56%
Forest Reserve	Zomba -Malosa Forest	0.52	0.68	0.16	30.77%
Forest Reserve	Tsamba Forest Reserve	0.58	0.79	0.21	36.21%
National Park	Lengwe National Park	0.34	0.38	0.04	11.76%
Forest Reserve	Matandwe Forest Reserve	0.38	0.39	0.01	2.63%
Forest Reserve	Mangochi Forest Reserve	0.52	0.68	0.16	30.77%
Forest Reserve	Neno Eastern Escarpment	0.38	0.46	0.08	21.05%
Total					19.67%

Source: Mukherjee, C. (2019)

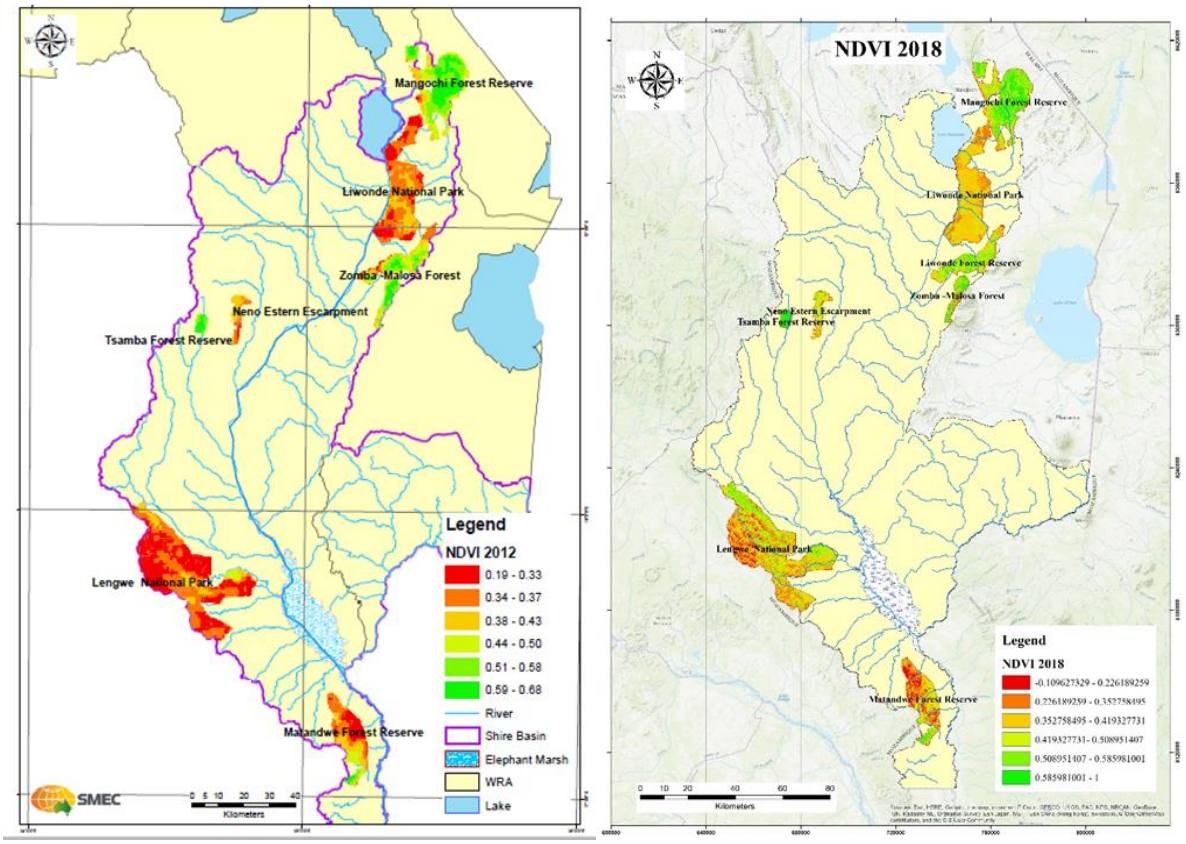


Figure 2: Changes in NDVI in National parks and reserves between 2012 and 2018 (**Source:** Mukherjee, C. (2019)

5. The improvement of status of vegetation in national parks and forest reserves benefitted by conservation practices, by comparing remote sensing data of 2018 against 2012 showed an increase of the NDVI index of 19.67%.

Improvement of management of national parks and forest reserves in Shire basin

6. The Project strengthen substantially the ability of these two national parks and five forest reserves to generate own resources for sustainable management of these protected areas. The *Sustainable Financing Study* prepared Business Plans for Mangochi forest reserve, Lengwe national park, Mwabvi game reserve, and the Elephant Marsh. A *Tourism study* proposed knowledge products and branding strategies that enhanced the management of the Shire Basin protected areas and increased visitor numbers through promotion of a suite of linked nature-based attractions. The construction of two Ranger Camps and the Conference Centre in Lengwe national park, construction of 10 solar powered groundwater pumps, equipment, fencing and vehicles improved the conditions of the protected areas. In addition, the provision of start-up livelihood grants to 26 Community Based Organization in national parks and communities in 71 Forest Co-Management Blocks in five forest reserves increased forest regeneration as reflected in para 36 and overall sustainability.

7. Results were measured with the GEF tool used to score changes in management effectiveness in protected are. The Management Effectiveness Tracker Tool (METT)[25], as part of the M&E system, was used to assessed management in all targeted natural habitat sites under the project. At appraisal, METT score was 42% and the target at completion was 65%. The results of the assessment conducted in March 2019 showed that for all national parks and reserves, the project achieved a METT score of 70%. This implies that protected areas and forest reserves within the Shire River Basin are now better managed.

Table 3 – Evolution management performance of national parks and forest reserves using MTT indicator (GEF)

	Name of Protected Area	Feb'12	Oct'15 (MTR)	Jul'17	Mar'19	Jul'17 as % of Total	Mar'19 as % of Total
1	Neno EE F/Reserve	37	53	61	51	62	58.6
2	Mangochi FR	37	52	77	55	79	59.1
3	Liwonde F/Reserve	42	57	67	56	68	60.2
4	Zomba/Malosa FR	52	59	73	67	74	69.8
5	Matandwe FR	52	58	73	52	76	55.9
6	Lengwe NP	45	60	76	76	78	81.7
7	Liwonde NP	66	70	91	89	93	95.7
8	Elephant Marsh	5	32	69	73	70	78.5
	Average	**42**	**55**	**72**	**65**	**73**	**70.0**

Impact on downtime of hydropower units due to sediments, weed or low flows

8. Before restructuring one the of PDO indicators was the reduction of the downtime (%) of the Shire hydropower facilities (three) due to siltation, weeds or lack water. At restructuring, after establishing that downtime of HPP in Shire was influenced by many other factors not directly connected to projects activities the indicator was dropped. At ICR, the team evaluated operation data provided by Malawi's Electricity Generation Company (ENGECO) showing that the percentage downtime of hydropower plants on the Shire River due to silt and sediments was reduced from 8 percent (baseline at 2009) to 5.3 percent (in 2015) and to zero percent in 2018 and 2019 (see Table 4). But during the same period downtime due to lack of water increased from 2.1% (2015) to 14.3% (2018) due to the restriction of water releases associated to the water saving policy introduced in 2017 to recover water storage in lake Malawi.

Table 4 – Hydropower plant (HPP) downtime

HPP downtime (%)	2015	2016	2017	2018	2019
% downtime due to sediments (4-month average during rainy season)	5.3%	0.9%	0.4%	0.0%	0.0%
% downtime due to low flows (8-month average during dry season)	2.1%	10.6%	10.2%	14.3%	n.d
% downtime due to both sediments and low flows	7.4%	11.5%	10.6%	14.3%	0.0%

Source: EGENCO

[25] The METT scoring system developed the WWF-World Bank Forest Alliance programme published in 2001 has been adopted by the Global Environment Facility. The methodology is a rapid assessment based on a scorecard questionnaire for stakeholders and managers that includes all six elements of management: context, planning, inputs, process, outputs and outcomes. *Management Effectiveness Tracking Tool Reporting Progress at Protected Area Sites: Second Edition. World bank/ WWF July 2007.*

ANNEX 8. Safeguard Policies Compliance

1. The project triggered six environment and social safeguard policies i. environmental assessment (OP 4.01); natural habitats (OP 4.04); forests (OP 4.36); pest management (OP 4.09); physical cultural resources (OP 4.11); involuntary resettlement (OP 4.12) and two legal safeguard policies i. safety of dams (OP 4.37) and ii. projects on international waterways (OP 7.50).

Environmental Assessment (OP/BP 4.01

2. Environmental and social impacts identified during preparation included construction related risks such as removal of vegetation during construction of both small scale structures and larger infrastructure investments, generation of construction waste (rock, soil, and other construction materials); disturbance to flow of traffic; health and safety issues for workers and local communities; barriers to animal or human access to rivers where steep embankments are constructed or reinforced for flood protection; disruptions to aquatic life and the fishing patterns of local communities due to the construction of temporary coffer dams; increased risk of drowning for wildlife particularly from the Liwonde National Park; restrictions on access to grazing in the protected areas of the catchment; and land acquisition for construction works.

3. An overall project ESMF and an ESIA/ESMP for Kamuzu Barrage were prepared during project preparation, reviewed and cleared by the Bank. During implementation, subprojects (4 feeder roads, 12 bridges, 13 market facilities, 5 flood mitigation structures) prepared ESIA/ESMP which were reviewed and cleared by the Bank. The implementation and monitoring of the ESMPs was carried out by the PMU in collaboration with contractors, district authorities and communities and monitoring reports were submitted as part of project progress reports to the Bank for information.

Natural Habitats (OP/BP 4.04)

4. Environmental screening done for all proposed subprojects deemed that the upgrading of the Kamuzu Barrage would affect dry season water levels in the upstream Liwonde National Park, with a reduction in some wildlife habitats such as sandbars and floodplain grasslands. Impacts of the Barrage on other protected areas, such as Lake Malawi National Park, were expected to be insignificant. On the contrary, the project's catchment and floodplain management activities were predicted to have beneficial environmental and social effects by improving the management of the Liwonde and Lengwe National Parks; the Eastern Escarpment, Tsamba, and Mangochi Forest Reserves, and the Elephant Marshes in the lower Shire Basin. The overall project ESMF made provisions for subproject ESIA/ESMP to undertake further assessment and provide mitigation of any potential negative impacts induced by project activities. ESIA/ESMP were prepared, reviewed and cleared by the Bank during project implementation and measures to mitigate site specific ecological impacts associated with proposed sub projects were adequately incorporated.

Forests (OP/BP 4.36)

5. Project investments under Component B were specifically targeted at improving the health and quality of natural forests in degraded production landscapes of priority catchments in the basin. The aim of these investments was to enhance the quality of natural forests and to reduce environmental degradation, soil erosion and sedimentation into the Shire River and its tributaries. The overall ESMF provided guidance for the screening of investments to ensure no significant harm to forests and the preparation of ESIA/ESMP to manage mitigation measures.

Pest Management (OP 4.09)

6. The project involved specific investments in the agriculture sector aimed at enhancing production. The project ensured that there was no procurement of pesticides in its investments and in cases where pesticides were used it was within existing production systems. The overall project ESMF provided guidance on the use of integrated pest management and the safe use, storage, and disposal of agro-chemicals.

Physical Cultural Resources (OP/BP 4.11)

7. Project investments that would happen in areas with archaeological relics, fossils, graves, groves or other physical or nonphysical cultural resources were guided by a chance finds procedure outlined within the overall project ESMF. In the event that an investment was screened and deemed to have the potential to uncover PCR during construction, a chance finds procedure was adequately incorporated into the subproject ESIA/ESMP, reviewed and cleared by the Bank. Regarding the construction of the Kamuzu Barrage, civil works contractors were required to follow a chance finds procedure that was detailed in the ESIA/ESMP prepared for the Kamuzu Barrage, reviewed and cleared by the Bank. Ultimately no PCR were impacted by project interventions.

Involuntary Resettlement OP/BP 4.12

8. The project was considered to have interventions that would potentially lead to the loss of land, assets, livelihoods and access to assets. In that regard, a Resettlement Policy Framework (RPF) and a Process Framework (PF) for the overall project were prepared, reviewed and cleared by the Bank and disclosed in-country and at the World Bank's InfoShop in January 2012. During construction, screening of subprojects established that a number of subprojects (i.e. feeder roads, bridges, market facilities) were on existing locations/sites and would not take land or affect assets and livelihoods and therefore would not require the preparation of resettlement plans. Further, other subprojects (i.e. flood mitigation structures) applied voluntary land donation. Small scale resettlement and loss of socioeconomic assets both at Liwonde and along the Shire River due to barrage operations was expected at the Kamuzu Barrage construction site and a Resettlement Action Plan (RAP) was prepared, reviewed and cleared by the Bank. The operation's subprojects did not entail physical relocation. However, there was economic displacement of 22 individual PAPs, 4 institutions (ESCOM, Maritime Police Office, Liwonde Town Council and Liwonde National Park) and 32 Fishermen at both the barrage and SRBA building. A project Grievance Redress Mechanism was established and utilized throughout project implementation. However, it was gauged as partially non-inclusive to all PAPs because larger business owners did not use it. By project closure one grievance remained unresolved and in the courts.

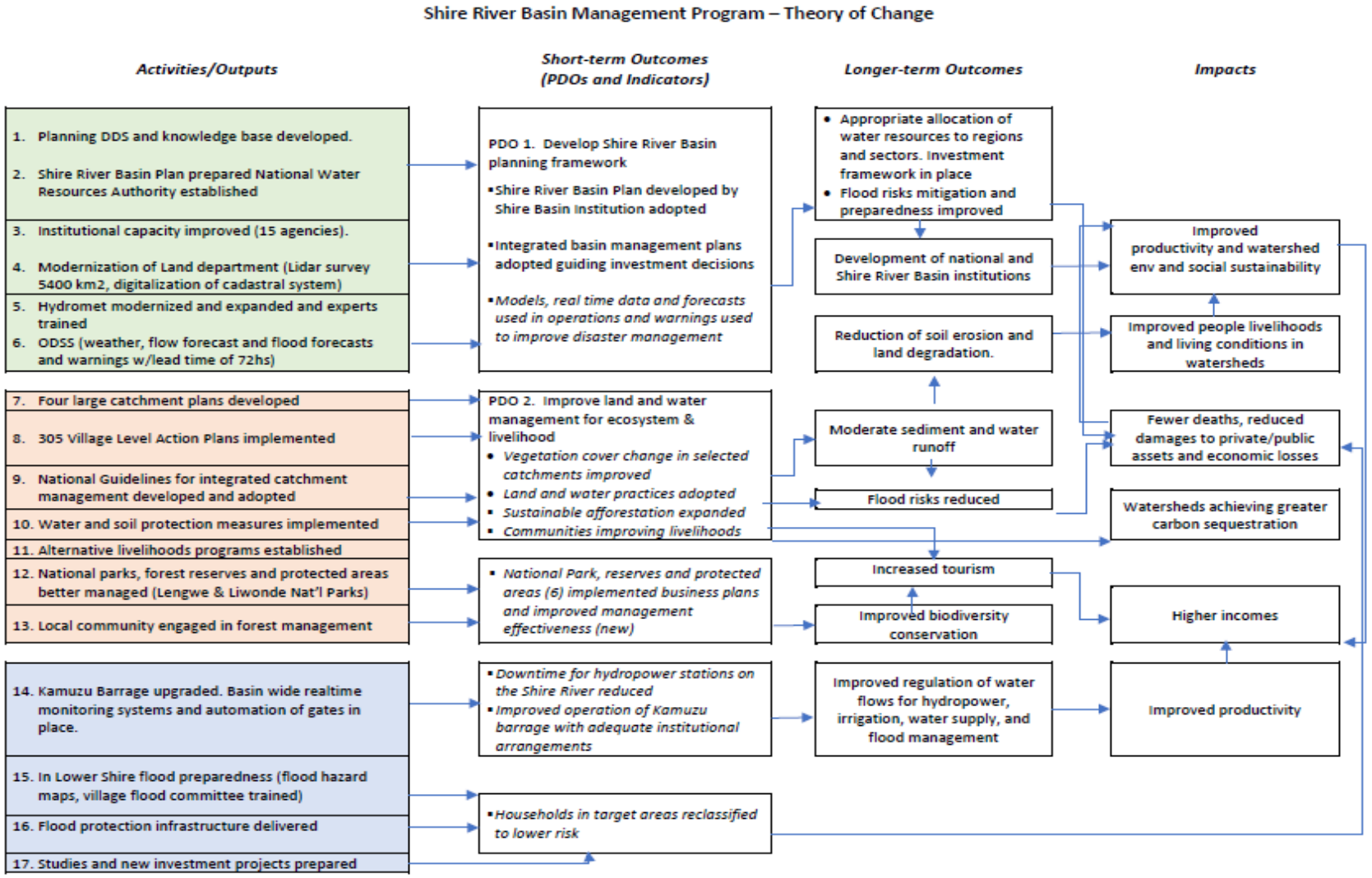
Safety of Dams OP/BP 4.37

9. Although the Kamuzu Barrage is only about 4 m in height (less than the 10m threshold for large dams), it is of strategic importance to Malawi and partially influences water levels in Lake Malawi, one of the world's largest freshwater lakes. Accordingly, the World Bank's Safety of Dams Policy (OP 4.37) was triggered and the Bank's Lead Dam Specialist provided strategic advice on measures to be taken to improve dam safety. Rehabilitation of the barrage involved the application of generic dam safety measures and was based on the advice of an international panel of experts and the recommendation of the Bank's quality assurance group. Dam Safety Plans (Instrumentation plan, Operation and Maintenance Plan, Dam Safety Plan and Emergency Preparedness Plan) were prepared in January 2019. The project did not finance the construction of any other large dams.

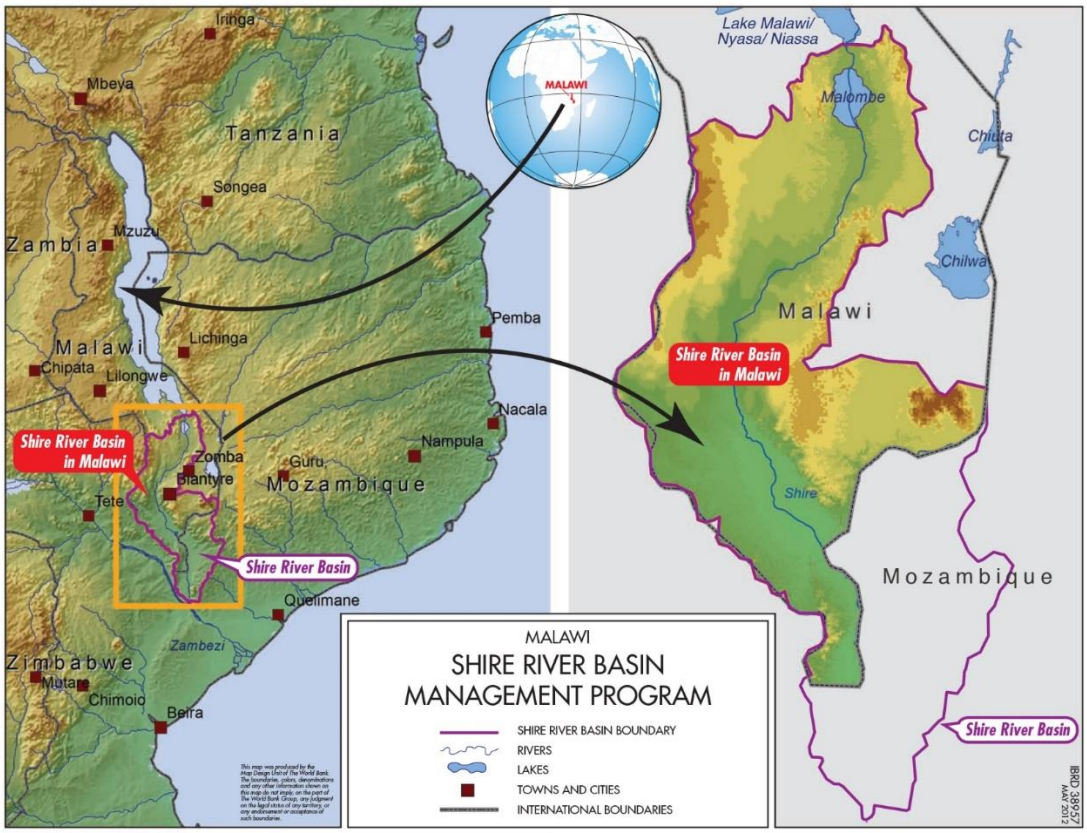
Projects on International Waterways (OP/BP 7.50)

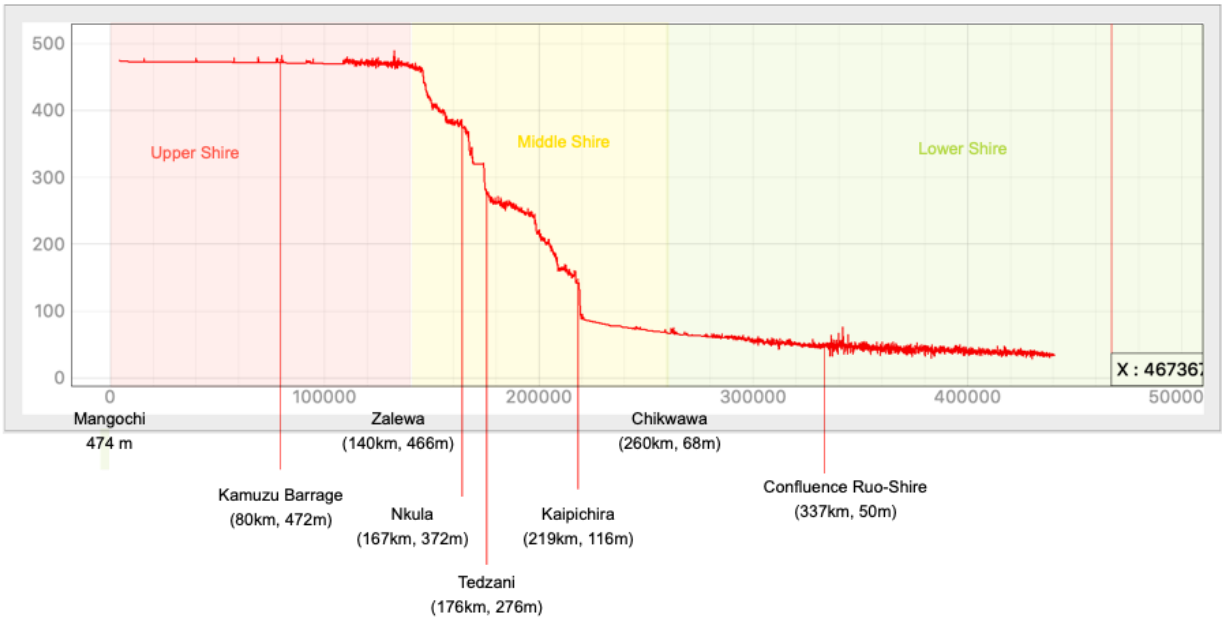
10. Malawi, Tanzania and Mozambique are co-riparian countries of the Shire River. Namibia, Angola, Zimbabwe, Botswana and Zambia are co-riparian countries above the confluence of the Shire and Zambezi Rivers in the greater Zambezi Basin. Riparian notifications, as specified by the operational policy, were prepared and communicated by the World Bank, on the request of the Government of Malawi, to all co-riparian countries of the Shire and Zambezi Rivers in 2012.

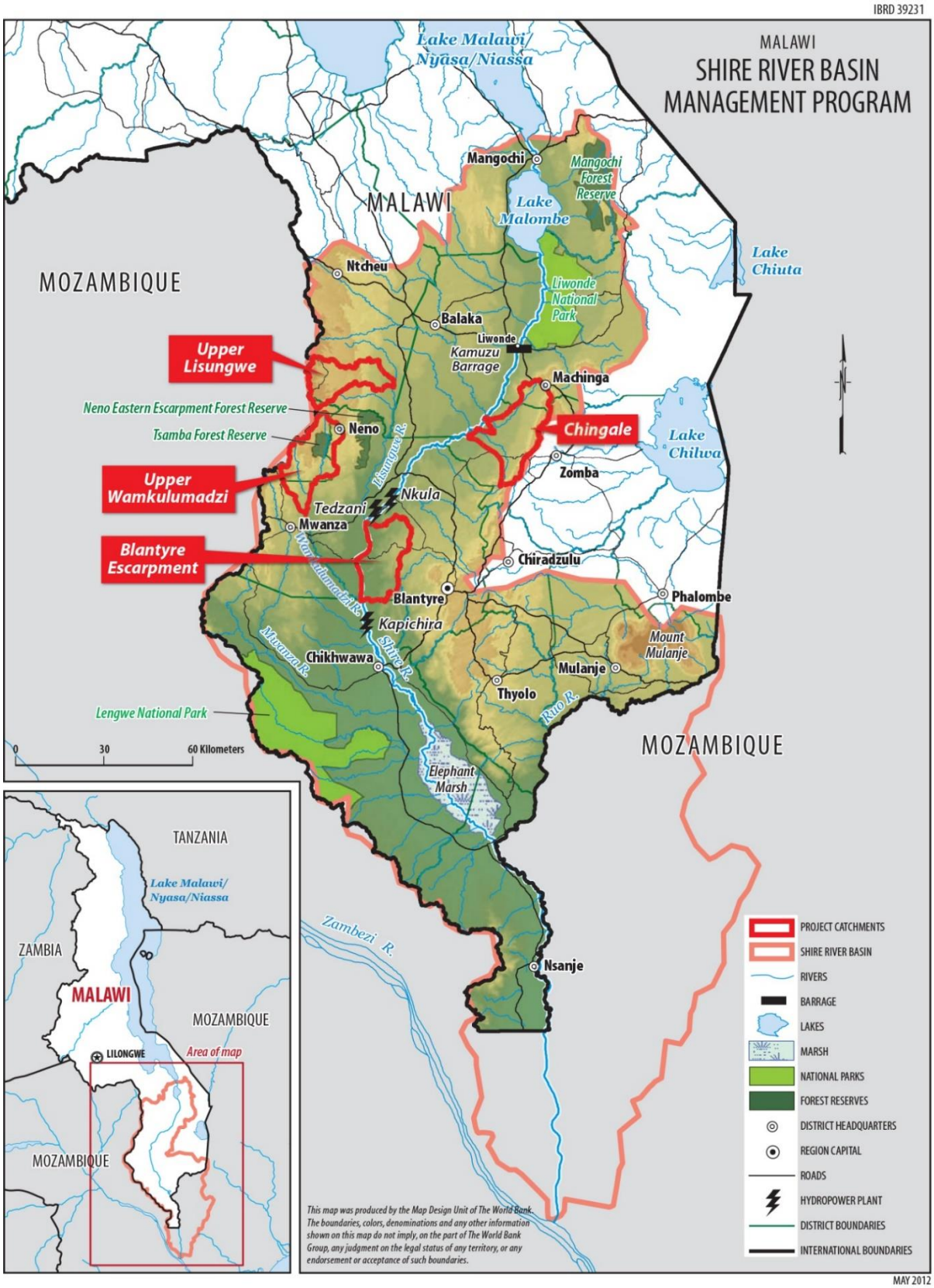
ANNEX 9. Theory of Change



ANNEX 10. Shire River Basin Location Map and Longitudinal Profile






IBRD 39231
MALAWI
SHIRE RIVER BASIN MANAGEMENT PROGRAM
Lake Malawi/ Nyasa/Niassa
MALAWI
MOZAMBIQUE
Mangochi
Mangochi Forest Reserve
Lake Malombe
Lake Chiuta
Ntcheu
Liwonde National Park
Balaka
Liwonde
Kamuzu Barrage
Machinga
Upper Lisungwe
Neno Eastern Escarpment Forest Reserve
Tsamba Forest Reserve
Neno
Lisungwe R.
Chingale
Lake Chilwa
Zomba
Upper Wamkulumadzi
Nkula
Tedzani
Mwanza
Wamkulumadzi R.
Blantyre Escarpment
Chiradzulu
Blantyre
Phalombe
Kapichira
Shire R.
Mwanza R.
Chikhwawa
Mount Mulanje
Mulanje
Thyolo
Ruo R.
Lengwe National Park
0 30 60 Kilometers
MOZAMBIQUE
Elephant Marsh
TANZANIA
Lake Malawi/ Nyasa/Niassa
ZAMBIA
MALAWI
MOZAMBIQUE
LILONGWE
Area of map
MOZAMBIQUE
Zambezi R.
Nsanje
This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.
PROJECT CATCHMENTS
SHIRE RIVER BASIN
RIVERS
BARRAGE
LAKES
MARSH
NATIONAL PARKS
FOREST RESERVES
DISTRICT HEADQUARTERS
REGION CAPITAL
ROADS
HYDROPOWER PLANT
DISTRICT BOUNDARIES
INTERNATIONAL BOUNDARIES
MAY 2012