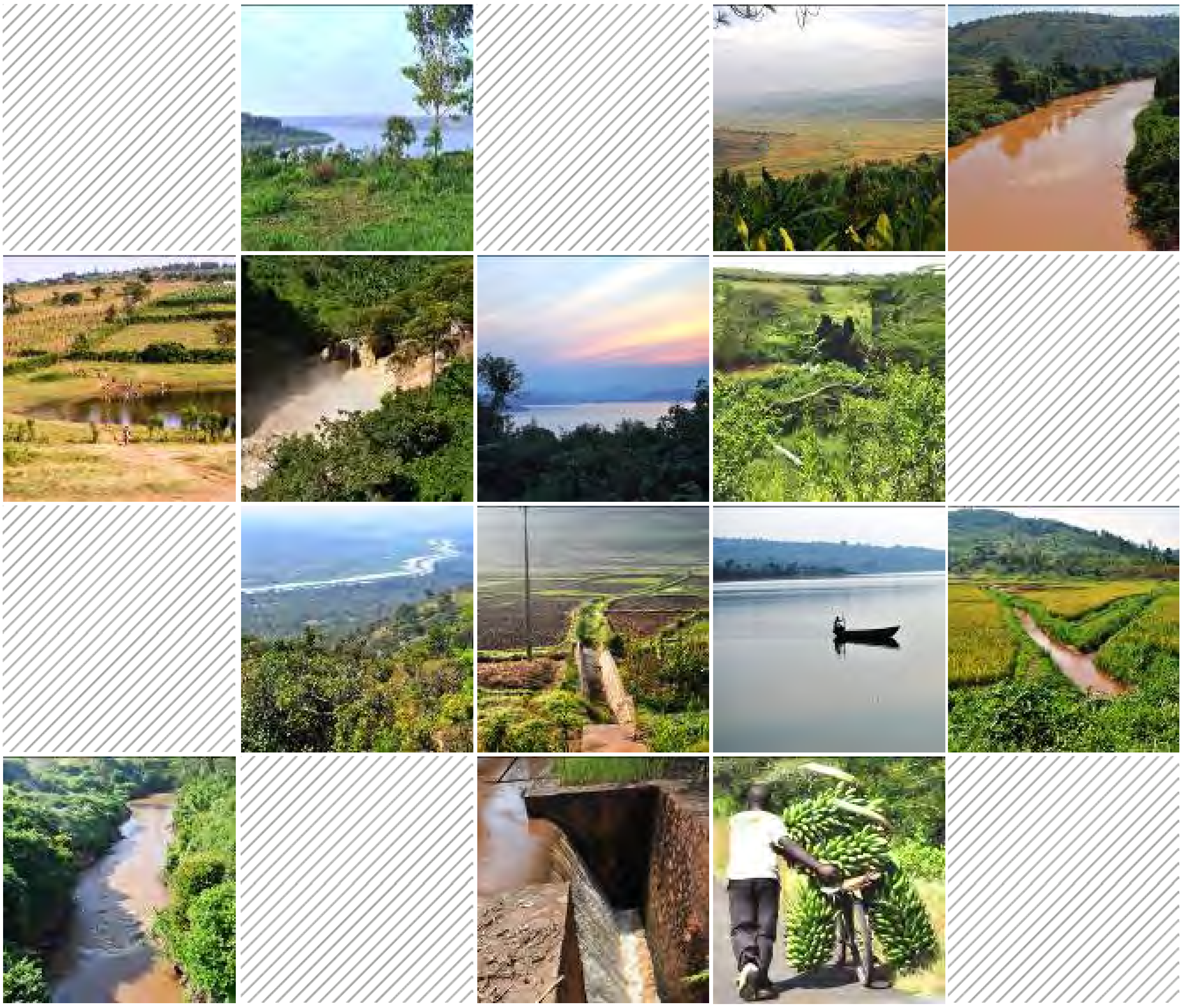

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Development of a Basin-wide IWRM-based Development Plan for the Kagera Basin

Submitted by:
Aurecon AMEI Ltd
Ebène House 3rd floor
33 Cybercity, Ebène, Mauritius

Contact Person:
Erik van der Berg
T: +27 21 526 5790 **F:** +27 21 526 9500
E: erik.vanderberg@aurecongroup.com

Submitted to:
Kagera River Basin PMU
NELSAP, NBI
P.O. Box 7054
Kigali
Rwanda

Submission date: December 2012

WEMA Consult (T) Limited
WEMA TWINS, 3rd Floor, Bagamoyo Rd,
Wazo-Tegeta, Basihaya Area,
Box 6737 Dar es Salaam, Tanzania
T: +255 22 2630539**F:**+255 22 2630534
E:info@wemaconsult.com

Strategic Planning Report

Final

Report No: 7321/108392

Nile Basin Initiative

Nile Equatorial Lakes Subsidiary Action Program

Kagera River Basin Management Project

STRATEGIC PLANNING REPORT

Consulting Services for

Development of a Basin-wide IWRM-based Development Plan for the Kagera Basin

Burundi, Rwanda, Uganda and Tanzania

Contract No.: Kagera/2011/S/BDP-01
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Prepared by:	**Aurecon AMEI Ltd**	
	Address:	P O Box 494, Cape Town, South Africa
	Tel:	+27 21 526 9400
	Fax:	+27 21 526 9500
	E-mail:	erik.vanderberg@aurecongroup.com
In Association with:	**WEMA Consult (T) Ltd**	
	Address:	P.O. Box 67371, Dar Es Salaam, Tanzania
	Tel:	+255 22 263 0539
	Fax:	+255 22 263 0534
	E-mail:	machibya@wemaconsult.com

December 2012

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ANNEXURES

ABBREVIATIONS AND ACRONYMS

AfDB	African Development Bank
AMCOW	African Minister's Council on Water
AU	African Union
CAADP	Comprehensive Africa Agriculture Development Programme
CITES	Convention on International Trade on Endangered Species
CFA	The Nile River Basin Cooperation Framework Agreement
CNCA	Coordination nationale des Aides
DEM	Digital elevation model
DRC	Democratic Republic of Congo
DSS	Decision Support System
EAC	East African Community
EAPP	East Africa Power Pool
EFR	Environmental flow requirements
EIA	Environmental Impact Assessment
ENSAP	Eastern Nile Subsidiary Action Programme
ENTRO	Eastern Nile Technical Regional Office
ESIA	Environmental and Social Impact Assessment
ESRI	Environmental Systems Research Institute
FAO	Food and Agriculture Organization of the United Nations
GCS_WGS	Global Coordinate System
GDP	Gross Domestic Product
GHCN	Global Historical Climatology Network
GIS	Geographic Information System
GWP	Global Water Partnership
GWh/a	Gigawatt hours per annum
ha	Hectares
HIV/AIDS	Human Immunodeficiency Virus / Acquired Immuno-Deficiency Syndrome
ICCON	International Consortium for the Cooperation on the Nile
ICP	International Cooperating Partners
ICRAF	International Centre for Research in Agroforestry
IFC	International Finance Corporation
IGAD	Intergovernmental Authority for Development
IPCC	Intergovernmental Panel on Climate Change
IS	Information System
ISWC	Integrated Soil and Water Conservation
IT	Information technology
IUCN	International Union for Conservation of Nature and Natural Resources
IWRM	Integrated Water Resources Management
JMP	Joint Monitoring Programme
KBO	Organization for the Management and Development of the Kagera River Basin
km	Kilometres
km^2	Squares kilometres
km^3/a	Cubic kilometres per annum (1 km^3/a = 1 billion m^3)
kW	Kilowatt
kWh	Kilowatt hours
l	litre
LSU	Livestock Standard Unit
LTS	LTS International
LVBC	Lake Victoria Basin Commission
LVDP	Lake Victoria Development Program
LVEMP	Lake Victoria Environmental Management Programme
m	Metres
m^3	Cubic metres
m^3/s	Cubic metres per second
MAP	Mean annual precipitation
MAR	Mean annual runoff
masl	Metres above mean sea level
Mℓ	Megalitre
mm/a	Millimetres per annum

Mm^3/a	Million cubic metres per annum
MDGs	Millennium Development Goals of the United Nations
MINIRENA	Ministry of Water Energy and Natural Resources, Rwanda
MINITERE	Ministère des Terres, de l'Environnement, des Forêts, de l'Eau et des ressources naturelles
MoWLD	Ministry of Water and Livestock Development, Tanzania
MOU	Memorandum of Understanding
MW	Megawatts
MWE	Ministry of Water and Environment, Uganda
NBI	Nile Basin Initiative
NBI CF	Nile Basin Initiative Catchment Framework
NEL-CU	Nile Equatorial Lakes Coordination Unit
NELCOM	Nile Equatorial Lakes Committee
NELSAP	Nile Equatorial Lakes Subsidiary Action Programme
NELTAC	Nile Equatorial Lakes Technical Committee
NEMA	National Environment Management Authorities
NEPAD	New Partnership for Africa's Development
NFA	National Forestry Authority
NGO	Non-Governmental Organisation
NLO	National Liaison Officer
NSGRP	National Strategy For Growth and Reduction of Poverty
O&M	Operation and maintenance
PGNRE	Projet de Gestion National des Ressources en Eau, Rwanda
PMU	Project Management Unit
PPP	Public-Private Partnership
RAMSAR	Convention for wetlands of international importance
RBO	River Basin Organisation
REGIDESO	Régie de Production et de Distribution d'Eau et d'Électricité
RNRA	Rwanda Natural Resources Authority
RPSC	Regional Project Steering Committee
RSSP	Rural Sector Support Programme
SADC	Southern African Development Community
SIDA	Swedish International Development Cooperation Agency
SWOT	Strengths, Weaknesses, Opportunities, Threats
SVP	Shared Vision Programme
TAFSIP	Tanzania Agriculture And Food Security Investment Plan
TAMP	Transboundary Agro ecosystems Management Programme
ToR	Terms of Reference
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UN	United Nations
USD	United States Dollars
US$	United States Dollars
UTM	Universal Transverse Mercator
VIP	Ventilated Improved Pit Latrine
WACDEP	Water and Climate Development Program
WC/WDM	Water Conservation and Water Demand Management
WFP	United Nations World Food Programme
WHO	World Health Organization
WRMD	Water Resources Management Department, Uganda
WSRG	Water Strategy Reference Group
WSS	Water supply system
WWF	World Wildlife Fund

Development of a Basin-wide IWRM-based

Development Plan for the Kagera Basin

STRATEGIC PLANNING REPORT

1. INTRODUCTION

1.1 Brief Description and Context of the Consultancy

The overall objective of the Consultancy is to *establish a sustainable framework for the joint management of the water resources of the Kagera River Basin and prepare for sustainable development oriented investments*, in order to improve the living conditions of the people and to protect the environment.

The consultancy assignment specifically aims to:

- Establish baseline conditions in the Kagera Basin (Diagnostic Assessment);
- Assess water resources and water use of different sectors (Diagnostic Assessment);
- **Formulate and evaluate alternative development options that will meet those demands (Strategic Planning);**
- **Recommend specific Water Resources Management and Development Options (Strategic Planning);**
- Develop a sound and environmentally sustainable IWRM Development Plan (Basin Development Plan); and
- Translate the IWRM Development Plan into an Implementation Strategy and Action Plan to realize the Development Plan (Basin Development Plan).

This is the ***Second Interim Report*** which addresses the 3rd and 4th specific objectives of the assignment.

1.2 Objective of this Phase of the Consultancy

Figure 1.1 on the following page illustrates the workflow for the study and Strategic Planning Task, indicating the various tasks undertaken, the stakeholder workshops held and the deliverables. The Strategic Planning Task (Task No 3 as shown in the Figure) shows the specific activities under this task, which it aims to address, namely:

a. Strategic options and priorities for sustainable development of the basin;
b. Justification (criteria) for development priorities;
c. Prioritised portfolio of projects and programmes
d. Assessment of basin wide development scenarios; and
e. Formulation of strategies to address development and conservation priorities.

1.3 Approach

The Strategic Planning undertaken so far in the Consultancy was both consultative and collaborative, with contributions from national level authorities. This process was carried out in two phases:

a. Stocktaking, information gathering, assessment and consultation with key stakeholders, resulting in the Diagnostic Assessment; and

b. Drafting of the Strategy which included the strategic areas, prioritised projects, development scenarios and strategies.

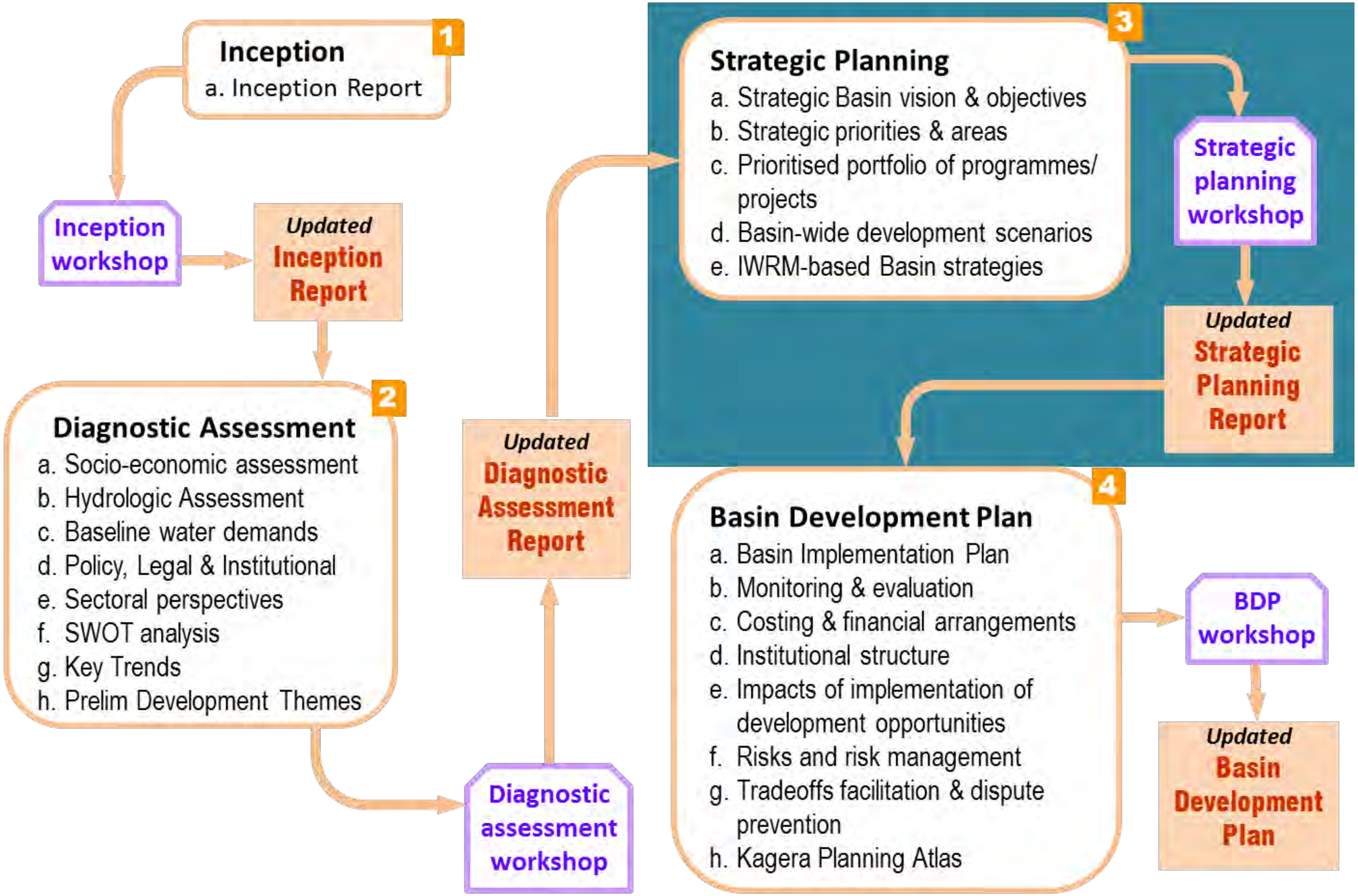

Figure 1.1: Workflow of the study Phases

The workflow for the various activities undertaken in this tasks and how this links with the previous deliverables is illustrated in **Figure 1.2.**

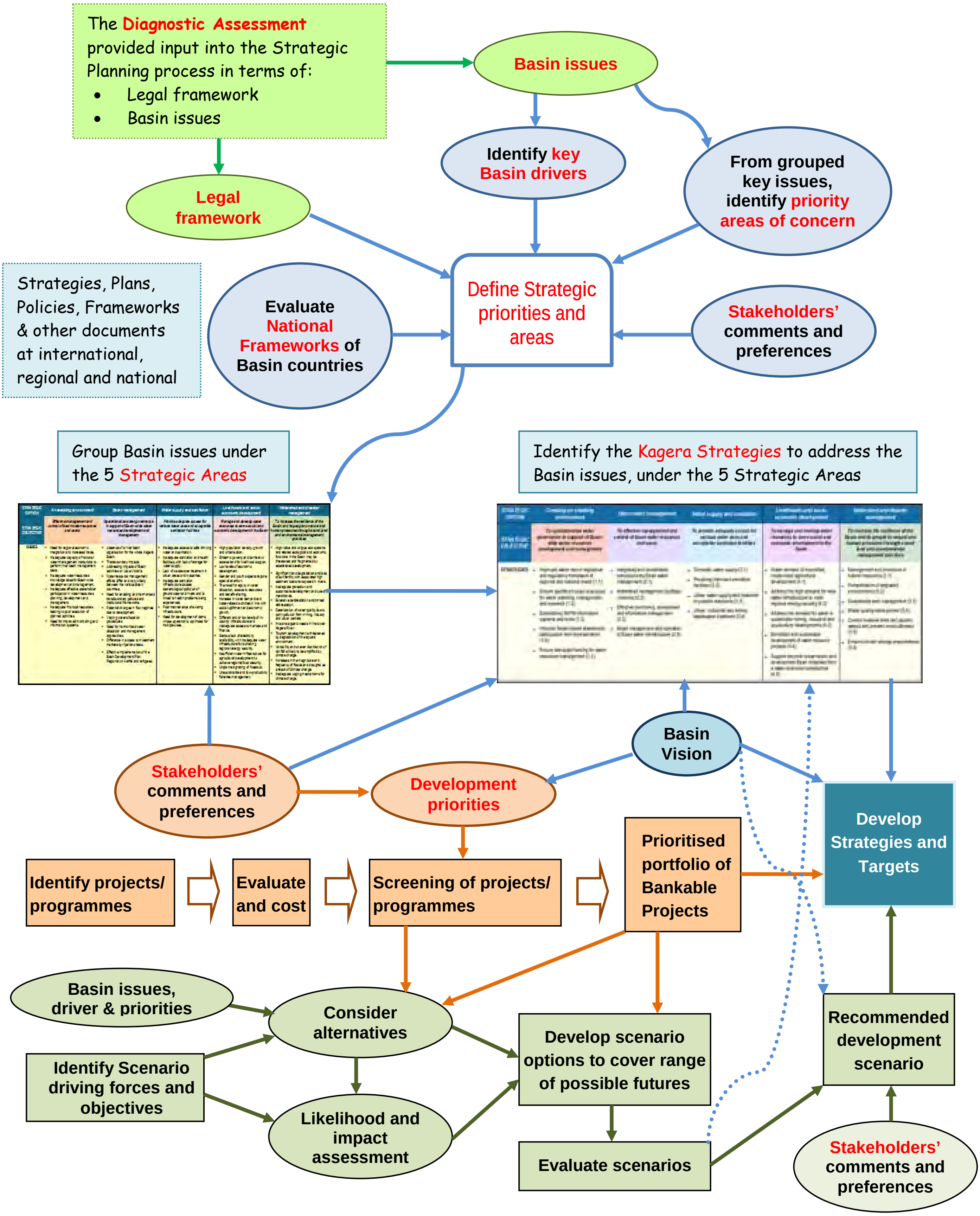

Figure 1.2: Workflow for the activities of the Strategic Planning Task

Strategic areas and priorities of the Basin have been identified by synthesising key issues and priorities from:

- The diagnostic assessment conducted;
- Evaluation of national Policy, Regulatory and Strategic Frameworks of the Basin countries and regional initiatives.
- Considering stakeholder comments and preferences.

A Draft Basin vision and specific development objectives are presented .Following this, the various areas for sustainable development of the Basin were identified.

A prioritised portfolio of Basin projects was developed by identifying projects that have been previously identified and studied, and documenting such projects according to a standard template. Projects evaluated and screened in the NELSAP concurrent study on Watershed Management Projects were taken into account. A few additional projects were developed to fill project gaps. These projects were then screened according to screening criteria developed in accordance with the Consultancy objectives and strategic areas and priorities, and as commented on by Basin stakeholders. This provided a prioritisation of projects to consider for the building of Basin development scenarios.

A range of development Scenarios were identified and described. Selected scenarios were evaluated, implications of the various scenarios were determined, and strategies to deal with this were identified.

Basin strategies were formulated to address Basin concerns and key issues, identified scenarios and opportunities in terms of development and conservation priorities.

1.4 Layout of the Report

The report is structured in eight chapters, as follows:

CHAPTER 1: Introductory chapter, presenting a brief description and context of the study, and an overview of the methodology used for this Phase of the Consultancy.

CHAPTER 2: Discusses the strategic areas and priorities for development and conservation of the Basin.

CHAPTER 3: Presents a strategic Basin vision, associated goals and criteria for development priorities

CHAPTER 4: Presents identified projects, an evaluation process and a Prioritised Portfolio of Programmes and Projects.

CHAPTER 5: Basin-wide development scenarios are presented.

CHAPTER 6: IWRM-based Basin strategies for Basin development and conservation.

CHAPTER 7: Kagera Planning Atlas.

CHAPTER 8: The way forward.

2. STRATEGIC PRIORITIES AND AREAS

The chapter consists of four sections. The first section deals with issues of relevance to the Consultancy objectives, followed by Section Two on national policy and strategic objectives and priorities of the Kagera Basin countries, in the context of the management of Lake Victoria. Section Three addresses key Basin issues and priority areas of concern. Section Four deals with strategic areas and strategies.

2.1 Relevance to the Consultancy Objectives

This Chapter summarises the key Basin issues, challenges, drivers and priorities synthesized from the policies, strategies and development plans of the various Basin countries and the Basin Diagnostic Assessment Report undertaken in Task 1 of this Consultancy. It presents and explains the strategic areas for the sustainable conservation, management and development of the Basin. The information provided in this chapter informs the development of the Basin-wide development scenarios and strategies for the Integrated Water Resources Management and Development of the Kagera River Basin.

2.2 National Frameworks of Basin Countries

2.2.1 Approach

This section gives an overview of the policy and strategic environment that governs the management of the Kagera River Basin. The policies and strategies are presented at regional, Basin, and national level to provide context. The objective is to provide strategic areas and priorities for sustainable management of the Basin, and justification for development priorities.

A close look at the institutional arrangement in the Basin is important in terms of the implementation of the Basin Development Plan. Macro-institutional aspects and the institutional set-up in the Basin countries were already discussed in the Diagnostic Assessment Report. This provides the legislative context, and will not be covered again in this Report.

The needs, concerns and strategic development priorities of the Basin countries are thus obtained from this analysis of national policies, strategies and plans. Justification of such priorities is described in these documents.

2.2.2 International Context and Priorities

This section highlights the international, regional and Basin policies that are relevant to the development of an IWRM Plan for the Kagera River Basin.

In particular the international and regional policies were detailed in the Legal Diagnostic Analysis in the Diagnostic Analysis Report, and are listed here.

International level

- Ramsar Convention for wetlands of international importance (requires declared wetland management plans);
- UN Convention on biological diversity (requires national plans);
- UN Convention on the non-navigational uses of international watercourses (requires Basin Agreement);
- UN Convention to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa (requires National Plans);
- Draft Articles on the Law of transboundary aquifers (requires transboundary aquifer agreements).

Regional level

- East Africa Treaty, 1999, establishing the East Africa Community;
- Protocol for Sustainable Development of Lake Victoria Basin, 2003;
- SADC Protocol on shared watercourses, 2002, (through Tanzania);

- The Nile River Basin Cooperation Framework Agreement (CFA);
- Common Market for Eastern and Southern Africa (COMESA);
- Intergovernmental Authority for Development (IGAD).

Basin level

The Kagera Basin is an important water resource for the Nile Basin and Lake Victoria. The overall vision of the management of the Kagera Basin therefore needs to fit in with the objectives of the Nile Basin Initiative (NBI) and the Lake Victoria Basin Commission.

The primary objectives of the NBI are:

- to develop the water resources of the Nile Basin in a sustainable and equitable way to ensure prosperity, security and peace for all its peoples;
- to ensure efficient water management and the optimal use of the resources;
- to ensure cooperation and joint action between the riparian countries, seeking win-win gains;
- to target poverty eradication and promote economic integration; and
- to ensure that the program results in a move from planning to action.

The vision and mission of the Lake Victoria Basin Commission is *"A prosperous population living in a healthy and sustainably managed environment providing equitable opportunities and benefits"* and *to promote, facilitate and coordinate activities of different actors towards sustainable development and poverty eradication of the Lake Victoria Basin*, respectively.

When identifying the concerns at the Basin-level, the issues identified in the documents listed in Table ***2.1*** *were considered.*

Table 2.1: **List of NBI documents reviewed**

Title	Organisation	Year compiled
NELSAP - Agricultural Water In The Nile Basin – An Overview 2008	NBI, NELSAP	2011
East African Community Development Strategy 2006 – 2010	East African Community	2006
Development of Kagera Integrated River Basin Management and Development Strategy	NBI, NELSAP	2010
The Nile Basin Wetlands Management Strategy (2010 – 2016)	Nile Basin Initiative Secretariat	2010
Review and harmonise policies, legal and Institutional Frameworks governing utilization of water resources in the Lake Victoria Basin	East African Community Lake Victoria Basin Commission Secretariat	2010
Review of Existing Documents for the Rusumo Falls HEP 2003	World Bank	2003
Agricultural Water In The Nile Basin – An Overview	Nile Basin Initiative	2008
Lessons Learnt on Community Participation	Lake Victoria Environmental Management Project (LVEMP)	2005
Alleviating Land Degradation through Biodiversity Conservation in the Catchment of the Kagera River Basin in Rwanda, Uganda and the United Republic of Tanzania	FAO with the support of UNEP and UNDP	2001

2.2.3 National Policies, Strategies and Plans

Water is a cross-cutting resource across many sectors and aspects of life and livelihoods. In order to appreciate the demands on the water sector in this greater context it is necessary to review the key strategies, plans and policy documents of the Basin States in order to identify the key issues, vision and objectives affecting water resources management and demand in each of the member states. Although more documents have been accessed and studied, the documents that provided specific strategies are shortlisted. The detailed summary of the policy documents is included in **Annexure A**. The following sections provide a brief summary of the water sector requirements for each country.

Burundi

The Government's vision for the water sector is a "*state where water is available in quantity and quality sufficient to meet the needs of present and future generations and used efficiently and equitably for sustainable socio-economic development without compromising the Environment*". The key objectives for the water sector are to ensure:

- Availability of water resources for today and tomorrow.
- Equitable access to good quality water.
- Use of water for sustainable socio-economic development.
- A viable and sustainable environment.

Water to ensure food security, power generation and economic growth are key issues in Burundi. Floods, hail damage, population pressure and poor land management are contributing towards degrading water resources in the country.

Table 2.2: **List of the *Burundian* policy documents reviewed**

Title	Ministry/ Organisation	Year compiled
Burundi National Water Sector Policy	Water and Environment	2009
Infrastructure Action Plan for Burundi	African Development Bank	2009
Agricultural Water In The Nile Basin – Burundi Country Overview	NBI	2008
Burundi Water and Sanitation Profile	USAID	2010
Lake Victoria Region Water and Sanitation Initiative. Report on Mission to Burundi 2007	UN-Habitat	2007
Water and Sanitation Programme of Burundi	Deutschen Gesellschaft für Internationale Zusammenarbeit (GIZ)	2011
Burundi Vision 2025	Government of Burundi	2010
Agricultural Sector National Strategy 2008-2015	Ministry of Agriculture and Livestock	2008
Economic Development and Poverty Reduction Strategic Framework	Government of Burundi	2012
Burundi Country Strategy Paper 2012-2016	AfDB	2011
Nile Basin Regional Water Quality Monitoring Baseline Study Report	Nile Basin Initiative	2005
National Investment Policy for Agriculture 2012 - 2017	Oxfam Research Reports	2011
Burundi Coffee Project Appraisal Document	World Bank	2011
Food Security and Vulnerability Analysis Report	WFP Burundi WFP-VAM Rome	2004
Global Agriculture and Food Security Program	Ministry Agriculture and Livestock	2012

Rwanda

The vision of the Water Resources Management Policy is: "*A water resources sub-sector governed by a policy, legal and institutional framework that promotes sustainable use of water resources and which contributes meaningfully to the socio-economic development of Rwanda*". In order to achieve this vision, the water sector needs to ensure a proper framework for managing water resources in Rwanda that allows:

- Sustainable use of water resources; and
- Significant socio-economic development of the Country.

Key demands on water include improving livelihoods, economic development and power generation. Further, population pressure, wetland degradation, and soil erosion leading to water contamination and flooding are key contributors to impacts on water resources in the country.

Table 2.3: **List of Rwandan policy documents reviewed**

Title	Ministry/Organisation	Year compiled
Economic Development and Poverty Reduction Strategy 2008-2012	Finance and Economic Planning	2007
National Industrial Policy	Trade and Industry	2011
Updated version of the National Human Settlement Policy in Rwanda	Infrastructure	2009
Rwanda Vision 2020	Finance and Economic Planning	2000
Rwanda State of Environment and outlook Report	Rwanda Environment Management Authority (REMA)	2009
National Strategy and Action Plan for the Conservation of Biodiversity in Rwanda	Lands Resettlement and Environment	2003
Five-Year Strategic Plan for the Environment and Natural Resources Sector 2009-2013	Natural Resources	2009
National Energy Policy and Strategy	Infrastructure	2011
Strategic Plan for the Forest Sector 2009-2012	Forestry and Mines	2010
A revised Rwandan Mining Policy	Natural Resources	2009
National Policy and Strategy for Water Supply and Sanitation Services	Infrastructure	2010
Rwanda Irrigation Master Plan	Agriculture and Animal Resources	2010
Rwanda National Coffee Strategy 2009-2012	Agriculture and Animal Husbandry	2008
Revised Tea Strategy for Rwanda	Agriculture and Animal Resources, Trade and Industry	2008
Rwanda National Export Strategy	Government of Rwanda	2011
Strategic Action Plan for Agricultural Transformation in Rwanda Phase II	Agriculture and Animal Resources	2009
Water Supply and Sanitation in Rwanda	AMCOW	2010
Agricultural Water In The Nile Basin – Rwanda Country Overview	NBI	2008
Water and Climate Development Program (WACDEP): Towards water security and climate resilience in Eastern Africa - Report of the Workshop of 24-25 July 2012, Bugesera, Rwanda	AMCOW, GWP	2012

Tanzania

The main aim of the National Water Policy, 2002, is to provide a comprehensive framework for sustainable development and management of the Nation's water resources, in which an effective legal and institutional framework for its implementation will be put in place. The National Water Policy has the following overall objectives:

(i) to address cross-sectoral interests in water use, watershed management and participatory integrated approaches in water resources planning, development and management;

(ii) to lay a foundation for sustainable development and management of water resources through changing roles of the Government from service provider to that of coordination, policy and guidelines formulation and regulation;

(iii) to ensure full cost recovery in urban areas and cost sharing in rural areas with considerations for provision of water supply services to vulnerable groups through various instruments including lifeline tariffs; and

(iv) to ensure full participation of beneficiaries in planning, construction, operation, maintenance and management of community based water supply schemes in rural areas.

Table 2.4: **List of Tanzanian policy documents *reviewed***

Title	Ministry	Year compiled
National Irrigation Policy (2010)	Ministry of Water and Irrigation	2012
National Water Resources Act	United Republic of Tanzania	2009
Water Supply and Sanitation Act	United Republic of Tanzania	2009
District Irrigation and Water Harvesting Support (Mainland)	Government of the United Republic of Tanzania - NEPAD, FAO	2005
Medium Term Expenditure Framework Forward Budget for 2012/2013 to 2016/2017	Ministry of Water	2012
National Water Sector Development Strategy 2005 to 2015	Ministry of Water and Irrigation	2005
Water Sector Status Report	Ministry of Water and Irrigation	2009
Tanzania Development Vision 2025	Ministry of Water and Irrigation	2010
Tanzania Environmental Management Act	United Republic of Tanzania	2004
Lessons Learnt Report on Wetlands Management	Vice President's Office - LVEMP	2005
Tanzania Agriculture And Food Security Investment Plan (TAFSIP) 2011-12 To 2020-21	United Republic of Tanzania	2011
National Strategy For Growth and Reduction of Poverty (NSGRP)	Vice President's Office	2005
Integrated Soil and Water Conservation (ISWC). Final Report On Lessons Learnt	Vice President's Office - LVEMP	2005

Uganda

The National Water Policy promotes the principle of integrated water resources management as a means for ensuring sustainable management and utilization of Uganda's water resources. The objectives of the water policy are to:

(i) manage and develop the water resources of Uganda in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs of the present and future generations with full participation of all stakeholders;

(ii) ensure sustainable provision of safe water within easy reach and hygienic sanitation facilities, based on management responsibility and ownership by the users, to 75% of the population in rural areas and 100% of the urban population by the year 2000 with an 80-90% effective use and functionality of facilities; and

(iii) Promote development of water supply for agricultural production in order to modernize agriculture and mitigate effects of climatic variations on rain fed agriculture.

Table 2.5: **List of Ugandan policy documents reviewed**

Title	Ministry	Year compiled
Water for Production Strategy and Investment Plan 2009	Ministry of Water and Environment	2009
National Development Plan 2010/11 to 2014/15	Government of Uganda	2010
Water and Environment Sector Performance Report 2010	Ministry of Water and Environment	2010
National Irrigation Master Plan For Uganda (2010-2035)	Ministry of Water and Environment	2010
Climate Change Vulnerability Assessment, Adaptation Strategy and Action Plan for the Water Resources Sector in Uganda	Ministry of Water and Environment	2010
Strategy for National Agricultural Development Horizon 2010	Ministry of Agriculture	2010
Uganda State of the Environment (SOE) Report	National Environment Management Authority	2008
Strategic Sector Investment Plan for the Water and Sanitation Sector in Uganda	Ministry of Water and Environment	2009
Water and Sanitation Sector - District Implementation Manual 2007	Ministry of Water and Environment	2007
Water Act 1997	Government of Uganda	1997
National Water Policy 1999	Ministry of Water and Environment	1999
National Environmental Management Policy 1994.	Ministry of Water and Environment	1994
National Policy for the Conservation and Management of Wetland Resources (1995)	Ministry of Water and Environment	1995
National Forestry Policy (2000)	Ministry of Forestry and Mines	2000
The Uganda Wildlife Policy (1999)	Ministry of Tourism, Trade and Industry	1999
Energy Policy for Uganda (2002)	Ministry of Energy and Mineral Development	2002
National Land Use Policy (2007)	Ministry of Lands, Housing and Urban Development	2007
National Industry Policy (2008)	Ministry of Infrastructure	2008
National Fisheries Policy (2000)	Ministry of Agriculture	2000
National Health Policy (1999)	Ministry of Health and Social Welfare	1999

2.2.4 Harmonising of legislation required

Differences and similarities in legislation between the Basin countries are shown in **Table 2.6,** represented by the areas where the policies/legislations of the partner states converge or diverge.

It should however be noted that all issues regarding harmonisation need to be addressed by all partner states. This analysis undertaken for the study: "*Review and harmonise regional policies, legal and institutional frameworks governing utilization of water resources for the Lake Victoria Basin*" undertaken in 2012 assisted in proposing a harmonised water policy and a Water Act for the EAC countries. As four of the five EAC countries are the same as the Kagera Basin countries, this is a very relevant exercise.

Table 2.6: Areas of convergence or divergence of policies/legislation between Basin countries

Areas of convergence or divergence of policies/legislation	Burundi	Rwanda	Uganda	Tanzania
Cooperation in water resources and development for management of water resource (incl. other water related)				
Water resources and inter-sectoral cooperation	✓	✓	✓	✓
Integration of economic incentives into management of water resources	X	X	✓	✓
Communication and collaboration mechanisms	X	X	X	X
Conflict management mechanisms	X	X	X	X
Benefit sharing and equity consideration	✓	X	X	X
Sustainable water resource management and development (incl. other water related)				
Utilization of water for socio-economic development	✓	✓	✓	✓

Areas of convergence or divergence of policies/legislation	Burundi	Rwanda	Uganda	Tanzania
Development and management of water resources by river basin approach	✓	X	✓	✓
Integrated Water Resources Planning approach	X	✓	✓	✓
Water conservation and demand management provisions	✓	✓	✓	✓
Development of dams	X	X	✓	✓
Water permits authorization	✓	✓	✓	X
Water for environment and ecosystem sustainability				
Water allocation for the environment/sustaining aquatic ecosystems	✓	✓	✓	✓
Procedure for preparation of water allocation plans	X	X	X	X
Addressing alien invasive species	✓	X	X	X
Climate change mitigation measures	X	✓	✓	✓
Other water-related water for environment and ecosystem sustainability				
Water allocation for the environment/sustaining aquatic ecosystems	✓	✓	✓	✓
Procedure for preparation of water allocation plans	X	X	X	X
Addressing alien invasive species	✓	✓	✓	✓
Climate change mitigation measures	✓	✓	✓	X
Water quality management and pollution control (incl. other water related)				
Provisions for water quality monitoring and assessment	✓	✓	✓	✓
Water quality standards (receiving water quality standards, effluent discharge standards)	✓	✓	✓	✓
Water pollution control	✓	✓	✓	✓
Climate change and security from water related disasters				
Climate change	✓	✓	✓	✓
Protection from floods and droughts	✓	✓	✓	✓
Prediction, planning and management of natural disaster management	X	X	X	X
Provisions for dam safety management	X	X	✓	✓
Other water-related climate change and security from water related disasters				
Climate change	X	✓	✓	✓
Protection from floods and droughts	✓	X	✓	✓
Prediction, planning and management of natural disaster management	X	✓	✓	✓
Provisions for dam safety management	X	X	✓	✓
Water resources information, management and exchange				
Data collection and information management	X	✓	✓	✓
Data Quality Control provisions	X	X	✓	✓
Data and information exchange	X	X	✓	✓
Other water-related water resources information, management and exchange				
Data collection and information management	X	✓	✓	✓
Data Quality Control provisions	X	X	X	X
Data and information exchange	X	✓	✓	X
Institutional framework for water resources management				
National frameworks promote decentralised management of water resources	✓	✓	✓	✓
Framework and structure for conflict resolution mechanisms (DSS)	✓	✓	✓	✓
Stakeholder participation, awareness creation and capacity building				
Conflict resolution mechanisms	✓	✓	✓	✓
Involvement and participation of stakeholders in planning, management and decision making at all levels	✓	✓	✓	✓
Capacity building needs of regional and national levels	✓	✓	✓	✓
Higher learning institutions to mainstream IWRM principles in their water related curricula	✓	✓	✓	✓
Gender mainstreaming in water resource use and management	✓	✓	✓	✓
Research and development				
Undertake demand-driven water sector research and technology development	X	✓	✓	✓
Mechanisms for sharing of research findings and information	X	X	X	X
Other water-related research and development				
Undertake demand-driven water sector research and technology development	X	✓	✓	✓

Areas of convergence or divergence of policies/legislation	Burundi	Rwanda	Uganda	Tanzania
Mechanisms for sharing of research findings and information	X	✓	✓	✓
Watershed management (incl. other water related)				
Protection of Catchment and protected areas	✓	✓	✓	✓
Mechanisms for protection of water sources	✓	✓	✓	✓
Land management practices	✓	✓	✓	✓

"X" denotes areas of divergence (potential conflict)
"✓" denotes areas of convergence

2.3 Key Basin Issues and Priority Areas of Concern

2.3.1 Introduction

The literature review involved extensive review and analysis of research and studies conducted in the Lake Victoria and Kagera Basin, key policy and planning documents, strategies and action plans for the area. These were reviewed with an objective of identifying problems, issues and priorities for the Basin that warrants immediate and long term action.

Consultations were done at various levels using various approaches. Under the auspices of the NELSAP, a Consultancy workshop was held to identify issues from the Kagera Basin of national concern. Additionally, key Basin stakeholders were identified and consulted individually. These issues have been documented in the Diagnostic Assessment Report (1st Interim Report) in various ways.

The first step in developing a strategic plan is to get a clear idea of the water and land resource management issues and on-going activities in the basin. Key Basin issues and priority areas of concern that were identified through literature review and consultation were compiled.

There are significant social concerns as well as concerns about the ecological state of the Basin. The following sections provide an analysis of the drivers that potentially can affect change in the Basin, what impact the driving factors have in the Basin and what the areas of concern are for the Basin countries and for the Basin as a whole. The impact and implications of these driving forces have been taken into account in determining scenarios and strategies.

2.3.2 Key Basin Drivers, Issues and Concerns

The Kagera River Basin is currently suffering ecological degradation mainly as a result of high population density, scattered settlements, poor land management practices and contamination of water resources. Current trends of increasing population pressure, poverty, and uncoordinated management of Basin resources is further threatening the Basin. The following sections provide an analysis of the drivers that potentially can affect change in the Basin, what impact do the driving factors have in the Basin and what are the areas of concern for the Basin as a whole.

Driving factors

Several key factors have been identified that will drive change in the Kagera River Basin. All these drivers are interrelated and they impact on the priority concerns for the Kagera River Basin and downstream Lake Victoria. Changes in flow regimes will lead to changes in land use and livelihood options. These factors are equally important in the member States as in the Basin as a whole.

Population pressure will increase the demand for resources, lead to further fragmentation of land and put pressure on the various ecosystems; but for poverty to be alleviated, more resources will need to be utilised. In areas of high poverty, food insecurity and water scarcity, increased population growth is undesirable. However, in areas where income levels are higher and livelihood option s are more diverse and not too dependent on the environment, population growth is not always a problem, and may facilitate economic activity and generate growth.

Poverty therefore, needs to be understood in socio-economic contexts, and its multiple dimensions appropriately addressed. High-use developments on the basin will not necessarily lead to a reduction in poverty; as the main reason for high levels of poverty is the unequal distribution of resources and wealth. Therefore, improved access to resources and development benefits will be crucial for reducing poverty. Direct access to wetland resources is critical for households' livelihoods and access to natural resources for food and fuel are important for meeting basic household needs and also important for income generation.

Climate change will exacerbate poverty by reducing the coping abilities of households and individuals and increasing their vulnerability to its impacts such as hail, floods and droughts. As a way of reducing risks associated with climate change and an unstable environment, residents in the Basin and Region need to maintain a diversified income generation system. However, activities such as fishing and marshland agriculture can be adversely affected by changes in flood regimes.

Land use change is a driving force for change and will have an impact on water quality and biodiversity in the Kagera Basin. There is an increased demand for arable land along the Basin tributaries and tourism establishments. If not well managed, these will have significant impacts on the quality of water and the ecosystem as a whole.

The impacts of ineffective *governance* including unimplemented policies and poorly capacitated institutions could result in further environmental and land degradation. Poor management and unregulated land use activities could negatively affect flow regimes and water quality of both surface and groundwater resources. Further, coordinated management of activities in the Basin will lead to increased sharing of benefits for the member States of the Basin. It is therefore important to recognise and understand the interconnectedness of the issues and come up with integrated solutions for potential problems. For the Basin, these issues are enhanced by the fact that it is located upstream of Lake Victoria and the greater Nile Basin.

Availability of investment capital is a factor of *political stability*. Although the days of major conflict in the Kagera Basin countries have passed, stability in the region is still a concern, particularly from an international perspective. Continued instability (or perception thereof) will impact on development in the Basin in three ways. Firstly, it affects the ability of the specific country to organise and implement projects and programmes. Secondly, it hampers the ability of the Basin countries to work together in achieving integrated planning, particularly in terms of water resources. Thirdly, it affects the confidence of donors / funders and therefore decreases the likelihood of continued international assistance and investment in the Basin.

Market access and commodity prices: The Kagera River Basin economies are based mainly on agriculture which provides a large proportion of the raw materials for industry. Food processing alone accounts for 40% of total manufacturing. Access to markets is a barrier for many agricultural producers and they do not have the benefit of reasonable commodity prices for their produce or product.

Industrialisation and diversification: Despite the perception of instability in the region, economic growth is generally high. Economic growth in all the Basin countries was higher than the world average in 2012, although coming off a low base. Rwanda in particular has a strong emerging economy, ranking 23rd in the world. Strong economic growth goes hand in hand with a growth in water requirements as a result of an expansion in industrial and mining activities (diversification), increased urbanisation, and increased per capita water requirements, resulting from the implementation of water supply programmes. The industrial sector of the Kagera Basin is not significantly developed and industrial (and non-domestic) water use only accounts for approximately 4% of the total Basin water demand. Economic growth will also impact on the ability of the region (financially) to meet the projected water demands through the implementation of projects and programmes and decrease the reliance on donor funding.

Availability of energy: Economic growth and diversification (along with population growth) will also affect the demand for energy. The Kagera Basin countries considered in this study have one of the highest reliance on biomass for day-to-day energy needs in the world, with a regional dependence on biomass of 93% and with electricity sharing less than 1% of the total energy production in the region. The need for development in the energy sector in this region, with a population of more than 100 million people, is evident.

International economic climate: The ability of the Basin countries to meet the growth in demand also depends on the international economic climate. The current global financial crisis (particularly in Europe, brings with it a weakened export market for minerals and agricultural produce. Access to export markets will always be a concern, especially for landlocked Uganda, Burundi and Rwanda. The international economic climate will also affect the availability of donor funding and the willingness of donor organisations to take investment risks, particularly considering the instability of the region as previously discussed. The general donor trend appears to be focused on smaller local projects rather than large-scale infrastructure development. The viability of smaller schemes requires more and tighter management (placing a demand on institutional capacity), and their ability to make a meaningful impact on Basin water resource development is a concern.

Agricultural development / policies on agricultural funding: Agriculture forms the economic backbone of the Kagera River Basin and will certainly remain important for growth and poverty reduction in the future. In recent years (between 2006 and 2011) agriculture contributed between 20 and 45% of the GDP of the Basin countries. Moving into the future, agricultural development will be driven by the ability of Basin countries and stakeholders to agree on common goals and priorities for agricultural development; supportive trading policies; access to markets; transport infrastructure to move goods locally and internationally and the availability of water for irrigation and livestock

Access to information and the availability of technology: These are really institutional and/or governance functions, but can be provided in different ways with communications technology one of the key drivers. Information in an agrarian society is however best spread through a wide and well trained network of agricultural and forestry extension officers. Typical technologies include erosion control, agroforestry, borehole technology (and access to spare parts).

Priority areas of concern

The drivers mentioned above will have an impact on the integrity and functioning of the Kagera River Basin, causing several changes in the areas of concern for the riparian countries. Some of the issues identified do have an impact on several areas of concern and are indicated where applicable. The key areas of concern are grouped in **Figure 2.1**.

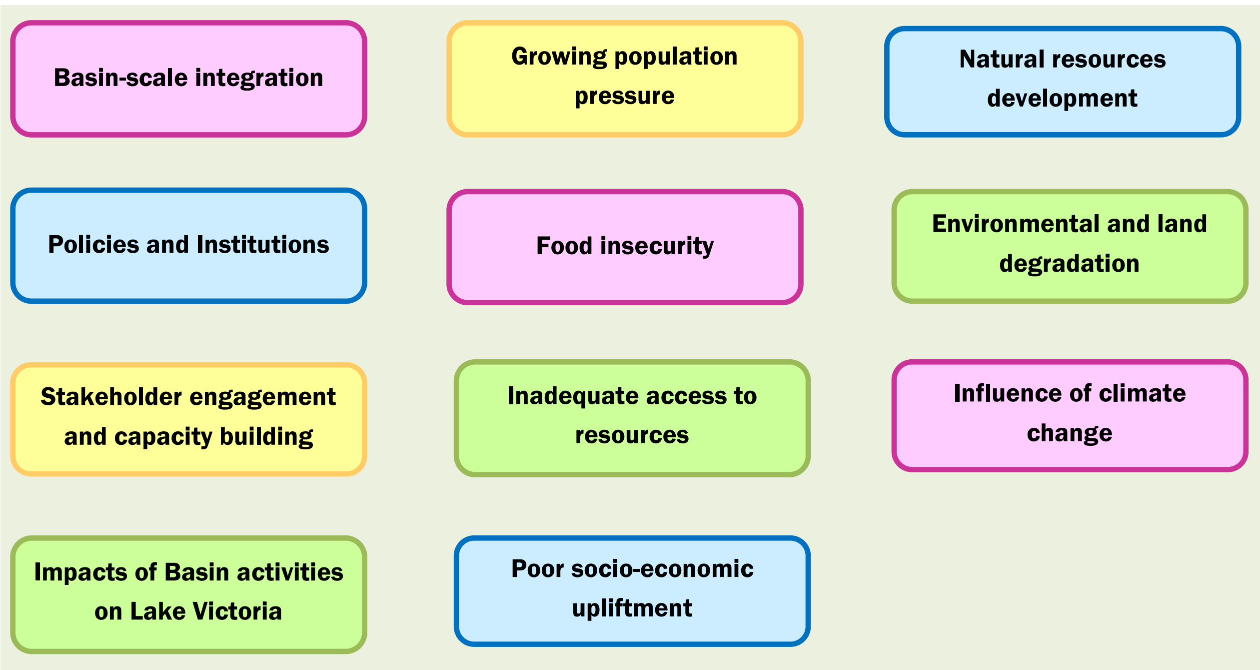

Figure 2.1: Key areas of concern for integrated resources management of the Kagera River Basin

Table 2.7 summarises the priority areas of concern and the underlying issues for the Basin.

Table 2.7: Basin Issues grouped by Basin Concerns

BASIN CONCERNS	ISSUES
Basin-scale integration	• Refusal of Sudan and Egypt to sign the Nile River Framework Agreement. • Kagera Basin Institutional Agreement not yet concluded. • Need for regional economic integration and increased trade. • Need for enabling and harmonised transboundary policies, institutional frameworks, and resources management of the Basin countries. • Water resource management efforts differ and vary widely between the various Basin countries. • The need for sustainable management of Basin resources. • Data generation and modelling is needed at a basin scale. • Exchange of and access to information should be improved. • Overcoming economic inequity and power asymmetry of Basin countries. • Civil strife in the region. • Mechanism for settlement of disputes needed.
Policies and institutions	• Water allocation - licensing of use and enforcement is limited. • Basin variability needs to be dealt with through sub-catchment approaches and appropriate lower-level water management institutions, e.g. WUAs. • Need for improved monitoring and information systems. Real-time data is needed for agriculture. Inadequate availability of hydro-meteorological and water quality data. • There is inadequate pollution control legislation in the basin countries, and the lack of institutional capacity to enforce existing effluent standards where these exist. • Need for improved understanding of water use. • Significant policy constraints in the region handicap the development of both local and regional energy projects. Significant concerns remain regarding the effectiveness and willingness of inter-regional co-operation between countries in the region. Barriers to development need to be understood and overcome. • Inadequate institutional capacity to implement projects and programmes. Clarification is needed on who should implement. Best practice is to work through national structures, and do co-ordination at Basin level. • Availability of donor funding in water resource management activities/projects must be coordinated. • Development must be sustainable from a social, environmental and economic perspective. • Sustainable funding mechanisms are needed for water resource management, development and use of waterworks. • The key constraint facing IWRM is the lack of adequate financial resources which lead to poor execution of planned activities. The current available financial resources in the riparian countries are not adequate and sustainable to cater for the demand of the planned interventions.
Stakeholder engagement and capacity building	• Effective participation and representation of stakeholders at various levels, and public consultation is needed. • Public awareness and local participation in development and conservation initiatives. • There is a need to build capacity and expertise among practitioners in the water sector in IWRM. • Ensure sharing of information and experience among stakeholders. • Working tools need to be made available. • Gender and youth aspects must receive special attention. • Strengthen knowledge base.
Impacts of Basin activities on Lake Victoria	• The Kagera River contributes about 3% of the Lake's water supply. • The Basin acts as a nursery for water hyacinth that is washed to Lake Victoria. • Sedimentation is polluting Lake Victoria. • Significant water resources infrastructure development could influence the water levels of Lake Victoria.
Growing population pressure	• The Basin has a rapidly growing Basin population and high population density. • Urbanization in the Basin is a result of natural urban population increase, rural migration to the

BASIN CONCERNS	ISSUES
	urban centres, transformation of rural settlements into towns and overall social, economic and political growth of the region. • Rigorous establishment and improvement of health facilities and nutrition has steered population growth in some parts of the Kagera Basin, especially the upper part of the Basin. • Conflict from the eastern regions of the Democratic Republic of Congo (DRC), from where people flee into the Kagera Basin as they feel insecure. • Due to differences in soil fertility, polygamous practices, and urbanisation, there have been density variations even within the upper Basin. • Population and economic growth will result in a concomitant increase in water demands that will place pressure on water resource allocation and supply.
Food insecurity	• Agriculture, which is the mainstay in the Basin, is generally practiced at a subsistence level, characterized by low productivity. • Need for intensification of land use for agriculture to meet food production requirements. • Highly fragmented land leads to low productivity. • There has been inadequate investment in agricultural research and infrastructure. • Negative trends of inland fisheries are expected to continue unless fisheries management is improved. • Rain-fed agriculture, which is currently the norm, will not meet the demand of the basin population in 2032. There is a need to reduce dependency on rain-fed agriculture. • Need for mechanization of agriculture, including irrigation. • Rice is the main crop grown in the irrigation schemes. Rice has higher productivity and returns for water and other factor inputs.
Inadequate access to resources	• The Kagera River Basin and region faces a serious lack of electricity availability. Electricity is very expensive and access to electricity is very low. Increased energy supply is a high priority. • Biomass is almost the only source of energy, with local need for timber (fuelwood and poles). The Kagera Basin countries have one of the highest dependencies on biomass for day-to-day energy needs in the world. The regional dependence on biomass is 93%, with electricity sharing less than 1% of the total energy production in the region. • Access to land is limited with many land ownership models. Landless people need a way to access land. • Inadequate access to safe drinking water and sanitation. MDG and country targets for water supply and sanitation should be met. • The current conveyance infrastructure is inadequate to transport electrical energy to the majority of the population. • Marketing of produce is a problem - farmers should gain some negotiated power to market their products.
Poor socio-economic upliftment	• Endemic poverty is experienced. • Most of the population is dependent on subsistence agriculture for their livelihood. • Diseases are the top life expectancy reducing factor in the Basin, as a result of unsatisfactory health and hygienic conditions and insufficient sanitary infrastructure. • Low levels of education and skills. • Youth account for half of the Kagera Basin population, and they are faced with multiple challenges including HIV/AIDS, agricultural land fragmentation, illiteracy and lack of professional qualifications. • Basin women are economically weaker than men. In rural areas, which make up the majority of the Basin area and where agriculture and livestock rearing are extensive, women do not own land or livestock. • Inadequate sanitation and health facilities, with lack of storage for water supply. • Lack of wastewater treatment in urban areas and industries. • Uneven distribution of water resources in the Basin, as well as seasonality of flows. • Ineffective operation and control of groundwater schemes. • Need for protection of groundwater resources. • Electricity is very expensive, there is low availability and access to electricity is very low. • Biomass is almost the only source of energy, with local need for timber (fuelwood and poles). The regional dependence on biomass is 93%, with electricity sharing less than 1% of the total energy production in the region. • Access to land is limited with many land ownership models. Landless people need a way to

BASIN CONCERNS	ISSUES
	access land. • Inadequate access to safe drinking water and sanitation. • The current conveyance infrastructure is inadequate to transport electrical energy to the majority of the population. • Marketing of produce is a problem
Natural resources development	• Many opportunities exist for water resource development and hydropower generation and power trading. • Water for multi-purpose use has a high priority, i.e. crops, irrigation, livestock, aquaculture, rural water supply, industries, eco-tourism, etc. • While the region has a high rainfall, the availability of water availability for hydropower generation tends to be very seasonal. • Large-scale expansion of marshlands irrigation and plains irrigation are planned. The current level of commercial irrigation is limited. • There are Basin development opportunities in the fisheries, forestry, tourism, mining and industrial sectors. • The potential of tourism is closely linked to water resources, and has been realised to a limited extent only. • Substantive mineral resources are present in the Basin which has not yet been exploited. • Significant hydropower potential, dependent on flow regimes, conveyance infrastructure and potential uptake.
Environmental and land degradation	• Ensuring an adequate flow regime for ecological functioning. • A number of important biodiversity hotspots, fragile areas, protected areas and wetlands are located within the Basin, which provide important and unique ecosystems that need to be demarcated (if not already) and protected. • There is a trend of degradation of Basin water resources and loss of bio-diversity. • There is an urgent need for watershed and catchment rehabilitation, conservation and restoration of ecosystems, to restore biodiversity and ecological processes. • Exploitation and consumptive use of marshland resources is worrying. • The aquatic weeds problem in the lower Kagera River needs to be controlled. • There is pollution of water resources. • Bacteriological contamination is being experienced in many water sources. • A significant amount of industries are without wastewater treatment processes. • Mining activities are the cause of extensive environmental damage in many areas within the Kagera Basin and restoration is needed. • Significant land degradation and loss of soil fertility is experienced. • High sediment loads are transported in rivers due to poor land management practices. • Deforestation - historic trends show a very sharp decline in woodland and forest resources. • Scarcity of land and land fragmentation is experienced. • Current practices of farming on steep slopes cause high soil erosion rates. • There is high deforestation and limited reforestation. • Unplanned grazing of livestock. Uganda and Tanzania have differing livestock priorities.
Influence of climate change	• Climate change is expected to impact the region within the next twenty years if appropriate adaptation and mitigation measures are not developed and implemented. • The physical manifestation of climate change impacts can threaten many aspects of water use, including food security, human health, economy, agriculture and poverty if not addressed. • Increases in the magnitude and frequency of floods and droughts as a result of climate change. • Disaster management: regional (Basin-wide) programs contributing to risk reduction is needed.

2.4 Strategic Management Priorities and Options

With the issues identified, the next step is to set priorities and decide on strategic areas. It is evident that the Basin has many challenges and problems to overcome. The best approach is not to try and resolve all the problems simultaneously, but rather to set priorities and incrementally improve the Basin situation, although the availability of funding will influence this situation. More feasible development and "low hanging fruits" should be tackled first.

In response to the problems identified at a transboundary level and the priority areas of concern, five strategic areas were identified for the Basin, to reflect the Basin priorities. All the key issues of the Basin can be sorted under these strategic areas, to be delineated further to address the key Basin concerns and opportunities.

Table 2.8 shows the identified strategic areas, associated priority concerns and opportunities, and related driving factors.

Table 2.8: Strategic areas, priority concerns and opportunities, and driving factors for the Basin

Strategic areas	Priority concerns and opportunities	Driving factors
1. An enabling environment	Basin-scale integration; Climate change; Stakeholder engagement; Policies and institutions; environmental and land degradation	Governance; change in land use, political stability, international economic climate, policies on agricultural funding, access to information and the availability of technology
2. Basin water management	Basin-scale integration; Lake Victoria; Climate change; environmental and land degradation	Governance; climate change, Access to information and the availability of technology
3. Water supply and sanitation	Population pressure; socio-economic upliftment; natural resource development	Population pressure; poverty, governance, climate change
4. Livelihoods and Socio-economic development	Population pressure; socio-economic upliftment; Food insecurity; Natural resource development; stakeholder engagement	Poverty; population pressure; governance; industrialisation and diversification; climate change, availability of energy, political stability, market access and commodity prices, agricultural development/policies on agricultural funding
5. Environmental Protection, land and disaster management	Lake Victoria; Climate change; population pressure; stakeholder engagement; Environmental and land degradation	Change in land use; governance; climate change; population pressure; environmental protection.

Each strategic option relates to one or more strategies that it aims to achieve. For each of the strategies in a strategic option, interventions and targets that realize the strategy need to be identified. Interventions are actions undertaken (projects or programmes) to realize a deliverable. **Table 2.9** provides a brief description of each strategic option and associated Basin issues, while **Table 2.10** sets out the proposed Basin strategies. The impact and implications of the driving forces and priority concerns and opportunities have been taken into account in determining the scenarios and strategies. The strategies are therefore clustered under the same strategic areas and objectives as the issues identified.

Table 2.9: Strategic Framework and Issues

STRATEGIC AREA	An enabling environment	Basin water management	Water supply and sanitation	Livelihoods and socio-economic development	Environmental Protection, land and disaster management
STRATEGIC OBJECTIVE	*Effective management and control of basin water resources and users*	*Operationalize water governance in support of Basin-wide water resources development and management*	*Provide improved access for various water uses and sanitation facilities*	*Manage and develop water resources to serve social and economic development in the Basin*	*To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices*
ISSUES	▪ Need for regional economic integration and increased trade. ▪ Inadequate capacity of national water management institutions to perform river basin management tasks. ▪ Inadequate water resources knowledge base for Basin-wide development and management. ▪ Need for improved monitoring and information systems. ▪ Inadequate effective stakeholder participation in water resources planning, development and management. ▪ Gender and youth aspects require special attention ▪ Inadequate financial resources leading to poor execution of planned activities.	▪ Absence of a river basin organisation for the whole Kagera Basin. ▪ Transboundary impacts. ▪ Addressing impacts of Basin activities on Lake Victoria. ▪ Water resource management efforts differ and vary widely between the various Basin countries. ▪ Need for enabling and harmonised transboundary policies and institutional frameworks. ▪ Lack of monitoring of potential changes in flow regimes due to development. ▪ Varying water allocation procedures ▪ Need for harmonized water allocation and management approaches. ▪ Difference in access to investment markets by riparian states. ▪ Poor maintenance of existing infrastructure. ▪ Effective implementation of the Basin Development Plan.	▪ Inadequate access to safe drinking water and sanitation. ▪ Inadequate sanitation and health facilities, with lack of storage for water supply. ▪ Lack of wastewater treatment in urban areas and industries. ▪ Inadequate sanitation infrastructure causes bacteriological pollution of groundwater and rivers and is linked to health problems being experienced.	▪ High population density, growth and urbanisation. ▪ Endemic poverty and barriers to access land for livelihood support. ▪ Insufficient water infrastructure for agricultural development to achieve regional food security. ▪ Unplanned grazing of livestock. ▪ Unsustainable and low-productivity fisheries management ▪ Low levels of economic development. ▪ Need for development of projects such as dams whose operation is optimised for multiple uses. ▪ Different and/or low levels of in-country infrastructure and inadequate access to markets and finance. ▪ Serious lack of electricity availability, with inadequate water infrastructure for achieving regional energy security. ▪ The need for equity in water allocation, access to resources and benefit-sharing. ▪ Increase in water demand and water-related activities in line with social upliftment and economic growth.	▪ High-value and unique eco-systems and related ecological and economic functions in the Basin may be threatened and fragmented by accelerated development. ▪ Significant land degradation and loss of soil fertility with associated high sediment loads transported in rivers. ▪ Inadequate protection and sustainable development and use of marshlands. ▪ Extensive deforestation and limited reforestation. ▪ Deterioration of water quality due to point pollution from mining, industry and urban centres. ▪ Invasive aquatic weeds in the lower Kagera River. ▪ Tourism development is threatened by degradation of the aquatic environment. ▪ Variability and uneven distribution of rainfall is likely to be amplified by climate change. ▪ Increases in the magnitude and frequency of floods and droughts as a result of climate change. ▪ Inadequate coping mechanisms for climate change.

Table 2.10: Strategic Areas and Strategies

STRATEGIC AREA	*Creating an enabling environment*	*Basin water management*	*Water supply and sanitation*	*Livelihoods and socio-economic development*	*Environmental protection, land and disaster management*
STRATEGIC OBJECTIVE	*To operationalize water governance in support of Basin-wide water resources development and management*	*To effective management and control of basin water resources and users*	*To provide improved access for various water uses and sanitation facilities*	*To manage and develop water resources to serve social and economic development in the Basin*	*To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices*
STRATEGIES	▪ Harmonised and improved water sector legislative and regulatory framework at regional and national levels to promote regional economic integration and increased trade (1.1). ▪ **Ensure qualified human resources and knowledge base within water management institutions for water planning, management and research (1.2).** ▪ **Strengthen knowledge base and establish IWRM information systems and tools (1.3).** ▪ Promote broad-based stakeholder representation and participation in water resources planning, development and management (1.4). ▪ Ensure adequate funding for water resources management (1.5).	▪ Integrated and coordinated transboundary Basin water management (2.1). ▪ Watershed management by Basin countries (2.2). ▪ **Effective monitoring, assessment and information management for adequate management and allocation of water (2.3).** ▪ Asset management and operation of Basin water infrastructure (2.4).	▪ Improved Rural domestic water supply (3.1) ▪ Urban water supply and treatment to potable standards (3.2) ▪ Providing improved sanitation facilities (3.3). ▪ Urban, industrial and mining wastewater treatment (3.4)	▪ **Water demand of intensified, modernised agricultural and aquaculture developments (4.1).** ▪ **Address the high demand for new water infrastructure to meet regional energy security (4.2).** ▪ Address the demand for water in sustainable mining and industrial developments (4.3). ▪ **Support sectoral conservation and development Basin initiatives from a water resources perspective (4.4).**	▪ Management and protection of natural resources (5.1). ▪ **Rehabilitation of degraded environments (5.2).** ▪ **Sustainable land management (5.3).** ▪ Water quality management (5.4). ▪ Control alien invasive aquatic weeds and prevent new outbreaks (5.5). ▪ Climate change adaptation and preparedness (5.6).

** Prioritised strategies, in line with the Specific Strategic Objectives, have been bolded. This may relate to strategies, targets or activities.*

3. STRATEGIC BASIN VISION AND OBJECTIVES

The chapter consists of three sections. The first section deals with issues of relevance to the Consultancy objectives, followed by Section Two on the Basin Vision. Section Three addresses strategic Basin objectives.

3.1 Relevance to the Consultancy Objectives

It is a necessary and good practice in Basin management to organise dialogue between stakeholders and consult with interested parties and/or the general public. The outcome of the strategic planning process should be a clear statement of the “shared vision” for the basin organisation or basin initiative, setting out its goals. Through dialogue around the strategic themes and options of “*seeking common solutions for common problems”,* participants build knowledge, relationships and trust. Together they should define a shared vision of a knowledge-based partnership of countries that fairly and effectively manages and develops the water resources of the Kagera Basin from the highlands to Lake Victoria. A shared Basin vision sets a goal of a better future, and then builds shared knowledge to catalyse cooperation and realise benefits.

3.2 Basin Vision considerations

3.2.1 Developing a Vision and Objectives

A vision outlines what the Basin IWRM Development Plan wants to be, or how it wants the context in which it operates. It is a long-term view and concentrates on the future. It can be emotive and a source of inspiration. The objectives are steps towards achieving the vision. The objectives start to identify the key areas and actions necessary in order to achieve the vision. As one further unpacks the necessary steps and actions needed to achieve the vision, the base or contributing elements increases, as illustrated in **Figure** 3.1. Ultimately the Vision and Objectives are the summary of the strategic plan.

Figure 3.1: Hierarchy of the Vision and Objectives

The strategies and targets are described later in this report.

3.2.2 Drafting the Kagera Basin Vision

The Kagera Basin has many demands on it. It is an important water resource for the Nile Basin and Lake Victoria, it is a key water resource to the member states of the Basin, and it is a resource of the East Africa Community (EAC). Each of these groups has their own visions and objectives, which include the utilisation of the Kagera Basin. Each of these needs to be considered, together with the Consultancy objectives and the problems and issues identified in the Basin area, in order to determine the appropriate vision and objectives for the Kagera IWRM BDP.

EAC, Nile Basin and Lake Victoria applicable visions

The Africa 2025 vision is "*An Africa where there is an equitable and sustainable use and management of water resources for poverty alleviation, socio-economic development, regional cooperation and the environment."*

While the East African Community (EAC) vision is "*One People One Destiny",* and the Southern Africa Water vision is "*Equitable and sustainable utilisation of water for social, environmental justice, and economic benefits for present and future generations."*

The Goal of the Nile Basin Initiative is *"To achieve sustainable socio-economic development through the equitable utilization of, and benefit from, the common Nile Basin water resources"*
The primary objectives of the NBI are:

- to develop the water resources of the Nile Basin in a sustainable and equitable way to ensure prosperity, security and peace for all its peoples;
- to ensure efficient water management and the optimal use of the resources;
- to ensure cooperation and joint action between the riparian countries, seeking win-win gains;
- to target poverty eradication and promote economic integration; and
- to ensure that the programme results in a move from planning to action.

The vision and mission of the Lake Victoria Basin Commission is "*A prosperous population living in a healthy and sustainably managed environment providing equitable opportunities and benefits*" and "*to promote, facilitate and coordinate activities of different actors towards sustainable development and poverty eradication of the Lake Victoria Basin*", respectively.

Member State's Visions

Each of the member States has their own National Water Policies and Vision 2025 for growth and development, which includes the utilization the water resources of the Kagera Basin. These are listed in **Appendix B**.

Consultancy Objectives

The goals of this consultancy for the Kagera Basin were:

- Poverty reduction;
- Environmental degradation reversal; and
- Economic development.

Basin Criteria

Drawing on the themes and aspects of the above mentioned visions and objectives, the following criteria for developing the Kagera Vision and Objectives were identified: *(listed alphabetically)*:

- Adaption to climate variability and climate change
- Capacity building
- Environmental and water resource protection

- Equitable and reasonable utilisation of water resources
- Financial support
- Future generations
- Governance accountability
- Improved livelihoods
- Improved sanitation
- Institutional structures
- Knowledge growth and training
- Legislative framework
- Peace
- Poverty reduction
- Regional Cooperation
- Stakeholder participation
- Sustainable social and economic development
- Water resources management
- Water supply

These were drawn from various sources such as the Basin issues, policy documents of the Basin countries, good practice etc.

3.3 Kagera Basin Vision

The Vision and strategic objectives are developed from the synthesis of the national policies and consultation workshops conducted with the key National stakeholders. The synthesis of the most important policies and strategies that were reviewed are contained in **Annexure A**: National policy and strategy frameworks of Basin countries. The results of the consultation with stakeholders are attached in **Annexure B**.

It was decided at the Strategic Planning workshop that a small Working Group of key Basin stakeholders should take this further and finalise the Basin Vision and strategic objectives. The process resulted in the following vision statement:

> **"Joint management and sustainable development of the Kagera Basin water resources for peace and prosperity"**

This vision statement is a declaration of where you are headed – a summary of your preferred future state – in order to formulate a picture of what you are trying to achieve in the Basin. The vision encompasses the two major areas of basin development and sustainability, as described below:

Sustainability of water use will ensure the following:

a) A basic water requirement will be guaranteed to all humans to maintain human health.
b) A basic water requirement will be guaranteed to restore and maintain the health of ecosystems.
c) Water quality will be maintained to meet certain minimum standards. These standards will vary depending on location and how the water is to be used.
d) Human actions will not impair the long-term renewability of freshwater stocks and flows.
e) Data on water resources availability, use, and quality will be collected and made accessible to all parties.
f) Institutional mechanisms will be set up to prevent and resolve conflicts over water.
g) Water planning and decision-making will be democratic, ensuring representation of all affected parties and fostering direct participation of affected interests.
h) Human capital and Knowledge base.

Basin development (water resource development): With reference to the situation analysis, the following thematic areas of development opportunities can be identified:

a) Improved rain-fed agriculture productivity (land use productivity).
b) Increased irrigated agriculture: There is a potential to significantly increase the currently irrigated 40 780 hectares in the Basin, when compared to the total of 2.2 million ha of cultivated land in the Basin.
c) Hydropower development: Ten hydropower sites were identified and nine large scale dam sites were identified that could *inter-alia* development hydropower.
d) Water supply: The projected 2032 domestic water demand is expected to be 533 million m^3/a.
e) Industrial and non-domestic water use: The industrial and non-domestic demand for the Basin is expected to be 97 million m^3/a in 2032.
f) Fisheries and aquaculture development: Within the region, 968 km^2 of surface water bodies have been identified for possible capture fisheries development as well as the possibility of aquaculture development within the 1 755 km^2 of available wetlands.
g) Tourism is a significantly growing activity in the Basin, with pro-poor tourism to be encouraged.
h) Navigation (longer term): Navigation is possible along the lower part of the Kagera River and through to Lake Victoria but is of a lower priority in the Basin.

3.4 Strategic Basin Objectives

3.4.1 Draft strategic objectives

Drawing on the criteria identified from the Basin a set of draft objectives was tabled by the consultant for discussion at the Consultancy Diagnostic Assessment Workshop. These were:

a. Integrated and coordinated water resources development/ management;
b. Achieve higher levels of economic and social development;
c. Committed sustainable environmental / natural resources management; and
d. Enduring capacity building and information sharing

The attendees split into working groups by country and commented on the Draft Objectives. The detailed comments of these discussions are included in **Annexure B**.

3.4.2 Criteria for selection of the specific strategic objectives

It is well understood that it is not likely that all development opportunities will be undertaken with the scope of this planning horizon. It has been agreed that at most five development opportunities will be developed further using the following criteria and taking into consideration that at-least one specific objective will ensure sustainability of the proposed development opportunities. The key criteria for selection were the following

a) Impact on the Basin development;
b) NELSAP selection criteria;

3.4.3 Specific Strategic Objectives

Using the above criteria, the following five specific objectives were prioritized:

a) Human capital and knowledge base;
b) Improved rain-fed agriculture productivity (land use productivity);
c) Increased irrigated agriculture;
d) Hydropower development; and
e) Fisheries and aquaculture development.

4. PRIORITISED PORTFOLIO OF PROGRAMMES / PROJECTS

The chapter consists of seven sections. The chapter commences with issues of relevance to the Consultancy objectives (Section 4.1) and an introductory paragraph on the Terms of Reference (Section 4.2). The third section (Section 4.3) deals with the identification and selection of projects and programmes, while Section 4.4 addresses the screening of projects. The screening results and prioritisation are explained in Section 4.5. Strategic recommendations on the prioritised portfolio of projects and programmes follow in Section 4.6, while Section 4.7 summarises the cumulative impacts on water resources.

4.1 Relevance to the Consultancy Objectives

It is required that a project portfolio of structural (investment) projects and supporting non-structural projects be included in the Development Plan - with the objectives of developing some of the Kagera Basin's water and related resources, and of minimising harmful effects that might result from natural occurrences and man-made activities. The link with the previous Chapter's recommendations is in the justification of the development priorities, and application of development screening criteria representing the development objectives and priorities to the potential projects.

4.2 Introduction

The ToR for this Basin Development Plan (BDP) stresses the "*need to develop a package of structural and non-structural options as a contribution towards providing security of access to water and an environment that is resilient to change*". The plan is expected to "*include a project portfolio of structural (investment) projects and supporting non-structural projects, to develop some of the Kagera Basin's water and related resources and minimise harmful effects that might result from natural occurrences and man-made activities*".

Paraphrasing from **Section 3.2.2** in the ToR the plan is expected, in identifying, categorising and prioritising projects and programmes at basin level, to:

- Develop a database of bankable programmes and projects, summarising their technical specifications and specifying transboundary and/or common aspects.
- Include non-structural and supporting or enabling activities.
- Integrate the project portfolio into the BDP, including cost and financing considerations, and the many possible impacts of implementation.

The task has been to gather and evaluate, in a single package for the whole Basin, the various development options that have been identified and proposed by many different parties over many years. The task is one of consolidation, screening and evaluation, and finally integration. This integration is critical in that it provides perspectives on:

(i) The overall extent and impact of development (local and cumulative impacts).

(ii) How resources can be shared within the basin.

(iii) The nature of past investigations and plans and their strengths and weaknesses, thereby allowing for recommendations to be made within the framework of IWRM.

4.3 Selection: Identification of Projects and Programmes

4.3.1 What is a Bankable Project?

It was expected of the Basin Development Plan that:

- Projects would be water resources related.

Comment: It was understood that bulk water schemes would, in all likelihood, predominate. This has proven correct.

- Local individual projects would be excluded from the Kagera Basin Project portfolio.
  Comment: This did not prove to be a realistic criterion, as each country must be allowed its own projects - and whilst these may not be directly matched in other countries the integrated portfolios can still be balanced.

- Trans-boundary projects would be prioritised. Alternatively projects should be matched or replicated in two or more countries.
  Comment: A weakness of previous project selection has been the attempts to match projects in different countries rather than to balance national portfolios. The balancing of portfolios, which may comprise different individual projects, has been the approach adopted in this BDP.

- Development programmes, such as catchment watershed management programmes, which can be implemented across the landscape and by definition, can impact across boundaries, could be considered.
  *Comment: These programmes are, to a greater or lesser degree, being addressed by a concurrent study undertaken by LTS International (LTS, 2012). The LTS research is discussed in **Section 4.3.8**.*

The term "bankable" can be interpreted as applying to projects that are indicative of being a good investment - with investment either by government, development agency, or financial institution, each of which may have very different reasons for justifying that investment. To be fully bankable an investor would need to have all the information needed to make a decision. In the Kagera Basin the *Rusumo Falls Run of River hydropower scheme* and the far smaller but still significant *Kikagati run of river hydropower scheme* both fit into this category.

Many projects do, however, show that they are ***potentially bankable***, i.e. the evidence is sufficient to warrant investment in further studies towards achieving '*investor bankable statuses*. Such investment may be by government or donor, if not by an investment company or banking institution. In the absence of clearly "*bankable*" projects within the Kagera Basin, the BDP has reviewed previously identified projects with a view to their potential bankable status. Screening, cost-benefit analysis, and consideration of potential fatal flaws are all part of this process.

4.3.2 Overview of the project selection process

Project proposals, plans, and studies dating back to 1976 were reviewed for selection in terms of the 'bankable' criteria as outlined above. The level of project investigation was found to be very variable, with information contained either in preliminary investigations of proposed projects by consultants – often in response to terms of reference for the investigation of development opportunities – or in pre-feasibility or feasibility studies undertaken.

There has been a high level of feasibility study activity in 2012, with Dr Ntale's investigation for NELSAP of nine large dams released only in October 2012, Tractebel's feasibility studies into four more dams completed in November 2012, and the LTS Kagera Integrated Water Management Plan dated 15 November 2012. This new information has required that a number of projects be re-evaluated.

Some proposed projects have been "on the books" for a very long time, with these projects re-appearing as possibilities each time an investigation is undertaken. All identified projects of significant scale for which some information was provided or could be found are included here. Projects that are clearly unsuitable should be relegated to a database of "evaluated but rejected projects".

Projects that have been named by stakeholders but for which there is no detail have been listed (table 4.1(c)) these could not be evaluated. Any "missing" projects should be added to this list for future evaluation.

Gaps in the existing project portfolio are also identified (**Section 4.3.9**).

Classification of projects

Projects of very different type and magnitude cannot reasonably be compared with each other for selection and prioritisation, and were therefore first fitted into categories for screening. Once screened within categories it becomes possible compare the merits of different investments in accordance with the scoring system developed. The following categories were used:

(i) *Hydropower schemes*

These are schemes where the key rationale is the production of hydropower. Where dams are constructed (i.e. where schemes are not strictly 'run of river' and based on weir impoundments only) irrigation may be an additional activity. Hydropower schemes requiring dams are not included with other "larger dams" as the cost recovery potential of hydropower has a large impact on scores.

(ii) *Larger dams*

These are all large projects - some of which could support small or micro hydropower installations, particularly where these could be connected to the electricity grid. These dams would primarily provide water for irrigation and domestic supplies, with hydropower at least providing the energy for the pumping of domestic water. All these dams have a wall height of >15 m and a capacity of >30 million m^3.

(iii) *Smaller dams.*

The World Bank classifies any dam with a wall height of < 15 metres as a small dam, but for screening purposes "capacity" proves a more useful comparative measure. Dams with a height of <15 m OR with a capacity of < 30 million m^3 were therefore grouped together as "smaller dams", these mainly supplying water for irrigation and domestic use. *(The ICOLD classification classes dams of 5-15m and with a capacity of > 3 million m^3 as large dams but that would group all dams considered in this study into one class.)* Hydropower generation is unlikely to be viable at most of these smaller dams, other than to pump water to local domestic supply systems.

(iv) *Irrigation schemes*

These are dedicated irrigation schemes that do not require the construction of a dam. However, scheme development may require complex water resource capture and distribution systems such as diversion weirs, farm dams, canals and pipelines.

(v) *Other projects (Pipelines, Water quality and mining, Aquaculture, Water kiosks)*

None of these projects can be strictly compared, and each should be considered on its own merits.

(vi) *Watershed and wetlands management projects (LTS)*

This is a very important suite of projects proposed by LTS International, with a Draft Final Report released on 15 November 2012. The detail for these projects is well covered in the LTS Report (LTS, 2012), along with project prioritisation, costing and scheduling. For an introduction to these Watershed Management Projects see **Section 4.3.8**. A listing of sub-projects proposed and prioritised by LTS is included under **Section 4.5.7** in this report (see **Table 4.12**).

Scoring provides a measure of individual merit <u>within</u> the various categories. Scores should not be compared <u>across</u> categories.

Impact of environmental flows on available water and on potential for hydropower development

This analysis of projects is based on existing study reports. Very few of these studies took environmental flow releases into account.

All rivers should be left with sufficient water, after abstraction and use, for their continued environmental functioning. This is the environmental flow, and the guarantee of this flow is a very strict requirement of funding agencies, both donor and loan funding. Environmental flows are aimed at ensuring that rivers continue to provide social, health, economic and environmental benefits that would be lost if river function deteriorates beyond a certain tipping point. These benefits are aimed at the users of the watershed concerned and far outweigh the cost of the water that is not used but allowed to remain within the system, sometimes through deliberate releases from dams to ensure continued flows in rivers downstream.

The design and operation of any dam or project must therefore take account of the environmental flow requirements of the river downstream. Water should be released to the river downstream of any dam to mimic the natural seasonality of the river. This may affect the utilisable yield and the generation of hydropower.

Environmental flows are also required where rivers are seasonal, or have very low dry season flows. In these rivers the environmental flows should not be more than the actual natural flow that would be expected at that season. This means that the release of stored water to generate power in the low season may also be limited, contributing to the difficulty in managing variable power output.

In the case of releases for hydropower or irrigation, the river ecology may be disturbed if the river channel is used as a conduit for the released water.

Annexure E of the Basin Development Plan provides a discussion and determination of environmental flow requirements in the Kagera Basin and it is recommended that all further studies should address this requirement.

4.3.3 Costs of Schemes

Assumptions made for cost estimates

Cost estimates have been based on information gleaned from the many various reports. In cases where the information provided in these reports proved inconsistent with the assumptions described below, revised figures were determined. The procedures for checking the consistency of the information provided in the reports were as follows:

Hydropower Schemes

- For Kakono, Kishanda Valley, Nsongyezi 85 MW and Rusumo Falls run of river hydropower schemes the Megawatt capacity was based on the head and on the mean annual runoff (MAR) stated in the reports, assuming an efficiency of 90%. Annual Gigawatt hours were determined on a similar basis.
- For the Nyabarongo and Ruvyironza schemes a similar procedure was used except that annual Gigawatt hours of energy was based on 80% of the head in the reservoir to account for average drawdown in the reservoir.

Larger and Smaller Dams

- The hydropower potential in Megawatts of multipurpose dams was determined as described above assuming that all releases for irrigation and domestic supplies would generate power.
- The areas that could potentially be irrigated were based on the yield, which was assumed to be 80% of the MAR, divided by the assumed irrigation requirement based on assumed evapotranspiration of 2 m per annum less mean annual rainfall based on the isohyetal map, and efficiency for flood irrigation of 50%.
- The distance downstream was also checked by dividing the irrigable area by the average valley widths and assuming that the maximum distance below the dam that could be irrigated would be limited to 30 km.

- The domestic demands in the reports are generally based on 30 litres/person/day and the corresponding demands were checked on this basis.

Significant gaps in the information provided by most of these previous investigations are the costs of the infrastructure that would be served by the proposed dams. The following are examples of this infrastructure, with approximate cost assumptions:

- In the case of the hydropower schemes some of the estimates make provision for the cost of the dam and the hydropower installation, but where this is not provided a cost of $3000/kW was assumed.
- None of the investigations provide estimates for the costs of the irrigation schemes. It is recognised that in some areas the existing irrigators may already be served by rudimentary schemes. However in order to make full use of the proposed dams, main canals or other distribution systems should be provided as well as appropriate systems to effectively distribute the water to the farms/fields. For cost estimation it was assumed that irrigation schemes would cost $5000 / hectare.
- The capital costs of domestic water supply including the treatment works, pumps, rising mains, reservoirs and distribution pipelines were assumed to cost $250 / person each supplied with 30 l/day. The numbers of persons served were based on the numbers identified in the reports, although these numbers generally seem to be very high.

4.3.4 Selected projects

The projects identified in previous studies that have been selected for further screening are listed by category in **Table 4.1** and their locations are shown in **Figure 4.1**.

Projects understood to already be in the implementation phase are listed in **Table 4.2** whilst further projects put forward by stakeholders but which are already planned as part of existing national programmes or for which there is no information or which, in some cases lie outside the Basin, are listed in **Table 4.3.**

Relevant information for each project selected for screening was assembled and recorded against a standardised information template for use in the screening process. Information *inter-alia* includes: location, technical data, benefit sharing, social and environmental impacts, and preparedness for implementation, along with risks and possible fatal flaws. This information is to be found in **Appendix C**.

For those projects at identification or prefeasibility stage, the available information is often weak or non-existent. Often projects appear to have been selected on physical opportunity (e.g. the presence of an apparently suitable dam site or, perhaps, the presence of a site that allows for projects that match across countries), rather than on identified need or the optimisation of benefit.

The added assumption that many dams can meet both irrigation and hydropower demands appears to have been driven by the requirement that dams be developed as “multipurpose dams” when this may not be technically practical, particularly with regard to the generation of hydroelectric power. This has led to a revision of purpose in many of the smaller and some of the larger dams – putting the focus on domestic water supply and irrigation, with dams probably only generating sufficient hydropower to pump water to holding reservoirs for supply purposes.

Table 4.1: Projects selected for screening as potential bankable projects

Hydropower schemes	Larger dams	Smaller dams	Irrigation schemes	Other projects
Tanzania • Kakono • Kishanda Valley **Uganda-Tanzania** • Kikagati • Nsongyezi (85MW, 65MW and 39MW options) **Rwanda-Tanzania** • Rusumo Falls RoR **Uganda** • Maziba Gorge 1.18MW - refurbish **Rwanda** • Nyabarongo II • Ruramba (4MW) **Burundi** • Ruvyironza	**Tanzania** • Kakanja **Uganda** • Kagitumba-Mazimba **Rwanda** • Cyanuzi-Kagogo • Muvumba • Nyabarongo **Rwanda-Burundi** • Kanyaru **Burundi** • Upper Ruvubu • Ruvyironza	**Tanzania** • Karazi **Uganda** • Bigasha • Kabuyanda **Rwanda** • Taba-Gakomeye **Burundi** • Buyongwe • Gashayura • Kavuruga • Mbarara • Munyange-Vumbi	**Tanzania** • Ngono Valley **Rwanda-Burundi** • Bugesera **Rwanda** • Nyanza Hillside **Burundi** • Buyongwe	**Basin countries** • LTS Watershed projects • LTS Wetlands projects • Aquaculture - fingerponds • Katuna water kiosks • Mining (water resource protection) **Rwanda** • Mutobo pipeline

Table 4.2: Projects currently being implemented

Hydropower schemes	Larger dams	Smaller dams	Irrigation schemes	Other projects
Rwanda • Nyabarongo I (Mwogo R – 27.5 MW) • Nyabarongo II - out to tender (Nov 2012)	•	•	• Nyanza Hillside Irrigation	• Mutobo pipeline

Table 4.3: Projects brought to the attention of the Consultancy but not evaluated

Country and Project	Reason why not evaluated
Tanzania • Kagera Region irrigation schemes (including Bigombo and Burigi irrigation) • Miyogozi Dam. Proposal at preliminary level.	• Knowledge of dam first provided by stakeholders in Bujumbura on 27 November 2012. No further information available.
Rwanda • MINAGRI irrigation schemes • Ntaruka A: 11.3 MW and/or irrigation: Mukungwa catchment (upper Nyabarongo – Ruhengeri)	• MINAGRI has an extensive list of schemes. Only larger irrigation schemes have been considered • Proposal by Ngali Energy – Digitech. Insufficient information available.
Burundi *Irrigation schemes:* • 160 ha rice and 1450 ha sugarcane on the Rutana, Ruyigi, Cankuzo plains. • 14 470ha rice in the high altitude areas of Ngozi, Muyniga, Karuzi, Gitega. *Power plants* • Water and power (75 MW) for the Musongati mine belt • Kaganuzi (5MW) - Ruzizi catchment • Kabu 16 (20MW) - Ruzizi catchment • Mpanda (10.4MW) - Kabira River Basin	• Small and dispersed project. Not considered under infrastructure portfolio • Dispersed projects • Outside the Kagera Basin • Outside the Kagera Basin • Outside the Kagera Basin • Outside the Kagera Basin

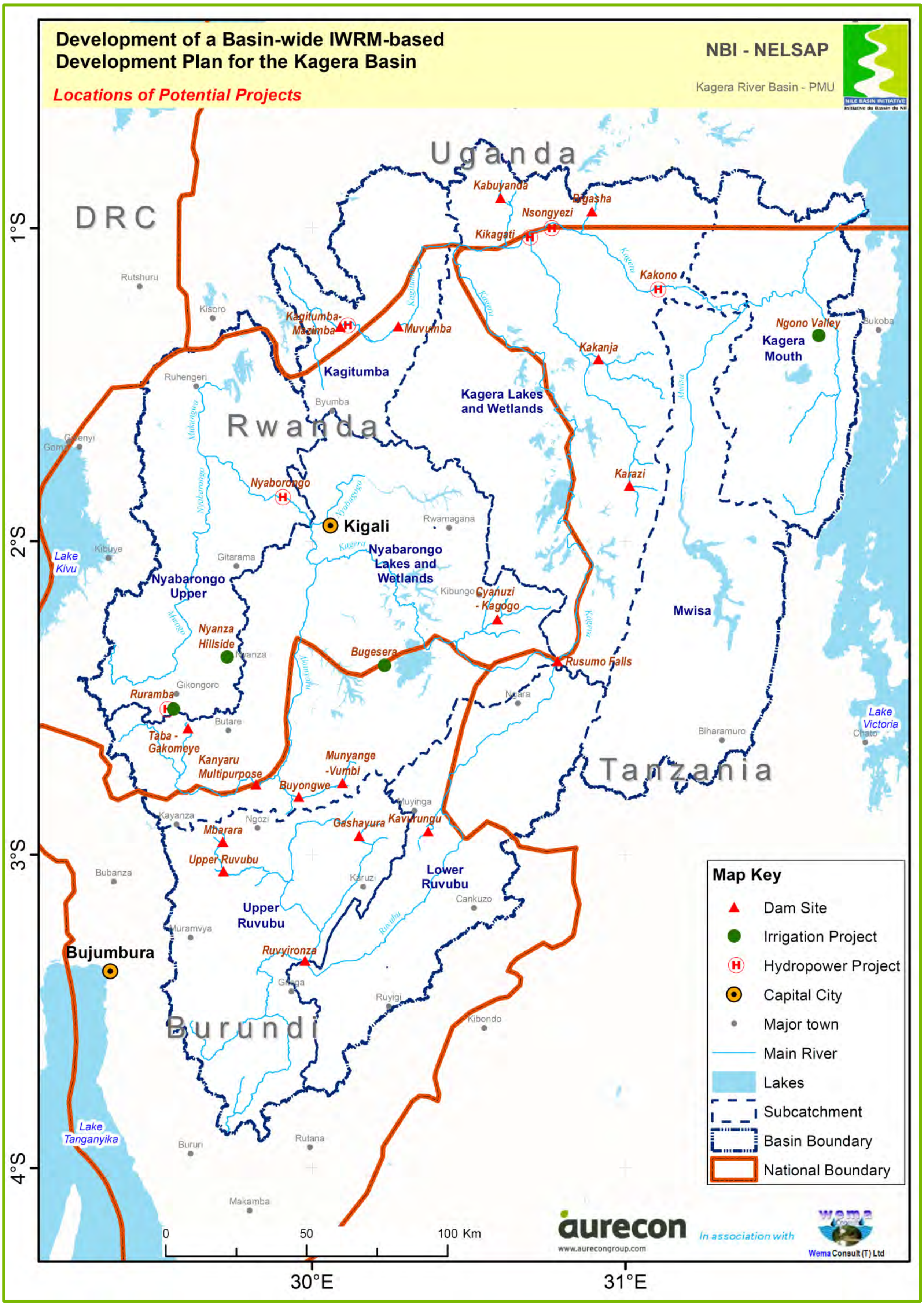

Figure 4.1: Location of Projects

4.3.5 Hydropower schemes

The main features of the Hydropower Schemes that have been evaluated are summarised in **Table 4.4** which also summarises the estimated peak power and average annual energy benefits:

- The Kakono, Kishanda Valley, Nsongyezi 39 MW, Kikagati and Rusumo Falls Run-of-River Hydropower Projects would essentially operate as run of river schemes with limited active storage, although Rusumo Falls would be the only scheme with no reservoir storage. The run-of-river operation of these schemes would have small impacts on river flows downstream; however the reservoirs of the first three schemes would inundate significant reaches of river with associated socio-economic and compensation costs as well as environmental impacts. The Nsongyezi 39 MW and Kikagati schemes would operate in a similar fashion. Proposals have previously been made for large areas to be irrigated from the Kakono and Kishanda schemes.
- The Nyabarongo II Dam would generate hydropower and would also provide water to irrigate 2 612 ha and supply 18 million m^3/annum to Kigali. The significant storage provided would enable year-round operation of the hydropower scheme in accordance with electricity demands, with the high MAR meaning that there is little concern with regard to meeting the environmental flow requirements, although siltation will most probably reduce the longevity of the dam. The scheme would have high socio-economic impacts.
- The Ruvyironza Dam for hydropower would inundate a significant area, with consequent social impacts. With storage of 373 million m^3 in a river with a MAR of 788 million m^3 this dam should enable year round operation, depending on the environmental flow requirements of the river downstream.

The Kakono, Nsongyezi and Rusumo Falls hydropower schemes could all make significant contributions towards meeting the growing electricity requirements of the Kagera Basin countries; however only the Rusumo Falls scheme has recently been investigated at feasibility level. Kishanda Valley would have such high social and economic impacts that it is unlikely to be considered bankable by any funding agency.

The Nyabarongo Dam is centrally located in Rwanda and, given the power requirements of nearby Kigali, is unlikely to provide additional power to other Basin countries. The feasibility studies of 2008 and 2012 both identified significant social impacts, and further work should be undertaken to reassess the project – although it is understood that this project has recently been put out to tender (Stakeholder input, Bujumbura, 27 November 2012). The current construction of another hydropower dam on the nearby Mwogo River (Nyabarongo I; 27.5 MW) does not appear to impact on the feasibility of the Nyabarongo II Dam scheme but the cumulative impacts of these two dams must be borne in mind.

The Ruvyironza Dam in Burundi is also centrally located in that country and is unlikely to have surplus power to supply beyond national borders

Table 4.4: Main Features of Hydropower Schemes

	Kakono Hydropower Project	Kishanda Valley Hydropower Project	Nsongyezi 39 MW Hydropower Project	Nyabarongo Multi-purpose Dam	Rusumo Falls Run of River Hydropower	Ruvyironza Multi-purpose Dam	Kikagati Hydropower Project	Maziba Small Hydropower Project	Ruramba Small Hydropower Project
Countries	**Tanzania**	**Tanzania**	**Uganda and Tanzania**	**Rwanda**	**Rwanda and Tanzania**	**Burundi**	**Uganda**	**Uganda**	**Rwanda**
MAR (million m^3/annum)	7 400	7 400	6 951	2 176	6 951	788	6 951	142	19
Height (m)	26	100	20	48	27	96	12	39	35
Active Storage (million m^3)	27	240	unknown	221	0	373	0	0	17
Consumptive use (million m^3/a)				70.2		35.4			
Peak Power (MW)	53	207	39	20	46	28	16	1	3
Average Energy (GWh/a)	426	1 633	309	134	401	106	115	7	
Irrigated Area (Ha)				2 612		1 800			
Domestic Supply Population				1 642 710		264 531			
CAPITAL COSTS ($ million)									
Dam and Hydropower	414	1 149	160	165	235	162	60	3	13
Domestic Supply				13		9			
Irrigation, Livestock & Aquaculture				411		66			
TOTAL	414	1 149	160	589	235	237	60	3	13

NOTES:

1. Kakono average energy based 1976 UNDP Report. Capital costs based on 1976 UNDP Report and escalated in accordance with Rusumo estimates.
2. Kishanda average energy based 1976 UNDP Report. Capital costs based on 1976 UNDP Report and escalated in accordance with Rusumo estimates.
3. Nsongyezi capital cost unknown
4. Nyabarongo energy based on 2008 Report and capital costs based on 2008 Report escalated. Capital cost estimate includes "compensation" and "administrative, engineering and contingency costs" each comprising about 25% of the total cost.
5. Rusumo capital cost based on 2008 Preliminary Report estimate escalated to 2012 and energy also on 2008 Report
6. Ruvyironza capital cost and energy based on approximate current cost estimates.
7. Kikagati capital cost unknown
8. Maziba capital cost based on 2010 study
9. Ruramba capital cost based on July 2012 study
10. Capital costs do not include provision for transmission lines.

4.3.6 Larger dams

The main features of the six Larger Dams assessed as multipurpose schemes are summarised in **Table 4.5,** which also indicates the potentially irrigable areas, and the estimated numbers of people that would be provided with supplies of water for domestic use. **Table 4.5** also summarises the hydropower potential of the proposed dams assuming that hydropower would be developed by all releases.

The valley below Muvumba Dam (Nyagatare Water Resource Development Project) is wide with a large area that could be irrigated within reasonable proximity to the dam as indicated in **Table 4.5**. The primary purpose of this project however is domestic and stock water supply, with an area below the dam targeted for irrigation and growth. The number of persons that would be served by the dam if development is focused upstream is not clear from studies, but currently appears to be 30,000 people, growing to 120,000, and with a potentially irrigable area of 8400 ha that would be served by a 45 km long canal, however the yield of the dam would only be sufficient to serve about 6,000 hectares. The 2012 feasibility study considerably downsized the capacity of this dam, from 191 million m^3 to 109 million m^3. Up to 3 MW of hydropower could be generated, some of which would be utilised for pumping the domestic supply. The cumulative impact of this dam, together with the Kagitumba-Mazimba dam must also be determined – again with possible trade-offs between these schemes.

The valleys below the other dams are relatively narrow and the full allocations would not be utilised within the 30 km limit assumed as a maximum for supplying water for irrigation below the dams. This may also increase the costs of distributing water for irrigation to more than those indicated in **Table 4.5**. It should also be noted that the cost estimates for these analyses do not provide for any additional costs that may be required to prepare the agricultural areas for irrigation or for local water distribution.

The hydropower potential shown in **Table 4.5** is affected by the available yields and heights of the dams. Hydropower releases may be constrained by the environmental flow requirements and by the irrigation requirements as indicated above.

Table 4.5: Main Features of Larger Dam Schemes

	Cyanuzi-Kagogo Dam	Kagitumba-Mazimba Dam	Kakanja Dam	Kanyaru Dam	Muvumba Dam	Upper Ruvubu Dam
Countries	**Uganda and Rwanda**	**Uganda and Rwanda**	**Tanzania**	**Rwanda and Burundi**	**Rwanda**	**Burundi**
MAR (million m^3/annum)	64	148	75	826	198	239
Height (m)	25	280	14	52	43	46
Active Storage (million m^3)	40	26	72	334	109	110
Consumptive use (million m^3/a)	13	15	30	26	85	18
Peak Power (MW)	0.0	10.7	0.3	14.5	2.9	3.6
Average Energy (GWh/a)	3	81	2	84	17	21
Irrigated Area (Ha)	unknown	178	2 493	12 479	2 198	8 137
Domestic Supply Population	unknown	46 728	12 000	614 202	29 788	154 613
CAPITAL COSTS ($ million)						
Dam	13	32	6	92	104	70
Hydropower	1	32	1	44	9	11
Domestic Supply	8	12	3	154	7	39
Irrigation, Livestock & Aquaculture	3	1	3	62	11	41
TOTAL	25	77	13	351	131	160

4.3.7 Smaller dams

The main features of the Smaller Dams assessed as multipurpose schemes are summarised in **Table 4.6.**

The assumptions for the distribution of water for irrigation and domestic use from the Smaller Dams, and their limitations, are identical to those for the Larger Dams. The irrigable areas downstream of the Bigasha, Kabuyanda and Karazi Dams would be limited by the available supply and the area below Munyange-Vumbi Dam by the assumed maximum distance of about 30 km. The areas below the Gashayura, Kavuruga and Mbarara Dams were determined by the previous studies.

Table 4.6 also shows that there is very limited potential for hydropower generation at the smaller dams except at Gashayura and Kavuruga Dams where more than about 0.2 MW (200 kW) of power could be generated.

Table 4.6: Main Features of Smaller Dam Schemes

Dam	Bigasha Dam	Gashayura Dam	Kabuyanda Dam	Karazi Dam	Kavuruga Dam	Mbarara Dam	Munyange-Vumbi Dam	Taba-Gakomeye
Countries	**Uganda**	**Burundi**	**Uganda**	**Burundi**	**Burundi**	**Burundi**	**Burundi**	**Rwanda**
MAR (million m^3/annum)	10	81	14	30	60	17	39	42.9
Height (m)	12	20	20	10	20	19	14	14
Active Storage (million m^3)	6	20	10	9	11	10	7	8.1
Consumptive use (million m^3/a)	5	33	11	9	11	10	26	*8.3 potential*
Peak Power (MW)		0.4	0.1		0.3	0.1	0.2	
Average Energy (GWh/a)		3	1		2	1	1	
Irrigated Area (Ha)	430	1 212	435	500	452	489	900	*900 potential*
Domestic Supply Population	168 000	170 720	73 009	125 000	47 764	79 783	10 000	*468 000 potential*
CAPITAL COSTS ($ million)								
Dam	37	17	13	18	12	11	18	10
Hydropower	0	1	0	0	1	0	0	
Domestic Supply	18	43	17	5	12	20	5	
Irrigation	2	6	2	27	2	2	27	
Aquaculture & Livestock	3			4			4	
TOTAL	60	67	33	54	28	34	54	10

4.3.8 Watershed management projects

The consultancy LTS International has undertaken the preparation of a *'Feasibility Study for an Integrated Watershed Management Programme for the Kagera River Basin'*. This very thorough feasibility study was undertaken in conjunction with NELSAP as part of the Nile Basin Initiative (NBI) under Basin Grant TF095077. The draft final report for this study is dated 15 November 2012.

The focus of the LTS study is on watershed management and wetlands projects. The projects are required to address:

- Land and vegetation degradation / soil moisture deficits.
- Hydrological change – flows, sedimentation, pollution (caused by land degradation, including deforestation), and pollution, and
- Threats to wetlands.

This complements the BDP study in that it provides for a very different suite of small-scale but highly replicable development activities, as opposed to the larger infrastructure projects on which the BDP is focused. The approach has been strongly participatory and has aimed at identifying intervention activities to locate projects in hot-spot areas determined through sub-watershed characterization with ranking based on:

- Land degradation; population pressure and soil erosion risk.
- Soil moisture deficits (need for additional water to enhance productivity).

The feasibility study has, quite logically, recommended country-based programmes. Each country programme has a range of ***watershed management projects*** and up to five (additional) ***wetlands projects***. Two trans-boundary wetlands programmes have also been recommended. Village water supply and irrigation are also listed, but not given attention as these, together with energy, are the focus areas for the infrastructure projects.

There are a number of features to the proposals made in the LTS study, these being:

(i) **Soil and water conservation** projects predominate - and rightly so. There are already national programmes to deal with the issue of land degradation and it is these that should be developed and supported with great urgency.

(ii) **The wetlands projects** are predominately structured around assessment, evaluation, research and the development of guidelines, with some demonstration trials or projects. The intention is presumably that these studies and demonstrations will lead to the development of national programmes for implementation, and the question is whether these national programmes could not be introduced more rapidly rather than only as trials. This especially where the need is clear and there is ready experience elsewhere on which to draw (for example SIDAs work in soil and water conservation in Kenya).

(iii) **The watershed projects** are also at this stage a range of small projects scattered across the four countries. It is argued, correctly, by LTS that circumstances are different in each country, but these projects are unlikely to have any impact unless they can be implemented, adopted, and adapted widely and rapidly. Experience also needs to be shared between countries as there are clearly important project themes missing in some countries (for example forestry in Rwanda).

(iv) **Rainwater harvesting** is given one project – yet this is typically a programme that can be implemented widely and immediately across all countries in close alignment with soil and water conservation measures and programmes to improve catchment soil water deficits and agricultural production.

(v) **Groundwater** is the most important gap, with only one project in Tanzania. Projects on groundwater fall right between the large infrastructure projects of the Aurecon/WEMA study and the Wetlands and Watershed projects of the LTS Feasibility Study. Although much of the Kagera Basin is well-watered, rainfall is strongly seasonal and groundwater is both a singularly important and accessible resource in supplying hundreds of thousands of scattered villages and homesteads. The importance of groundwater as a reliable source of safe and clean water is rarely acknowledged. Large infrastructure projects can provide surface water only to a few small pockets of the population, and that at great expense, whilst access to groundwater can be locally and affordably implemented and has the potential to bring water within the reach of the vast majority. This will, however, require facilitation.

More details of the LTS Watershed Study can be found in **Appendix D**.

For further discussion see also **Section 4.5.7** and **Table 4.12**.

4.3.9 Projects selected: weaknesses and gaps

The BDP project prioritisation process focuses on projects that have been recently investigated but not yet adopted for implementation. The large Hydropower schemes that have been evaluated are site specific, whereas some of the Larger Dam schemes and most of the Smaller Dams are typical of schemes that could also be implemented at many locations. If balance in investment and use of water is a criterion for Basin sharing, then existing infrastructure should also be added into the accounting of the national infrastructure stock of each of the four basin countries. This could have a major influence on project selection across catchments or countries.

Many of the studies, some of which are on-going, have not yet addressed the additional infrastructure and other development requirements that would be needed to utilise the water and electricity that would be provided by dams at the identified sites. There is consequently a lack of information required for decision-making as many of the schemes have not been integrated in terms of clear overall cost and benefit. This has made it necessary to:

(i) Estimate the MAR for many of the catchments along with the yields of the schemes.
(ii) Estimate potentially irrigable areas from valley widths and local topography, and
(iii) Calculate construction costs of dams from available information, and the costs of pipelines to serve the estimated irrigable areas.

With regard to the identified infrastructure projects, the recommendations in this chapter (**Section 4.5**) show that while most of the proposed Hydropower supply projects would make useful contributions to the supply of electricity to the Basin States, and some of the Larger Dam projects could also provide limited hydropower, however this would still be a long way from meeting the actual and growing need. The Larger and Smaller Dam projects would certainly augment the supply of water and boost the economy but cannot do all that is required.

The implication is that the identified infrastructure projects currently on the table would have useful but limited significance in meeting the overall needs of the Basin countries; this in terms of power supply, additional irrigated land, and numbers of people provided with domestic water. This suggests that a far more wide-reaching project design is required. Typically this could be facilitating access to groundwater, as noted above. The construction of a few larger dams cannot replace an intervention to facilitate a large number of small farm dams or rainwater harvesting tanks.

Water supplies to Kigali, Gitarama, Ruhengeri, and Gitega need special attention and this probably applies to all towns in the Basin. Kigali has a population of 886 000 in 2012. There are another eight towns with a population of > 50 000 people, and 14 with between 20 000 and 50 000 people. Urban population figures can be found in **Table 3.1** of the Kagera Basin Development Plan, Diagnostic Assessment Report (p.12).

Gaps identified include:

- Access to groundwater.
- Rainwater harvesting and small farm dams.
- Catchment or country-scale land management plans focussed on runoff control, infiltration, and the prevention of erosion.
- Sedimentation (sustainability - longevity of dams).
- Water quality research and management.
- Water supply and particularly supplies to towns and cities.

4.4 Screening of Projects

4.4.1 Screening criteria

All projects were evaluated on the following basis and scoring system (with the positive scores shown as "Benefits" and the negative scores as "Disbenefits" in the **Tables 4.7**, **4.8** and **4.9** below):

Benefitting countries (1-4)	This addresses the spread of benefit across the Basin in terms of benefitting countries. Scores 1 (if only one country benefits) to 4 (if all countries in the basin potentially benefit). This has a particular impact on the scores of hydropower projects, where the benefit can more easily be distributed, and also for some large dams located on shared rivers or close to national borders.
Benefit sharing (1-5)	This is a measure of distribution of benefits. There is a measure of double counting in that if there is more than one benefitting country the benefit sharing scores the maximum of 5, but this only goes to emphasise the importance of shared benefit as a measure.
Preparedness for implementation (1-5)	This is a measure of how much work has been done in preparing the project. In some instances projects have only been identified as prospects, possibly with a Terms of Reference for further study developed. In others a pre-feasibility or feasibility study may have been undertaken. In one or two instances work on projects may already have started (although all the preparatory work may not necessarily have been completed), and in others pre-feasibility work is so dated that this would have to be commenced anew, and the project is considered as at the identification stage only.
Extent of benefit / User demand / Benefit to community (1-5)	Multipurpose schemes score better than single-purpose schemes as benefits are more widely distributed across sectors. However, weight is also given here to the obvious need of community and the necessity of the scheme.
Economic viability and cost recovery (1-5)	Cost estimates and expected income to offset costs with scores as follows: If the project would have to be entirely supported (cost construction and utilisation) by government or grant funding (1); if there is likely to be some measure of self-support paying, typically, for the Operations and Maintenance costs of running the project (3), or if the project could be fully self-funded, covering both investment loans and long-term operating costs (5).
Negative environmental impacts (-1 to -5)	Negative scores reflect disbenefits and offset positive benefits. Environmental impacts include the impact on the environmental flow requirements of rivers, and the loss of biodiversity. Irrigation schemes may also have a negative impact on the water quality of rivers. The scores were weighted by both estimated degree and extent of impact.
Negative socio-economic impacts (consequences) (-1 to -5)	This score reflects the negative consequences or disbenefits that the project might have on society. Typically negative impacts might be the loss of land to inundation, and the inundation of homes and homesteads with people requiring relocation. Positive socio-economic and environmental impacts are incorporated under benefits above.
Negative risk of fatal flaws (-1 to -5)	This is an important element providing a measure of potential risk to the project. Fatal flaws are prospective 'show-stoppers' that could bring a project to a halt, unless the problem can be mitigated.
Institutional capacity (O&M) (not scored)	This factor was not scored. It is widely recognised that institutional capacity is an issue, and that the management of remote and difficult projects is a challenge facing all countries and all projects, although more so for more remote and management intensive projects. This is an issue considered to weight all projects equally and one that must receive attention at national and Basin level.

4.4.2 Screening process

(i) The following steps were undertaken in preparation for screening:

- Projects were identified from existing studies, plans, and programmes (see **Table 4.1**)
- Information on projects was collated into a standardised format (**Appendix C**)
- Projects were categorised (see **Table 4.1 and Section 4.3.2**)
- Additional data was assembled with regard to project outputs (power, irrigation, and domestic supply) and project costs as described in **Sections 4.3.5, 4.3.6** and **4.3.7.**
- Screening criteria were developed (**Section 4.4.1**)
- Projects were entered into a spreadsheet to be used for scoring against screening criteria.

(ii) Projects were then scored by an evaluation team against the screening criteria set out in **Section 4.4.1**.

*Details of how scores were determined for each project are provided in the "project decision sheets" contained in **Appendix E**. The spreadsheet summarising the scoring is also provided in **Appendix E.***

Scores do not provide a definitive evaluation of a project. There are too many variables, and too many ways of arriving at scores. Scores are also strongly influenced by spreadsheet design and allocated weighting. Scores do, however, provide strong indicators against which recommendations can be made.

At the time of the screening undertaken for this study the information on environmental flow requirements (EFRs) for rivers on which storage dams could be constructed had not yet been finalised. This environmental impact was interpolated on the basis of storage capacity and expected abstraction from the dam in relation to the MAR. (The closer the dam capacity is to the Mean Annual Runoff the greater the potential for impact. This can be regulated through flow releases, reducing the effective capacity of the dam).

A final analysis and reasoned set of recommendations is provided in the Prioritised Projects and Programmes Portfolio (**Section 4.5**).

4.5 Screening results and prioritisation

The distribution of schemes within the Kagera Basin that were evaluated is shown in **Figure 4.1.** The prioritisation of schemes in each of the various categories: Hydropower, Larger Dams, Smaller Dams, Irrigation and other Water Resource projects have been based on the weighting assigned by the screening process as described below.

4.5.1 Hydropower projects

The results of the screening of the Hydropower projects are shown in **Table 4.7** with the prioritisation based on the screening scores.

Table 4.7: Screening scores and prioritisation of Hydropower projects

PROJECTS WHERE HYDROPOWER IS THE PRIMARY RATIONALE				
Project or Programme	**Benefits (+ve scores)**	**Dis-Benefits (-ve scores)**	**Net Score (Max 24)**	**Action – next steps**
Rusumo Falls Run-of-River	24	-1	23	**Implement.**
Kikagati Run of River (16MW)	18	-2	16	**Implement**. Already out on tender. Ensure Basin cooperation and country-sharing agreements. Support and pursue implementation.
Maziba Gorge SHPP upgrade and refurbishment (1.18MW)	15	-2	13	**Implement**
Kikagati				**Implement**
Kakono Dam and hydropower	15	-4	11	Undertake a pre-feasibility study followed by a full feasibility study.
Ruvyironza Dam and hydropower	15	-4	11	The detailed identification study (NELSAP) 2012 was very favourable. Social and Environmental Impact Assessment required with emphasis required on relocation impacts
Nsongyezi 39 MW	15	-5	10	**Implement if funding can be raised.** This appears to be the favoured option.
Nsongyezi 65 MW	14	-5	9	Implement best Nsongyezi option if results of feasibility study are favourable
Nsongyezi 85 MW	15	-7	8	Lower score as bigger dam has higher environmental impacts – but differences cannot be assessed at this level. Implement the best Nsongyezi option on the basis of full feasibility study
Nyabarongo Dam and Hydropower	16	-9	7	**Project already out on tender?** High relocation impacts affect this decision. Consider only once alternative future supplies to Kigali have been exhausted.
Ruramba SHPP	8	-3	5	Further investigation required. A large structure with limited output. Impacts on Environmental Flows will require mitigation. Irrigation opportunity mooted but impacts of irrigation not integrated with power production.
Kishanda Valley Hydropower	12	-10	2	Negative environmental impacts cannot be mitigated and preclude option of funding. Do not consider further.

Hydropower projects can attain relatively high scores due to the weight accorded to shared benefit, with the larger Hydropower schemes offering electricity that can be shared widely across the Basin through the grid. The merits and impacts of the various projects are discussed below:

- The Rusumo site is situated on the Kagera River on the border between Rwanda and Tanzania. The Rusumo Falls Run of River project results in low environmental and social impacts. The Run of River project also provides reasonable cost-benefits.

- The Kikagati run of river scheme is a smaller (16 MW) project, also on the Kagera River. This is on the site of a long defunct much smaller (4MW) scheme. The project has financial support and has already been put out to tender. Implementation should be supported.

- The Maziba Gorge 1.18 MW Small Hydropower Plant (SHPP) is the upgrade and refurbishment of a now defunct 1 MW system. Plans are well advanced and this project should be implemented.
- The Kakono Dam site on the Kagera River in Tanzania is situated much closer to Kagera Mouth. This is also a run of river project but the dam would inundate a significant reach of river and would have consequent social and environmental impacts. Without taking possible compensation costs into account the project appears to be reasonably cost effective and should be accorded a prefeasibility study. If favourable this should be followed by a full feasibility study.
- The Ruvyironza Dam site is located on the Upper Ruvubu River in central Burundi and would be a relatively expensive scheme. Nevertheless the value of the energy that would be generated, and the benefits provided by the supply of water, could mean that the scheme would be economical. The detailed identification study undertaken by NELSAP was very favourable in terms of this dam and should be followed by a full feasibility investigation with strong focus on social and environmental impacts.
- The Nsongyezi Dam site for the 65 MW and 85 MW options is situated on the Kagera River on the Uganda-Tanzania border approximately midway between Rusumo and Kakono. Information on the project is currently lacking but can be expected from the current feasibility study, including assessments of the environmental and social impacts.
- The Nsongyezi 39 MW option has recently been added to the portfolio. This appears to have donor support and as such is likely to be the most favourable option. The recommendation is to implement an optimally sized scheme at the Nsongyezi site, given a favourable outcome to feasibility studies.
- The 16 MW Kikagati hydropower scheme would be situated immediately upstream of the Nsongyezi 39 MW scheme and is likely to be implemented in the near future. The scheme would have very limited social and environmental impacts
- The multipurpose Nyabarongo II Dam on the Nyabarongo River in Rwanda would mainly develop hydropower and serve existing and new irrigable areas. It was also planned that it would provide 18 million m^3 of water to Kigali. A hydropower and water supply scheme (Nyabarongo I) is already under construction on the Mwogo River, an upstream tributary of the Nyabarongo River. As the Nyabarongo II scheme would have high social and environmental impacts, and as its long-term life would be reduced by siltation, its construction is not recommended at this stage. The scheme should be reassessed alongside other alternative future supplies of water and power, and particularly schemes to supply water to Kigali. It is understood, however, that tenders have already been called for this project, which is viewed as having strong national priority.
- The Ruramba SHPP has some promise. This proposal has been developed independently of a proposed associated irrigation scheme which is still at the proposal stage. These two projects should be evaluated together and the degree of mutual dependence made clear. It is recommended that the Ruramba SHPP and Irrigation Schemes be integrated into a single multipurpose project proposal for the assessment of impacts, cost, benefit and viability.
- The Kishanda Valley Scheme involves diverting the Kagera River into another watercourse, thus depriving the Kagera below the point of diversion of most of its natural flow. Consequently the scheme would have very significant environmental and social impacts. This is a complex and expensive scheme, with impacts that would prove unacceptable to any investor or funding organisation, and is not recommended for further studies.

4.5.2 Larger Dams

The results of the screening of the Larger Dam projects are shown in **Table 4.8** with the prioritisation also based on the screening scores.

These dams would all supply water for irrigation and domestic use and some would have potential to develop hydropower. The Cyanuzi-Kagogo, Kagitumba-Mazimba, Kanyaru and Upper Ruvubu Dams have been studied together at prefeasibility level and none are reported to have severe social or environmental impacts. Their hydropower potential may be influenced by the environmental flow requirements of the rivers downstream and whether pipelines, canals or the river channel are used to convey the irrigation releases. The Kakanja Dam and Muvumba Dam are being studied independently at pre-screening and prefeasibility levels respectively.

Table 4.8: Screening Scores and prioritisation of Larger Dams

LARGER DAMS: WATER SUPPLY, IRRIGATION, SOME HYDROPOWER (Dams >30m^3 capacity)				
Project or Programme	**Benefits (+ve scores)**	**Dis-benefits (- ve scores)**	**Net score (Max 20)**	**Action – next steps**
Kanyaru	16	-4	12	**Implement full feasibility study**. Cross border sharing supports high benefit score. Follow through on NELSAP's detailed identification study recommendations.
Muvumba (Nyagatare Water Resources Development)	12	-4	8	**Implement full feasibility study**. Note potential cumulative impact of Kagitumba-Mazimba.
Upper Ruvubu	11	-4	7	**Implement full feasibility study**
Kagitumba-Mazimba	12	-7	5	**Implement feasibility study but as low priority.** Cumulative impact on Muvumba Dam. Increased social impact due to need for canal race
Kakanja	8	-5	3	Review preliminary to possible pre-feasibility. High evaporative losses – but this is a low cost dam
Cyanuzi-Kagogo	6	-6	0	On site of existing, functional structure. **This dam should not be considered further.**
Nyabarongo Dam[1] (evaluated for hydropower but with important storage element)	(16)	(-9)	(7)	Evaluated under Hydropower but requires a large dam. Water for domestic purposes is an important function, as is irrigation
Ruvyironza Dam[1] (evaluated for hydropower but with important storage element)	(15)	(-4)	(11)	Evaluated as hydropower project, but this requires a large dam. Irrigation is an important function, particularly desired in Burundi.

[1]The Nyabarongo and Ruvyironza Dams were evaluated primarily as hydropower projects and these scores should not be used for comparison with other large dams.

Several of these larger dams show promise and should be taken to the level of a full feasibility study, although none is ready for immediate implementation. The merits of the various schemes are discussed in order of prioritisation below;

- The Kanyaru Dam was given a high score because it is sited on the border of Burundi and Rwanda and therefore would benefit both countries. The dam has reasonable potential for irrigation, although this would be limited by the valley width. The dam would also have moderate potential for hydropower development, as the 40 m high dam would be located on a large river with substantial flows. Depending on confirmation by the current prefeasibility study this dam is recommended for feasibility study.
- The Muvumba Dam site is situated in Rwanda. This dam would be located upstream of a wide flood plain and would irrigate a large area. The dam might also have some hydropower potential, as the 40 m high dam would be situated on a moderate sized river. The potential for hydropower would depend on whether releases for irrigation would be made via pipeline, canal or the river channel. This scheme should be studied at feasibility level.
- The Upper Ruvubu Dam would only serve Burundi. Its irrigation potential would be limited by the relatively narrow valley width. On the other hand the dam would have some potential for small hydropower development, as the 42 m high dam would be located on a moderate sized river. Depending on the recommendations of the current prefeasibility study this dam is recommended for feasibility study.
- The Kagitumba-Mazimba Dam in Uganda would have 38 m high dam wall, with the dam situated on a moderate sized river in a relatively narrow flood plain. This would be the most expensive of the Larger Dams. It would only irrigate a modest area but would have potential for small hydropower. Depending on the recommendations of the prefeasibility study it could be considered for feasibility study. A potential fatal flaw to this scheme is the impact it would have on the Muvumba Dam in Rwanda.
- The Kakanja Dam, on a small river in Tanzania, would have a low wall height of 14 m. The dam would inundate a large area, increasing the socio-economic and environmental impacts, and the higher evaporation losses would reduce its yield. The dam would be able to irrigate a reasonable area but would have very limited hydropower potential. Depending on the recommendations of the pre-screening study it could be considered for study at prefeasibility level.
- The Cyanuzi-Kagogo Dam was planned as a 25 m high dam on the site of an already existing but much smaller dam on a relatively small river in a narrow valley of Rwanda. It would irrigate a limited area and have limited hydropower potential. Given the uncertainty regarding the additional benefits that this larger dam would provide **it is recommended that the original dam be retained and this dam dropped from the list of bankable projects**.
- The implementation of more, smaller dams spread more widely across the landscape, should be researched as an alternative approach to storing water, in place of large and far more costly structures.

4.5.3 Smaller Dams

The results of the screening of the Smaller Dam projects are shown in **Table 4.9** with the prioritisation also based on the screening scores.

Table 4.9: Screening Scores and prioritisation of Smaller Dams

SMALLER DAMS: WATER SUPPLY, IRRIGATION (Dams <15m height or <30m^3 capacity)				
Project or Programme	**Benefits (+ ve score)**	**Dis-benefits (- ve score)**	**Net score (max 20)**	**Action – next steps**
Gashayura	10	-1	9	**Implement full feasibility**. This is a medium cost dam that serves a large number of people with limited social and environmental risk
Bigasha	10	-4	6	**Implement on favourable technical and cost : benefit evaluation of new feasibility study, ESIA and RPF**
Kabuyanda	8	-5	3	**Take to next stages of feasibility.** Preliminary feasibility complete (NELSAP). Environmental impacts (Rwoho Central Forest Reserve). Relatively low-cost but irrigation area smaller than estimated.
Karazi	8	-5	3	Review technical feasibility study. Undertake full social and environmental feasibility studies. Re-evaluate once feasibility study reports become available.
Kavuruga	8	-6	2	Low priority. Well studied but not suited to development. Large existing HPP 6km downstream.
Buyongwe	9	-7	2	Not recommended as a dam. Consider as a **diversion scheme for irrigation** only (see irrigation schemes)
Taba-Gakomeye	9	-7	2	Consider as a dam for **flood protection** of downstream investments.
Munyange-Vumbi	7	-6	1	Low priority. Limited level of study. Social impacts high. Limited power generated. Sedimentation risk.
Mbarara	8	-7	1	Not recommended. Upper Ruvubu will have major impact if implemented.

Table 4.6 in **Section 4.3.7** shows that hydropower is unlikely to be viable at any of the smaller dams other than for pumping water for domestic use. Therefore the main purpose of these smaller dams would be for irrigation and domestic water supply.

Table 4.6 also shows that the proposed Buyongwe and Taba-Gakomeye dams would both have small capacity relative to mean annual runoff. As it is reported that there is significant erosion in these catchments, sediment loads in the rivers will be relatively high and there is a high risk that the useful lifespan of these dams would be short. Therefore, although the Buyongwe Dam would be well located to irrigate a significant area, it has been withdrawn from further consideration. The recently released Detailed Identification Study (Ntale, NELSAP 2012) came to the same conclusion and recommended that instead of this dam an irrigation scheme using a diversion weir should be planned. Buyongwe Dam is therefore now listed as an "irrigation project not requiring major infrastructure" and will need to be evaluated on this basis. At the Basin Development Plan workshop held in Bujumbura under this consultancy, it was mentioned that the Taba-Gakomeye Dam would be used for flood control to protect infrastructure located downstream, therefore requiring more complex infrastructure.

The Gashayura Dam is reviewed favourably in the detailed identification study of NELSAP (2012). This study should be taken to full feasibility. The Kabuyanda Dam should be prioritised for fully feasibility study.

The feasibility study of the Karazi Dam in Tanzania by NewPlan was expected by September 2012, but this study report had not been received. A very large number of uncertainties that may be unlocked by the feasibility study surround this dam. This dam is viewed as being of high priority in Tanzania but the implications and sustainability of this structure should be assessed very carefully.

4.5.4 Discussion of Larger and Smaller Dams

Whilst none of the multipurpose dam schemes is ready for **immediate** implementation there are several schemes that show promise ~ lacking only sufficient evaluation. A number of projects should be hastened into feasibility or prefeasibility stages of investigation. Of the larger dams, Kanyaru, Muvumba and Upper Ruvubu should all be put forward for full feasibility studies. A feasibility study has been completed on the Bigasha Dam (Tractebel, Nov. 2012) and if this is favourably evaluated, along with the recent ESIA and RPF studies (Newplan, 2012) then this project could be scheduled for implementation. Gashayura is recommended for full feasibility, while Kabuyanda should be taken to the next phase of study (pre-feasibility). This selection and prioritisation exercise is in agreement with the recommendation made in the recently completed feasibility study that the small Buyongwe Dam should not be promoted as a dam, but that a diversion weir for irrigation should be investigated at this site. This is an option that should also be considered at other less suitable dam sites. Taba-Gakomeye Dam will be further investigated as a flood attenuation dam.

There are several weaknesses in the information currently available which should be addressed by the on-going studies:

- The greatest weakness has been the identification of sites for dams without the apparent identification of the corresponding **need** or, more accurately, ability to make use of the water. Evidence of such identification and assessment of infrastructure requirements, beyond preliminary consultation with some local communities in the vicinity of some of the proposed dams, could not be found in any documentation.
- Dams were also planned without the recognition, or realisation, that it may not be feasible to operate and distribute hydropower other than via the grid, for which a minimum scheme capacity of about 200 kW would probably be required. Nor was there any indication of whether grid distribution was conveniently situated. The environmental flow requirements of rivers were also not addressed. In most instances irrigation would be the most feasible option, with the generation of sufficient power only to pump water to supply domestic users in the vicinity of the irrigated area.
- A third critical aspect of the available information for almost all dams (related to “need” above) is that the assessment of availability of land for irrigation was not included in identification studies. In reviewing the sites, Aurecon/WEMA made the assumption that only the flatter valley floor downstream of the dam site could be used as irrigation would be by gravity and found that valley bottoms varied in width from 200m to 1200m. For many of the Larger Dams even if a canal or pipeline was constructed for 30 km below the dam there would only be enough irrigable land to utilise 50% of the available water. The balance of the flow could be used for hydropower development provided that the releases meet the environmental flow requirements and the cost of the power line and connection to the grid is feasible. If hydropower generation is not feasible then there may be a mismatch between dam size and the availably of land, which would mean that only some of the water in these dams would be used, and most of the proposed dams would be over-designed for the apparent possible use.

This suggests a different approach in seeking development opportunities:

- In the first instance **opportunities** for use must be determined. (It is recognised that there is almost always **need** given the density of population). Secondly opportunities for infrastructure should be planned with either hydropower **or** irrigation designated as the primary purpose, with domestic water supplies always an added use. Multipurpose dams are an ideal but the concept should not be adopted to mean "equal purpose" dams. In the case of irrigation dams, more hydropower can be generated if water is released and distributed via a canal system rather than through a pipeline, but power output would remain low and very erratic. The additional need to balance the environmental flow requirements of rivers may be another important constraint in the generation of hydropower, particularly in the dry season when flows are naturally low and should be kept that way.

It is possible that a very different development model may emerge, with more of the smaller dams providing far greater benefit at far lower cost. Diversion schemes may sometimes prove more efficient than dams - at a fraction of both impact and cost - but these would not have been considered if hydropower was a specified output of schemes to be identified.

4.5.5 Irrigation schemes not requiring dams

The results of the screening of irrigation schemes which would not require dams are provided in **Table 4.10**.

Table 4.10: Screening Scores and prioritisation of Irrigation Schemes not requiring Dam Construction

IRRIGATION SCHEMES NOT REQUIRING DAM CONSTRUCTION				
Project or Programme	**Benefits (+ ve score)**	**Dis-benefits (-ve score)**	**Net score (max 20)**	**Action – next steps**
Bugesera	16	-3	13	Pursue implementation. Project well advanced. Serves two countries. Mitigation of high environmental impacts required.
Ngono	11	-2	9	Pursue feasibility research and implementation
Buyongwe	11	-2	9	Undertake needs analysis feasibility study as irrigation project. (Proposal for "smaller dam" scored very poorly ~ a diversion weir for irrigation is a suggested alternative but this requires more detailed study.)
Nyanza Hillside	8	-3	5	More information required. Concern re cumulative impacts on Mwogo/Nyabarongo

Both of the Bugesera and Ngono schemes are planned to irrigate 8000 ha. Bugesera would serve both Rwanda and Burundi and is already at the project appraisal stage and thus is closer to implementation. Ngono serves only Tanzania and the project is not as advanced as Bugesera. Technically the two schemes are well matched and there is no apparent reason not to continue with both sets of plans. Care should be taken with Bugesera not to inflict undue damage on the Nyabarongo Lakes and Wetlands.

The Buyongwe project was evaluated (and rejected) as a dam (Ntale 2012) – with the diversion weir irrigation schemes an alternative proposal that will cost less with less environmental impact. This project needs further feasibility evaluation.

Nyanza Hillside has had a feasibility study done but there are gaps, at least in available reportage. According to stakeholders (Bujumbura workshop, 27 November 2012) contract negotiations are already underway and construction is planned to start soon.

4.5.6 Other Water Resource Projects

The screening scores of other various water resource projects are presented in **Table 4.11**.

Table 4.11: Screening Scores of Other water Resource Projects

OTHER WATER RESOURCE PROJECTS		
Project or Programme	**Score (max 24)**	**Action – next steps**
Mining - protecting water resources whilst enhancing local cooperative small-scale mining	16	Implement
Water supply kiosks	15	Implement
Aquaculture - fingerponds	11	Implement significant pilots
Mutobo Water Supply	5	Do not consider further

All of the above projects, with the exception of the Mutobo pipeline to Kigali, show high positive scores. Given that these are not major infrastructure projects there is far less risk in investing in their implementation:

- The cooperative small-scale mining programme is a win-win-win for all the basin governments, the miners, and the environment, and should receive immediate government support.
- Water supply kiosks have been proven successful not only in Katuna but elsewhere in Uganda and East Africa. With the right incentives this could probably be a successful private sector programme.
- The implementation of aquaculture fingerponds is likely to a more drawn-out learning experience and would be a cooperative programme between government and development NGOs with a presence across the basin.

The Mutobo Water Supply project may have political support given the importance of Kigali but there are potential sources of water far closer to the city that could probably provide water at far lower cost. What the Mutobo proposal does highlight is the issue of water for towns and cities, which seems to be a neglected issue. The only dam evaluated in this portfolio specifically targeted to provide water to one of the larger towns in the Basin is the Nyabarongo, to provide water for Kigali. That, perhaps, should be the first criterion for any further infrastructure identification projects.

4.5.7 Watershed and Wetlands Management Projects

Table 4.12 below is a summary of the priority projects proposed by LTS International (2012) for the first five-year implementation phase of a Watershed and Wetlands Management Programme (KIWMP). Projects have been prioritised in terms of national "hotspots".

Source of Information: LTS International, 2012, Feasibility Study for an Integrated Watershed Management Programme for the Kagera River Basin, Grant No. TF095177, Draft final report to NELSAP, 15 November 2012.

The implementation of these projects is essential to the success of the Basin Development Plan and this programme should be seen as integral to the BDP. No attempt has been made to further prioritise or screen these projects. However, in the event of partial implementation of this programme, priority should be given to projects in the headwater catchments of planned infrastructure schemes.

Table 4.12: Watershed and Wetlands Management projects (LTS, 2012)

WATERSHED PROJECTS	ID	PROJECT DESCRIPTION	COST (USD)
Burundi	B01	Integrated Water Resources Management, Akanyaru Sub-watershed	$145 m
	B02	Stabilisation of banks of watercourses to reduce erosion and siltation	$ 68 m
	B03	Hill irrigation and rainwater harvesting	$ 60 m
Rwanda	R01	SWC on terraces, Soil Improvement, Increased Fodder & Fruit Trees in Nyaruguru District, Akanyaru Sub-watershed	$ 50 m
	R02	Rainwater harvesting, Small-scale irrigation, Fodder & Fruit Trees in the Kagitumba Sub-watershed	$ 63 m
	R03	Sustainable Fishing at Lake Muhazi	$ 0.5 m
Tanzania	T01	Soil conservation in the Karagwe and Ngara Districts	$ 34 m
	T02	Protection & conservation of water sources in Kagera sub-basin in Tanzania	$ 24 m
	T03	Potable water supply to 15 villages & Kayanga, Bunazi & Kyaka Townships in Karagwe District	$ 20 m
Uganda	U01	Land rehabilitation in Isingiro District, Kikagate	$ 10 m
	U02	Integrated Water Resource Management (IWRM) Project, Rakai District	$ 16 m
	U03	Integrated Water Resource Management Project, Maziba River watershed, Kabale district	$ 17 m

WETLANDS PROJECTS	ID	PROJECT DESCRIPTION	COST (USD)
Burundi	BW1	Protection of wetland ecosystems through environmental flows and sustainable abstractions	$0.73 m
	BW2	Alternate livelihoods for wetland communities through an ecosystem approach	$1.13 m
	BW3	Impacts on wetlands of water harvesting and development of groundwater resources	$0.80 m
Rwanda	RW1	Protection of wetland ecosystems through environmental flows and sustainable abstractions	$0.73 m
	RW2	Artificial wetlands for sustainable urban drainage	$1.15 m
Tanzania	TW1	Flood Management in Bigomba & Burigi Valleys, Ngara & Muleba Districts	$ 21 m
	TW2	Robust Evidence Base for informed Wetlands Management Decision Making	$ 4.1 m
	TW3	Feasibility Study for Fisheries in Karagwe District + Fish Ponds	$ 4.3 m
Uganda	UW1	Robust Evidence Base for informed Wetlands Management Decision Making	$ 1.0 m
	UW2	Payments for wetland ecosystem services	$ 0.8 m
	UW3	Alternate livelihoods for wetland communities through an ecosystem approach	$ 1.13 m
Transboundary Wetlands		Transboundary Wetlands Management Projects	$ 15 m

Programme Management		**Kagera Integrated Water Management Project - NELSAP**	**$35 m**
Capacity Building and Institutional Strengthening		NELSAP	$ 9 m

TOTAL PROGRAMME COST		**All project and operational expenses**	**S 615 m**

4.6 Bankability of projects by country

Table 4.13 provides a summarised listing of project recommendations by country. This table gives an indication of the overall investment spread, should recommended projects move towards implementation. The table provides a good spread of opportunity. Projects recommended for full feasibility have shown positive potential for implementation.

Table 4.13: Projects prioritised for implementation by country

Country	Project	Type	Recommendation
Burundi	Ruvyironza	Hydropower and large dam	Implement on favourable finalisation of feasibility studies
	Bugesera	Irrigation	Implement (shared with Rwanda)
	Upper Ruvubu	Large dam	Undertake full feasibility
	Gashayura	Smaller dam	Undertake full feasibility
	Kanyaru	Large dam	Undertake full feasibility (shared with Rwanda)
	Buyongwe	Irrigation (diversion)	Undertake feasibility study for revised purpose (irrigation)
	Kavuruga	Smaller dam	Uncertain – low priority
	Munyange-Vumbi	Smaller dam	Uncertain – low priority
	Mbarara	Smaller dam	Not recommended
Rwanda	Rusumo Falls	Hydropower	Implement (shared with Tanzania)
	Nyabarongo II	Hydropower and large dam	Out on tender
	Nyanza Hillside	Irrigation	Contract negotiations are underway and construction is about to commence. Feasibility reporting needs strengthening.
	Bugesera	Irrigation	Implement (shared with Burundi)
	Muvumba	Large dam	Undertake full feasibility
	Kanyaru	Large dam	Full feasibility (shared with Burundi)
	Taba-Gakomeye	Smaller dam	Feasibility study for revised purpose
	Ruramba	SHPP (4MW)	Review. Link to irrigation opportunity
Tanzania	Rusumo Falls	Hydropower	Implement (shared with Rwanda)
	Nsongyezi 39 MW	Hydropower	Implement (shared with Uganda)
	Kikagati	Hydropower	Implement (shared with Uganda)
	Karazi	Smaller dam	Review technical information
	Kakono	Hydropower	Undertake pre-feasibility
	Kakanja	Large dam	Uncertain – provisional pre-feasibility
	Ngono Valley	Irrigation	Undertake feasibility study
Uganda	Nsongyezi 39 MW	Hydropower	Implement (shared with Tanzania)
	Kikagati	Hydropower	Implement (shared with Tanzania)
	Maziba Gorge	SHPP(1.18MW)	Implement
	Bigasha	Small dam	Implement if technical review of feasibility favourable
	Kabuyanda	Small dam	Undertake feasibility study
	Kagitumba-Mazimba	Large dam	Feasibility study but low priority
Basin-wide	LTS Watershed	Watershed Management	Implement
	LTS Wetlands	Wetlands Management	Implement
	Mining - Water resource protection	Introduction of technology	Implement

4.7 Strategic Recommendations (Projects and Programmes)

Water resource development projects have as their first objective the better utilisation of available resources to the benefit of the people in the Basin, without undue negative impact on the environment, whilst ensuring that sufficient water reaches Lake Victoria, and that the greater Nile Basin is not unduly affected.

Projects and Programmes may broadly be divided into:

- Large infrastructure projects (dams, hydropower, and pipelines).
- Irrigation schemes not requiring dams. Weirs and canals would be required for most irrigation schemes.
- Watershed and wetlands management projects. These include soil and water conservation programmes, rainwater harvesting and agricultural and forestry practices.
- Local water supply and sanitation.
- Non-consumptive utilisation (aquaculture).
- Water quality protection.
- Groundwater utilisation and management.

A number of strong strategic messages have come from this review:

(i) There are high expectations of the benefits that would be provided by the proposed large infrastructure projects – yet, in summing the impact of all of these projects, the outcomes do not keep pace with the growing need for development. Hydropower projects would benefit the largest number of people and water supply projects for large towns and cities would have the greatest immediate impact.

(ii) Benefit sharing should be executed at a higher strategic level than in the design of individual projects or programmes. The principle of "Basin Sharing" is important but should not be used as the driving principle in selecting projects or suites of projects. Projects should first and foremost be selected on the basis of need within the respective basin countries. If the concern is that international investment should be reasonably divided amongst the Basin States then the overall investment portfolio should be audited at intervals and balance sought by applying new focus where necessary. Funding to identify "one project in each country to ensure benefit sharing" could lead to the identification of projects based on the wrong criteria.

(iii) There are large volumes of water available for possible utilisation. It is an important wisdom that, whilst water is essential to development, water alone does not bring development. Water will support development and must be used in this role.

This review of infrastructure projects has found that most of the proposed projects (mainly comprising dams) were sited on the assumption that the existence of these dams would automatically mean development. This has resulted in various projects at scattered locations within the basin that are not best designed to meet the overall needs of the Basin, other than the larger hydropower projects which could provide electricity for distribution throughout the Basin.

In the first instance dams must have associated infrastructure, and planning this infrastructure requires assessment of downstream needs and certainty that the water can be effectively used. These needs were not assessed in the most of the available reports, and attention has not yet been given to associated infrastructure. Projects must be designed to meet clear requirements, within the framework of opportunity.

(iv) The strong belief in smaller "multi-purpose dams" could also lead to unwise investment planning, and the multi-purpose ideal needs to be very carefully considered. Whilst dams should always be able to supply rural domestic users, villages, and possibly even small towns, irrigation and hydropower generation may be incompatible objectives - particularly if the environmental flow requirements are to be met. Only in systems where the MAR is sufficient to supply irrigation *and* more than about 200 kW to the grid (which would need to be accessible) would such multipurpose projects be feasible. Most dams need to be planned, sited and designed for a primary purpose (typically hydropower or irrigation, occasionally domestic supply), with other (multipurpose) uses being smaller secondary benefits.

(v) The project (and therefore investment) identification approach in the Kagera Basin should be reviewed in terms of clear overall cost and benefit. Projects should be identified firstly on the basis of need. It should not be an objective to "*find a site for a dam*", or to "*locate a project in each country*". There is widespread need for development and an undisputed resource (water); the challenge being to devise ways of most cost-effectively using that resource to meet the needs. This does not appear to be happening at the moment. The implementation of currently identified projects would consume both budget and energy, perhaps leaving individual countries with the sense that they are achieving something … but the opportunity cost of this investment should be recognised, and at least some of the development funding and development energy redirected.

(vi) Where should investment and development energy go?

(a) Implementation of the best identified projects should be pursued, but this should not be allowed to distract from the greater need.

(b) Smaller dams (e.g. capacity of about 1 million m^3 perhaps sited off-channel) and diversion weirs may be a better way of investing funds and developing resources, than the construction of a few large schemes. This is particularly indicated by the fact that there is often very limited irrigable land within downstream reach of large planned structures as is the case for the Buyongwe and Taba-Gakomeye dams.

(c) Small scale projects (e.g. small stock watering dams or rainwater harvesting) that can be implemented at local authority, village or even individual level should be planned, encouraged and supported. Programmes need to be established to implement multiple homestead and village scale developments that cover the countryside – rather than a few large developments that benefit limited areas. The irrigation schemes (Bugesera, Ngono, and now also Taba-Gakomeye and Buyongwe) currently on the table are closest to meeting this ideal.

(d) Groundwater is a neglected resource – yet supplies some 40% of villages and households with water. Groundwater is a cost effective resource, usually of good quality provided that the sources are protected. The LTS Watershed Management Programme has identified a groundwater programme in Tanzania, and development of surface water resources for domestic use should not be considered anywhere without exploration of groundwater opportunities. Often sources can be optimised through conjunctive use.

(e) Water to towns may require dams of significant size and investment - and this is a recommended focus for a water resource development programme, with benefits reaching a large number of people. A programme to ensure that all towns are adequately resourced with water should be undertaken with urgency.

(f) Watershed management should not be an option but a given. Watershed projects, such as catchment rehabilitation for erosion control and infiltration, do not have the same appeal to development investors as infrastructure projects, but can offer better value for money. Dams should not be built at some identified sites due to the sedimentation risk. Seasonal drought is also exacerbated by "soil drought" - with eroded catchments unable to hold water for infiltration and vegetation / crop production. Programmes to improve agricultural, and forestry practices are part of the suite of watershed and wetlands approaches. Watershed and wetlands programmes should be popular, people-based initiatives. This approach should be vigorously pursued.

It is also very important to identify the organisations that would manage, operate and maintain projects as many of the best planned projects have failed on account of the lack of institutional capacity to implement and manage.

(vii) It has been recommended in this chapter that many of the listed infrastructure projects should be taken forward to pre-feasibility or feasibility stage. This is on the assumption that other more suitable projects have not been missed as a consequence of the requirements in earlier Terms of Reference for project identification. It is probable that some opportunities for investment that have been overlooked, and to focus only on those that have been selected to date could be an expensive mistake. All projects should be assessed with this in mind. A review of other potential opportunities should be undertaken as soon as agreement is reached on a revised approach to project identification.

4.8 Cumulative impacts on water resources

Cumulative (cascading) impacts

Projects are intended only to bring benefit, but can also result in opportunity costs, or can severely impact on other planned projects – upstream or downstream. There are not many examples of this in the Kagera Basin at this stage, partly because most dams are relatively small, but also because the large hydropower projects are based on run of river, and hence non-consumptive.

The Nyabarongo I Dam on the Mwogo River does not impact on Nyabarongo II on the Nyabarongo River downstream.

The proposed Kagitumba-Mazimba Dam (Uganda) could well have a negative impact on the downstream Muvumba Dam (Rwanda).

There is little point in constructing the Mbarara Dam and also the Upper Ruvubu on the same system in Burundi. It is for this reason that the Mbarara Dam is not considered further for implementation.

Cumulative (total) impacts

The consumption of water from all the possible Larger and Smaller Dams described in this report, together with the evaporation from these reservoirs and from the various Hydropower scheme reservoirs, would total about 500 million m^3/annum, or approximately 7% of the annual flow of the Kagera River into Lake Victoria. Given that only a few of these dams are ever likely to be built, the total impact on flow will be far smaller.

Of more immediate concern is the potential impact of developments on water quality, although this has not been assessed. The largest impact is likely to be the additional leaching of herbicides, pesticides and especially fertilisers that are part and parcel of high intensity irrigated agriculture. However on account of the very significant dilution that would take place there would be little impact on the Kagera River itself, and less on Lake Victoria where further dilution would take place.

Against these possible impacts on Lake Victoria must be weighed the positive impacts of watershed management interventions and particularly the potential reductions in sediment loads that could be achieved by improved land use practice.

If the recommended ecological flows are released from Smaller and Larger Dams then there should be limited environmental impacts on the river systems below the dams. The proposed Hydropower projects on the Kagera River would also have little impact if these are developed as run of river projects, as is currently proposed for the Rusumo Falls project and for other hydro schemes.

Other and different projects are sure to be added to the development programme in the future, and it will be important to keep an account of total cumulative impacts as development proceeds.

5. BASIN-WIDE DEVELOPMENT SCENARIOS

The chapter consists of five sections. The first section deals with issues of relevance to the Consultancy objectives, followed by a discussion of the development scenario context including the key Basin drivers in Section Two. Selected scenarios are presented in Section Three, and Section Four deals with an evaluation of the scenarios. Section Five concludes with a preliminary recommendation targeting the preferred Scenario with the objective of achieving this.

5.1 Relevance to Consultancy Objectives

A range of Basin development scenarios has been selected to provide a perspective on development opportunities and their impacts. As required by the Terms of Reference the formulation and assessment of Basin wide development scenarios takes into consideration a variety of factors, including the existing and projected hydrological conditions, the water demands and other issues in national policies and socio-economic plans. The range of scenarios evaluated is sufficient to cover the most likely impacts that can be expected over the next 20 years.

5.2 Scenario Development Context

5.2.1 Introduction to Scenario Planning

The aim of scenario planning is to "*provide a consistent and coherent description of alternative hypothetical futures that reflect different perspectives on the past, present and future developments, which can serve as a basis for action*" (Van Notten, 2005). Development scenarios produce alternative pictures of the future based on identified driving forces and allow for planning of projects and actions to suit a realistic future and accommodate uncertainty. In the context of the BDP, the proposed Basin development scenarios are related to the specific strategic objectives identified in Section 3.4.3.

The approach followed in order to develop the possible scenarios is based on a six step scenario development process as outlined in **Figure 5.1**.

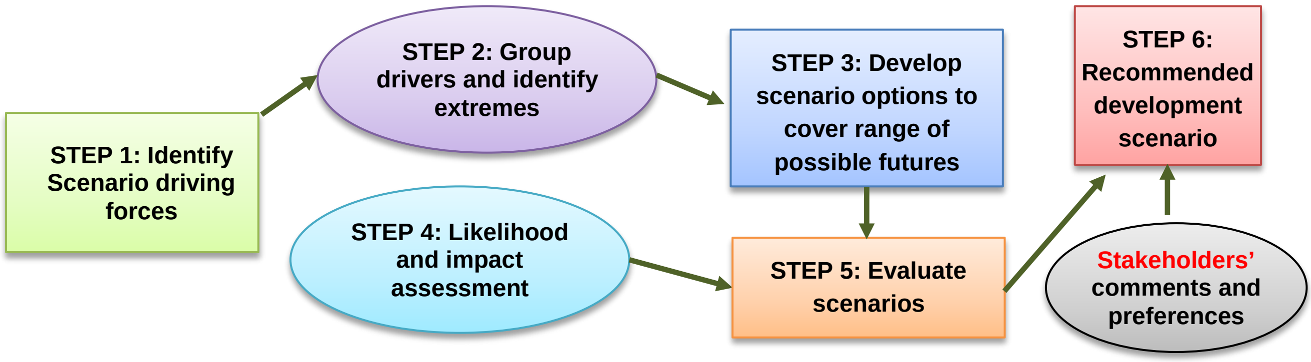

Figure 5.1: Schematic diagram of the scenario development process

Three introductory questions guide the process:

a) *What is the key question to be answered by the analysis?* The key question to be answered is essentially: "What projects and programmes must be implemented over the planning horizon in order to meet the likely needs of the Basin". Although the scenarios themselves are not portfolios of projects, they paint a picture of the development context and allow for quantification of future water requirements.
b) *What is the time and scope of the analysis?* All planning is done for a 20-year period, i.e. up to 2032.

c) *Who are the major stakeholders?* The major stakeholders were identified as part of the Diagnostic Assessment, but are mainly the functionaries of the line departments of the Basin countries. A stakeholder list is included in the first interim report.

5.2.2 Identification of Driving Forces

In Section 2.3.2, factors were identified which will drive change in the Kagera River Basin. All these drivers are interrelated and they impact on the priority concerns for the Kagera River Basin. As noted in Section 2.3.2, these factors are equally important in the member States as in the Basin as a whole.

(i) Population pressure and urbanisation

The current population growth of around 3% per annum is leading to increased pressure on resources in the Basin. The growing number of people increases the demands for food, energy and water, which can stress the available resources and lead to environmental degradation. Population growth is influenced, *inter alia*, by the following factors:

- Prevalence of diseases such as HIV/AIDS and Malaria
- Access to health care
- Access to potable water and sanitation
- Food security
- Economic opportunity
- Political stability
- Education

Despite weaknesses in health, food security, stability and water supply, the population growth in the Basin has been very high at approximately 3%. Further growth will put ever greater pressure on land, which cannot at present offer food security to the entire population. Water is the one resource which is seemingly readily available for food production and in support of growth.

Growing population pressure has encouraged rural-urban migration and increased *urbanisation*, with a growing proportion of the still largely rural population concentrating in urban centres. The urban population in the Basin is currently estimated at around 12% and is expected to rise considerably in the next twenty years with a rate exceeding 3% per annum. The main factors which influence urbanisation include:

- Natural urban population increase
- Rural migration to the urban centres, as influenced by:
    - Rural poverty
    - Limited land availability
    - Lack of job opportunities in the rural areas

Although urbanisation can benefit the socio-economics of the Basin, the fact that this trend in the Basin is not accompanied by industrialisation, alongside a lack of appropriate urban planning and management policies/tools, has had strong negative impacts and hindered the overall development of the Basin. Urbanisation may take some pressure off rural densities but has brought limited employment opportunities for residents, increased natural resources depletion, and added stress to utilities and infrastructure (water supply, sanitation, power/energy, communication, roads, housings, etc.) of the towns.

Despite the urbanisation trend, numbers in the rural areas are still growing fast and the countryside is becoming less and less able to sustain its own numbers. Both urban and rural areas are therefore urgently in need of development strategies that will optimise the sustainable use of available resources, in this case, most particularly, water.

(ii) Poverty

Poverty reduction in the Basin will be driven by many of the other drivers discussed in this section including:

- Population growth and migration (as previously discussed)
- Economic development (agriculture - but also industrial, manufacturing and mining)
- Institutional capacity
- Provision of water and sanitation
- Watershed management
- Capacity building / education / human resource capacity
- Alternative livelihoods / diversification
- Government support

One direct strategy in reducing poverty is through *improved water supply and sanitation*. It is estimated that only half of the population residing in the Kagera Basin has access to clean and potable water. The main sources of water supply are protected springs, dug wells, shallow and deep wells. Impoundment reservoirs are used to supply water to some, but far from all, of the urban population. Domestic water supply will be driven primarily by policy and intent, the capacity of the Basin countries to provide these services ~ both institutionally and financially. Financial ability will be driven by access to finance, i.e. the international investment climate, and the ability and willingness of people to pay.

(iii) Climate Change

Climate Change, an increase or decline in rainfall, changes in the seasonality of rainfall, and a certain increase in temperature and with this evapotranspiration, will have an impact on land use activities, water requirements, water availability and water quality. This is a major driver for the Basin. While change is predictable the direction and timing of such change are not yet certain. What is certain is that adaptation will be required.

(iv) Land use change / land degradation

Land use change can take many forms: from natural vegetation (forest or grazing) to ploughed or even irrigated land; from marshland to farmed (often irrigated) land; to homesteads or urban sprawl; or to degraded land lost through erosion. These 'negative' changes will have an impact on water quality and biodiversity in the Kagera Basin particularly If not well managed. Land use change can also be positive and have positive impacts – with agricultural and watershed management practices, agroforestry and reforestation all playing a major role. The key driver remains water and whether rainfall has the opportunity to infiltrate the soil mantle and sustain crops and natural vegetation along with groundwater tables and river baseflows, or whether it runs off rapidly causing erosion and flooding.

(v) Institutional capacity / Governance

The ability to implement projects and programmes to meet the growing demands is dependent on the institutional capacity of member states and of the Basin as a whole. IWRM requires an enabling environment in which role players can work harmoniously and where the necessary resources and skills are available.

Poor governance and institutional capacity and lack of clear policy direction (including environmental policies) could result in any or all of the following impacts on the Basin, with each of these a driver for weak or even negative economic growth:

- Unregulated land use activities
- Lack of service delivery (water supply and sanitation)
- Poor transport infrastructure (access to markets)
- Wasted water and weekend flow regimes (with less water reaching Lake Victoria)
- Declining water quality (from mining pollution, fertilizer and pesticide runoff, biological pollution)
- Environmental and land degradation

(vi) Political stability and investment capital

Although the days of major conflict in the Kagera Basin countries have passed, stability in the region is still a concern, particularly from an international perspective. According to Euromoney's quarterly country risk assessments, Rwanda and Burundi fall in Tier 5, the highest risk category with Uganda and Tanzania only marginally better in Tier 4. According to the Failed State Index which assesses countries in terms of political, social and economic security, Burundi and Uganda are ranked in the "Alert" zone with Tanzania and Rwanda in the "Warning" zone (Fund for Peace, 2012). Continued instability (or perception thereof) will impact on development in the Basin in three ways. Firstly, it affects the ability of the specific country to organise and implement projects and programmes. Secondly, it hampers the ability of the Basin countries to work together in achieving integrated planning, particularly in terms of water resources. Thirdly, it affects the confidence of donors / funders and therefore decreases the likelihood of continued international assistance and investment in the Basin.

(vii) Industrialisation and diversification

Despite the perception of instability in the region, economic growth is generally high. According to the CIA World Factbook, growth in GDP in Rwanda, Uganda, Tanzania and Burundi was at 7%, 6.4%, 6.1% and 4.2% respectively in 2012, all higher than the world average, although coming off a low base. Rwanda in particular has a strong emerging economy, ranking 23rd in the world. Strong economic growth goes hand in hand with a growth in water requirements as a result of an expansion in industrial and mining activities (**diversification**), increased urbanisation, and increased per capita water requirements, resulting from the implementation of water supply programmes. The industrial sector of the Kagera Basin is not significantly developed and industrial (and non-domestic) water use only accounts for approximately 4% of the total Basin water demand.

Economic growth will also impact on the ability of the region (financially) to meet the projected water demands through the implementation of projects and programmes and decrease the reliance on donor funding.

(viii) Market access and commodity prices

The Kagera River Basin economies are based mainly on agriculture which provides a large proportion of the raw materials for industry. Food processing alone accounts for 40% of total manufacturing. Access to markets is a barrier for many agricultural producers and they do not have the benefit of reasonable commodity prices for their produce or product

(ix) Energy availability

Economic growth and diversification (along with population growth) will also affect the demand for energy. The Kagera Basin countries considered in this study have one of the highest reliance on biomass for day-to-day energy needs in the world, with a regional dependence on biomass of 93% and with electricity sharing less than 1% of the total energy production in the region. The need for development in the energy sector in this region, with a population of more than 100 million people, is evident.

(x) International economic climate

The ability of the Basin countries to meet the growth in demand also depends on the international economic climate. The current global financial crisis (particularly in Europe brings with it a weakened export market for minerals and agricultural produce. Access to export markets will always be a concern, especially for landlocked Uganda, Burundi and Rwanda.

The international economic climate will also affect the availability of donor funding and the willingness of donor organisations to take investment risks, particularly considering the instability of the region as previously discussed. The general donor trend appears to be focused on smaller local projects rather than large-scale infrastructure development. The viability of smaller schemes requires more and tighter management (placing a demand on institutional capacity), and their ability to make a meaningful impact on Basin water resource development is a concern.

(xi) Agricultural development / policies on agricultural funding

Agriculture forms the economic backbone of the Kagera River Basin and will certainly remain important for growth and poverty reduction in the future. In recent years (between 2006 and 2011) agriculture contributed between 20 and 45% of the GDP of the Basin countries. Rwanda, Burundi, Tanzania and Uganda are irrigating 19 850 ha, 23 380 ha, 7 015 ha and 532 ha within the Kagera Basin respectively. Irrigation accounts for the bulk of water use in the Basin, however the majority of agriculture is rain-fed.

Livestock production represents a more limited proportion of the Kagera River Basin GDP and is a fairly minor water use (approximately 2% of the total demand). Cattle pre-dominate, representing 70% (in Livestock Units) of the Basin livestock population.

Moving into the future, agricultural development will be driven by:

- The ability of Basin countries and stakeholders to agree on common goals and priorities for agricultural development
- Supportive trading policies
- Access to markets
- Transport infrastructure to move goods locally and internationally
- Availability of water for irrigation and livestock

(xii) Access to information and the availability of technology

- These are really institutional and/or governance functions, but can be provided in different ways with communications technology being one of the key drivers. Information in an agrarian society is however best spread through a wide and well trained network of agricultural and forestry extension officers. Typical technologies include erosion control, agroforestry, borehole technology (and access to spare parts).

5.2.3 Grouping of Drivers and Identification of Extremes

The drivers discussed in Section 5.2.2 can be grouped into three broad categories:

- **External drivers** related to conditions outside of the Kagera Basin such as the international economic climate.
- **Political and economic drivers** which are related to institutional development and capacity as well as economic activities such as agriculture and industry.
- **Social drivers** which are related to human factors such as population growth.

The grouping of the drivers into these categories is presented in **Table 5.1.**

Each of the identified drivers has a range of possible outcomes. A combination of these extremes will indicate possible futures that one could expect for the Basin. **Table 5.1** lists each driver and the possible range of outcomes.

Table 5.1: Negative and positive extremes for each driver

Driver	Negative Extreme	Positive Extreme
External Drivers		
Climate Change	Water resource availability declines with lower rainfall and increasing temperatures. Seasonality and variability in rainfall become more pronounced.	Rainfall increases and seasons lengthen, bringing about an increase in water resource availability.
Commodity prices	Prices remain high and volatile.	Prices normalise and remain stable.
International economic climate	Global financial system collapses.	Major upturn in global economy and increases availability of donor funds.
Political and Economic Drivers		
Institutional Capacity / Governance	Failure of the plans for a Basin-institution. No development of skills or capacity. No development of skills or capacity.	Sufficient institutional capacity is created to plan for the Basin future, cooperate and implement large scale projects and programmes.
Political stability	Collapse in the government of one or more of the Basin countries Civil war Invasion (war over water)	All Basin countries declared low–risk and excellent places to do business
Market Access	Limited opportunities for trade Economic sanctions Development of transportation and communication infrastructure	Excellent trade partnerships created with foreign countries
Industrialisation and diversification	No industrial, mining or tertiary development	Complete diversification of the Basin economy with development in all sectors
Agricultural development / policies on agricultural funding	No commercial agricultural development No improvement in current practices No improvement in irrigation efficiency	Large scale commercial agricultural development coupled with access to markets for all farmers, improved practices in all regions and minimisation of water requirements through improved irrigation efficiency
Land use change / degradation	Farming taking place in all wetlands All natural land cover converted to agriculture Sustainable land use practices	Managed, controlled and regulated land use change
Social Drivers		
Population pressure	Increased population growth to more than 5% per annum	Declines to a population growth of less than 1% per annum
Urbanisation	Unplanned and unsustainable rural-urban migration	Planned and sustainable rural-urban migration going hand in hand with job creation and provision of services and infrastructure
Poverty	Increase in the number of people living below the poverty line, increased unemployment	Substantial decrease in the number of people living below the poverty line, substantial decrease in unemployment
Availability of electricity	"No investment in electricity generation Continued reliance on biomass"	Generation of sufficient electricity to connect all Basin residents to the grid
Improved Water Supply and Sanitation	No further provision of water supply and sanitation services. Services decline.	> 90% of Basin population served. The balance is self-sufficient.
Access to information and the availability of technology	No further development of current telecommunications network. Limited stakeholder engagement."	Wide network of well-trained agricultural and forestry extension officers established.

5.3 Development of Scenario Options

5.3.1 Approach to scenario options

Given uncertainties relating to future development (i.e. changes in food production, food security and world commodity prices; alternative predictions for fuel sources and power generation over the next fifty years; and the extent to which regional energy pools and markets are likely to be developed), any scenario is likely to contain large inaccuracies. This leaves aside the question of political stability, which is probably the biggest determinant of all.

Economists do not produce scenarios for economic out-turns more than two years ahead because of the enormous range of variables involved which invalidate their assumptions. We have advised on four scenarios, culled from a larger set discussed under section 5.3.2, below:

- a decline in economic activity (Failed State or 'catastrophic' scenario)
- maintenance of the status quo (Baseline)
- a moderate increase in economic activity (Gradual Improvement)
- high growth scenario (Diversified Economy)

The baseline, gradual improvement and diversified economy scenarios do include projects and programmes that will influence the forecast, but where advance planning makes likelihood reasonable.

The focus is on the latter three scenarios, which cover the range of outcomes and present firm choices for action. The alternative approach would have been to promote a debate on a wide range of variant possibilities, which would distract from the key issues.

Trying to predict the future of a major water resource scheme with a design life of 50 years highlights the uncertain value in building scenarios, which may look sophisticated but are based on predictive guesswork. The primary task is to give decision-makers clear guidance options.

5.3.2 Scenario identification

Based on the drivers discussed in Section 5.2, a number of different potential scenarios were developed as listed below. **Table 5.2** presents a summary of the driving forces behind each scenario.

- **Catastrophic or 'failed state' scenario:** The catastrophic or 'failed state' scenario reflects a complete failure for participating states to come to grips with the issues facing the Kagera Basin, both within country and through a Basin organisation. Population will grow; land degradation and erosion is severe, deforestation will increase; plot sizes will decrease but the urban population will grow rapidly; water demands will increase without the added ability to supply. Existing systems of water supply and water treatment will fail and will not be replaced. Water quality will decline at local level, as will the quality of flow to Lake Victoria. The invasive weeds problem will increase massively in rivers and the Lake. Actual volumes of water to the Lake will stay stable or even increase as capacity to use water (through irrigation) declines. Hydropower will be generated but in limited amounts. This is a completely unacceptable scenario but one that could follow on failure to set up a River Basin Organisation, increased political instability in more than one basin state, collapse of the world economy resulting in loss of both markets and funding, and lack of personal and political will to keep population numbers within sustainable limits.

- **Baseline Scenario**: The current trends regarding population growth, urbanisation and land use will prevail and growth in water requirements will continue as is. On-going projects and programmes will be implemented under existing institutions. A lack of Basin-wide cooperation will mean implementation of *major* projects is difficult.

- **Uprising Scenario**: One of the Basin countries will experience major civil unrest resulting in rapid political changes, safety and security concerns, a lack of institutional capacity and an imbalance in the Basin priorities and concerns. Significant migration to other Basin countries will result, leading to rapid growth of urban centres putting a strain on the available water resources and shortages of water supply and sanitation services. Disparity between Basin countries will result in a disintegration of Basin-wide management and fragmented planning and project implementation.

- **Each-to-their-own Scenario**: The current trends in the Basin will prevail in terms of high population growth, urbanisation and economic development; however each Basin country will be focussed on their own needs with limited cooperation and integrated planning. In one country irrigation might be the priority (e.g. Burundi) whereas in another hydropower will be the primary focus (e.g. Uganda). Little or no effort is made to share resources and as a result, development is fragmented and unequal.
- **Gradual Improvement Scenario**: Political stability in the region will improve resulting in increased investment and donor funding. A Basin organisation will be established but it will not have sufficient capacity to implement a very large number of projects simultaneously. Some of the national plans for irrigation expansion, particularly in the marshlands will be realised and industrial development and diversification will continue slowly.
- **Diversified Economy Scenario**: Population growth slows to a more manageable rate of ±1%. Significant agricultural and industrial development will take place, however the main focus will be on diversification of the economy. This brings great economic benefit but also results in large increases in water requirements. Domestic demands will also increase as a result of rapid urbanisation and provision of water supply and sanitation infrastructure to the bulk of the Basin population. An upturn will be experienced in the global economy resulting in increased investment and donor funding. The Kagera River Basin Organisation will be fully operational allowing for cooperation and the implementation of large projects and programmes.
- **Visionary Scenario**: Population growth will slow to less than 1%, with decreasing population pressure and strain on resources. Urban centres will grow at a manageable rate and all Basin inhabitants will be provided with potable water supply and improved sanitation. Only environmentally sensitive agricultural practices will be used and irrigation efficiency will be vastly improved. Basin countries will work in a completely integrated and harmonious fashion, sharing resources and only implementing projects which benefit the Basin as a whole.

A summary of the scenarios in terms of level of Basin development and scale of impacts is presented in **Figure 5.2**.

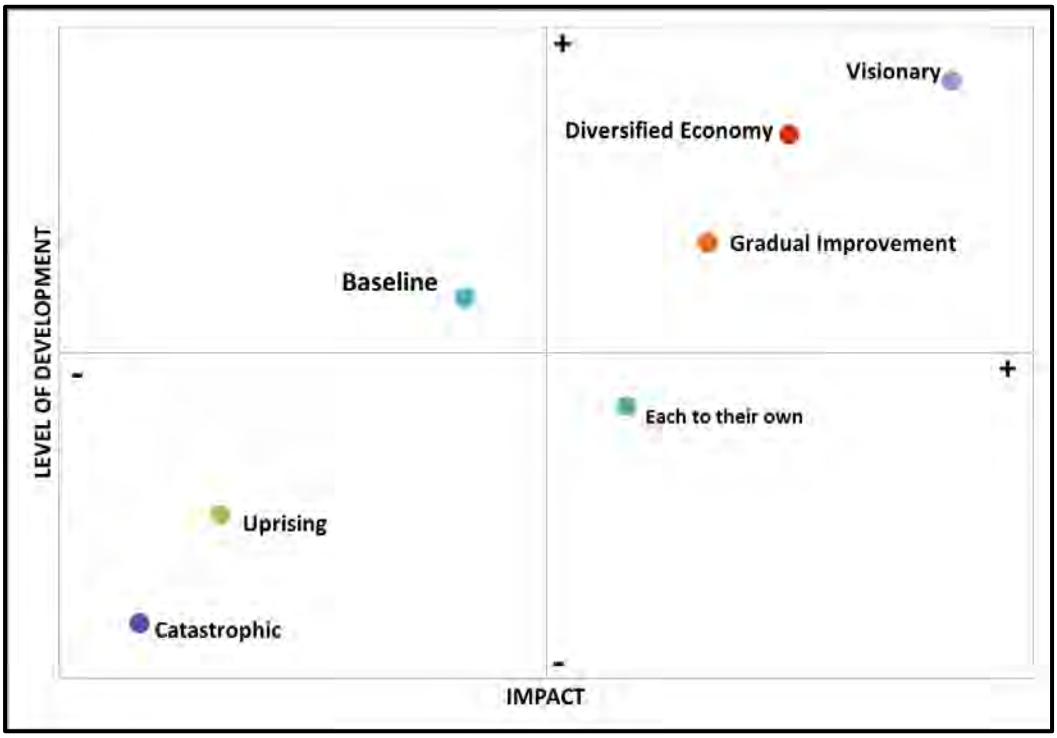

Figure 5.2: Indicative quadrant graph of possible scenarios

Table 5.2: Summary of changes in drivers for each scenario

Drivers	Scenarios						
	Catastrophic	Baseline	Uprising	Each to their own	Gradual Improvement	Diversified Economy	Visionary
External							
Climate Change		Climate change resulting in decreased water availability and increased demands		Climate change resulting in decreased water availability and increased demands	Climate change resulting in decreased water availability and increased demands	Climate change resulting in decreased water availability and increased demands	
Commodity prices		Prices remain high and volatile		Prices remain high and volatile		Prices stabilise encouraging trade	Prices stabilise encouraging trade
International economic climate	Uncertainty in the global economy worsens	Current uncertainty in the global economic climate prevails	Current uncertainty in the global economic climate prevails		Improved economic climate and increased donor funding	Improved economic climate and increased donor funding	Stable and positive global economic growth
Political and Economic							
Institutional Capacity / Governance	No Basin organisation therefore planning is fragmented and country focused	Establishment of a Basin organisation but institutional capacity is limited	Disparity between countries leading to failure of Basin organisation	No Basin organisation therefore planning is fragmented and country focused	Functional Kagera River Basin organisation but slow in implementation	Fully functional Kagera River Basin organisation	Fully functional Kagera River Basin organisation
Political stability	Political instability and lack of willingness to invest in Basin		Major failure of one of the Basin states				
Market Access			Limited access to markets, worsened by political turmoil	No attempts at inter-country transport planning	Improved transport networks around major urban centres	Development of a Basin-wide transport network linking producers to the main markets	Development of a sustainable Basin-wide transport network (road, rail, air)
Industrialisation and diversification		Slow increase in secondary and tertiary activities		Investment in key mining / industrial projects that are of a national priority	Increased investment in industry	Well-developed industrial and mining sectors creating increased demand for primary resources	Well-developed secondary and tertiary sectors

Drivers	Scenarios						
	Catastrophic	Baseline	Uprising	Each to their own	Gradual Improvement	Diversified Economy	Visionary
Agricultural development / policies on agricultural funding	No investment in improving current practices leading to decreased productivity and food shortages	Subsistence farming with continued land degradation		Investment in large agricultural projects of national priority	Improved farming practices and steady increase in formalised irrigation (on a small scale)	Major decline in subsistence agriculture and significant improvements in crop yields and efficiency of water use	Mechanised agriculture with many large scale irrigation schemes
Land use change / degradation	Massive land degradation and soil erosion	Continuation of current land use practices	Over-exploitation of resources and worsening soil erosion	Continuation of current land use practices	Expansion of urban centres and changes in land use	Reforestation and soil erosion mitigation / repair	Only sustainable land use practices employed.
Social							
Population pressure	Increased population growth	Current population growth continues	Massive population movements due to instability / war	Current population growth continues	Death rate decreases faster than birth rate decreases resulting in net increase in population growth	Birth rate decreases and death rate decreases resulting in decreased population growth	Population growth of less than 1% per annum
Urbanisation		Current rapid rates of urbanisation prevail with little planning	Massive unsustainable migration to urban centres	Current rapid rates of urbanisation prevail with little planning	Some level of urban planning and design	Sustainable urbanisation resulting from increased availability of employment opportunities in urban centres	Planned and sustainable rural-urban migration going hand in hand with job creation and provision of services and infrastructure
Poverty	Severe poverty	Continuation of current efforts to reduce poverty	Severe poverty	Steady increase in employment opportunities and reduction in poverty	Steady increase in employment opportunities and reduction in poverty	Large scale poverty reduction and employment in sectors other than agriculture	Large scale poverty reduction and employment in sectors other than agriculture
Availability of electricity	No investment in electricity generation and degradation of existing infrastructure	Investment in selected hydropower projects		Priority electricity projects developed per country to meet only their own needs	Investment in selected hydropower projects	Development of large scale energy projects	Electricity provided to all Basin consumers

Drivers	Scenarios						
	Catastrophic	**Baseline**	**Uprising**	**Each to their own**	**Gradual Improvement**	**Diversified Economy**	**Visionary**
Improved Water Supply and Sanitation	No investment in water supply and sanitation infrastructure and degradation of existing infrastructure	Continued efforts to provide improved sanitation and potable water to meet MDGs	Worsening water supply and sanitation coverage due to population migration	Continued efforts to provide improved sanitation and potable water to meet MDGs	Continued efforts to provide improved sanitation and potable water to meet MDGs	Major water supply and sanitation projects	Water supply to 90% of Basin consumers and sanitation to all Basin consumers
Access to information and the availability of technology	Lack of stakeholder engagement and information sharing	Attempts to improving access to information		Limited transboundary information sharing	Well-developed communication networks	Well-developed communication networks	Well-developed communication networks

5.3.3 Scenarios to be developed

The *Catastrophic and Uprising Scenarios* are worst-case situations presenting a very undesirable and unacceptable picture of the future. The *Each-to-their-Own Scenario* does not fit well with the Basin vision and objectives. Conversely the *Visionary Scenario* is a best-case scenario that is also very unlikely to be realised within the 20 year planning horizon although it may present a picture of a possible very long term future. These scenarios were therefore not developed further in this Consultancy. Should circumstances change, it is recommended that these scenarios be revisited, updated and, if required, developed further.

Of the remaining scenarios, the Baseline Scenario, Gradual Improvement Scenario and Diversified Economy Scenario were selected for further analysis as they provide a good spread of possible futures given the current Basin trends. The Catastrophic Scenario has been added as possible, even if unacceptable. However, as a scenario this does not allow for planning beyond damage control and mitigation.

5.3.4 Catastrophic Scenario

The Catastrophic Scenario reflects a state of inertia, decline and collapse, along with continued population growth and growing pressure on the landscape and on the resources of the Basin. A projection to 2032 assumes that planned projects will not come to fruition. Even watershed and land management programmes, built around education and capacity building, will come to a halt. Water demands will grow but the ability to meet these demands will show very little increase. An approximate status quo is assumed with regard to growth in water use (as opposed to water demand). There will be some increase in use as individuals develop their own ways of abstracting and using water and these increases will balance the failure of collective systems currently managed by water authorities. Domestic and livestock use will grow along with numbers but per capita usage will be static. Water use will therefore be little more in 2032 than it is today.

Drivers

Under the Catastrophic Scenario it has been assumed that:

a) *Population growth* will continue at similar rates. *Urbanisation* will increase even faster than at present as land becomes less able to support people.
b) *Water supply and sanitation* will not improve. There will be an overall decline as systems do not keep pace with the growing population. Water treatment plants and Wastewater treatment works will start to fail and will not see refurbishment and renewal, with declining water quality and increasing health implications.
c) *Political stability will decline* – particularly as population pressures create land hunger. Lack of political stability will be a major driver leading to the failed state situation.
d) *Economic growth will decline*, despite sporadic developments, mostly in the mining sector.
e) *Agricultural water use will slowly decline* as schemes become dysfunctional. Local systems for water capture and use will remain prevalent. The agricultural economy will slip into a local subsistence economy with very few commercial enterprises.
f) *The global economy will decline further* – with less and less investment support. It will not be possible to raise international funding for projects. Local funding sources will also decline along with the tax base and the ability to collect payments for existing resource use (power and water).
g) *Institutional capacity will decline* through lack of training and bleeding of skills to countries outside the Basin.

Agricultural water use

For the failed state scenario a growth rate of 0% is assumed for all countries sharing the Basin. The total irrigation requirement will stay approximately stable (at 718 million m^3/a). Existing schemes will become less efficient and there will be a decline in agricultural production but water losses will increase. Local schemes will also take more and more water at source, compensating for the water lost or not used by formal schemes.

The livestock requirement will increase from 12.1 million m^3/a in 2012 to 18.7 million m^3/a - as for the baseline situation.

Domestic and Industrial supply

Domestic water demand will increase along with the population and increase in urbanisation. With the population continuing to grow at 3% per annum the population will grow from 16 million in 2012 to 29 million in 2032. Where this differs from the Baseline Scenario is that water use per capita will not increase in the urban areas, due to failing supply systems and lack of finance and capacity to continue upgrades, even at current rates. However urban populations will grow at a faster rate (5%) due to more rapid in-migration from rural farms. Demands of 50l/capita/day for urban use and 20l/capita/day for rural use were assumed into the future.

Industrial and non-domestic water, currently assumed at 15% and 25% of rural and domestic water use respectively will increase, but very slowly, under the failed state scenario. Increase is projected to be from 29 million m^3 in 2012 to only 52 million m^3 by 2032 (1/3rd of baseline growth)

None of the currently proposed distribution and supply projects (pipelines) are funded and built in this scenario. There may be some small increase in groundwater abstraction.

Summary of Catastrophic (failed state) water scenarios

- Irrigation remains at 718 million m^3/a.
- Domestic and urban use grows with the population at 2012 consumption rates from 16 million to 29 million m^3/a.
- Industrial and non-domestic use will grow from 29 million m^3/a to 52 million m^3/a.

Total increase in water use: 36 million m^3/a

5.3.5 Baseline Scenario

The Baseline Scenario reflects the current status of development in the Basin and a projection to 2032 based on the assumption that growth in demand will continue to follow the historic Basin trends (as presented in the First Interim Report), as a result of the implementation of on-going projects and programmes. Water demands will grow substantially and it is assumed that they will be met by existing groundwater supplies, other water supply schemes and informal surface water extraction rather than by *major* projects or interventions. The baseline is the reference state to compare other "potential futures" against.

Drivers

Under the Baseline Scenario it has been assumed that:

a) *Population growth and urbanisation* will continue at similar rates to the current trends resulting in increased domestic water demand and the need for urban water supply and sanitation.

b) *Water supply and sanitation* will continue to improve as a result of the many programmes currently underway aimed at meeting MDG targets.

c) Current trends regarding *political stability* in the region will not change.

d) *Economic growth* will slow slightly from current levels, allowing all water use sectors to grow but not too significantly.

e) A continuation of the current situation in which *agricultural water use* will increase, but primarily on a subsistence scale and to meet local demands, with some intensification and irrigation initiatives.

f) The *global economy* will remain much the same meaning that the current donor climate will continue, and as a result sourcing funding for the implementation of very large high-risk projects is likely to be a problem. It is assumed that funding of small-scale projects will be the norm.

g) In terms of *Institutional capacity*, countries will continue to implement projects on a national basis through the existing institutions without the establishment of a Basin organisation. Skills and capacity to implement, operate and maintain such schemes will be largely lacking and as a result, there is a high risk that such significant projects will not be successfully implemented.

Agricultural Water Use

For the baseline scenario, growth rates in the irrigated areas of 3.0%, 2.2%, 2.0% and 1.2% were assumed for Rwanda, Burundi, Tanzania and Uganda respectively, slightly lower than the historic growth rates. Gross irrigation water requirements of 1 500 mm and 2 200 mm along with efficiency factors of 1.2 and 1.5 were assumed for plains irrigation and marshlands irrigation respectively. The resulting projected baseline irrigation water requirements per sub-catchment are presented in Table F-1 in **Annexure F**. The total irrigation requirement will grow from 718 million m^3/a in 2012 to 1172 million m^3/a in 2032.

The current and projected livestock water demands per sub-catchment are presented in Table F.2 in **Annexure F**, based on an assumed growth rate of 2.2% per annum, which is slightly lower than the projected population growth rate. The total livestock requirement will grow from 12.1 million m^3/a in 2012 to 18.7 million m^3/a in 2032.

Domestic and Industrial Supply

The Basin population was projected at between 2.8% and 3.0% per annum (depending on the sub-catchment) bearing in mind the current Basin country growth rates of between 2.8% and 3.0%. The result was an increase from 16 million to 29 million people by 2032. These values form the basis of all scenarios. Present day (2012) per capita demands of 70 l/capita/day and 20 l/capita/day were assumed for urban and rural populations respectively. As a result of the many programmes currently underway aimed at improving access to potable water and given the advancements already made in reaching the MDG targets, as a baseline it was assumed that the per capita demands would grow to 110 l/capita/day and 40 l/capita day for the urban and rural populations respectively. In addition, allowance was made for rural-urban migration of 0.18% per annum, resulting in a change in the urban proportion of the Basin population from 12% to 15% and giving an equivalent urban population growth rate of 4% per annum..

The forecasted domestic water demand for each of the Basin sub-catchments is presented in Table F.3.1 in **Annexure F**, showing an increase from 156 million m^3/a in 2012 to 533 million m^3/a in 2032.

As a baseline, it was assumed that industrial and non-domestic water use together are approximately 15% and 25% of the rural and urban domestic water use respectively and will therefore grow at the same growth rate. This is a reasonable assumption considering that in light of continued high population densities and growth rates, industrial development and diversification will be necessary. Increased urbanisation will also result in increased non-domestic demands. The projected baseline industrial and n on-domestic water requirements are presented in Table F.4. The industrial and non-domestic requirement for the Basin will grow from 29 in 2012 million m^3/a to 97 million m^3/a in 2032.

Summary of Baseline Scenario water requirements

A summary of the projected total Basin water demands per sector over the 20-year planning horizon for the Baseline Scenario is presented in **Figure 5.3**. The total demand will increase from 915 million m^3/a to 1 824 million m^3/a, which equates to an average annual growth rate of 3.5%.

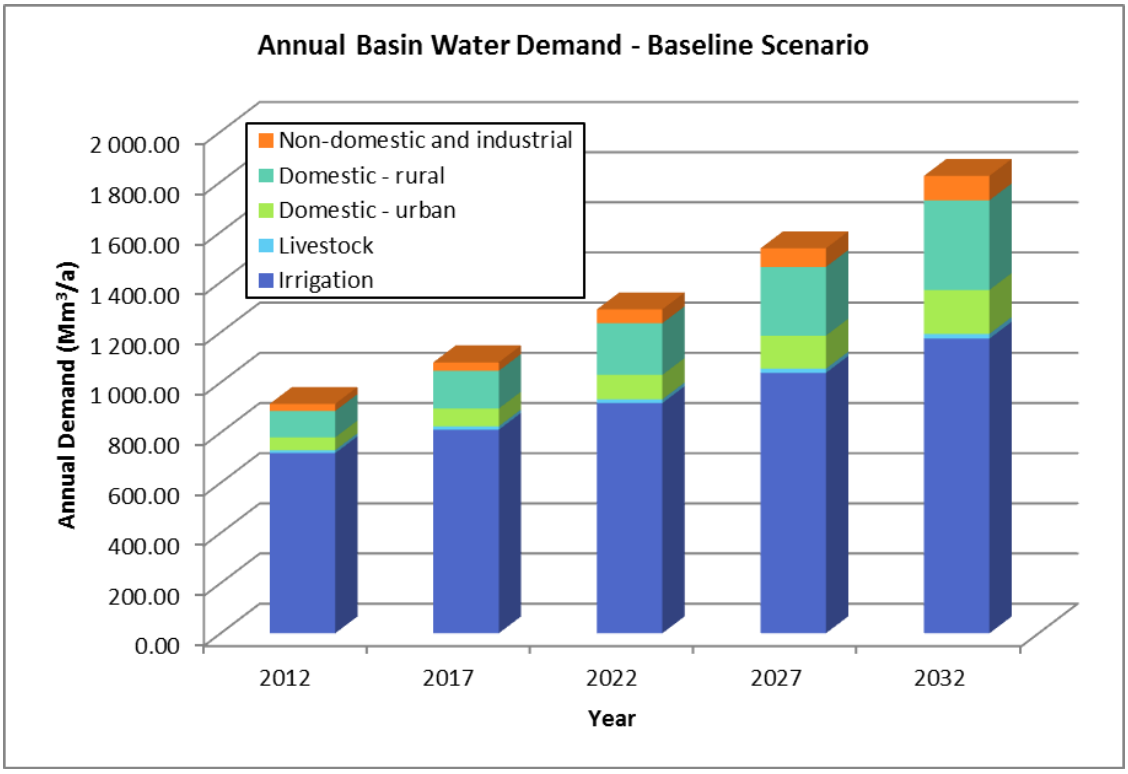

Figure 5.3: Water demands for the Baseline Scenario

5.3.6 Gradual Improvement Scenario

The *Gradual Improvement Scenario* assumes an improvement of the status quo, to a degree which is considered realistic and attainable, provided that an enabling environment is provided. This essentially entails gradual improvements in the main problem areas of the Basin through the implementation of the planned programmes and improved governance. Growth in water requirements will be somewhat higher than the Baseline as a result of economic development and institutional strengthening. A stronger institutional base will allow for the implementation of some of the identified projects and programmes, which will contribute towards meeting a higher growth in demand.

Drivers

Under the Gradual Improvement Scenario it has been assumed that:

a) In terms of *political stability*, annual improvement in each country's risk rating will take place, moving out of the high risk / alert zones. Such a political climate will be achieved through improved governance, clamping down on corruption, a free and fair democratic process and an attempt to tackle some of the major social issues.

b) *improved governance* will allow for increased economic growth, particularly in the industrial and mining sectors which will have an impact on the water requirements of the Basin. The creation of more economic opportunities in the urban centres will increase the rate of urbanisation and thus push up the average per capita domestic requirements and also the non-domestic requirements associated with business etc. in the urban centres.

c) an improvement in the *international economic climate* would also be beneficial, allowing for increased exports, particularly of agricultural products. High commodity prices and improved market access will encourage a move away from subsistence agriculture towards commercial irrigation schemes. Development of the agricultural sector will obviously have to go hand in hand with improved infrastructure, particularly in terms of access (road, rail etc.).

d) *international donor funding and investment* will also be key for implementation of some of the large projects. This will be stimulated by improved regional stability, economic stability and the international financial situation.

e) *The Kagera River Basin Organisation* will be operational to realise adequate institutional capacity for large transboundary projects to be implemented. This is perhaps the most important aspect to be realised. For this Scenario it is assumed that the organisation will be functional but not up to full institutional capacity, meaning that the number of projects that can be realistically implemented is limited. However, at a national level a strengthening of skills and governance will allow for implementation and operation of smaller schemes.

f) *agricultural practices* will improve with a steady increase in formalised irrigation and more commercial type farming. In addition, steady investment in *water supply and sanitation* as well as *energy* will occur.

Water requirements inclusive of those in the Baseline Scenario

Agricultural Water Use

Under the Gradual Improvement Scenario it is assumed that some of the ambitious national plans for irrigation expansion, particularly in the marshlands, will be at least partially realised, resulting in an effective growth rate in irrigated area of 3.0% per annum, as opposed to the value of 2.5% under baseline conditions. The resulting irrigation demands are given in Table F.5 in **Annexure F** showing an increase in irrigation demand to 1 326 million m^3/a by 2032.

Increased urbanisation and standard of living generally goes hand in hand with increased demand for meat, meaning that the growth in livestock water demand will also be higher. A Gradual Improvement Scenario growth rate of 2.85% (equal to the average population growth rate) per annum was assumed giving the projected demands shown in Table F.6, with an increase in demand to 21.3 million m^3/a by 2032.

Domestic and Industrial Supply

For all scenarios it has been assumed that the total Basin population growth will be the same. It is only the urban/rural split and the per capita demands that will vary. For the Gradual Improvement scenario it was assumed that per capita requirements would increase to 120 and 50 l/capita/day by 2032 for the urban and rural populations respectively. A higher rural-urban migration rate (0.36%) was assumed, resulting in a 2032 urban population equating to 18% of the total Basin population and a resulting average urban population growth rate of 5.0% per annum. The resulting domestic demands are provided in **Table 5.7**. The total Basin domestic demand will increase at 7.5% per annum to 659 million m^3 per annum.

The same assumptions were made regarding non-domestic and industrial demands as a percentage of the domestic demands resulting in the values shown in Table F.8.

Summary of Gradual Improvement Scenario water requirements

A summary of the projected total Basin water requirements per sector over the 20 year planning horizon for the Gradual Improvement Scenario is presented in **Figure 5.4**. The total demand will increase from 915 Mm^3/a to 2 128 Mm^3/a which equates to an average annual growth rate of 4.3%.

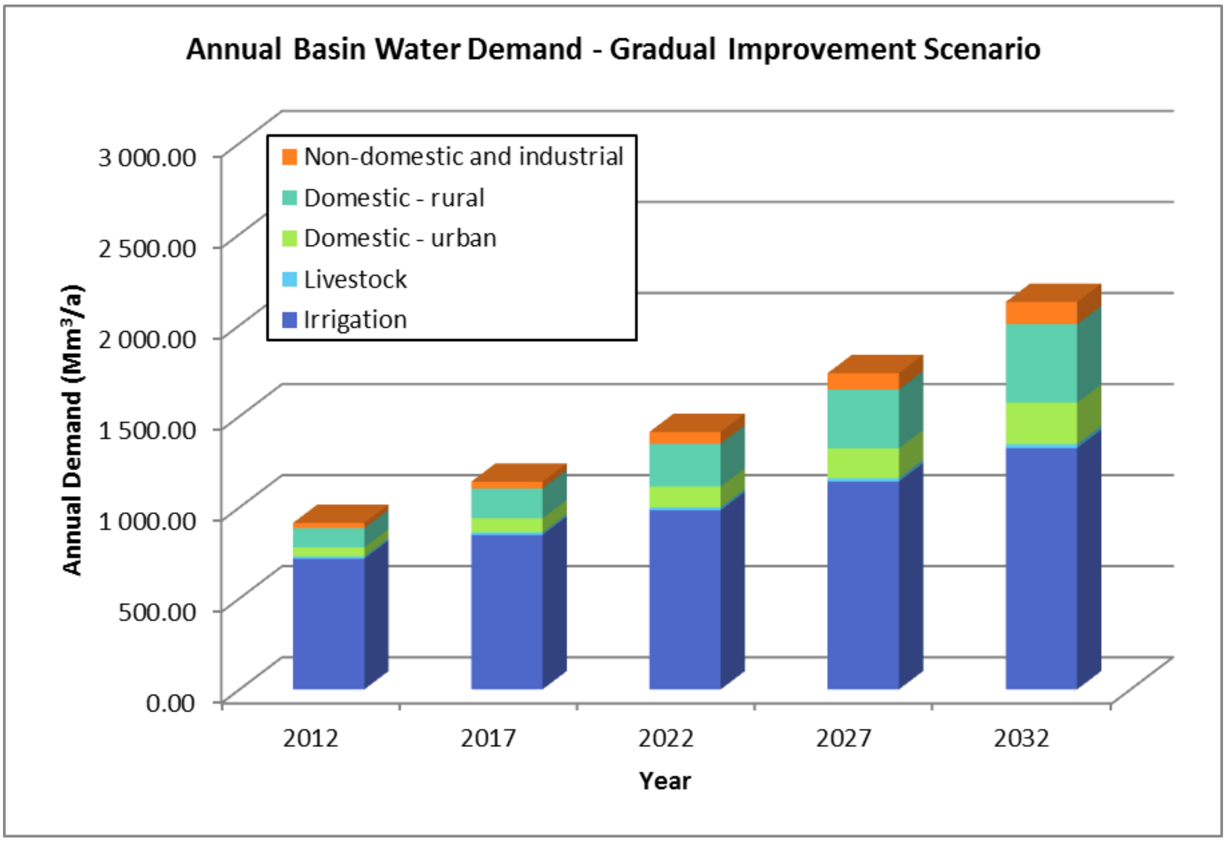

Figure 5.4: Water demands for the Gradual Improvement Scenario

5.3.7 Diversified Economy Scenario

While the Baseline and Gradual Improvement scenarios are both considered achievable, the *Diversified Economy Scenario* was developed to show the influence of very high growth in water demands on the Basin. This scenario is driven by rapid economic growth and investment in the secondary and tertiary sectors as a result of a positive global economic outlook and strengthened institutional capacity and improved governance. The result is a rapidly diversifying economy and growth in industrial and non-domestic water demands. The growth projection is high enough to deliver significant benefits but not too high so as to be unrealistic or outside of the realm of what could reasonably be achieved under very favourable circumstances. The Diversified Economy scenario will be characterised by a major shift from the status quo, facilitated by both external and internal drivers.

Drivers

Under the *Diversified Economy Scenario* it has been assumed that:

a) an upturn in the global economic situation allows for Basin economic growth through increased investment, significant industrial development and growth in the export markets.

b) donor climate is positive, with donors funding more significant infrastructure projects which have a positive influence on the Basin.

c) projects and programmes are carefully planned in a cooperative and integrated manner and good-practice feasibility assessments are undertaken to ensure that money is well-spent to ensure maximum beneficiation.

d) the Kagera River Basin Organisation will be fully operational with sufficient numbers of adequately-skilled staff, facilities and funding. This will be key to facilitate the implementation of large scale transboundary projects and programmes.

e) the region and Basin countries are politically stable, which helps efforts to secure sufficient economic investment to grow Basin country economies and encourages increased donor funding. Any degree of uneasiness amongst external investors will significantly hamper the ability of the Basin to achieve High Growth.

f) transparent and effective national and regional governance implementing effective major programmes to tackle service delivery and social issues.

g) investment into transportation and energy infrastructure allows for access to markets and rapid industrialisation which will increase water demands but can also pose major threats to Basin water resources.

h) rapid urbanisation taking place but in a planned and systematic way so as to allow for provision of basin services to all urban residents.

Water requirements further to the Baseline and Gradual Improvement Scenarios

Agricultural Water Use

Under the Diversified Economy Scenario it is assumed that significant expansion in formalised irrigation will take place, driven firstly by a growth in the local market and secondly by substantial growth in the export market. An effective growth rate in irrigated area of 4.0% per annum was assumed, as opposed to the value of 2.5% under baseline conditions. The resulting irrigation demands are given in Table F.9 in Annexure F showing an increase in irrigation demand to 1 671 million m^3/a by 2032.

As for the Gradual Improvement scenario, increased urbanisation and standard of will go hand in hand with increased demand for meat products, meaning that the growth in livestock water demand will also be higher. A high growth rate of 4.0% per annum was assumed giving the projected demands shown in Table F.10, with an increase in demand to 26.6 million m^3/a by 2032.

Domestic and Industrial Supply

Improved standards of living would result in per capita requirements increasing substantially to 150 and 80 l /capita/day by 2032 for the urban and rural populations respectively. A higher rural-urban migration rate (0.63%) was assumed, resulting in a 2032 urban population equating to 22% of the total Basin population and a resulting average urban population growth rate of 6.0% per annum. The resulting domestic demands are provided in Table F.11. The total Basin domestic demand will increase at 9.5% per annum to 954 million m^3.

The same assumptions were made regarding non-domestic and industrial demands as a percentage of the domestic demands resulting in the values shown in Table F.12.

Summary of water requirements

A summary of the projected total Basin water requirements per sector over the 20-year planning horizon for the Diversified Economy Scenario is presented in **Figure 5.5**. The total demand will increase from 915 million m^3/a to 2 819 million m^3/a, which equates to an average annual growth rate of 5.8%.

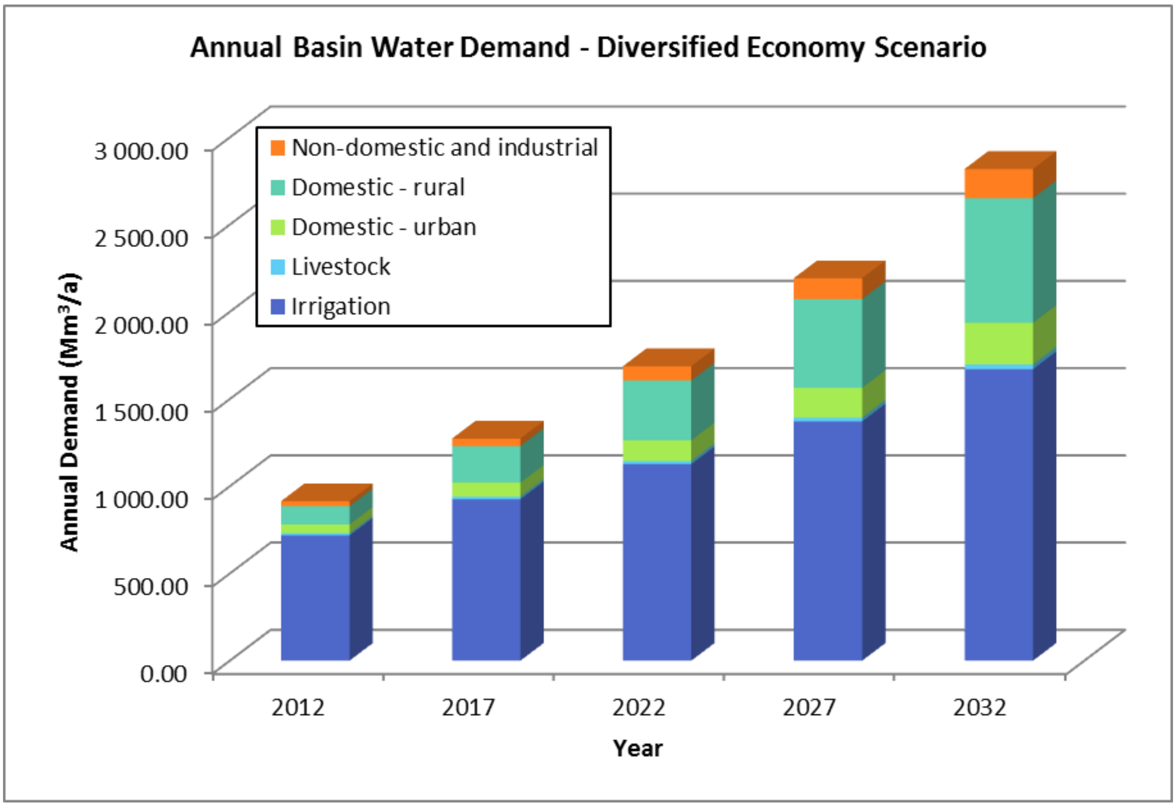

Figure 5.5: Water demands for the Diversified Economy Scenario

5.4 Evaluation of Development Scenarios

5.4.1 Monthly water balance

As part of the Diagnostic Assessment Task, a baseline water resource model was set up using Mike Basin, allowing for the simulation of monthly flows for each sub-catchment. These flows can now be compared to the present day and projected water demands in order to ascertain the impact of the potential scenarios on water resource availability and river flow in the Basin. Note that these comparisons are based on average flows only.

Baseline Scenario

Table 5.3 shows the natural runoff, the present day flows given use in 2012, and the future flows considering the 2032 demands for the Baseline Scenario. The reduction in MAR from 2012 to 2032 at the Kagera mouth will be approximately 12% in total.

Table 5.3: Change in MAR for Baseline Scenario

BASELINE								
Sub-Catchment Basin state	MAR (Mm^3/a)							
	Kagitumba	Kagera Lakes and Wetlands	Mwisa	Kagera Mouth	Nyabarongo Upper	Nyabarongo Lakes and Wetlands	Upper Ruvubu	Lower Ruvubu
Natural	438	7255	771	8651	2114	3345	2197	3472
Present Day (2012)	421	6440	749	7736	1927	2934	2084	3258
Future (2032)	386	5623	718	6827	1750	2514	1952	3031
% Change from 2012 to 2032	-8%	-13%	-4%	-12%	-9%	-14%	-6%	-7%

The changes in **monthly flows** for each of the sub-catchments under the Baseline Scenario are shown in **Figure 5.6**. The largest impact will occur in the dry months (August and September) due to higher irrigation requirements in these months which form the bulk of the total demand. The reduction in average monthly flow in September from 2012 to 2032 at the Kagera Mouth is a significant 21%.

Gradual Improvement Scenario

The natural runoff, present day flows given use in 2012, and future flows considering the 2032 demands for the Gradual Improvement Scenario, are shown in **Table 5.4**. The reduction in MAR from 2012 to 2032 at the mouth will be approximately 16%.

Table 5.4: Change in MAR for Gradual Improvement Scenario

GRADUAL IMPROVEMENT								
Sub-Catchment Basin state	MAR (Mm^3/a)							
	Kagitumba	Kagera Lakes and Wetlands	Mwisa	Kagera Mouth	Nyabarongo Upper	Nyabarongo Lakes and Wetlands	Upper Ruvubu	Lower Ruvubu
Natural	438	7255	771	8651	2114	3345	2197	3472
Present Day (2012)	421	6440	749	7736	1927	2934	2084	3258
Future (2032)	375	5350	706	6523	1690	2381	1905	2950
% Change from 2012 to 2032	-11%	-17%	-6%	-16%	-12%	-19%	-9%	-9%

The changes in **monthly flows** for each of the sub-catchments under the Gradual Improvement Scenario are shown in **Figure 5.7**. Again the largest impacts occur in the dry months (August and September) due to higher irrigation requirements. Average monthly flow in September will reduce by almost a third (28%) from 2012 to 2032 at the Kagera Mouth.

Diversified Economy Scenario

Table 5.5 shows the anticipated annual average flows under the Diversified Economy Scenario. The reduction in MAR from 2012 to 2032 at the mouth will be approximately 25%.

Table 5.5: Change in MAR for the Diversified Economy Scenario

DIVERSIFIED ECONOMY								
	MAR (Mm^3/a)							
Sub-Catchment **Basin state**	**Kagitumba**	**Kagera Lakes and Wetlands**	Mwisa	Kagera Mouth	**Nyabarongo Upper**	**Nyabarongo Lakes and Wetlands**	**Upper Ruvubu**	**Lower Ruvubu**
Natural	438	7255	771	8651	2114	3345	2197	3472
Present Day (2012)	421	6440	749	7736	1927	2934	2084	3258
Future (2032)	350	4731	682	5832	1555	2073	1799	2770
% Change from 2012 to 2032	-17%	-27%	-9%	-25%	-19%	-29%	-14%	-15%

The changes in **monthly flows** for each of the sub-catchments under the Diversified Economy Scenario are shown in **Figure 5.8**. The changes in average monthly flows are quite significant, much greater than the changes in annual flow. In September, a reduction of 44% will be apparent at the Kagera Mouth.

5.5 Recommended Targeted Development Scenario

The Baseline Scenario represents a continuation of the status quo with very little improvement, which given the dramatic improvements in the Basin over the last few years, is an unlikely Scenario. The project plans and programmes currently in place all aim higher than the baseline and at least some of these are achievable under current conditions. So, whilst the situation may turn around in the future (up or down) it is recommended that the Gradual Improvement Scenario be targeted for future development in the Basin. This Scenario is much more ambitious and requires institutional strengthening, economic growth and increased investment, but at levels which are certainly achievable. The Diversified Economy Scenario is not considered achievable at this stage but should be a future target, particularly with regard to the institutional strengthening.

A potential approach would be to focus on a Gradual Improvement Scenario by implementing smaller schemes and then to transition to higher growth, as institutional and funding capacity, and other enabling factors, develop. The migration from a scenario with lower growth to one with higher growth could be accommodated in the Basin Development Plan. Final selection should depend on Basin Stakeholders.

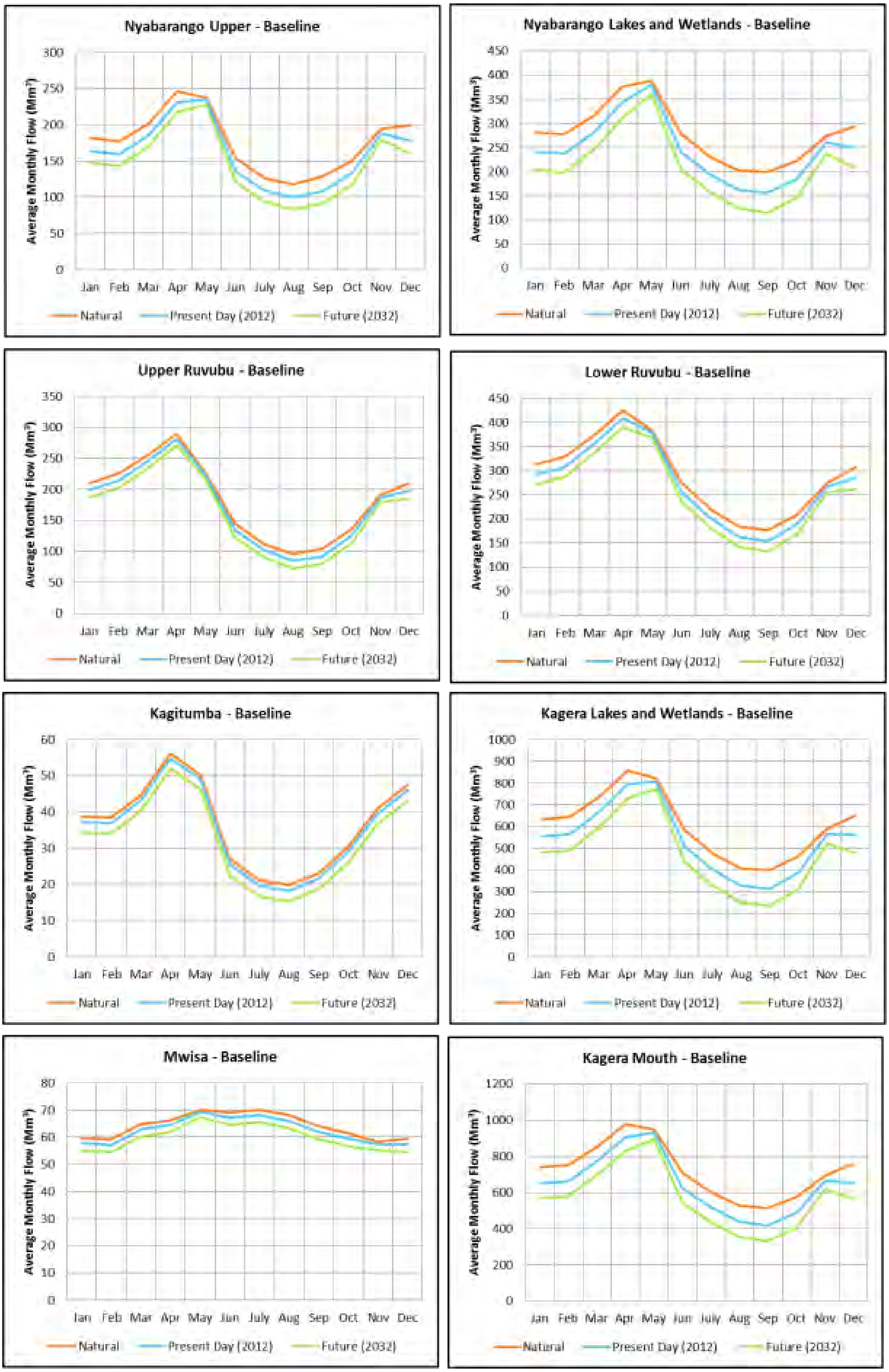

Figure 5.6: Monthly (cumulative) water balance per sub-catchment for Baseline Scenario

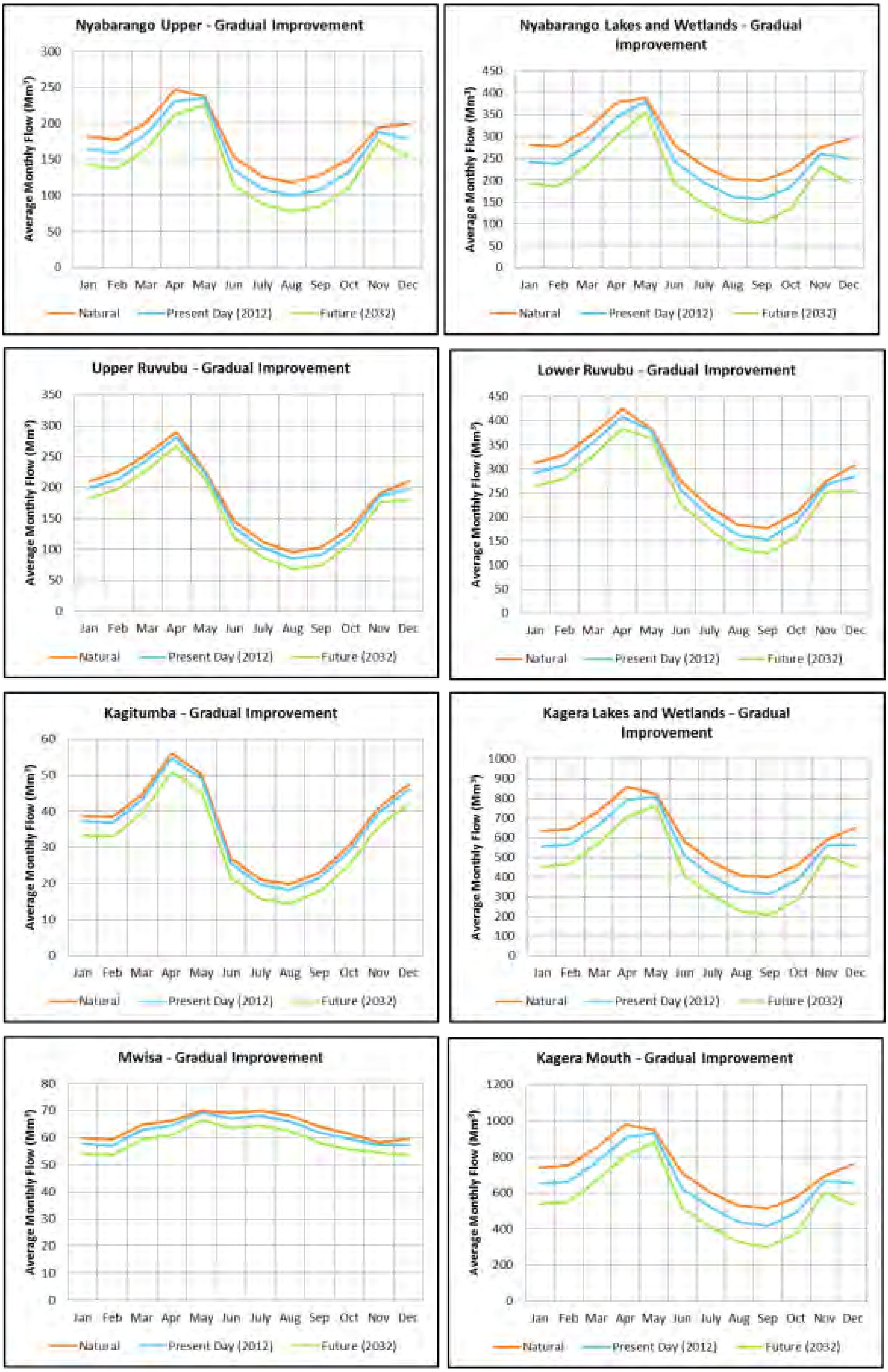

Figure 5.7: Monthly (cumulative) water balance per sub-catchment for Gradual Improvement Scenario

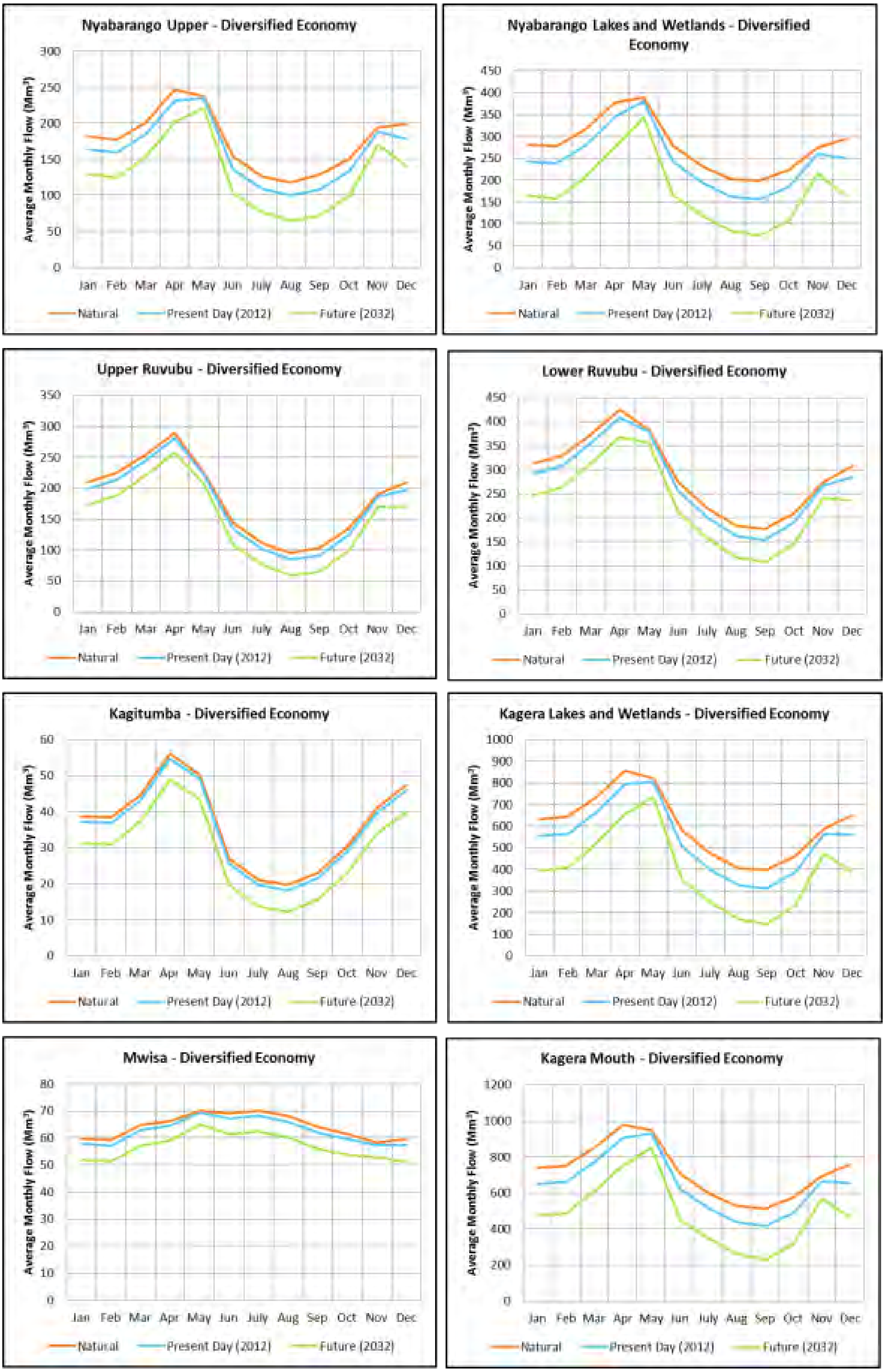

Figure 5.8: Monthly (cumulative) water balance per sub-catchment for Diversified Economy Scenario

5.6 From scenarios to strategies

NELSAP provided five specific strategic objectives that form a subset of the strategic areas/strategies (IWRM Framework) presented (see Chapter 6, section 6.4).

These specific objectives are (our italics):

1. *(Development of)* Human capital and knowledge base
2. Land use productivity *(through)* improved rain-fed agriculture - soil and water conservation
3. Increased irrigated agriculture
4. Hydropower development
5. Fisheries and aquaculture development.

Success factors and drivers that would impact on these objectives were tabulated for each of a sequence of scenarios for each of the above objectives. The key purpose of this exercise is to identify the strategies that should ultimately be adopted in order to deal with the situation under different scenarios. These strategies are incorporated and further developed under Chapter 6 and in the Implementation Plan.

In this exercise, the focus is on success factors that align with the specific strategic objectives, and not on the full spectrum of IWRM strategies.

Success factors, drivers, the weightings assigned to a matrix of impact and certainty levels of success/factor driver combinations (low, medium or high) for the four scenarios selected – and the strategies that arise as a consequence of this exercise are presented in **Table 5.6**, below.

Each driving factor was rated as low, medium or high based on the following two factors:

- **Impact:** The impact of each driver was assessed in terms of effects of changes in the driver on water resource quantity and quality, water and energy requirements and the ability of the Basin countries to meet these requirements.
- **Certainty:** The certainty of each driver was determined based on how sure one can be of change occurring. For example, industrialisation might have a low certainty as it is not known whether industrial development will change from the status quo. Climate change however has a high certainty as although there is little certainty regarding the actual changes that will occur, there is consensus that things will change.

Table 5.6: Development drivers for the selected sequence of scenarios, together with counteracting strategies

Success factors	Drivers	Catastrophic (failed state)		Baseline		Gradual Improvement		Diversified Economy		Strategies
		Impact	Certainty	Impact	Certainty	Impact	Certainty	Impact	Certainty	
Enabling environment (legal framework)	Policies	high	low	medium	medium	high	medium	high	high	• Water sector legislative / regulatory framework supporting harmonisation and growth • Monitoring and law enforcement • Structures for trade-offs, conflict prevention and resolution
	Level of law enforcement	low	low	medium	medium	high	high	high	high	
	Trade-offs, conflict prevention and resolution	high	low	medium	medium	medium	high	high	high	
	Political stability	high	medium	high	medium	high	medium	high	medium	
Effective organisational set-up	Government policies (agriculture, energy and fisheries/aquaculture)	high	medium	medium	medium	high	high	high	high	• Harmonised /improved legislative and regulatory framework for agricultural intensification, and energy and fisheries/aquaculture • Mixed model of governance – separate strategies for transboundary & in-country water management • Encourage private sector participation in the water sector
	Decentralisation vs. centralisation	high	low	medium	medium	medium	medium	medium	medium	
	Private sector participation	medium	low	medium	medium	high	medium	high	high	
Capacitated human resources / Effective Governance	Level of education	high	medium	high	medium	medium	medium	medium	medium	• Education, training and capacity building programmes and institutions • Capacity building and mentorship • Applicable government policies • Supporting good development initiatives • Change management. Improve attitudes / morale • Extension officers provide technical support, especially for agriculture and land use
	Prior experience	medium	high	high	medium	medium	medium	low	medium	
	Level of government support	high	high	medium	medium	medium	medium	low	medium	
	Skilled/unskilled labour	high	medium	high	medium	high	medium	medium	medium	
	Training incl. education institutions	high	high	high	medium	high	medium	high	low	
	Attitude to training	medium	high	medium	high	medium	medium	medium	low	
	Availability of technical services	high	high	high	high	high	medium	high	low	
Knowledge management	Skilled labour	high	high	high	high	medium	medium	low	medium	• Qualified and trained human resources • Monitoring and information management
	Access to information and technology	medium	high	medium	high	low	medium	low	medium	
Investment capital	Donor willingness	high	low	high	low	high	medium	high	high	• Create enabling environment for donor funding • Structures for trade-offs, conflict prevention and resolution • Favourable investment policies / tax breaks • Funding of water resources development and management
	Political stability	high	medium	high	medium	high	medium	high	medium	
	Private sector participation	medium	low	medium	medium	high	medium	high	high	
	Policies on agricultural funding	high	medium	medium	medium	high	high	high	high	
Sufficient water	Population and development pressure	high	high	high	medium	high	medium	high	low	• Sustainable water supply services

Success factors	Drivers	Catastrophic (failed state)		Baseline		Gradual Improvement		Diversified Economy		Strategies
		Impact	Certainty	Impact	Certainty	Impact	Certainty	Impact	Certainty	
quantity and good quality	Watershed degradation	high	high	high	high	high	medium	high	low	• Soil and water conservation • Climate preparedness • Policy adaptation
	Climate variability and change	high	low	high	low	medium	low	low	low	
	Effective national policies	high	medium	high	medium	medium	medium	low	medium	
Improved livelihoods	Poverty	high	high	high	high	high	high	medium	medium	• Intensification of existing agriculture • Rainwater and runoff management • Irrigation • Extension support officers • Improved energy sources / hydro-electricity • Sustainable fisheries • Aquaculture development
	Population pressure	high	high	high	high	high	high	medium	high	
	Land use change / degradation	high	high	high	high	high	medium	high	low	
	Policies on funding of livelihoods improvement	high	low	medium	medium	high	high	high	high	
	Facilitation of social and economic development	low	low	low	medium	medium	high	high	high	
Commodity prices	National policies on trade	high	high	high	medium	medium	medium	medium	low	• Policy adaptation and harmonisation • Energy and transport strategies • Support for and investment in technology
	International price variations	low	high	low	medium	medium	medium	high	medium	
	Support infrastructure	high	high	high	high	high	high	high	high	
	Technology availability	medium	medium	high	medium	high	medium	high	medium	
Access to markets	Access to information	medium	high	medium	high	low	medium	low	medium	• Improve access to information • Develop value-adding facilities • Transport and energy strategies • Promotion of private sector investment • Government investment /funding
	Value adding facilities	high	high	high	high	high	medium	high	medium	
	Support infrastructure	high	high	high	high	high	high	high	high	
	Private sector level of development	low	high	medium	high	medium	medium	high	low	
	Level of government support	high	high	medium	high	medium	medium	low	low	
	Transportation policy	high	high							
Downstream industries such as agro-processing	Private sector development	medium	low	medium	medium	high	medium	high	high	• Sustainable private sector development • Government policy support • Seek international investment • Labour relations • Develop energy resources • Develop transport infrastructure
	Government policies	high	high	high	medium	high	medium	high	high	
	Access to finance	medium	low	medium	medium	high	medium	high	high	
	Labour availability	medium	high	medium	high	medium	high	medium	high	
	Energy availability	high	low	high	low	high	medium	high	medium	
	Transportation facilities	high	medium	high	low	high	medium	high	medium	

Success factors	Drivers	Catastrophic (failed state)		Baseline		Gradual Improvement		Diversified Economy		Strategies
		Impact	Certainty	Impact	Certainty	Impact	Certainty	Impact	Certainty	
Industrialisation and diversification	Urbanisation	low	low	medium	medium	medium	high	high	high	• Irrigation focussed on export • Energy / hydropower development by countries • Development of country and regional energy distribution networks - Short/medium term: focus on in-country expansion - Longer term: regional energy distribution
	Support infrastructure	high	high	high	high	high	high	high	high	
	Availability of electricity	high	high	high	high	high	medium	medium	medium	
	International economic climate	high	high	medium	high	low	medium	low	low	
	Market access	high	high	high	medium	medium	medium	low	low	
	Access to information and technology	medium	high	medium	high	low	medium	low	medium	
Social responses	Project acceptability	low	high	medium	high	high	high	high	high	• information sharing on projects • Diversification • Capacity building • Governance • Information systems • Capacity building - education and training
	Alternative livelihoods	high	low	medium	medium	low	medium	low	medium	
	Available social capital (labour)	medium	high	medium	high	high	high	high	high	
	Level of support services	high	medium	medium	medium	medium	medium	high	high	
	Information access	medium	low	medium	medium	high	high	high	high	
	level of education	high	low	high	medium	high	medium	high	high	
Improved and sustainable land use	Improved agricultural practices	low	low	low	low	medium	medium	medium	medium	• Sustainable land management • Rehabilitation of degraded environments • Land tenure harmonisation/ reform • Extension support officers • Stakeholder representation and participation
	Land tenure systems	medium	medium	medium	medium	high	medium	high	medium	
	Availability of electricity	high	high	high	high	high	medium	medium	medium	
	Effective land management	high	high	high	high	high	medium	medium	medium	
	Effective stakeholder engagement	high	high	high	medium	medium	medium	high	high	

6. IWRM-BASED BASIN STRATEGIES

This chapter consists of nine sections. The first section deals with issues of relevance to the Consultancy objectives, followed by Section Two which summarises challenges and opportunities. Section Three outlines the methodology for determining strategies, while Section Four introduces the strategic Basin areas and strategies. Sections Five to Nine presents the strategies developed under each of the five strategic areas for the full IWRM Framework.

6.1 Relevance to the Consultancy Objectives

The Basin strategies provide strategic direction to serve as a basis for decision-making for the management and development of the water resources of the Kagera Basin. These take into account the issues, constraints, opportunities, drivers and development and conservation priorities in the Basin to set strategic approaches that will lead to effective, environmentally sound and socially sustainable Basin development. These strategies are aimed at sensible and beneficial conservation and development of the overall resources of the Kagera River Basin, to support poverty alleviation and socio-economic upliftment.

6.2 Challenges and Opportunities

In spite of some economic growth evidenced in parts of the Basin in recent years, and the abundant water and other natural resources, poverty and environmental degradation are major challenges in the Basin. The majority of the people in the Basin have low access to water supply and sanitation, particularly in the rural areas. There are periodic food deficits caused by combination of factors including failure of the rain season (most food production is rain-fed), poor supply of agricultural inputs, inadequate road networks and inadequate management. The majority of the population has no access to electricity and depends on fuelwood and charcoal for cooking. Water shortages are experienced as a result of seasonality of river flows, notably in the drier eastern parts of the Basin.

The Basin is rich in resources, with a very high and growing population. The Basin has considerable potential for development in agriculture, tourism, hydropower and mining. As the global economies develop, this creates considerable opportunities for the Kagera Basin. Water resources development and management will be a key factor in the socio-economic development of the EAC region as a whole and in the Lake Victoria Basin specifically.

6.3 Methodology for Determining Strategies

Strategy is a combination of the ends (objectives) for which the BDP is striving and the means (targets) by which it is seeking to get there. A strategy is sometimes called a roadmap - which is the path chosen to follow towards achieving the end vision.

Strategic planning and decision processes should end with objectives and a roadmap of ways to achieve them. The goal of strategic planning mechanisms like formal planning is to increase specificity in business operation, especially when long-term and high-stake activities are involved.

One of the core goals when drafting a strategic plan is to develop it in such a way that is easily translatable into action plans that can be pursued in parallel. Most strategic plans address high level initiatives and overarching goals, but don't get translated into day-to-day projects and tasks that will be required in order to achieve the plan. The most common method of rectifying this are specific, time bound statements of intended future results and general and continuing statements of intended future results, which most models refer to as either targets or goals (sometimes interchangeably).

Terminology or word choice, as well as the level a plan is written, are both examples of easy ways to fail at translating a strategic plan in a way that makes sense and is executable by others.

People typically have several goals at the same time. "Goal congruency" refers to how well the goals combine with each other. *Does goal A appear compatible with goal B? Do they fit together to form a unified strategy?* "Goal Nesting" consists of the grouping one or more goals within the same strategy.

There are many approaches to strategic planning but for the purpose of this consultancy the *Draw-See-Think-Plan* approach was used. The basin methodology is outlined below:

- **Draw** - *what is the ideal image or the desired end state?* This is achieved be determining the Basin Vision.
- **See** - *what is today's situation? What is the gap from ideal and why?* This is achieved by compiling the diagnostic analysis and comparing to the Basin objectives.
- **Think** - *what specific actions must be taken to close the gap between today's situation and the ideal state, and by defining strategies to address potential future scenarios?* This is achieved by identifying strategic areas and their objectives and strategies to be implemented to achieve the Basin vision
- **Plan** - *what resources are required to execute the activities?* This is detailed in the Implementation Plan.

As a summary the activities and targets in the implementation plan culminate in the strategies and strategic areas which culminate in the Basin vision, as illustrated below.

Figure 6.1: Draw-See-Think-Plan approach

6.4 Kagera Basin Strategic Areas – Introduction to the Basin IWRM Framework Strategies

A Strategy is essentially the set of options determined to be the best measures for addressing the issues affecting water resources development and management in the Kagera River Basin. Strategy formulation thus provides the occasion and opportunity to analyse strategic areas for the Basin. Drawing from the Basin criteria, the Basin vision and objectives and the scenario development, the following strategic areas have been identified:

- **Creating an enabling environment** which addresses the criteria of capacity building, financial support, governance accountability, institutional structures, knowledge growth and training, legislative frameworks, stakeholder participation and water resources management.
- **Basin water management** addresses the criteria of Peace, regional cooperation and water resources management.
- **Water supply and sanitation** addresses the criteria of future generations, improved sanitation, poverty reduction and water supply.
- **Livelihoods and socio-economic development** addresses the criteria of equitable and reasonable utilisation of water resources, future generations, improved livelihoods, poverty reduction, sustainable social and economic development and water resources management.
- **Environmental protection, land and disaster management** which addresses the criteria of adaptation to climate variability and climate change, environmental and water resource protection and environmental rehabilitation.

Discussion of issues and options analysis was a component of the Diagnostic Assessment workshop conducted with the Basin states with stakeholders at national level. While the options analyses were primarily subjective (group discussions), the results present synthesis of collective knowledge, experience and expertise; hence greater weight was given to the outputs of these consultative meetings.

The strategic areas and strategies are discussed in the following five sections. The strategy numbers align with the numbers allocated to each strategy in **Table 2.10** above.

6.5 Creating an Enabling Environment Strategies

6.5.1 Context

There is currently a disjunction between the member states in terms of levels of governance, institutional capability, management tools and support mechanisms to facilitate growth and development of the Kagera River Basin.

Addressing the challenges of integrated and coordinated water resources management and development begins by ensuring crucial administrative tools are in place, including human capacity, knowledge management, institutional arrangements, legislative and policy frameworks. The effectiveness and success of the Kagera River Basin IWRM Plan depends on the capabilities of the participating states and transboundary institutions that will have to implement it. Governance is a key element because it is what enables better decision making on an on-going basis on all aspects of water resources development, management and use. Water governance refers to the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society.

Developing water security to reduce poverty and environmental degradation requires water to be a key part of national development. Achieving these goals requires water laws, policies and institutions to be established at the national scale.

6.5.2 Strategic Objective

The strategic objective is:

“To operationalise water governance in support of Basin-wide water resources development and management”

6.5.3 "Creating an enabling Environment" Strategies

The following strategies are cross cutting elements required for all strategies and are particularly important for developing an enabling environment that adopt an integrated development approach and support the growth and development of the Kagera River Basin:

a) Harmonised and improved water sector legislative and regulatory framework at regional and national levels (1.1).
b) Ensure qualified human resources and knowledge base within water management institutions for water planning, management and research (1.2).
c) Strengthen knowledge base and establish IWRM information systems and tools (1.3).
d) Promote broad-based stakeholder representation and participation in water resources planning, development and management (1.4).
e) Ensure adequate funding for water resources management (1.5).

These strategies are described as follows:

Strategy 1.1 Harmonised and improved water sector legislative and regulatory framework at regional and national levels to promote regional economic integration and increased trade

Basin resource planning and management must be linked to the participating countries' overall sustainable development strategy and public administrative frameworks. This requires the participating States to ensure they have an adequate legislative and regulatory framework in place, such as the necessary legislation and policies to govern the use, management and protection of water resources and activities impacting on water resources, as well as the institutional capacity and capability to support and enforce the governance framework. Good existing policies and frameworks must be harmonised.

a) *Member States support the BDP through a harmonised governance framework.* Each of the member states already has a set of legislation and policies in place. In order to ensure the effective and sustainable management of the Basin, it is necessary to ensure that these legal frameworks support and promote the objectives of the Basin Development Plan and the tools and mechanisms necessary to implement the plan.

b) Institutional structures for Basin water resources management are operationalized. In order to implement the governance framework, and thereby implement the various levels of the Basin Plan, requires capacitated institutions with clear mandates, functions and jurisdictions at the national and lower levels.

c) Harmonised or improved regulation of national legislative framework. In order achieve successful implementation and effect change requires the regulation of legislation. This requires establishing compliance and enforcement units within the institutions and developing the necessary tools and mechanisms to enable regulation.

Strategy 1.2 Ensure qualified human resources and knowledge base within water management institutions for water planning, management and research

In order to capacitate the various institutions to carry out the functions of water resources development and management in the Basin and within the member States requires qualified human resources and appropriate knowledge base within water management institutions. This is necessary at Basin, national and local level, and across the various water-related disciplines e.g. water resources management to service delivery. This capacity is established through two mechanisms, i.e. training and research to develop and improve water resource methodology.

a) *Training and capacity building.* Training in water resources needs to take place at a variety of levels, from community based natural resources management, through school education awareness programmes, to tertiary education and in-job training. Training also needs to cover a variety of topics such as IWRM, groundwater management, monitoring, information management, GIS, IT, etc.

b) *Practical and focused research and technology development:* Applied research and technical knowledge plays a role in understanding the Kagera Basin's water resources and will contribute to the development of many of the techniques and tools used for IWRM purposes. New challenges in the basin's water resource continually arise and require new understanding and new tools and techniques. To meet these challenges, the Basin Organisation should support practical research and evaluation of technology choices that will deal with issues affecting water resources of the Kagera Basin.

c) Infrastructure management staffing: Sufficient and effective capacity and capability is necessary in all the elements of water resources management from policy and regulation to infrastructure management and operation. The activities in this target are aimed at identifying what are the necessary levels of capacity and competency for the various elements of water resources management.

d) Learnerships in water resource management: In order to grow capacity and capacity in the institutions it is necessary to promote knowledge growth. This can be achieved through mentoring programmes, scholarships, training programmes, etc.

Strategy 1.3 Strengthen knowledge base and establish IWRM information systems and tools

Without good information, it is not possible to manage properly. Sound governance of water depends on effective information systems and a good knowledge base. In order to manage water resources at the basin level, it is important for decision makers to have easy access to comprehensive, representative and reliable information. Basin member States need to create an Information System that will meet their own particular needs, both for managing the data they collect and for delivering information to different groups of users in formats they can understand and make use of, as well as to report information at a Basin scale.

In order to develop such information systems it is important to have strong support from decision makers. It is therefore very important to make decision makers aware that an Information System (IS) is a priority tool for water resources governance. Information systems are also important for knowledge management and participatory management of the river basin. They provide stakeholders with easy access to relevant information and a way for water users and resource managers to interact. A Basin Information System allows information on Basin management to be shared clearly and transparently.

The Kagera Basin needs an effective water information management system that is linked to information systems for water resources and services in the Basin countries. The Basin information system does not have to be sophisticated. What is important is that it should be affordable and work for the Kagera Basin. The information system needs to be interactive, accessible, affordable, appropriate and equitable. There is a need to establish or improve Basin-wide water resources technology, data collection, processing, information transfer systems and repository databases, custodianship and compatibility. In addition, adequate water resources models and working tools should be provided.

a) Develop/upgrade/modernise an Information Management System

Kagera Basin information systems and tools should include:

- A hydrological information system, for the quality and quantity of both surface and groundwater resources, as well as seasonal and annual fluctuations.
- A water resource quality information system.
- Biotopes and aquatic environments, and their degrees of sensitivity.
- A water use and pollution register.
- The risks of recurrent extreme phenomena, such as floods, droughts and accidental pollution.
- Social and economic indicators, for example costs, prices, and taxes.
- Spatial data, aerial photography and mapping systems.
- Basin river simulation package and associated suite of modelling tools, e.g. MIKE Basin.
- Accreditation of laboratories.
- Standardisation of information management approaches and aspects, to be agreed between Basin countries, e.g. key transboundary monitoring points and the monitoring spatial and time scales.

Strategy 1.4 Promote broad-based stakeholder representation and participation in water resources planning, development and management

Stakeholder participation is a key component for sustainable water resources management. Participation especially at the local level builds trust in projects, as well as gathers local knowledge. The approach to promote broad-based stakeholder participation includes:

a) *Promote dialogue within and across the National water sectors:* Integrated water resources management must ensure that the interests of the diverse stakeholders who use and impact water resources are taken into account. Management of water resources and the impacts of activities on these resources are best understood by the specialists and scientists working in the water sector and the stakeholders affected don't necessarily understand the complex systems, cumulative impacts or technical jargon. Therefore on-going dialogue with stakeholders should not be once off when specific projects are being implemented but should rather be an on-going process in order to develop understanding and a knowledge base in the relevant communities as well as institutional memory.

b) *Comprehensive public engagement and participation:* Involving stakeholders dramatically improves the quality of decisions as well as compliance with the decisions made. It builds trust, lays the foundations for implementation and community ownership of projects, and often results in a better balance of equity, economics and environmental impact mitigation. However, when stakeholder engagement and participation is undertaken without clear objectives or timeframes, the process can be stalled, undermine the proposed development, and impose heavy costs on both the participants and/or development project. A clear framework for stakeholder participation should be developed. Gender and youth aspects and involvement of these groups require special attention.

c) *Awareness-raising:* Efficient and sustainable use of water should be promoted through awareness raising campaigns.

d) *Effective change management:* In order to ensure sustainable and reasonable utilisation of the Kagera Basin resources, will require a certain amount of change in lifestyles and traditional practices. In order to ensure effective change and support by the basin population will requires sound change management.

Strategy 1.5 Ensure adequate funding for water resources management

All activities and development will require financial investment. Funding to support development of water resources in the Kagera Basin will be necessary. The financial viability of development activities is vital to ensure sustainability.

The following will be required:

a) *Water tariffing:* In order to ensure that the cost of water is acknowledged and recovered to carry out further activities such as operation and maintenance of infrastructure, an effective water tariffing system should be designed and implemented.
b) *Efficient planning of donor aid:* In order to facilitate poverty reduction and economic development in the Basin, donor aid projects need to be aligned with National and Basin strategies and priorities, to prevent 'white elephants' that are a drain on budgets cannot be maintained or remain unutilised.
c) *Public-Private Partnerships:* Public-Private Partnerships for water resources management must be promoted and strengthened.
d) *Sustainable funding for water resources development:* Water resources development is very capital intensive and risk adverse for developing countries. Mechanisms to ensure sustainable funding for development need to be developed and implemented.
e) *Sound financial management:* It is important that funding allocations actually reach the necessary infrastructure and development projects in order to reduce poverty and promote economic growth and development in the Basin. Mechanisms for sound financial management need to be designed, legislated and implemented.

6.6 Basin Water Management Strategies

6.6.1 Context

Many activities are currently being undertaken by the Basin countries and many other organisations to support water management in the Kagera Basin. These is however limited coordination of such activities. The policy, legal and institutional framework has been documented in Chapter 5 of the Diagnostic Assessment Report of this Consultancy. This shows the functions of most water management institutions.

6.6.2 Strategic objective

The strategic objective for this challenge is:

"Effective management and control of basin water resources and users."

6.6.3 "Basin water management" strategies

The following strategies are necessary to ensure sound water management for the Kagera River Basin:

a. Integrated and coordinated transboundary Basin water management (2.1).

b. Watershed management by Basin countries (2.2).

c. Effective monitoring, assessment and information management for adequate management and allocation of water (2.3).

d. Asset management and operation of basin water infrastructure (2.4).

These strategies are described as follows:

Strategy 2.1 Integrated and coordinated transboundary Basin water management

In order to ensure effective management and development of the Kagera River Basin as a whole, an effective governance structure needs to be implemented. This is implemented at the Basin scale by ensuring mechanisms such as a legislative framework, i.e. a Basin Agreement and institutional capacity (a River Basin Organisation), are established to facilitate Basin management. This governance structure needs to be supported by the member States. The establishment of these mechanisms will be implemented through the following approaches:

a) *Basin Management Agreement.* Many attempts and versions have been drafted in the past. It is crucial that a formal Agreement be negotiated and signed that supports the future development and management of the Basin including transboundary aquifers. This Agreement forms the legislative framework and backbone for integrated and coordinated development of the water resources of the Kagera Basin.

b) *River Basin Organisation:* An organisation needs to be established in order to facilitate the transboundary management and planning of the Kagera River Basin. The organisation will be mandated by a Basin agreement.

c) *Regional Cooperation.* The Kagera Basin and its Basin States are members of several regional organisations, including the East Africa Community, the Southern Africa Development Community (through Tanzania) and the Nile Basin. Each of these has their own legislative frameworks and institutional arrangements. The actions of this strategy aim to ensure that these regional perspectives are taken into consideration in the development and management of the Kagera Basin

d) *Coordinated management.* Although the Basin needs to be managed in a holistic manner, the implementation of plans and programmes will ultimately be carried out by the member states at the national and local levels. In order to coordinate these activities, mechanisms for coordination at the national and local levels need to be established.

e) *Control of transboundary impacts.* In compliance with the UN Convention on the non-navigational use of international watercourses, impacts on the Kagera River Basin need to be prevented or where they cannot be prevented then managed, controlled, eliminated and/or mitigated. The actions of this strategy are to establish a framework for the management of such impacts at a Basin scale.

f) *Trade-offs facilitation and conflict prevention and resolution.* The Basin Agreement will identify mechanisms for trade-off facilitation and conflict prevention and resolution at the Basin scale. The actions of this strategy are to establish these mechanisms.

g) *Management of transboundary bulk water infrastructure.* Inadequate synergy arrangements in the Basin and thus overlapping and duplication of efforts should be avoided. Systematic capitalization of the available opportunities in the Basin should be sought with the aim of promoting multi-purpose uses and maximize sharing of benefits.

h) *Resource sharing:* The Kagera Basin flows through four countries, in order to maximise benefits from the basin it is essential that all the member states have the same baseline resource management criteria.

Strategy 2.2 Watershed management by Basin countries

Different regions and areas of the Basin are characterised by different environments, problems and pressures. Although planning and strategic management takes place at the Basin-scale, IWRM calls for the 'on the ground' management of water resources at the smaller watershed/catchment level. In order to achieve effective management at the River Basin scale requires that linkages and coordination must be made across spatial scales and levels of decision-making.

This strategy addresses the strategic planning and operational management functions needed to be undertaken by the Basin member States. This involves the protection, use, development, conservation, management and control of water resources. Implementation of this strategy requires the following approaches:

a) *Watershed management:* The management of water resources at watershed level, within each of the Basin member States, will require the delineation of the applicable watersheds and the establishment of institutional management arrangements and capacity. These management structures will be responsible for various activities in their respective watersheds which could include determining water availability and water balances, drought management and mitigation, water quality monitoring, compliance monitoring, asset management and operation, information management, disaster management and preparedness, etc.
b) *Watershed strategies:* Each of the watersheds should develop a strategy for the systematic management of water resources in the watershed. The objective of the watershed strategy should be to implement the Basin vision and goals in the watershed context. The strategy should balance the needs of the users in the watershed with future water demand and environmental protection.
c) *Watershed stakeholder coordination:* Within each watershed there are a variety of stakeholders including *inter alia*, rural users, production users, industry, mines, urban users, the environment, etc. The needs of all the stakeholders should be considered in the management of the watershed. Further to build trust of the stakeholders and understanding of water resources management regular interaction with the stakeholders is encouraged.
d) *Hydrology:* Updating of the surface water Basin model and implementation and refinement of aquifer *models.*
e) *Integrated Basin-level planning:* The approach will be for a future Basin organisation and the various national water departments to work with and to inform district/local authorities. Promote up-front liaison and agreement between such departments and district or local authorities on proposed significant water developments. Promote awareness at district/local level of the need to inform government of their water resource development plans and to consult with Basin/national staff before making recommendations.
f) *Sector water use planning:* detailed water strategies should be developed per sector, taking into consideration institutional arrangements, permit requirements, water use and demand, impact mitigation, and setting targets for efficiency and water quality.

g) *Water allocation:* Processing of water use applications and registration of water use on a central water use register for improved water use management.

h) *Water Conservation / Water Demand Management (WC/WDM):* In order to ensure the sustainable utilisation of water resources, water efficient techniques and utilisation should be developed and promoted through all sectors and to all users.

Strategy 2.3 Effective monitoring, assessment and information management for adequate management and allocation of water

Effective monitoring systems are needed to collect appropriate data and information for water resources. The Basin countries national line agencies already operate many gauging stations that collect some of the required data and information. However, the systems were developed and are being operated largely in isolation from one another. Spatial coverage is incomplete and as a result little or no information is collected in some areas. Problems are also being experienced with the quality and reliability of information. The dissemination of and access to information is not as effective or as comprehensive as it should be. There is a lack of either personnel and equipment or skills to monitor adequately, and a lack of funds to increase monitoring points at an acceptable rate.

Existing and planned monitoring and assessment systems should ideally be amalgamated into a structured and coherent monitoring, assessment and information system. This is however not always financially viable or practical and it will be necessary in many cases to rely on the existing monitoring and information systems of the Basin countries, but significantly improve the sharing of data and information, as well as ensuring that information gaps are cooperatively and collaboratively addressed. The first step lies in identifying role-players and in a joint assessment of needs, roles and responsibilities.

This strategy is required to address:

a) *Information requirements*, which include an ICT-based data and information protocol and a database update mechanism.

b) *Monitoring networks for climate, surface water and groundwater*: Monitoring is required to better assess resource availability, to introduce billing, to ensure compliance with water licence conditions where appropriate, and to control all water use.

Effective regional monitoring networks need to be put in place, data capturing and processing should be undertaken and the networks and databases must be managed, to ensure adequate availability of data for the management of sustainable water use and protection of surface freshwater bodies and groundwater. Meteorological monitoring, and monitoring for surface water, groundwater, water quality and river health is also required.

The availability of reliable data and information on all aspects of water resources management is fundamental to the successful implementation of the Basin Development Plan. Proper decisions cannot be made unless it is informed by reliable, relevant, up-to-date information. This includes management of water resources in terms of quantity, quality, allocation, use and resource protection.

Strategy 2.4 Asset management and operation of basin water infrastructure

Sustainable delivery of water supply and sanitation services can only be achieved through effective management of available and planned assets. Lack of proper asset management in the Kagera Basin has resulted in deterioration of the existing facilities and in reduction of service delivery. Lack of operation and maintenance expenditures and a “fix as it fails” approach adopted by most operators and owners resulted in the overall increase of the life cycle cost of assets.

This strategy aims to effectively manage water supply and sanitation assets to maximize their service delivery whilst minimising costs over the life cycle of the asset.

The approaches to achieve this strategy are:

a) *Improvements to asset practices:* Improvement of asset management practices according to an improvement plan.

b) *Asset management plan and maintenance plan:* Compile plans for the management and maintenance of assets, including staffing requirements, finance options, etc.

c) *Asset inventory and status*: Identifying all available water and sanitation assets and preparing an inventory is the starting point of asset management. Owner of such facilities should prepare a database of the assets. The asset inventory should be updated periodically to include new assets developed or implemented. Assessment of current conditions of all assets should be made including the need for maintenance, refurbishment, rehabilitation and replacement of assets. Asset assessment shall be conducted periodically and shall identify the changes in the condition of the asset since the last assessment

d) *Refurbishment of assets on the basis of priority.* This involves identifying key assets that will have the most impact on the system and the service delivery, in general. Those assets must be prioritised and refurbished.

e) *A mechanism to ensure maintenance and efficient utilisation of water supply facilities and distribution networks established:* An operation and maintenance plan, which forms part of the asset management strategy, shall be formulated. The O&M plan shall be a proactive approach (the O&M plan shall be developed during the planning and design stage of the particular asset of infrastructure) and shall ensure the sustainability of the O&M investment and the level of service that can be attained while reducing projected expenditure over the life cycle of the asset. The O&M plan shall consider the life cycle cost of the asset which includes capital, operation, maintenance and decommissioning expenditures.

f) *Dam safety*: A dam safety register that is regularly updated is needed. Safety inspections of large dams need to be undertaken.

6.7 Water Supply and Sanitation Strategies

6.7.1 Context

Adequate domestic supply of safe drinking water and basic sanitation plays an important role in livelihood, community wellbeing, health and dignity. The level of development to be attained is the target of the Millennium Development Goals, in particular MDG 7 (Water and sanitation), in this case halving by 2015, the portion of population without sustainable access to safe drinking water and basic sanitation. Following a robust approach and expecting that UN MDG targets will be reached ahead of time, member countries of the Kagera Basin have also set their own MDG targets. While the majority of the population of Kagera Basin have access to water supply and sanitation this is usually of a very basic service scale.

Urban water issues tend to be disconnected from planning processes and Basin-level management. Urban water master plans need to account for the various infrastructural components of water management including water purification, water supply, wastewater collection and treatment, non-waterborne sanitation, storm water drainage, and solid waste management. Further, in the urban context, land development should take into consideration water sensitive urban design.

6.7.2 Strategic objective

The strategic objective is:

"Provide improved access for various water uses and sanitation facilities"

6.7.3 “Water supply and sanitation” strategies

The strategies to achieve this objective are:

a. Rural domestic water supply (3.1).

b. Providing improved sanitation facilities (3.2).

c. Urban water supply and treatment to potable standards (3.3)

d. Urban, industrial and mining wastewater treatment (3.4)

These strategies are described as follows:

Strategy 3.1 Rural Domestic water supply

This strategy aims to guide the planning of domestic water supply to homesteads, villages and towns, to make water available to people in sufficient quality and quantity. Allocation of water for domestic use has a high priority, while other uses will be subject to social and economic criteria.

Population growth is the most important driving force as it directly influences water demand and the extent of water supply facilities necessary to satisfy the demand. Urbanisation, socio-economic upliftment and economic development further contribute to growth in domestic water demands. Based on the projection of this study, Basin domestic water demand will increase significantly, from 427 Mℓ/day in 2012 to 1 422 Mℓ/day in 2032.

In most parts of the Basin the available surface and groundwater resources can satisfy domestic water demand. The highlands are well endowed with comparatively high rainfall and both surface and groundwater resources. Available water resources are expected to meet the water supply needs of the rapidly growing population residing in these areas. In contrast, the lowlands of the Kagera Basin, close to the outfall to Lake Victoria and comprising of parts of Rwanda, Uganda and Tanzania, can be classified as water stressed areas; especially considering forecasted populations. This is mainly due to lack of storage and distribution rather than a water balance shortfall. In general, access to clean and potable water is the main issue in most of the Basin rather than water resource availability.

The main sources of water supply are protected springs and wells. In most cases, the water supply system is a point source system. However, small water supply networks are available with gravity-fed systems being the dominant type. In a few instances, impoundment reservoirs are used to supply water to the urban population. Drinking water quality problems is a major concern. There is a lack of proper operation and maintenance mechanisms for the available water supply facilities and a lack of sufficient administrative and technical capacity in the main actors of the water supply and sanitation sector. As part of each Basin country’s development agenda a number of water supply and sanitation projects have been formulated, studied and prepared for implementation.

An integrated overall sectoral approach is needed for the planning and management of water resources, taking into account the competition and conflicts for water among different water uses.

a) *Water supply from surface and ground water sources:* While the Basin’s water resources are adequate to meet potential growth in demands for a very long time in most areas, the real issue is the ability to supply water when and where it is needed at a reasonable cost. Due to climate and runoff variability, which can potentially be exacerbated by climate change, the mismatch between supply and demand will increase. In order to secure domestic water supply the potential and feasibility of various water sources per watershed in the Basin should be investigated and prioritized.

b) *Rain Water Harvesting (RWH):* Rain water is an accessible resource during the wet months in the basin. Further investigation and development should be done into harness rain water for domestic use.

c) *Self-sufficiency in remote communities and households:* Considering the hilly terrain and dense population in the majority of the basin. Community or household scale grey water treatment should be further investigated and developed.

Strategy 3.2 Urban water supply and treatment to potable standards

This strategy is aimed to ensure sustainable and affordable access to safe water supply and purification services to urban water users, as a contribution to poverty reduction, public health improvement, economic development and environmental protection, and to reduce the risks of pollution and disease through adequate and safe wastewater treatment facilities.

Planning and implementation of water supply schemes to provide access to safe and clean water should be undertaken according to the principles of sustainability, efficiency and affordability. The Millennium Development Goals and Country Targets for urban water supply and sanitation will provide the targets to aim for.

a) *Water supply from surface water, groundwater or rainwater for identified cities, towns or urban areas:* Planning and implementation of water supply infrastructure, including the necessary institutional framework and technical capacity of such institutions. Water conservation and water demand management (WC/WDM) should be an integral part of the planning processes for water supply and the provision of water services.

b) *Kigali water supply and wastewater (subset of a)):* Kigali is the only significant city in the Basin and needs particular attention, especially with the shortages in supply, increasing urbanisation and inefficiency of treatment facilities being experienced.

c) *Treatment technology development:* Planning and implementation of treatment infrastructure, including the necessary institutional framework and technical capacity of such institutions.

d) *Prepare and implement Business Plans and O&M Plans for water utilities:*

e) *Regulation of effluent discharge:* Dedicated WSS authorities with substantial operational autonomy to be established.

d) *Good water planning practices entrenched:* Good practice procedures should be followed in the planning, design, implementation, and O&M of water supply systems and treatment works.

Strategy 3.3 Providing improved sanitation facilities

Sanitation coverage of the Kagera Basin is very low and is limited to available sanitation facilities in urban settings. Further, where available it doesn’t necessarily satisfy acceptable hygienic standards. Improved/hygienic sanitation is at its lowest level in most parts of the basin. A sanitation plan, catering for the needs and requirements of acceptable sanitation coverage, is an important component of this sanitation strategy. The plan shall address the sustainable provision and management of improved sanitation facilities for the betterment of the quality of life and dignity of the people of the Kagera basin.

The approaches to achieve this strategy are:

a) *Improved Sanitation Facilities*: The main challenge of providing sanitation is to develop the physical sanitation infrastructure at reasonable distances from the user community/population. The type and scale of the infrastructure depends on the number of users which in turn is governed by population density. In rural areas since the population pattern is relative scattered on-site sanitation facilities are preferable. Improved on-site sanitation facilities include simple pit latrines, Ventilated Improved Pit (VIP) latrines and composting latrines. In urban areas, where dense settlement prevails, reticulated sanitation is advisable. This includes flush toilets, septic tanks and wastewater conveyance and treatment facilities.

b) *Support health and hygiene initiatives from a water perspective*: Sanitation infrastructure development must go hand-in-hand with awareness creation and hygiene-health promotion interventions. These interventions shall be targeted in enhancing the knowledge, changing the attitudes and practices on basic hygiene and sanitation. Although this is required for both urban and rural inhabitants more effort needs to be put to rural areas where hygienic knowledge and practices are at the lowest. Hygiene and health promotion must be done in coordination with institutional stakeholders including water utilities/providers, municipals/administrations, health facilities and financing bodies.

Strategy 3.4 Urban, industrial and mining wastewater treatment

Untreated municipal sewage and in some cases industrial and mine effluent poses a significant risk to water quality and health. Since very few wastewater treatment facilities are found in the urban centres of the Basin, municipal sewage and industrial effluent are generally discharged into receiving water bodies.

Currently, no major wastewater treatment facilities are available in the Basin. As a result, municipal, industrial and mine effluents are often discharged into receiving water bodies imposing hygienic and health risks on the urban population and riparian environment. The problem is aggravated by lack of proper and efficient wastewater quality regulating framework and legal background. Following urbanization in the region it is expected that the challenge of municipal, industrial and mine wastewater related problems and risks will increase. Strategic planning is necessary to offset the challenges related to wastewater management.

The approaches to achieve this strategy are:

a) *Setting Wastewater Quality Standards*: A quality standard for safe municipal, industrial and mine effluent discharge shall be set. The standards shall be set according to the type of effluent and the sensitivity of the environment into which it is discharged. Refer Strategy 5.4.

b) *Selection of Technologies and Provision of Facilities*: Municipal and industrial wastewater can be treated considering two main approaches which are based on location of facilities, level of treatment required and cost of the infrastructure. The two main approaches are decentralized and centralized treatment of wastewater. In particular facilities in Kigali need to be investigated.

6.8 Livelihoods and Socio-economic Development Strategies

6.8.1 Context

Poverty, climate change, land use change and population dynamics are among the key driving forces that can potentially have an impact on livelihood options for many people in the area. Most of the changes in livelihood options arise from changed levels of access to productive resources, either through land use change, population dynamics or climate change. Socio-economic development should serve many purposes – hydropower and irrigation, but also fishery and aquaculture, marshland agriculture – and benefits and costs should be shared among the Basin countries.

6.8.2 Strategic objective

The Strategic Objective is:

"To develop and manage water resources to serve social and economic development in the Basin"

6.8.3 "Livelihoods and socio-economic development" strategies

The strategies to ensure sustainable livelihoods and support coordinated sectoral development are:

a. Water demand of intensified, modernised agricultural and aquaculture development (4.1).
b. Address the high demand for new water infrastructure to meet regional energy security (4.2).
c. Address the demand for water in sustainable mining and industrial developments (4.3).
d. Support sectoral conservation and development Basin initiatives from a water resources perspective (4.4).

These strategies are described as follows:

Strategy 4.1 Water demand of intensified, modernised agricultural and aquaculture development

This strategy allow for the sustainable and orderly development and use of water for animals and irrigation, as well as for enhanced crop production, productivity and profitability that will contribute to food security and poverty reduction. Agriculture provides safe food production, whilst irrigation can generate high-value crops and employment. Investment in agricultural water can contribute to agricultural growth and reduce poverty directly by:

- permitting intensification and diversification on already developed land and raising farm outputs and incomes;
- bringing food security and opportunities for additional cash-cropping;
- increasing farm employment and discouraging migration to urban centres in search of better wages; and
- increasing availability of food on local markets thereby reducing local food prices and improving real net incomes.

Agriculture forms the economic backbone of the Kagera Basin and remains important for growth and poverty reduction in the Basin. In recent years (between 2006 and 2011) agriculture contributed between 20 and 45% of the GDP of the Basin countries.

Agriculture in the region remains a largely subsistence activity; production has not kept pace with population growth, the numbers of malnourished people are consequently rising and food self-sufficiency has declined. Insufficient investments, inadequate involvement of farmers and support to them and ineffective central state management has resulted in poor performance of many traditional and state irrigation schemes.

Irrigation development within the Basin takes two forms, namely the irrigation in the marshlands and irrigation in the lowland plains. Rwanda, Burundi and the Ugandan part of the Basin are largely characterized by a rolling topography with a continuous pattern of hills and valleys, with lakes and marshy lowlands at the bottom of the valleys. Investment in the drainage systems of the marshlands converts the marshlands into irrigable lands. Rice is the main crop grown in the irrigation schemes. On the other hand, there is huge untapped potential for plains irrigation in Tanzania in the lower part of the Basin. Taking into consideration the current land scarcity, land fragmentation is expected to persist along with the current practices of farming on steep slopes.

Aquaculture is a livelihood activity for riparian communities that has not yet realised its potential in terms of food security and income generation, despite the abundant water resources. Aquaculture is mostly subsistence, relying on family labour and on–farm inputs and most of the harvest is consumed locally. Prospects are good as the Basin countries are putting in deliberate efforts to promote aquaculture. Aquaculture can also play an important role in enhancing depleted fish stocks in lakes and rivers through re-stocking. It can also enhance productivity of man-made dams through stocking of hatchery reared juvenile fish. Dams provide opportunities for fishing, and fish capturing is not perceived to have an associated water use.

Transformation and modernization of agriculture starts with efficient and sustainable integrated management of land and water resources, which will shape the futures of agriculture in the Basin. Land management is broad but for the case of the Kagera River Basin soil erosion control is critical.

a) *Rain-fed agriculture management:* In-field rainwater management will increase the effectiveness of rainfall and, coupled with structural storage of runoff to meet other needs of their farming systems, will permit additional income-generating activities. It will reduce the risk that communities face due to the vagaries of climate by utilising technologies for in-field rainwater management for dryland crops.
b) *Runoff water harvesting:* Water harvesting that involves reducing run-off by improving the infiltration of rainwater where it falls, storage in the soil profile and increased uptake by crops must be encouraged. This involves the collection and use of run-off, and in situ rainwater management.
c) *Irrigation and drainage:* Irrigation is among the top agendas of the efforts towards modernization and transformation of agriculture, and this is emphasized in various development plans. The options and opportunities for subsistence farmers to take up irrigation should be increased, using localised low cost water harvesting technologies for increasing agricultural production and productivity in crops and livestock all year round. Areas under irrigation should be increased, new schemes are needed and the efficiency of irrigation or water harvesting infrastructure should be improved. Large-scale expansion of marshlands irrigation and plains irrigation are already being planned. Irrigation development will depend on the availability of land for different forms of irrigation in marshlands/wetlands and plains, the availability of water for irrigation in perennial water bodies and availability of funds for investment. The potential to use groundwater for irrigated agriculture in the Kagera Basin has not been extensively explored.
d) *Water storage structures:* The development of feasible small, medium and strategic large-scale water storage structures and/or inter-basin transfers of water should in addition be promoted. Development of small to medium community-based irrigation schemes seems to be the best option. Small-scale irrigation schemes that are managed and owned by the farming communities have proved to be a profitable, sustainable and pro-poor model of advancing irrigation in Africa.
e) *Marketing outlets and export:* Irrigators should also be supported to identify and access marketing outlets and mobilise resources to improve related market infrastructure. Building capacity among irrigators is required to fully realise the economic and social benefits of irrigation. There is also a need to build public and private sector capacity to establish and manage irrigation schemes. A package of complementary support that overcomes the wide variety of constraints is needed. Traditional exports are dominated by agricultural cash crops like tea, coffee, cotton and tobacco. Export market expansion would involve the intensifications of agricultural crops aimed at the export market, and associated processing facilities. Commercial irrigation is still limited. Expansion of commercial irrigation by the private sector should be encouraged and the way should be smoothed for private investors. Production of high-value crops for export should be promoted.
f) *Promoting water for livestock production:* Ensure improved access to reliable water supplies for livestock development through promotion of small-scale rainwater harvesting. For the upper part of the Kagera Basin with high population densities, improved livestock keeping practices to suit the limitation of pasture land is recommended. For the lower part of the Basin, control of livestock diseases will support the expansion of pasture land.

g) *Aquaculture and sustainable fisheries:* Aquaculture has immense economic potential for poverty alleviation in riparian communities. This however can only be achieved if aquaculture is undertaken without causing environmental degradation. This requires a Basin-wide strategy for development of fisheries and aquaculture. The strategy should place special emphasis on aquaculture to relieve pressures on capture fisheries and as a novel income generating activity. However, the strategy should ensure that aquaculture follows an ecosystem approach whereby it is integrated within the wider ecosystem. This will ensure that it promotes sustainable development, equity, and resilience of interlinked social and ecological systems. The potential building of dams will provide opportunities for this sector.

h) *Fish-production habitat management:* This should be addressed for fisheries activities (both inland captures and aquaculture) for improving fish production and sustainable fishing. Measures to reverse habitat degradation, water pollution, eutrophication, alien species and other sort of unsustainable exploitation of fish are important. The development of increased post-harvest handling and value-addition must be supported, as well as institutional capacity development.

Strategy 4.2 Address the high demand for new water infrastructure to meet regional energy security

The Kagera Basin countries have one of the highest reliance on biomass for day to day energy needs in the world, with electricity-sharing less than 1% of the total energy production in the region. Hydropower is in total more than 10 GW, either in operation or already identified as future potential. The continued dependence on this source of energy is ensured through the relative abundance of water in the region and will remain the backbone of any energy expansion and planning for the foreseeable future. The provision of electricity is a significant factor in socio-economic upliftment and is afforded a very high priority. There is a serious lack of the availability of electricity. Electricity is very expensive and access to electricity is very low.

With economic development intimately tied to the growth in energy production, it is imperative that a number of key energy projects be developed as a matter of priority. Many hydro-power opportunities in the Basin have been identified, and these development opportunities have been studies at various levels of detail.

Energy options are mainstream hydropower as well as small and mini hydropower developments, which are critical development interventions in the Basin if economic development has to be realized. In addition, for sufficient supply of electricity in the Basin a regional, transboundary and multi-sectoral (i.e. hydro, thermal, geo-thermal, methane and wind) approach should be followed to provide electricity necessary for transformational development in the region in the long-term.

Development of hydropower can provide sufficient, reliable and affordable energy supplies. If planned and operated correctly, it is an environmentally sound and sustainable form of energy production,

The aim to achieve energy security will be implemented through the following approaches:

a. *Energy efficiency and conservation:* Promote efficient use and technologies, and ensure energy demand management, energy efficiency audits and economic incentives for energy saving

b. *Integrated energy planning:* The provision of energy for poverty reduction, social development and export should be balanced. Ensure effective coordination and cooperation between water and energy planning and management.

c. *Contribute towards sound energy decision-making:* Maximize technical efficiency, whilst ensuring economic benefits, and limiting environmental and social impacts. Separate institutional policy making and strategy formulation from implementation. Large-scale projects could have significant environmental and social implications for the Basin.

d. *Develop local/indigenous energy resources first:* This is the most economic approach, to be continually re-assessed. Local “small” hydropower schemes will therefore be supported.

e. *Energy resources developed*: Hydro-electric schemes must be identified, evaluated and prioritised for support by government and/or development partners according to current sector priorities, in a structured and transparent process. For electricity projects the priority list shall be determined by the cost effectiveness of competing projects in facilitating increased access to electricity, reducing the average cost of electricity supply and enhancing security of supply. Identification of hydropower schemes must always consider end-use/s and distribution, as well as the variability in flow regime, which can be very limiting for electricity production, and which in certain circumstances make multi-purpose schemes infeasible.

f. *Energy pricing, subsidy policies, and private sector participation:* At least recover operating and maintenance costs and at a later stage also capital costs if possible. Once-off capital subsidies from donors to enhance access to modern forms of energy are preferred. In order to make electricity affordable for most parts of the Rwandan population, subsidies might be required. In particular for small, medium and large hydro-electric schemes, and encourage PPP models to invest in the construction of small mini and micro hydropower plants.

Strategy 4.3 Address the demand for water in sustainable mining and industrial development developments

The Kagera Basin has good potential for mining development, and many mining industries and quarries have been established within the Basin, although most of it very small-scale mining. Mining and industry support social and economic development and economic diversification. Mining and industrial activities require water of adequate quality but also have by-products and wastes that can have a negative impact on water resources and thus on other water uses within the Basin. Mining activities are the cause of extensive environmental damage in many areas within the Kagera Basin.

There is limited development of the industrial sector in the Kagera Basin, with Rwanda being relatively the most industrialised. The main industries in the Kagera River Basin are agro-processing industries. All these industries produce by-products that can be processed to provide additional benefits to the community.

a) *Water for diversification and growth:* Efforts to diversify economies, which include industry and mining and to make them less dependent on traditional cash crops are obvious in all the countries of the Basin. However such diversification efforts require major changes in existing investment and trade policies. An increase in the number of jobs in the industrial and services sector helps to reduce the number of people dependent on agriculture for their livelihoods. The mining sector should be targeted for future Basin growth because of the substantive mineral resources. With appropriate planning and safeguards, the economic returns can be high. Water use by industry will likely also increase in line with Governments’ push to develop this sector.

b) *Sustainable mining:* Mining activities support significant proportions of livelihoods and local economies but there are concerns that current mining activities in especially Rwanda and Burundi are not sustainable. Appropriate mechanisms are needed to ensure a delicate balance between environment and livelihoods. The risk of surface and groundwater pollution from mining and industrial operations can have serious consequences, and control mechanisms should be improved.

c) *Containment of water contamination:* Water contamination due to industrialisation will likely be an increasing concern in urban and peri-urban areas, given the absence of adequate wastewater treatment facilities and engineered sanitary landfills. Planned industrial development and rapid urbanisation, especially in Kigali, can increase the risk of surface and groundwater pollution.

Appropriate treatment facilities needs to be planned for or improved and control of such use need to be tightened.

d) *Water resources development and management strategies implemented:*

Strategy 4.4 Support sectoral conservation and development Basin initiatives from a water resources perspective

Good co-operation regarding integrated water resources management is necessary between Basin water managers and sectoral water representatives. In addition, there is a need to proactively support good sectoral water practices, initiatives and projects. A platform of dialogue is required where different user groups and users can collaboratively negotiate, plan and develop.

This is aimed at improving sectoral co-operation and hence realising the benefits of sectoral water use. It addresses shared decision-making to achieve improved overall governance, to better manage the water resources of the Kagera Basin.

Water managers should manage the provision of water within a co-operative governance framework and communicate extensively with relevant partners to ensure information sharing, joint planning based on the realities of resource availability and possible impacts, and efficient use which meets the needs of the largest numbers of people.

This includes the following approaches:

a) *Sustainable farming practises, technologies, and development initiatives:* Harnessing rainwater resources is the starting point in managing water for agriculture in order to upgrade the productivity of the predominant rain-fed agriculture. Runoff harvesting for agriculture is a win-win situation that provide agricultural water while protecting the land from erosion and siltation of rivers and lakes downstream.

b) *Water-related initiatives for tourism.* The tourism sector, if developed, can generate significant multiplier effects across the economies of the Basin countries, and offer considerable economic value to the livelihoods of the poorest and most vulnerable sectors of society by creating investment opportunities and employment. Essentially, the sector can act as an important vehicle towards poverty reduction and sustainable development. The most important avenue through which wildlife resources contribute to local and national economies is through the tourism industry.

c) *Increased trade within the Basin within Basin.* Support trade facilitation and promotion as it relates to the water resources of the Kagera Basin. This includes the facilitating of opportunities, easing of business conditions and access to markets for the Kagera Basin entrepreneurs to improve the economic situation of the Kagera River Basin.

d) *Feasible transport and navigation initiatives.* Regional transport is important in terms of reducing costs, improving efficiency and promoting economic growth. Transport alone cannot reduce poverty, but it serves an all-inclusive and crucial complementary role by enhancing opportunities. Affordable and efficient access to markets and social services is important in lowering costs and prices and increasing economic efficiency. Transport and logistical investments are important in increasing the competitiveness of the agriculture sector.

6.9 Environmental Protection, Land and Disaster Management Strategies

6.9.1 Context

Basin inhabitants are very reliant on the utilisation of natural resources including fishery, agriculture, forestry and mining. Each of the Basin countries supports optimistic growth to reduce poverty and promote better living. This requires sustainable management of natural resources in order to prevent further degradation of the environment and maintain ecosystem services. Land use change, population dynamics and poverty are key drivers of change in the abundance and distribution of biodiversity. This change is not only contributing to biodiversity loss, but also threatens to impact on the lives that are dependent on these resources.

The effects of climate change and disasters such as hail, floods and drought could further impact on the heavily reliant natural resources of the Basin. Climate change affects everyone, but more to those individuals and communities that are totally dependent on climate sensitive sectors. Climate proofing and building the resilience of households and livelihoods will be important in the medium to long term. In the short term, creating awareness about the impacts of climate change and putting in place suitable mitigation and adaptation plans will be important.

6.9.2 Strategic objective

The strategic objective is:

> **"To increase the resilience of the Basin and its people to natural and human pressures through sound land and environmental management practices"**

6.9.3 "Environmental Protection, Land and Disaster Management" Strategies

The strategies that are important to the sustainable management of the environment in the Kagera Basin are:

a. Management and protection of natural resources (5.1).
b. Rehabilitation of degraded environments (5.2).
c. Effective land management (5.3).
d. Water quality management (5.4).
e. Control alien invasive aquatic weeds and prevent new outbreaks (5.5).
f. Climate change adaptation and preparedness (5.6).

These strategies are described as follows:

Strategy 5.1 Management and protection of natural resources

Appropriate management of the Basin's resources is key to Basin development, as it will ensure sustainable provision of goods and services. This includes land use planning to curb current poor practices, reforestation, and environmental programmes to address environmental degradation reversal, marshland management, sediment and eutrophication management and water quality management. This should also guide Basin development to be undertaken within the carrying capacity of the environment. In addition, all development should include measures for environmental management.

A vital requirement for ensuring sustainable conservation practices is the identification of conservation-worthy habitats or sensitive ecosystems. Compliance with the requirements of the environmental legislation of the Basin countries in terms of water resource management planning and development is necessary. Initiatives that promote water-related environmental protection and health should be supported.

The focus is on the overall health or condition of the water resource, and is a measure of its ecological status. This includes water quantity and water quality, the character and condition of in-stream and riparian habitats, and the characteristics, condition and distribution of the aquatic and terrestrial biota.

a) *Environmental flows.* This particularly pertains to new developments, to ensure that adequate flows are calculated and maintained to ensure the healthy ecological functioning of rivers and other water bodies.

b) *Conservation and protection of rivers, lakes and marshlands.* Manage especially tributary rivers to protect indigenous species.

c) *Protection of aquifers, springs and wells.* Without proper monitoring and management human impacts are usually difficult to detect. Because of the technical differences between surface and groundwater, groundwater management has to be considered in its own right, although an integrated approach is required if effective water resource management is to be achieved. The protection of groundwater quality will, however, mainly be achieved by focusing on land-based activities that impact on- and the monitoring of the underlying groundwater bodies.

d) *Payment for ecosystem services with income used for ecosystem management*. Encourage and adopt payment for ecosystem services as an incentive for sustainable management of watersheds.

e) *SEA for the Basin*: A Strategic Environmental Assessments need to be developed for the Basin.

Strategy 5.2 Rehabilitation of degraded environments

The majority of the population of the Basin is dependent on its natural resources for their livelihoods. Much is made of the degraded state of the landscape, most especially in Rwanda and Burundi, but this applies to all the Basin States. Degradation is in large measure a consequence of the high population pressure and the need for households to manage on less and less, as there is less land to share around. This becomes a vicious cycle, aided and abetted by climate change, as degradation further reduces the resource. Development activities are aimed at breaking the cycle.

Environmental degradation takes many forms: The most striking and visible is soil erosion and sedimentation, resulting in loss of local productivity but also causing sedimentation of dams, loss of river health (including fishery and aquaculture potential), and damage to marshes and wetlands. Deforestation is another most important manifestation of environmental pressure – resulting in changes to catchment hydrology, soil loss, and reduced availability of fuel. Natural vegetation cover keeps a landscape at its most resilient to population and climatic pressures. The loss of both forest and other natural cover comes with a loss of biodiversity and a reduced resilience.

This strategy has two approaches:

a) *Rehabilitation:* To prevent further losses to the landscape and the natural resource base – soil, plant and water, and to rehabilitate degraded areas, with the restoration of vegetation and soils allowing watersheds to recover natural ecosystem functions and productivity.

b) *Reforestation.* Through sound management of forests, forest resources will play increased roles in national economies and biodiversity conservation. Forestry is critical to IWRM in the Kagera Basin. Without provision of sufficient timber to meet the fuel and construction needs of local people the degradation of cover in the Basin will continue, as will consequent erosion and loss of productivity. Trees, if wisely established according to agricultural and ecological principles should reduce erosion, attenuate runoff, and encourage infiltration – thus supplementing springs and the groundwater table. The sustainability of reforestation projects requires support from all members of the public, including pastoralists.

c) *Mining:* Mining activities need to include rehabilitation activities as part of the mine operation. Denuded land, bank stability, acid mine drainage, etc. should be addressed.

Strategy 5.3 Sustainable land management

Land in the Kagera Basin is at a premium – for cropping, grazing, fuelwood production, and for household living space. The land is very heavily utilized, with pressures only decreasing in the drier areas to the east, where grazing is the predominant land use. Agriculture is practiced on the steepest possible slopes and these slopes erode. Natural forests have almost all been cleared for croplands in the higher rainfall areas, and few households have the luxury of sufficient land to grow a food crop, a cash crop, and enough timber for sustainable use. Some catchments are very badly degraded, with a loss of productivity adding to pressure on remaining land.

Agriculture in the Basin is primarily low input – and will continue to be so, with the exception of irrigation schemes where high intensity cropping may be practiced by the collective for specific high-value markets. High input inevitably means high risk.

This strategy promotes sustainable land use/ land management practices (e.g. correct design of terraces and contours, crop rotation, re-forestation, etc.). It is argued that this can only be achieved through a low risk approach that can be adopted by all farmers / land users.

The objective is to utilize land sustainably so that there is no loss of land and no decline in productivity. The ideological debate is whether this requires a shift from low input to high input agriculture, and whether either of these can be managed sustainably.

It is unlikely that land users do not recognize the negative consequences of poor (unsustainable) land management. At issue is people caught in a poverty trap with too little land on which to sustain them. Unsustainable land use, which draws on the capital provided by the land and its vegetation cover (typically grazing, or forest cover) is a short-term survival strategy from which there may appear to the land user to be little alternative.

A sustainable land management strategy must therefore aim at providing that alternative – and for that it has to be immediate and effective. The strength in the Basin lies in its human resources, which is also its key weakness as the population grows to what are considered unsustainable levels. Strategies need to draw on the human resource capital by providing land management approaches that may be labour intensive but can be implemented without financial cost, and yet show rapid returns in terms of fertility, productivity and food security. A practice is only sustainable if it is replicable and repeatable and is adopted on a permanent basis by the users of the land.

Technologies include agroforestry, simple improvements to forestry management (e.g. methods of felling and coppicing trees to optimize timber yield), terracing, the digging of contour bunds (‘fanya juu’), crop rotations etc. Fundamental is that rainwater should be treated as an asset that, if it infiltrates, increases productivity, and not as a liability that runs off carrying soil and fertility with it. Achieving this requires that a healthy vegetation cover be maintained, with water always managed *into* the soil.

The following is required:

a) *Optimising water use through sustainable agriculture to avoid degradation and loss of productivity:* Land care practices need to be improved in the basin and throughout the member states. Various tools to improve land care should be developed and implemented.
b) *Extension officers:* In order to assist in the guidance and implementation of improved land care practices, trained extension officers should be deployed to provide guidance and assistance to farmers.
c) *Improved forestry production and services:* Similar to improved land care, improved practices for forestry, agroforestry and woodlot management should be further developed and promoted.

Strategy 5.4 Water quality management

A number of water quality concerns have been identified in the Kagera River Basin, which includes:

- *Sedimentation* – Suspended sediment loads in rivers are very high, especially during the rainy seasons. The highest concentrations were recorded after rainfall events. The high sediment loads are the result of erosion from cultivating unsuitable lands or steep slopes, brick making activities near water courses, sand mining activities in river courses, and overgrazing and trampling by cattle. Sediment loads in the Kagera Basin have at least doubled between 1975 and 2007.
- *Nutrient enrichment and eutrophication* - Concerns have been expressed about nutrient enrichment in the Basin. The nutrients originated from soil erosion, leaching from cultivated agricultural lands, decomposing wastewater from urban areas, and decomposing of industrial wastewater with a high organic content. Elevated nutrient concentrations are highest in source areas and decrease in a downstream direction. However, a study published in 2009 concluded that nutrient enrichment could be less of a concern than previously found. This study highlighted the need for long-term water quality monitoring in the Basin to determine spatial and temporal trends.
- *Bacteriological pollution* - Bacterial pollution was identified as a serious concern in areas where untreated wastewater was discharged to rivers and streams. Studies found that very few towns had formal and functional wastewater treatment works. This, along with poor domestic sanitation, poorly sited pit latrines, and the use of bush toilets were the main causes of waterborne pathogens in surface water streams.
- *Organic pollution* - Concerns have been expressed about the discharge of effluents high in organic content into stream and rivers. A specific concern was the discharge of untreated or partially treated sewage, or wastewater from food and agricultural products processing plants. Low dissolved oxygen, elevated pathogen numbers, and high nutrient concentrations were also associated with such wastewaters.
- *Toxic substances and trace metals* - Concerns have been expressed about pollutants in mining and industrial effluents, and wash-off of agrochemicals used in weed and pest control programmes. Leachate from solid waste dumps was also regarded as sources of trace metals. Very few industries near Kigali, Rwanda, treated their wastewater before discharging it to surface waters. The industrial sector is expected to grow in future and if this practice continues, industrial pollution can become a major concern.
- *Salinity* - Salinity was generally low in the basin and was not regarded as a major water quality concern.
- *Water quality impacts on Lake Victoria* - The Kagera River is the major inflow into Lake Victoria. Eutrophication problems generally occurred in gulfs and bays located away from the inflow of the Kagera River into Lake Victoria.

Therefore, both point and non-point source pollution contributes largely to the deterioration of quality of water resources. Point source pollution of water resources is from increasing discharge of untreated and partially treated municipal, industrial and mine wastewater. Increased human activities including poor farming practices, soil erosion, eutrophication and sedimentation are the major sources of non-point source pollution. Generally pollution makes water unusable, its treatment is very costly and it reduces productivity of water resources. In addition pollution may seriously affect availability of the already scarce water resources for various uses including environmental sustainability.

In order to protect good water quality sources, and restore poor quality river reaches and thus contain water pollution associated problems, the approaches to be implemented will include the following:

a) *Transboundary water quality objectives.* Basin countries should develop and get agreement on trans-boundary water quality objectives that would balance the need for development in the upstream country with the need for water quality protection for the recipient country. Mechanisms should also be implemented to restrict importation of pollutants from other countries into the Basin countries for disposal.

b) *Water quality standards and guidelines.* Water quality standards and guidelines used in the Basin countries should be aligned to ensure consistent assessment of the fitness for use, and application of effluent standards across the Basin.

c) *Point and non-point source pollution.* To mitigate non-point source pollution Basin countries should promote the use of appropriate land management practices, raising of public awareness on proper land use practices, and introduce watershed protection and preservation management measures (strategy 5.1).

d) Wastewater effluent quality monitoring for industries and mining: Point sources of discharge at industries and mines should be routinely monitored in all the basin states in order to assess the extent of pollution from wastewater discharges.

e) *Water quality monitoring and water testing facilities.* There is an urgent need to implement routine national water quality monitoring in all the basin states in order to assess the present water quality status across the Basin, detect spatial and temporal water quality trends, and to serve as early warning system for emerging water quality problems. The water quality monitoring system described in the NELSAP report, "Harmonize national reports to assess, review and design of a suitable hydrometric network for Kagera River Basin", should form the basis for the routine water quality monitoring system. This report describes in detail the various components of the water quality and quantity monitoring system for the Basin.

f) Compliance and regulation - In order to address point source pollution basin countries should promote enforcement of compliance to set environment standards including effluent standards and institute effective mechanisms for effluent monitoring and assessment. The "polluter pays" principle should be applied in conjunction with other legal and administrative measures. (Strategy 3.4)

Strategy 5.5 Control alien invasive aquatic weeds and prevent new outbreaks

Aquatic weeds adversely affect water quality, biodiversity, amenity, navigation, commercial and artisanal fishing, and recreational values of Lake Victoria and water bodies in the Kagera River Basin. Invasive weeds also have adverse impacts on the structure and functions of wetlands and other riparian ecosystems. Water hyacinth, papyrus and other invasive aquatic weeds, once established, are very difficult to manage and eradication is often impossible. The costs of invasive weeds infestation on the environment, social and economic systems, though recognised, are difficult to calculate but estimated impacts may be in the range of millions of dollars.

The "Lake Victoria Basin water hyacinth surveillance monitoring and control strategy: 2012 to 2030" relies on the implementation of the strategy by the different Basin States. It requires Basin States to undertake the surveillance and monitoring of invasive aquatic weeds within their national boundaries to identify the type and geographic extent of infestations, to undertake control measures in hotspots when infestations occur, and to synchronize the water hyacinth surveillance, monitoring and controls with key role-players. There is a number of monitoring and surveillance techniques of which satellite imagery is the most accurate when combined with ground-truthing, followed by aerial digital photographic systems, land-based photography, and lastly ground surveys with canoe and outboard. Water hyacinth control programmes include manual extraction, mechanical removal, chemical control, and biological control. Best results are obtained with a combination of these control measures.

Although the water hyacinth strategy was prepared for the Lake Victoria Basin Commission Secretariat, its aim is to assist the Basin States to monitor, assess and control the water hyacinth in the Lake Victoria Basin in order to improve the environment, safeguard human health, ensure the effective use of water resources and facilitate the development of the populations living within the Lake Basin for the benefit of the Basin states. The strategy was reviewed and deemed suitable for implementation in the Kagera River Basin.

The approach includes:

a) *Removal and prevention of aquatic invasive alien species such as hyacinth, papyrus, bamboo, water lettuce, etc.*

Strategy 5.6 Climate change adaptation and preparedness

Africa is not exempt from climate change, with the continent being seen as particularly vulnerable due to a lack of preparedness and a low adaptive capacity. The situation for the Kagera Basin has been variously determined from General Circulation Models. The general consensus is that over the next 20 years temperatures will increase (0.6 – 1.0°C), that rainfall is likely to increase - possibly by 10-20% but also likely to increase in variability with shifts in seasonality and more frequent droughts and more serious floods. Evaporation will increase by more than 10%. Runoff may increase, with this prediction at variance with the overall prediction of run-off into Lake Victoria where a 50% decline in runoff received (20 billion m^3) has also been forecast. The message is one of change, but also of significant uncertainty associated with that change.

A weakness identified has been the lack of cooperation at a regional level with regard to developing an understanding of climate change, and in the planning and integration of disaster risk management.

Some climate change mitigation projects have been implemented through catchment afforestation and energy efficiency initiatives.

Climate change is expected to impact on tourism, fisheries, navigation, water availability, and water quality. Much of the basin is "water rich" and yet many people are entirely dependent on rainfall and local sources for supply. Increased seasonality (meaning droughts) and high intensity storms will be felt, most by rural subsistence farmers who make up the majority of the people in the Basin – and it is towards these farmers that strategies in climate change adaptation must be addressed.

The risk equation where *Risk = Hazard * (Vulnerability / Coping Capacity)* suggests that strategies must be focused on reducing vulnerability (for example ensuring that urban development is not on flood plains), and increasing coping capacity – which means building the resources and resilience of vulnerable people.

In order to provide an appropriate level of Disaster Risk Management in the Basin, it must be ensured that:

- National and local risk assessments based on hazard data and vulnerability information are available and include risk assessments for key sectors
- Early warning systems are in place for all major hazards, with outreach to communities
- Systems are in place to monitor, archive and disseminate data on key hazards and vulnerabilities
- Guidelines are in place to assess the disaster risk impacts of major development projects, especially infrastructure.

The aim to ensure climate change preparedness will be implemented through the following approaches:

a) *Ensure that Disaster Risk Reduction is a priority with an institutional basis for implementation:* Regional capacity and regional cooperation in adaptation strategies and mitigating the impacts of climate change must be addressed as priority.

b) Identify, assess and monitor disaster risk and enhance early warning: The knowledge base on climate variability and climate change, and consequent impacts on water resources must be improved. This will allow for climate-smart planning of agricultural water management.

c) *Use knowledge and education to build a culture of safety and resilience:* Disaster risk management is strongly encouraged, rather than the traditional response and recovery approach. Resilience should be built through increasing coping mechanisms, reducing vulnerability and effective responses that includes risk reduction strategies. Technical cooperation and awareness training and capacity development must be fostered. Noting the vulnerability of small-scale farmers to climate change and especially drought, the development of groundwater resources, which are better buffered against the vagaries of climate and seasonality, should be given priority in building resilience.

d) *Flood management*: In order to reduce the impact of floods, the delineation of floodlines and development of flood management plans should be undertaken.

e) *Drought management Plans*: As a requirement of the UN Convention to combat desertification, all countries are required to develop drought management plans. In order to ensure effectiveness in the basin, and integrated drought management plan for the basin should be developed.

7. KAGERA PLANNING ATLAS

This chapter consists of three sections. The first section deals with issues of relevance to the Consultancy objectives. Section Two provides an overview of geospatial information and information gaps. Section Three describes the GIS Database Inventory and Metadata for additional maps and spatial information created during the Strategic Planning Task.

7.1 Relevance to the Consultancy Objectives

River basin systems comprise a wide spectrum of physical, biological and socio-economic components, with complex spatial, temporal and regulatory interactions. River basin management and planning, therefore, is intrinsically geographic as it involves the handling of various forms of spatial data and information. In the framework of this assignment, GIS tools and techniques are used to provide for the collection, storage, analysis and presentation of spatial information, to enhance our understanding of the Basin's physical system, and judging how management actions might affect the system.

The main output of the GIS analysis is the incremental development of the Planning Atlas for the Kagera Basin, a map collection of the current state water resources, which is a visualisation of the potential development options and their impact on the Basin water resources over the planning horizon.

7.2 Existing Geospatial Information and Information Gaps

Considerable spatial data and information for the Kagera River Basin have been collected in previous studies commissioned by the Client. The Consultant was provided with a copy of all the available data at the beginning of the assignment, most importantly the Kagera GIS database assembled during the basin monograph and the online Kagera River data repository[1]. Additional GIS data was sourced from various research and consultancy studies about the region, the Consultant's own GIS archive as well as from other relevant institutions.

Through a critical review of relevant reports and the existing GIS database, a quality check and gap analysis was undertaken to identify additional spatial information and supporting datasets that are needed for the execution of this consultancy, in support of the Basin Development Plan.

Overall, the data provided by the Kagera Basin monograph GIS database was of good quality. Although no ground-truthing is been carried out at the moment, most of the important physical features appeared to be reasonably represented over the basin. Suspiciously represented features were verified against information from other resources, such as Google Earth and expert knowledge of the region, and the necessary adjustments were made.

It is important to note that much of the available dynamic dataset, such as population and livestock, was dated before 2006 and thus outdated. These datasets were accordingly updated, based on the available most recent information, such as recent publications/reports. Where no recent data was available, projections were made using appropriate techniques.

7.3 GIS Database Inventory and Metadata

An ESRI ArcGIS desktop software platform (version 10) was used to process, analyse and present the data. In order to conform to the projection of the existing database, a Geographic Coordinate System: GCS_WGS_1984 has been used. Where geometrical calculations were required, the datasets were projected into Arc 1960 - UTM Zone 36 South.

A number of raster and vector operations were carried out to derive useful information. Some of these analyses are briefly explained below:

[1] http://www.elmed-rostov.ru/Projects/Kagera/Main/index.php

7.3.1 Delineation of catchment areas upstream of the planned development projects

Some of the planned dams lacked information on their catchment area. This was determined by carrying out a terrain analysis of the basin digital elevation map (DEM), using the ArcHydro extension.

A determination of the average valley width downstream of planned dams was undertaken. A very dense (2m spacing) contour network was generated around the proposed dams from the available 90x90m DEM. The average valley width downstream of a dam was thus determined by manually measuring the width of the most continuous flat area after the dam location. This width was demarcated by a contour which is slightly below the dam elevation, say between 2-5m. As the width was not uniform in the immediate downstream; the valley width was measured at a location that appeared to be more representative of the plain surface.

7.3.2 New GIS maps produced

Several analyses were carried out and the following maps have been prepared during this part of the Consultancy:

- Location of development projects (included in this report)
- Development projects overlain with population density 2012
- Development projects overlain with population density 2032
- Development projects overlain with rainfall
- Development projects relative to towns

The complete Kagera Basin Atlas will be compiled at the end of the assignment and presented separately as an appendix. The atlas will include all the maps generated from the diagnostic assessment, through scenario analysis and project selection. All the spatial data used are currently being organised in a GIS database, which will be submitted together with the Kagera Basin atlas. Care is taken to create or update metadata for each dataset, and it is anticipated that an explanatory text on the content and structure of the database will also be provided, together with the database, to guide users.

8. CONCLUSION AND WAY FORWARD

Following the diagnostic assessment of the Basin, this document focussed on the strategic assessment of the Basin. Strategic priorities and options for the Basin were identified, and the Basin vision and specific strategic objectives were identified. A portfolio of Basin projects was evaluated, prioritised and commented on and Basin-wide development scenarios were evaluated. Based on the foregoing, the Basin strategies were developed to address Basin concerns, priorities and opportunities. It is evident that with its rapidly rising populations and deteriorating environmental conditions, the Kagera Basin is facing serious development challenges.

Upon acceptance of a development scenario by Basin stakeholders and approval and refinement of the Basin strategies, the consultancy team embarked on the development of the Basin Development Plan.

9. REFERENCES

1. A revised Rwandan Mining Policy, Ministry of Natural Resources, 2009
2. Agricultural Sector National Strategy 2008-2015, Burundi Ministry of Agriculture and Livestock
3. Agricultural Water in the Nile Basin - An Overview. NBI, 2008
4. Animal Resources, 2009
5. An Infrastructure Action Plan for Burundi, Accelerating Regional Integration, African Development Bank, 2009
6. Biosca Consultants Company Ltd., 2003- 2012, *Katuna Construction Project* [WWW], Biosca Website: http://biosca-ug.net/katuna.php
7. BRL Ingénierie, 15 July 2008: *Kagera River Basin, Transboundary Integrated Water Resources Management and Development Project Kagera River Basin Monograph: NBI, NELSAP, Kagera Transboundary Integrated Water Resources Management and Development Project.*
8. BRL Ingénierie, 2012. NBI, NEL *Multi Sector Investment Opportunity Analysis (MSIOA). Draft Situational Analysis Report. Main Report, 22 June 2012*
9. BRL Ingénierie, 22 June 2012: NBI, NELSAP, *Nile Equatorial Lakes Multi-sector Investment Opportunity Analysis, Draft Situational Analysis Report, Main Report.*
10. BRL Ingénierie, April 2012. NBI, *Consulting Services For Development of Tools And Guidelines For Climate Adaptation Mainstreaming in Water Infrastructure Development: Screening for an Infrastructure Project*
11. Bugamuhunda Turina, Interview with Sam Braid and Erik van der Berg, *Katuna Water Supply*
12. Burundi Coffee Project Appraisal Document, World Bank, 2011
13. Burundi Country Overview - Agricultural Water In The Nile Basin, NBI, 2008
14. Burundi Country Strategy Paper 2012-2016, African Development Bank, 2011
15. Burundi Food Security and Vulnerability Analysis Report, WFP Burundi and WFP-VAM Rome, 2004
16. Burundi National Investment Policy for Agriculture 2012 - 2017
17. Burundi National Water Sector Policy, Ministry of Water and Environment, 2009
18. Burundi Vision 2025, Government of Burundi
19. Burundi Water and Sanitation Profile, USAID, 2010
20. China National Electric Engineering Co. Ltd, July 2, 2012, *Feasibility Study of Water Resources Development in Nyabarongo River in Rwanda*, (Nyabarongo II Project)
21. Climate Change Vulnerability Assessment, Adaptation Strategy and Action Plan for the Water Resources Sector in Uganda, Ministry of Water and Environment, 2010
22. Coyne and Bellier, May 2012, *Feasibility Studies of 4 Small Multipurpose Dams at Karemba, Tabu-Gakomeye, Omumukara, and Karazi in the Kagera River Basin:* Second Interim Report by Tractebel Engineering
23. Diagnostic Assessment Report Draft version 2, Development of a Basin-wide IWRM-based Development Plan for the Kagera Basin, 2012
24. Denny, P., Kipkemboi, J., Kaggwa R. and Lamtane. H. (2006) *The potential of Fingerpond systems to increase food production form wetlands in Africa. International Journal of Ecology and Environmental Science 32*, 41-47 (presented at the 7th INTECOL International Conference on Wetlands in Utrecht, The Netherlands, July 2004).
25. Digitech*, July 2012, Pre-Feasibility Study for Ruramba Small Hydropower Plant*, Final report
26. Digitech, July 2012, *Project Proposal for Ruramba Irrigation Schemes*
27. District Irrigation and Water Harvesting Support (Mainland), Government of the United Republic of Tanzania – NEPAD and FAO, 2005
28. Dr Henry K. Ntale, 20 February 2012: *Detailed Identification Studies for Potential Large Dams in the Kagera Basin, Inception Report*, NELSAP, Kagera River Basin Management Project.
29. Economic Development and Poverty Reduction Strategic Framework, Government of Burundi
30. Edwin Musoni, May 2012, Rwanda: *Mutobo Water Project to Cost Rwf120 Billion*, All Africa [WWW], http://allafrica.com/stories/201205170143.html
31. Energy Policy for Uganda (2002), Ministry of Energy and Mineral Development, 2002

32. Eric Didier Karinganire, June 2012, *Mutobo water project to be completed in three years*, The Rwandan Focus [WWW], http://focus.rw/wp/2012/06/mutobo-water-project-to-be-completed-in-three-years/
33. Five-Year Strategic Plan for the Environment and Natural Resources Sector 2009-2013, Rwanda Ministry of Natural Resources, 2009
34. Gibb International Consultants, May 2012. *Interim report for the pre-feasibility study for an Irrigation Development and Watershed Management Project in the Lake Victoria Basin in Tanzania.*
35. Gibb International, September 2012, *Pre-Feasibility Studies for an Irrigation Development and Watershed Management Project in the Lake Victoria Basin in Tanzania*, Ngono Valley Irrigation Scheme, draft Final Pre-Feasibiliy Report
36. G. Karavokyris & Partners Consulting Engineers S.A., P. Antonaropoulos & Associates S.A., April 2012, *Detailed Design for Nyanza-23 (Kagondo – Mwogo) Hillside Irrigation*
37. Global Agriculture and Food Security Program, Burundi Ministry Agriculture and Livestock, 2012
38. Henry K. Ntale (Eng. Dr.), October 2012, Detailed Identification Studies for Potential Large Dams in the Kagera Basin, DRAFT REPORT, Volume I
39. H.P Gauff, K.G Consulting Engineers (1974). *Feasibility Study on the Ngono Multipurpose Project.*
40. Infrastructure Action Plan for Burundi, African Development Bank, 2009
41. Integrated Soil and Water Conservation (ISWC). Final Report On Lessons Learnt, Tanzania Vice President's Office – LVEMP, 2005
42. *Kagera Basin Organization Development Programme. Volume 3.* Energy, February 1982
43. Korea Water Resources Corporation, September 2008: *Feasibility Study of Water Resources Development in Nyabarongo River in Rwanda*, Rwanda MINIERA (Ministry of Natural Resources), Korean International Cooperation Agency.
44. Lahmeyer International, March 2010, *Shpp Maziba Upgrade Modernisation – Rehabilitation*, Feasibility Study, Final Report
45. Lake Victoria Region Water and Sanitation Initiative. Report on Mission to Burundi, UN-Habitat, 2007
46. Lessons Learnt Report on Wetlands Management, Tanzania Vice President's Office – LVEMP, 2005
47. LTS International, 2011. *Feasibility Study for an Integrated Watershed Management Program for the Kagera River Basin. Interim Report* - Annexes 6-7.
48. LTS International, November 2011: *Feasibility Study for an Integrated Watershed Management Program for the Kagera River Basin*, Interim Report + Annexes 1-8, Updated
49. LTS International, Phillips Robinson and Associates, March 2011*: Feasibility Study for an Integrated Watershed Management Program for the Kagera River Basin*, Inception report, Revised, NELSAP, NBI
50. Medium Term Expenditure Framework Forward Budget for 2012/2013 to 2016/2017, Tanzania Ministry of Water, 2012
51. M&E Associates Ltd in association with REAL Contractors s.a.r.l, September 2008, *Pre-feasibility report in 2007/08 aimed assessing the best option for the implementation of the Nyagatare Water Resources Development Project*, also known as the Muvumba Dam project. Final report
52. Michel A. Bouchard and J.B. Gashagaza, November 2008, *Two key sources are the PAIR report and the Summary Strategic Environmental and Social Impact Assessment.*
53. NELSAP: *Kagera River Basin Management Project, Terms of Reference for Consultant for Detailed Identification of Potential Large Dams in the Kagera River Basin.*
54. Newplan Limited, 2011, *Draft Environment and Social Impact Assessment (ESIA) Bigasha Dam*
55. Newplan Limited, 2011, *Draft Environment and Social Impact Assessment (ESIA) Karazi Dam Site*
56. Newplan Consulting Engineers and Planners, May 2012, *Environmental and Social Impact Assessment (ESIA) and Developing Resettlement Policy Frameworks (RPFs) for Four (4) Proposed Small Multipurpose Dams at Bigasha, Buyongwe, Karazi, and Taba-Gakomeye in the Kagera River Basin: Volume 1 A:* Draft Scoping Interim Report by
57. Nile Basin Regional Water Quality Monitoring Baseline Study Report, Nile Basin Initiative, 2005
58. Nile Equatorial Lakes Subsidiary Action Program (NELSAP): *Kagera River Basin Management Project, Terms of Reference for Consultant for Detailed Identification of Potential Large Dams in the Kagera River Basin.*

59. Norconsult A.S and Electro-Watt Engineering Services (1976). *Kagera Development Phase II studies.*
60. Norconsult A S and Electrowatt, April 1976: *Prefeasibility Studies Kagera River Hydropower Developments Rusumo Falls Hydropower Project, Kishanda Valley Hydropower Project, Kakono Dam Hydropower Project: Burundi – Rwanda – United Republic of Tanzania: United Nations acting for UNDP.*
61. P Droogers and W Bastiaanssen (2008). *Scoping study on five potential irrigation schemes in Tanzania: Mara Valley, Bugwema, Isanga Valley, Manonga-Wembere, and Ngono Valley*. Water Watch Report 2008.
62. Rwanda Country Overview *Agricultural Water in the Nile Basin*, NBI, 2008
63. Rwanda Economic Development and Poverty Reduction Strategy 2008-2012, Ministry of Finance and Economic Planning, 2007
64. Rwanda Irrigation Master Plan. Ministry of Agriculture and Animal Resources, 2010
65. Rwanda National Coffee Strategy 2009-2012, Ministry of Agriculture and Animal Husbandry, 2008
66. Rwanda National Energy Policy and Strategy, Ministry of Infrastructure, 2011
67. Rwanda National Export Strategy, Government of Rwanda, 2011
68. Rwanda National Industrial Policy, Ministry of Trade and Industry, 2011
69. Rwanda National Policy and Strategy for Water Supply and Sanitation Services, Ministry of Infrastructure, 2010
70. Rwanda National Strategy and Action Plan for the Conservation of Biodiversity in Rwanda, Ministry of Lands Resettlement and Environment, 2003
71. Rwanda State of Environment and Outlook Report, Rwanda Environment Management Authority2008
72. Revised Tea Strategy for Rwanda, Ministry of Agriculture and Animal Resources,
73. Rwanda Trade and Industry, 2008
74. Rwanda Vision 2020, Ministry of Finance and Economic Planning, 2000
75. SNC Lavalin International, October 2008: *Regional Rusumo Falls Hydroelectric and Multipurpose Project, Consultancy Services for Feasibility Study of the Generating Plant and Related Project Area, Preliminary Design*, Volume 1, Executive Summary (Final)
76. SNC Lavalin, February 2005: *Strategic/Sectoral, Social and Environmental Assessment (SSEA) of Power Development Options in the Nile Equatorial Lakes Region, Synopsis Report, Stage 1 – Burundi, Rwanda and Western Tanzania*, NBI, NELSAP, The World Bank.
77. SNC Lavalin, February 2007: *Strategic/Sectoral, Social and Environmental Assessment (SSEA) of Power Development Options in the Nile Equatorial Lakes Region,* Final Report, Volume 1, Main Report, NBI, NELSAP, The World Bank.
78. SNC-Lavalin (2011), "*Rusumo Falls Hydroelectric Power Development Project Power Generation Plant Final Feasibility Study Phase 1 RAP and LADP*", Report for NELSAP, May 2011.
79. SNC-Lavalin (2012), *"Rusumo Falls Hydroelectric Power Development Project Power Generation Plant Final Feasibility Study"*, Final Feasibility Design Report for NELSAP, February 2012.
80. Strumberger, Dr V., (undated). *Enhancement of local cooperative small scale mining and water protection in the Republic of Rwanda*. MINIRENA.
81. SWECO, February 2010: *Terms of Reference for the Feasibility Study of the Kanyaru Multipurpose Project.*
82. SWECO, May 2010: *Development of Kagera Integrated River Basin Management and Development Strategy*: NBI, NELSAP, Kagera Transboundary Integrated Water Resources Management and Development Project.
83. SWECO, *Terms of Reference for the Feasibility Study of Nsongyezi Hydropower Project*, February 2010
84. Strategic Plan for the Forest Sector 2009-2012, Rwanda Ministry of Forestry and Mines, 2010
85. Strategic Action Plan for Agricultural Transformation in Rwanda Phase II, Ministry of Agriculture and Water and Sanitation Programme of Burundi
86. Strategy for Uganda National Agricultural Development Horizon 2010, Ministry of Agriculture, 2010

87. Strategic Sector Investment Plan for the Water and Sanitation Sector in Uganda, Ministry of Water and Environment, 2009
88. Tanzania Agriculture And Food Security Investment Plan (TAFSIP) 2011-12 To 2020-21, United Republic of Tanzania, 2011
89. Tanzania Development Vision 2025, Ministry of Water and Irrigation, 2010
90. Tanzania Environmental Management Act, United Republic of Tanzania, 2004
91. Tanzania - National Investment Policy for Agriculture 2012 - 2017, Oxfam Research Reports, 2011
92. Tanzania National Irrigation Policy (2010), Ministry of Water and Irrigation, 2012
93. Tanzania National Water Sector Development Strategy 2005 to 2015, Ministry of Water and Irrigation, 2005
94. Tanzania National Strategy For Growth and Reduction of Poverty (NSGRP), Vice President's Office, 2005
95. Tanzania National Water Resources Act, United Republic of Tanzania, 2009
96. Tanzania Water Sector Status Report, Ministry of Water and Irrigation, 2009
97. Tanzania Water Supply and Sanitation Act, United Republic of Tanzania, 2009
98. Tractebel Engineering S.A., October 2012, *Feasibility Study Report – Draft report for Bigasha site in Uganda*
99. Tractebel Engineering S.A., October 2012, *Feasibility Study Report – Draft report about Buyongwe site in Burundi*
100. Tractebel Engineering S.A., October 2012, *Feasibility Study Report – Draft report for Taba-Gakomeye site in Rwanda*
101. Tractebel Engineering S.A., October 2012, *Feasibility Study Report – Draft report about Tanzanian site*
102. The Uganda Wildlife Policy (1999), Ministry of Tourism, Trade and Industry, 1999
103. Updated version of the National Human Settlement Policy in Rwanda, Ministry of Infrastructure, 2009
104. Uganda National Development Plan 2010/11 to 2014/15, Government of Uganda, 2010
105. Uganda National Water Policy 1999, Ministry of Water and Environment, 1999
106. Uganda National Environmental Management Policy 1994, Ministry of Water and Environment, 1994
107. Uganda National Policy for the Conservation and Management of Wetland Resources (1995), Ministry of Water and Environment, 1995
108. Uganda National Forestry Policy (2000), Ministry of Forestry and mines, 2000
109. Uganda National Land Use Policy (2007), Ministry of Lands, Housing and Urban Development, 2007
110. Uganda National Industry Policy (2008), Ministry of Infrastructure, 2008
111. Uganda National Fisheries Policy (2000), Ministry of Agriculture, 2000
112. Uganda National Health Policy (1999), Ministry of Health and Social Welfare, 1999
113. Uganda National Irrigation Master Plan For Uganda (2010-2035), Ministry of Water and Environment, 2010
114. Uganda State of the Environment (SOE) Report, National Environment Management Authority, 2008
115. UNESCO-IHE, 2006, *Fingerponds,* [WWW], UNESCO-IHE, http://www.ihe.nl/Fingerponds
116. Water Supply and Sanitation in Rwanda, AMCOW, 2010
117. Water for Production Strategy and Investment Plan 2009, Uganda Ministry of Water and Environment, 2009
118. Water and Environment Sector Performance Report 2010, Uganda Ministry of Water and Environment, 2010
119. Water and Sanitation Programme of Burundi, Deutschen Gesellschaft für Internationale Zusammenarbeit (GIZ), 2011
120. Water and Sanitation Sector - District Implementation Manual 2007, Uganda Ministry of Water and Environment, 2007

121. Water Act 1997, Government of Uganda, 1997
122. Wema C onsult (T) (2012), *Review a nd h armonise r egional po licies, l egal and i nstitutional frameworks governing utilization of water resources for the Lake Victoria Basin* Report
123. Wikipedia, 2012, *Nyabarongo Power Station*,
124. http://en.wikipedia.org/wiki/Nyabarongo_Power_Station

ANNEXURES

Annexure A:
National policy and strategy frameworks of Basin countries

National policy and strategy frameworks of Basin countries

Strategic areas in relation to policies and strategies of Burundi

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
Economic Development and Poverty Reduction Strategic Framework	*In the water sector, the strategic framework shows that the level of access to clean water access and basic sanitation coverage is very low. It also underlines existence of strong environmental degradation. The framework also shows that electric production domain remains at a very law level in spite of the existence of national hydroelectric potential. Orientations of the Strategic Framework are taking into consideration priorities set by community which include clean water and sanitation, and water for productive activities, mainly agriculture. Rational management of space and natural resources aimed at safeguarding environmental ecosystems while reconciling the needs of current and future generations.*	*The Strategic Framework also guided the formulation of a national water management in 2009, as an essential step towards development of other productive sectors such as agriculture, breeding, fishing sectors, hydropower production, protection of the environmental, and access to improved clean water access and basic sanitation services.* *Strategic areas include:* • *The rational and balanced development of the country* • *Environmental protection and sustainable management of resources* • *Combating pollution and cleaning up environments* • *Incorporating climate change in development programmes and policies.*
Burundi 2025 Vision	• *properly established water management;* • *better managed and exploited water resources, which will play a role in development and not be an environmental handicap (droughts and floods) for the country;* • *environmental protection, using the polluter-pays principle;* • *sanitation master plans are prepared and regularly updated;* • *safe rural and urban areas.*	*Burundians wish to achieve comprehensive and sustainable water resources management and development, in a manner that water resources play a central role in Burundi's social and economic development process. Like other EAC Partner States Burundi faces an increasingly complex water resources management challenge to assure a secure future for its people.*
Burundi National Water Sector Policy *"State where water is available in sufficient quantity and quality to meet the needs of present and future generations and efficiently and equitably used for sustainable socio-economic development, without compromising the environment"*	• *to improve the level of drinking water supply which is currently very low:* • *to improve the coverage of basic sanitation, which is currently very low;* • *to prevent environmental degradation;* • *to promote the production of electrical energy as there is much hydropower potential; and* • *promote production activities especially in agriculture, livestock, fisheries and aquaculture.* *Sectors of the vision include:* *i. Water resources availability today and tomorrow* *ii. Equitable access to good quality water;* *iii. Water use for sustainable socio-economic development* *iv. Viable and sustainable environment* *v. Improved livelihood*	***Specific objectives*** *1. Establish an effective, coherent and sustainable institutional structure for water resources management* *2. Improve the legislative and regulatory framework of the water sector* *3. Increase the rate of access to safe water and sanitation in order to achieve the MDGs by 2015* *4. Ensure access to water and sanitation services to the poor and other vulnerable groups* *5. Improve the infrastructure for basic sanitation.* *6. Improve the population behaviour in relation to water management and sanitation practices* *7. Ensure sustainability of water and sanitation services through financially viable institutions* *8. Maximize the contribution of water in economic growth* *9. Control population growth to ease pressure on natural resources;* *10. Preparedness, adaptation and mitigation of climate disasters* *11. Protect water resources against degradation*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
	Overall objective *To "ensure a sustainable water supply to cover the needs of all water users through a harmonious development of national water resources"*	*12. Mobilize funding for the Water Sector Development* *13. Establishment of regional cooperation frameworks for the sustainable management of transboundary waters* *14. Promote mutually beneficial cooperation programs* *15. Have qualified human resources for management, utilisation of and research in water resources* *16. Establishment of a reliable and adequate national water resources database for proper water resource development planning* *17. Develop and implement an integrated water resources management plan (IWRMP).* *18. Support the National Water Partnership for the management of water resources*
Burundi Country Strategy Paper 2012-2016	• *Making better use of agriculture export potential* • *Promote food security* • *Adaption to climate change* • *Environmental protection and sustainable soil and water management*	*i. Improvement of the business climate, adequate land management and strengthening of rural infrastructure.* *ii. Develop export potential of high quality coffee* *iii. Increase agricultural and honey production* *iv. Responding to Climate Change: Challenges and Opportunities* *v. Forestry and Catchment Basin Development Project*
Agricultural Sector National Strategy 2008-2015	***Overall objective*** *To contribute to the sustainable reduction of poverty and support economic growth in Burundi through increased productivity, maximize the value of production, diversification of income opportunities, and preservation and maintenance of natural and environmental resources.* ***Key Axis*** *1. Sustainable growth and productivity of agricultural production* *2. Promotion of dies and agri-business* *3. Support and professional development of producers and private initiatives* *4. Capacity management and development of agriculture*	*Main elements of the Priority Action Programme are:* *(i) Intensification of food production, livestock, industrial and forestry by the development and extension of a technological package. This would involve increasing the availability of agricultural inputs (fertilizers, seeds, pesticides, animals, agricultural machinery and equipment, etc.) And innovations in the fight against the enemies of crops and livestock, while taking measures that respect the environment. The research is expected to play a leading role in this field.* *(ii) carrying out the work of hydro-agricultural development to develop irrigated agriculture for food security improved,* *(iii) the diversification of activities in rural areas through the development of activities that promote local products and post-agriculture and the promotion of non-agricultural activities,* *(iv) the promotion and diversification of structures to support production through technical and financial support and institutional reform of state structures,* *(v) the development of initiatives through the private system of agricultural credit and micro-finance while supporting future promoters with advice and support structures to provide them with the required expertise in the field of management and organization,* *(vi) capacity building by specialization training in schools, institutes and*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
		agricultural universities taking into account the needs and constraints of agricultural land. It will train agricultural producers regularly on technical issues, taking into account the central role played by women in food production and family, *(vii) the commitment to land reform in order to secure small farms and permanently fix people in their land.*
The National Water Policy	***Objective*** *To guarantee in a sustainable manner the satisfaction of all the users' water needs by a harmonious and sustainable development of national water resources.*	*specific objectives of the policy are:* • *Set up on efficient, coherent and sustainable institutional structure of water resources management;* • *To Improve the legislative and regulatory framework of water sector;* • *Increase the access rate to clean water and sanitation in order to realize the Millennium Development Goals by 2015;* • *Insure to poor and other vulnerable categories, the access to water service and sanitation;* • *Improve basic sanitation infrastructure;* • *Change the population behaviour towards good practices of water management and sanitation;* • *Ensure the sustainability of water services and sanitation by the financial viability of institutions;* • *Maximize contribution of water resources in enhancing economic growth;* • *Control over the demographic increase to reduce the pressure on natural resources;* • *Minimize impacts of disasters and attenuate climatic disasters;* • *Protect water resources against degradation;* • *Ensure sustainable financing for the development of the water sector;* • *Set up sub-regional sustainable cooperative frameworks for transboundary water resources management and development;* • *Promote mutually advantageous cooperation programs;* • *Acquire qualified human capacities for the management, use and research in water resources;* • *Acquire a national water resources database for assessment, planning, management and development of water resources;* • *Prepare and implement an Integrated Water Resource Management Action Plan;* • *Promote national partnership for the water resources management.*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
National Investment Policy for Agriculture 2012 – 2017 *"The Burundian agriculture's fundamental mission is to ensure that all Burundians have food security in quantity and quality."*	*1. Increase sustainable production and food security* *2. Professionalization of producers and promoting innovation* *3. Chain development and agri-business* *4. Strengthening of public institutions*	*1. Protection of productive capital* *2. Management and rehabilitation of irrigation* *3. Intensification of agricultural production* *4. Development of fisheries and aquaculture* *5. Food security, nutrition and vulnerability management* *6. Organization of producers and their capacity building* *7. Development of local services and innovation* *8. Rural finance* *9. Research / Development* *10. Export sectors* *11. And animal food chains* *12. rural infrastructure* *13. Reform MINAGRIE* *14. Improvement of working conditions and* *15. Support the implementation of the NAIP*
Burundi Coffee Project Appraisal Document, 2011	*Strategic objective to promote sustainable and broad-based economic growth.* *Sub-sectoral strategy for wetland management and protection of watersheds in the agricultural sector (Strategic Sous Sectorielle d'Amenagement des Marais et de la Protection des Basin Versants).*	*Sustainable Land and Water Management (SLWM) programme:* *Component 1: Sustainable coffee production ($2.5m)* *Component 2: Sustainable coffee processing ($1m)* *Component 3: Sustainable coffee certification and marketing ($0.5m)* *Component 4: Project management and monitoring and evaluation ($0.2m)*
Infrastructure Action Plan for Burundi, 2009	*The Government's objective for the short- to medium- term is to manage a successful transition to an extended period of economic growth of 6-7 percent a year in real terms. At this level of growth, the country would have an opportunity to reduce the high incidence of poverty that is pervasive, and with the resulting stronger growth in incomes, increase substantially domestic demand for a wide range of goods and services.*	
Burundi Water Supply and Sanitation Profile, 2010 (USAID)	• *1 potable water source within 500m radius of each household;* • *1 covered indoor latrine in every household; and* • *1 public latrine in every public establishment.*	*Current priorities for Water Supply & Sanitation (WSS) include:* *1. Rehabilitation of drinking water supply systems which could considerably increase access to this commodity; (many pipes stolen during war)* *2. Construction of new systems in area with the most significant shortage so as to reduce regional disparities;* *3. Integrated management of the country's water resources through integrated multi-purpose information systems;* *4. Improved hygiene and sanitation; and* *5. Encouraging the private sector to invest in the sector to ensure its sustainability.*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
Land Tenure Profile, 2010, USAID	*"With intensive use for production of food and some export crops, Burundi's land resources are now characterized by significant land degradation, with soil erosion due to cultivation on steep slopes and degradation of watersheds. The heavy population pressure on the land has resulted in an average farm size of only 0.5 hectares, and even that area is, in many cases, fragmented. Little room for expansion remains; by some estimates, all land will be in use by 2020"*	
Food Security and Vulnerability Analysis Report 2004	*Specific objectives of the study include:* *• To determine who are the hungry, poor, and vulnerable people of rural Burundi* *• Where they live* *• To understand the causes of vulnerability and food insecurity* *• To identify areas of intervention where food aid has an advantage in addressing* *the problems of food security and vulnerability* *• To provide a basis for developing and improving existing food security monitoring* *systems*	*Recommendations:* • *Food aid sales* • *Further research* • *future assessments, monitoring, and surveillance*
Global Agriculture and Food Security Program 2012	*The **objectives** of the NAIP are as follows:* *i) To ensure food security for all;* *ii) To increase household incomes;* *iii) To obtain hard currency;* *iv) To provide raw material for the industrial sector and create jobs in the agricultural processing and service sector.*	*1. Sustainable growth in productive capital and production;* *2. Professional training of farmers and promotion of innovation;* *3. Development of value chains and agribusiness;* *4. Improvement in the institutional framework.*

Strategic areas in relation to policies and strategies of Rwanda

Policy and Goals	*Strategies/ Targets*	*Strategic areas and priorities*
Economic Development and Poverty reduction Plan 2008-2012 (2007)	*To increase the proportion of the population accessing safe water from 64% to 86%, and the proportion with sanitation services from 38% to 65%.* *To increase the proportion of the rural population living within 500m of an improved water source from 64% to 85%, and to raise the proportion of the urban population residing within 200m of an improved water source from 69% to 100%.* *The sector plans that the proportion of schools with latrines complying with health norms will rise from 10% to 80%, and that the corresponding proportion for rural households will increase from 38% to 65%.*	• *Accelerate growth and poverty reduction* • *Widen and strengthen the financial sector* • *Develop skills for a knowledge-based society* • *Promote science, technology and innovation for economic growth* • *Raise agricultural productivity and ensure food security* • *Raise the contribution of manufacturing and services to economic development for sustainable growth* • *Manage the environment and ensure optimal utilisation of natural resources* • *Build economic infrastructure* • *Improve health status and slow down population growth* • *Improve water resources management and access to safe drinking water and sanitation* • *Integrate and extend social protection* • *Promote decentralisation, citizen participation and empowerment, transparency and accountability* • *Promote vibrant and professional public and private media to enhance citizen's voice and dissemination of public information* • *Support youth to participate in economic and social development.*
Vision 2020 *The VISION seeks to fundamentally transform Rwanda into a middle-income country by the year 2020.* *Achieving annual per capita income of US$ 900 (US$ 290 today), a poverty rate of 30% (64% today) and an average life expectancy of 55 years (49 years today).*	*a) reducing agricultural population from 90 per cent in 2000 to 75 per cent in 2010 and 50 per cent by 2020;* *b) Increasing non-agricultural jobs from 200,000 in 2000 to 500,000 in 2010 to 1,400,000 by 2020.* *c) Waste management: At least 80% of the Rwandan population will have easy access to adequate waste management systems and will have mastered individual and community hygiene practices.* *d) By 2020, the rural and urban areas will have sufficient sewerage and disposal systems.*	*An increase in the number of jobs in the industrial and services sector helps to reduce the number of people dependent on agriculture for their livelihoods.* *Water: All Rwandans will have access to safe drinking water. Water resource management will be rationalized, integrated and in harmony with the national land-use master plans in all water dependent domains.* *Each town will be endowed with an adequate unit for treating and compressing solid wastes for disposal. Households will have mastered and be practicing measures of hygiene and waste disposal.*
Updated version of the National Human Settlement Policy in Rwanda (2009)	***Urban Sector specific objectives:*** • *the rational use of land;* • *control of the growth of population clusters;* • *matching the demand and the supply of building plots;* • *organizing a financing system;*	***Urban sector objectives and strategies:*** *1. Complete control and management of the urban planning and settlement.* • *Assessment of the socioeconomic environment in urban residential areas.* *2. Controlling the growth of urban population clusters* • *Development of urban planning systems*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
The organization and improvement of the current system of human settlements for sustainable socio-economic development. ***Urban sector:*** *To improve the settlement conditions of the urban population with a view to boosting the implementation of poverty reduction strategy.* ***Rural sector:*** *the improvement of the existing system of human settlements for sustainable socio-economic development.*	• *organizing and coordinating structures for the management of human settlement;* • *developing the building industry.* ***Rural sector specific objectives:*** • *the rationalization of land use;* • *the establishment of new homes;* • *the improvement of their quality;* • *the rational management of land;* • *the improvement of the agricultural production;* • *the creation of other income generating activities;* • *the establishment of basic facilities closer to the population;* • *the strengthening of the role of local communities in the management of human settlement; and* • *the organization of the human settlement financing system.*	• *Rehabilitation of residential areas* *3. Matching the supply and the demand of building plots in urban centres* • *Development of mechanisms for producing sufficient building plots in terms of quantity and quality* • *Land improvements and provision of facilities in residential areas* • *Enforcement of the principle of urban development costs recovery* *4. Organizing a human settlement financing system in urban areas* • *Establishment and strengthening of institutions involved in human settlement financing* *5. Organizing and coordinating human settlement management structures* • *Giving responsibilities to local communities in the management of human settlement* • *Promotion and organization of the participation of the beneficiaries of human settlement programmes* *6. Development of the building industry* • *Promotion of the production and sale of building materials* ***Rural Sector objectives and strategies:*** *1. Rationalization of national land use* • *Promotion of the regrouping of human settlement in rural areas and consolidation of currently established rural centres* • *Awareness raising* *2. Creating new housing units* • *Access to housing by vulnerable social groups* *3. Improvement of the quality of houses in rural areas* • *Promotion of the production and utilization of local building materials* • *Training and information of the population in appropriate technologies* • *Organizing trades bodies* *4. Strengthening the role of local communities in human settlement management* • *Strengthening institutional structures involved in human settlement management* • *Promotion and organization of the participation of beneficiaries in human settlement programmes* *5. Organization of a system for rural housing financing* • *Promotion of the home-savings scheme* • *Establishment of funds for the promotion and financing rural housing*
National Policy & Strategy for Water Supply and Sanitation Services (2010)	***Water Supply*** ***Rural - coverage*** *1. Raise rural water supply coverage to 85% by 2012 and to 100% by 2020 by assisting the Districts to plan, design, finance and implement*	***Rural - coverage*** • *Implement an ambitious, decentralised rural WSS programme based on harmonised procedures* • *Establishing a harmonised financing mechanism linked to district-led*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
Ensure sustainable and affordable access to safe water supply, sanitation and waste management services for all Rwandans, as a contribution to poverty reduction, public health, economic development and environmental protection.	*infrastructure projects.* ***Rural – functionality*** *2. Ensure sustainable functionality of rural water supply infrastructure by developing effective management structures and well-regulated public-private partnership (PPP) arrangements.* ***Urban*** *3. Ensure safe, reliable and affordable urban water supply services for all (100% service coverage by 2012) while strengthening the financial viability of the Utility.* ***Sanitation*** ***Individual sanitation*** *4. Raise household sanitation coverage to 65% by 2012 and 100% by 2020, and promote hygiene behaviour change.* ***Institutional Sanitation*** *5. Implement improved sanitation for schools, health facilities and other public institutions and locations.* ***Collective sanitation*** *6. Develop safe, well-regulated and affordable off-site sanitation services (sewerage and sludge collection, treatment and reuse/disposal) for densely populated areas.* ***Storm water drainage*** *7. Enhance storm water management to mitigate impacts on properties, infrastructure, human health and the environment* ***Solid waste Management*** *8. Implement integrated solid waste management in ways that are protective to human health and the environment.* ***Institutional Sector Framework*** *9. Develop the sector's institutional and capacity building framework.*	*implementation* • *Prioritize water supply service delivery in grouped settlements* • *Strengthen decentralised implementation capacities through technical support and capacity building* • *Support the preparation of WSS development plans for all Districts* • *Develop a range of affordable technology options for rural areas* • *Promote household connections to improve service levels, increase water consumption and improve the financial viability of water supply schemes* • *Encourage and mobilise private sector investments in new infrastructure* ***Rural – functionality*** • *Bring delegated management to scale while optimising the PPP model* • *Enhance regulation for better performance in PPP* • *Develop and implement a comprehensive capacity building programme* • *Develop tariff guidelines that take into account financial viability and affordability considerations* • *Strengthen community based maintenance system for rural point water sources* • *Develop a water quality surveillance system for rural water supply* ***Urban*** • *Consolidate the status of the Utility and the contractual basis for its operations* • *Move towards full cost recovery for urban water services* • *Improve service levels by encouraging household connections and developing pro-poor services* • *Improve operational efficiency and reduce unaccounted-for water* • *Develop production and distribution capacities* ***Individual sanitation*** • *Establish a cooperation framework for a comprehensive inter-sectoral programme to promote improved household sanitation and behaviour change* • *Raise sanitation coverage by enhancing the demand for sanitation through a combination of promotion measures* • *Develop private sector capacities for improved sanitation* • *Develop, pilot and demonstrate a range of individual sanitation technologies for different standings* ***Institutional Sanitation*** • *Implement a joint programme to provide hygienic sanitary facilities and promote hygiene in all schools, health centres and other public institutions* ***Collective sanitation*** • *Establish an effective regulatory and institutional framework for collective sewerage and sludge management*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
		• *Promote viable, low cost approaches for collective sewerage schemes* • *Implement cost recovery for collective sewerage systems* • *Prepare sanitation master plans for all urban areas* ***Storm water drainage*** • *Build the institutional and regulatory framework for cooperation and support in storm water management* • *Support districts and the City of Kigali in planning and design* ***Solid waste Management*** • *Minimize waste as a national priority* • *Develop an integrated approach for solid waste management in Rwanda* • *Recover value from waste and promote safe collection and reuse/recycling systems involving the private sector* • *Ensure safe disposal of residual waste and improve existing dumpsites* ***Institutional Sector Framework*** • *Promote sector harmonisation and aid effectiveness by developing a SWAp* • *Re-define and consolidate institutional roles and coordination mechanisms* • *Establish a dedicated WSS Authority with substantial operational autonomy* • *Improve communication, consultation and coordination in a multi-stakeholder environment* • *Develop a reliable and robust M&E and performance measurement framework* • *Develop professional training and education in WSS relevant fields* • *Promote innovative technologies / approaches and develop knowledge management* • *Seek exchange of lessons learned and good practices through regional and international cooperation*
Water Supply and Sanitation in Rwanda *Finance into services by 2015. (AMCOW)*	***Sector wide*** *• Build districts' capacity in terms of the quantity and skills of staff, to the level required to attain sector targets.* *• Develop a sector investment plan to guide the balance of investment to each of the subsectors, as urban water supply and sanitation are currently significantly underfunded relative to requirements.* *• Utilize modern communication technologies (for example, a user-friendly website), to promote a standard and 'official' set of figures and performance assessments.* ***Rural water supply*** *• Encourage donors to join harmonized procedures and to pool funding for rural water supply.*	*1. Priority actions for institutional framework: Build districts' capacity, in terms of the quantity and skills of staff, to the level required to attain sector targets.* • *Decentralization: ensuring capacity at local levels (30 districts under capacitated);* • *Regulation: developing Rwanda Utilities Regulatory Agency's (RURA) presence and powers in rural areas;* • *Donor coordination: ensuring sufficient focus on sanitation and underprivileged districts (balance donor aid to water supply and sanitation projects; underserviced areas);* • *Rural operators: reinforcing professionalism in public-private partnerships (PPP);* *2. Priority actions for financing and its implementation: Develop a sector*

Policy and Goals	*Strategies/ Targets*	*Strategic areas and priorities*
	• Publish a national inventory for RWS, including access rates and strategic ratios. *• Develop technical assistance support for private operators of rural schemes.* *• Closely monitor O&M performance by RWS operators, to ensure long-term sustainability of water services.* ***Urban water supply*** *• Undertake reform and revise tariff to improve operational performance and ensure financial viability of urban water services under the newly established EWSA.* *• Update water supply master plan for Kigali taking into account urban growth and projected settlement patterns.* *• Promote investment in urban water supply to expand production capacity and expand and rationalize distribution network.* *• Develop pro-poor programs to serve low-income households including improved management of public kiosks and social connections.* ***Rural sanitation and hygiene*** *• Establish district-level surveys of access and need, to better monitor equity.* *• Carry out research into appropriate technologies, aiming at a large-scale transition from traditional to hygienic latrines at affordable cost to households.* *• Encourage all projects to follow sector policy on user contributions.* ***Urban sanitation and hygiene*** *• Develop an action plan for Kigali, adapted to Millennium Development Goal targets, and based on on-site sanitation for the medium term in line with sanitation master plan.* *• Develop private sector involvement in both hygiene promotion and on-site sanitation (latrine equipment, cheaper septic tanks, emptying trucks, and safe dumping sites).* *• Improve coordination between MVK (that is, Kigali Town Municipality) and the new utility, Rwanda Water and Sewerage Corporation.*	*investment plan to guide the balance of investment to each of the subsectors, as urban water supply and sanitation are currently significantly underfunded relative to requirements.* *3. Priority actions for sector monitoring and evaluation: Utilize modern communication technologies (for example, a user-friendly web site), to promote a standard and "official" set of figures and performance assessments, made visible and accessible to non-experts.* *• Public expenditure reviews (PERs): Further improving value. (is done annually, needs more strategy information);* *• Rural water monitoring: Maintaining the database. (A new management information system is expected, but in the meantime an accurate understanding of where the facilities are in each district or of local access rates, is limited.)* *• Definitions and standards: Ensuring consistency. (While policies and strategies are regularly updated, the definitions on which they rely are not fully standardized, resulting in confusion when implementing or monitoring.)*
National Energy Policy and Strategy, (2011) *To contribute effectively to the growth of the national economy and thereby*	*The energy policy objectives are to support national development through:* *a) ensuring the availability of sufficient, **reliable and affordable energy** supplies for **all Rwandans**;* *b) promoting the **rational and efficient use** of energy;* *c) establishing **environmentally sound and sustainable** systems of*	***1. Integrated approach to energy planning*** *(a) Sectoral planning is to take fully into account the **linkages** between different energy sub-sectors and the economy as a whole.* *(b) In particular, energy sector development is to be planned to assist in **boosting exports**, the driver in the national growth strategy.* *(c) At the same time, a balance is to be struck between energy for growth and*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
improve the standard of living for the entire nation in a sustainable and environmentally sound manner.	*energy production, procurement, transportation, distribution and end-use.* ***Policy statements on energy sub-sectors:*** ***Biomass sub-sector*** *(a) Production of wood for woodfuel and charcoal must be recognised as an* ***important rural economic activity*** *that can be conducted in an environmentally sound manner if all regulations are adhered to and sufficient wood is planted.* *(b) Plantations, woodlots and mixed agro-forestry will be* ***expanded and better managed (planting and harvesting) on a sustainable basis*** *to support growing wood fuel and charcoal production.* *(c)* ***Improved technologies*** *for charcoal production and improved stoves to make more efficient use of biomass fuels will be disseminated.* *(d)* ***Under-exploited forms of biomass*** *such as papyrus and typha will be promoted particularly through the briquetting of such materials for cooking and heating.* *(e)* ***Other energy sources for cooking and heating*** *such as biomass briquettes (peat, papyrus, and waste), kerosene (using efficient and safe pressure stoves and lights), LPG or Solar energy for water heating will be promoted.* *(f) Dissemination of* ***biogas digesters*** *will be promoted to rural farmers which have the required animal dung or agricultural residue and to schools, hospitals and other institutions where human waste can be transformed into biogas and slurry.* *(g) Production of methane or other forms of* ***energy from solid waste landfills*** *or through* ***gasification processes*** *will be encouraged.* ***Biofuels*** *(a) Carefully explore the potential of biofuel production projects in Rwanda taking into account not just the direct costs and benefits, but indirect opportunity costs particularly in respect of potential reductions in food crops and import substitution or export cash crops, the implications for use of water resources and the environment, net employment implications and a detailed risk analysis.* *(b) Support the development of* ***small-scale biofuels projects*** *which can supply biofuels appropriately and economically for particular applications e.g. remote rural grinding mills.* ***Electricity sub-sector*** *(a) increasing* ***access*** *to electricity to the population, to businesses and social service institutions in order to support economic development (this will be mainly achieved through the National Electricity Access Roll Out*	*energy to further* ***social objectives and poverty reduction****.* ***2. Use of indigenous energy resources*** *(a)* ***Indigenous energy resources*** *are to be fully developed to meet as much of the country's energy needs as it is economic to do* *(b) The social and economic* ***viability of increasing the proportion of energy supplied from indigenous resources*** *will be continually re-assessed.* ***3. Energy efficiency and conservation*** *(a) The best use of energy supplies is to be made through using* ***efficient technologies*** *and providing appropriate* ***economic incentives*** *for prudent use of energy resources to satisfy energy needs* *(b) Major users of energy shall be urged to carry out regular* ***energy audits*** *and to follow up to address areas of inefficiency identified in the audits.* *(c) The potential for* ***energy demand management*** *to 'free up' energy from existing sources is to be exploited before energy supply augmentation projects are considered.* ***4. Energy pricing and subsidy policies*** *(a)* ***Energy prices are to be set to recover the costs of supply, at least of operating and maintenance costs and at a later stage also to recover capital costs.*** *Government or donor resources which are available for subsidies contribute more to equity and efficiency objectives if they are spent on once-off capital subsidies than on subsidies to recurrent costs:* *(b) Resources available for energy subsidies are to be spent primarily on* ***once-off capital subsidies*** *to enhance access to modern forms of energy than on recurrent on-going subsidies to reduce the cost of energy to those who already have access.* *(c) It is recognised that strict application of the energy pricing policy could cause difficulty for many consumers. In order to make electricity affordable for most parts of the Rwandan population, subsidies might be required. Where a recurrent subsidy is considered warranted on social grounds, the policy is that:* *(d)* ***All forms of subsidy should be made transparent*** *to energy consumers.* *(e)* ***Cross-subsidies*** *(for example within or between electricity customer categories) should be justified on the grounds of maximising social welfare.* *(f)* ***Direct subsidies*** *should be provided in a transparent fashion by the Government.* *(g) The* ***economic implications*** *of subsidies will be systematically analysed.* ***5. Regulatory framework*** *(a)* ***Independence*** *must be the basic principle governing energy price regulation and licensing of energy providers that is carried out by the Rwanda*

Policy and Goals	*Strategies/ Targets*	*Strategic areas and priorities*
	Programme) *(b) reduction in the **cost** of electricity;* *(c) **diversification** in sources of electricity supply;* *(d) increased participation by the **private sector** in the electricity industry specifically for generation;* *(e) enhanced **regional cooperation** in electricity to reduce overall costs and improve security of supply;* *(f) **clarification of roles** within public sector structures and development of **skills** in planning, procurement, and transactions' negotiation;* *(g) development of the **legal, institutional and financial framework** for rapid development of the electricity sector.* *The introduction of **competition** within the electricity industry is a long-term policy goal.* ***New and renewable energies*** *(a) Proceed with further **research and development** of biogas, biofuels and technologies to utilise methane, peat, geothermal, solar and wind energy.* *(b) Complement the technical side with investigations of **the economic feasibility and social acceptability** of using new and renewable forms of energy.* *(c) Work with **other countries and regional bodies** so as to have research programmes which complement one another, rather than duplicating efforts and wasting scarce resources available for these purposes.* *(d) Provide economically justified **feed-in tariffs** or other mechanisms to give incentives and reduce risks for electricity production from renewable sources.* *(e) Establish **norms, codes of practice, guidelines and standards** for new and renewable energy technologies.* ***2 Biomass Energy Strategy*** *a) Producing more biomass through better management of plantations and removal of restrictions on cutting and transport of wood and charcoal (except where the material originates from natural woodland)* *b) Saving biomass through more efficient charcoal production and improved stoves (for both wood and charcoal)* *c) Substituting biomass with other sources of energy (such as LPG and kerosene using pressure stoves). Electricity is expected to make a minor contribution, but only at the high end market due to its high cost.* *The primary goal of the accelerated electricity development strategy for the period 2011 to 2017 is to generate the planned additional 1,000 MW*	*Utility Regulatory Agency (RURA).* *(b) Sufficient **regulatory capacity** will be developed in RURA to regulate energy prices specifically for electricity and the various other regulatory bodies involved in the technical, environmental and safety standards necessary for the energy sector.* ***6. Energy sector governance*** ***(a)** Management of the energy sector, including decision-making about projects, must be **open, transparent** and firmly oriented on pursuing the **best interests of the nation as a whole.*** *(b) A common **Sector-Wide Approach (SWAp)** will be the basis of the process between the government and development partners to ensure proper coordination, efficiency and effectiveness in the use of resources in the Rwandan energy sector.* *(c) Procurement should be rooted in the principles of **transparency, equal treatment** and **non-discrimination** between competing bidders.* ***7. Institutional framework and capacity-building*** ***(a)** Each institution involved in the energy sector should have clearly defined **roles and responsibilities.*** ***(b)** Overall coordination of the energy sector is the responsibility of the Ministry of Infrastructure (**MININFRA).*** *(c) The separation of policy making and strategy formulation from implementation has been endorsed and the **Energy, Water and Sanitation Authority (EWSA)** will assume the implementation role.* *(d) Key institutions in energy sub-sectors in particular **the Rwanda Electricity Corporation (RECO)**will have sufficient autonomy under EWSA to be effective in executing its role, including autonomy in the setting of salaries to be able to hire staff with adequate skills and experience.* *(e) **Inter-ministerial teams** will ensure effective inter-ministerial and inter-agency coordination and shall be called upon for crosscutting issues for example on hydrocarbons (MINICOM), biomass (MINELA and MINIFOM), MINIJUST for contractual issues, MINECOFIN for investment decisions, MINALOC, MINISANTE and MINEDUC for electrification of public institutions etc.* *(f) An effective **energy information system**, housed in MININFRA, will be established to facilitate management of the energy sector.* *(g) Attention will be paid to **capacity-building** at all levels so that there are the human, computing and other resources necessary in the institutions for them to be effective.* ***8. Private sector participation in energy*** *(a) The **private sector** participation at any and all levels of the energy supply industry should be promoted particularly in the following areas:*

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	of electricity by developing least cost electricity generation options using indigenous energy resources and also from shared energy resources with the neighbouring countries of DRC, Burundi and Tanzania. The specific objectives of the strategy are to: *(a) Address the challenges in projects currently under implementation and develop plans to successfully complete them;* *(b) Implement the least cost electricity generation mix by developing specific projects with clear time lines;* *(c) Secure the necessary funding for planned electricity projects, including ensuring sufficient private sector investment (both local and foreign);* *(d) Develop the required legal & regulatory framework to support the implementation plan;* *(e) Develop conducive policies including appropriate incentives and tariffs to attract private sector participation;* *(f) Develop human resource capacity to implement the planned electricity generation projects;* *(g) Involve local communities to the extent possible in developing energy projects.* *The following targets have been set:* *(a) Hydropower generation shall be increased to about 340MW* *(b) Geothermal resources shall be developed to deliver 310 MW to the national grid* *(c) Methane gas to power projects shall deliver 300 MW to the national grid* *(d) Peat resources shall be developed to deliver 200MW to the national grid* *(e) 10 MW of additional diesel generation shall be required to meet the immediate power needs and serve as a backup for the short term.* *(f) 5 MW shall be generated from renewable energy sources (solar PV, micro hydro power or wind) and distributed to local communities beyond the national electricity grid* *(g) By 2017 we shall have reached a total of 1,200,000 connections to the national grid (from the current 204,000 connections) which will be equivalent to 50% of access* *(h) 100% of schools, 100% of health facilities and 100% of sector offices shall be electrified by 2017 either through connection to the grid or through reliable off-grid systems* *(i) The transmission grid shall be strengthened and expanded by an additional 2100 km in order to meet power supply and demand requirements (High Voltage lines and substations)*	*• forestry, charcoal and peat projects* *• petroleum and geothermal exploration* *• petroleum product storage and distribution* *• methane projects (methane from Lake Kivu, urban landfill or other sources)* *• large electricity generation projects* *• micro-hydro, solar PV and wind generation projects* *• small distribution grids* *• solar water heating* *• distribution and back-up service of household-level energy systems, including efficient and safe wood, charcoal, kerosene and LPG stoves and lights* *• energy efficiency initiatives* *(b) The Government will be committed to developing an overall framework and long term capacity in negotiating and establishing relations with the private sector regarding energy projects.* *(c) Where* ***Public-Private Partnerships (PPPs)*** *are desirable, government will work with private sector entities to ensure the speedy structuring and financing of PPP projects in the energy sector* *(d) MININFRA will work closely with other government agencies established to assist private investors in all sectors of the economy, particularly the Rwanda Development Board (RDB).* ***9. Financing energy sector investments*** *(a) Government will be committed to* ***optimising the financing of the energy sector*** *from the various sources that are available, particularly own fiscal resources and external financing.* *(b) Taking note of the country's macro-economic requirements, financing of projects which* ***minimise government guarantees*** *and hence* ***contingent liabilities*** *in the budget will be sought.* *(c) Energy projects must be* ***prioritised*** *for support by government and/or development partners according to current sector priorities. For* ***electricity projects*** *the priority list shall be determined by the cost effectiveness of competing projects in facilitating increased access to electricity, reducing the average cost of electricity supply and enhancing security of supply.* *(d) Expansion of* ***micro-financing options*** *for small energy projects will be encouraged.*

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	a. For Micro hydropower plants *(i) Encourage PPP models to invest in the construction of small micro hydropower plants with capacity not exceeding 0.25 MW. This shall include Local Government, Cooperatives and Local Private Sector.* *(ii) Government to assist in preparing feasibility studies, the procurement of consultants and service providers and provision of technical advice.* *(iii) Mobilize the Private Sector to invest in plants with capacity exceeding 0.25 MW.* *(iv) Government to mobilize Development Partners to support studies and construction of plants exceeding 0.25 MW*	
Strategic Plan for the Transformation of Agriculture in Rwanda – Phase II (PSTA II) (2009)	***Intensification and development of sustainable production systems*** *i) Create needed soil and water management structures such as progressive terraces, radical terraces and water harvesting structures in agricultural areas, always ensuring that the necessary complementary actions to restore soil fertility are undertaken. This is particularly necessary in the case of radical terraces, which may require up to 3-4 years of application of organic material and mineral fertilizers before being used for sowing crops. Equally, the progressive terraces need to be combined with the planting of appropriate agroforestry species.* *ii) Demonstrate to farmers and villagers the benefits of maintaining and using these structures and other practices to enhance soil fertility, and train them In those practices using participatory approaches for training farmers and learning how to best adapt practices to each locality.* *iii) Increase ownership of livestock and Improve and intensify animal husbandry practices so that they provide more household income, are consistent with the limited endowments of land per farm household, and contribute to maintaining soil fertility.* *iv) Improve cultivation practices and develop sustainable production systems in order to generate higher levels of production and farm incomes from the limited base of arable land and to reduce the perceived need to cultivate marginal and vulnerable lands.* ***1. Support to the professionalization of the producers*** *to empower farmers in the sense of giving them greater ability to develop solutions on their own initiative and to access the specialised forms of technical assistance that they need on particular issues.* ***2. Promotion of commodity chains and agribusiness development*** *to create, through institutional reforms, investments and incentives, an environment which is favourable for farmers and agro-entrepreneurs to develop high-value products, including processed products, and to access the markets which will justify the investments in those areas.*	***Intensification and development of sustainable production systems*** *1. Sustainable management of natural resources, water and soil conservation* *2. Integrated development and intensification of crops and livestock:* *2.1. Crop diversification and intensification* *2.2. Animal resources development* *3. Marshland development* *4. Irrigation development* *5. Supply and use of agricultural inputs* *5.1. Fertiliser and agrochemical supply and use* *5.2. Certified seeds and other inputs* *6 Food security, vulnerability management* ***1. Support to the professionalization of the producers*** *1. Promotion of farmers' organisations and capacity building for producers* *2. Restructuring of proximity services for producers* *3. Research for transforming agriculture* ***2. Promotion of commodity chains and agribusiness development*** *1. Creating an environment conducive to business and entrepreneurship development* *and market access* *2. Development of traditional exports:* *2.1. Coffee* *2.2. Tea* *2.3. Pyrethrum* *3. Development of non-traditional high-value export products* *4. Production and value addition for domestic staple products* *5. Market-oriented rural infrastructure* *6. Strengthening rural financial systems* ***3. Institutional development*** *1. Institutional strengthening and capacity building* *2. The policy and regulatory framework for the sector*

Policy and Goals	*Strategies/ Targets*	*Strategic areas and priorities*
	3. Institutional development *to strengthen the institutional framework through which the public sector supports agricultural development. This involves actions in a number of areas, including capacity building; redefining the roles of some institutions and personnel; improving management information systems and coordination mechanisms within the sector, including between the Centre and the Districts; strengthening the policy and regulatory framework; providing a better statistical and informational base for public policy decisions; making better use of information and communication technologies; and instituting procedures to ensure that the decentralisation programme functions well so that local-level actors are full participants in decision making and programme implementation.*	*3. Agricultural statistics and ICT* *4. M&E systems and coordination of the agricultural sector* *5. The decentralisation programme in agriculture*
Rwanda Irrigation Master Plan (2010) *To develop and manage water resources to promote intensive and sustainable irrigated agriculture, sustain food security and generate incomes for farmers.*	*Specifically, the plan's objective is to provide Rwanda with a planning tool for rational exploitation of its soil and water resources. This tool is intended to lead to an increase in crop production for local consumption, as well as to promote production of high value crops for export.*	*The planning tool will support decision making by:* *• identifying the most favourable areas to establish irrigation water infrastructure;* *• prioritising distribution of irrigation water;* *• identifying means of transporting water to selected sites; and* *• establishing irrigated agriculture in small-, medium- and large-scale projects on hillsides, marshlands and other topographically suitable areas.*
National Industrial Policy (2011) *Competitive industrial and advanced services sectors producing over $1.5 billion of exports by 2020, while increasing the number of off farm jobs* ***SHORT-TERM*** *Improve the feasibility of desirable industries and promote feasible sectors* ***MEDIUM-TERM*** *Promote new desirable sectors as they become feasible* ***LONG-TERM Reduce*** *support to successful sectors and provide support to new feasible sectors*	***Goals:*** *• promoting the growth of the economy with the target of becoming a middle-income country by 2020 - requiring GDP growth of at least 8 per cent on average per annum.* *• structural transformation, with industry accounting for 26% of GDP by 2020;* *• the national investment rate reaching 30 per cent of GDP; and* *• non-farm employment reaching 1.4 million.* ***Objectives:*** *1) Increase domestic production for local consumption* *2) Improve Rwanda's export competitiveness* *3) Create an enabling environment for Rwanda's industrialization*	*The prioritised policy actions are as follows:* ***A. Infrastructure*** *• Increase Government Investment in Energy* *• Allocate land for industries, develop industrial parks and SEZs* *• Transport* ***B. Human Resources*** *• Provide capacity building support to manufacturers* *• Design courses that are focused on the management and technical needs of firms in targeted sectors.* *• Increase scholarships to international higher learning institutions, focusing on science and technology.* ***C. Improved Access to Finance and Investment*** *• Mobilise long term funding for industrial development through BRD.* *• Develop feasibility studies to investigate the viability of potential investments in selected clusters* *• Fast track the development of the Rwanda Capital Market* ***D. Trade Facilitation*** *• Strengthen the effectiveness of Sanitary and Phyto-Sanitary measures (SPS) and Technical Barriers to Trade (TBT) enquiry points and consumer*

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		protection systems. • *Promote co-operation on productivity and technical improvements by manufacturers to meet compliance with international standards, including harmonisation with EAC standards.* • *Increase efforts at eliminating regional NTBs through the national and regional mechanisms.* ***E. Technology, Research and Innovation*** • *Restructure and expand the Institute of Scientific and Technological Research (IRST) to become the Industrial Research and Development Agency (IRDA) to facilitate the transfer of innovative technologies, to carry out industrial research and to stimulate national and international partnerships.* • *Establish Appropriate Technology Demonstration Centres (ATDCs) in industrial parks.* • *Increase funding to research institutions and higher-level academia to support desirable targeted industrial sectors.* ***F. Raw Materials and Industrial Inputs*** • *Conduct or update value chain analyses for targeted clusters* • *Undertake a review of the EAC Common External Tariff (CET) and develop negotiation positions to reduce tariffs on key inputs* ***G. Regulatory Environment*** • *Provide incentive packages that are time bound and based on a monitoring and performance measurement system for targeted viable industries;* • *Update the 1956 Law on Industrial Development;* • ***Promote the development of cottage industries*** *through appropriate technologies and other business development support;* • *Establish corporate governance rules to guide businesses;* • *Conduct Regulatory Impact Assessments before putting in place regulations affecting business.* ***H. Environmental Sustainability*** • *Enforce the establishment of industry specific waste management systems* • *Through the use of PPPs, construct factory and warehouse facilities in the SEZ (special Economic Zone)* • *Sensitize Industrialists and enforce cleaner production systems in all industries;* • *Allow the use of biodegradable plastics in industrial applications within the framework of appropriate standards, and promote recycling systems in industry.*

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Draft: A REVISED RWANDAN MINING POLICY (2009) *By 2015:* ***Metal substances:*** *Rwanda has developed a significant domestic extraction industry, which will enable it to become a true mining hub, consolidating, processing and certifying tin, colt an, wolfram and gold.* ***Quarry products:*** *"Reliably Rwandan" construction materials provide Rwanda's industrial, residential and infrastructure projects with value-for-money aggregates, tiles and cement produced by local businesses and cooperatives* ***Precious stones:*** *"Rwanda builds the know-how in gem selection, cutting and design expertise to offer sapphire, amethyst, beryl and tourmaline stones and jewellery to customers and retailers who are socially conscious"*	• ***Higher productivity*** *(3 industrial mines by 2020)* • ***Increased investment*** *($500 million by 2020)* • ***More employment & higher paying jobs*** *(50,000 employees by 2015)* • ***Increased exports*** *($240million per year by 2020)* • ***Reduced imports*** *($10million per year fall in construction material imports)* • ***Increased tax revenue*** *($30million per year by 2020)* • ***Reduced environmental impact*** *(no artisanal treatment in rivers)* • ***Greater macro-economic stability***	*1. Strengthen the enabling legal, regulatory and institutional environment.* *a. Streamline regulatory framework* *b. Institutionalise standards enforcement* *c. Address mining sector regulatory skills gaps* *d. Build capacity in policy development* *2. Develop competitive investment and fiscal policies for mining.* *a. Put in place fiscal strategy* *b. Introduce royalties* *c. Create mining development fund* *d. Create hedging instruments* *e. Improve price information and forecasts* *3. Improve mining sector knowledge, skills and practices.* *a. Consolidate existing information on mineral deposit potential* *b. Develop program of geological surveying* *c. Build human capacity and expertise* *d. Promote the EITI & corporate social responsibility* *4. Raise productivity and increase production from new mines.* *a. Establish a financing mechanism for artisans* *b. Raise productivity of artisanal miners* *c. Reform licensing for mineral traders* *d. Produce mining investment opportunities* *e. Promote mining based on proper estimation of value of deposits* *5. Diversify into new products and increase value addition.* *a. Develop new product investment opportunities* *b. Develop value addition investment opportunities* *c. Provide improved electricity supply for smelters* *d. Finalise plans to establish Kigali Mining Campus*
Strategic Plan for the Forest Sector 2009 – 2012 (2010) *Through sound forest*	*1. To increase forest and agroforestry resources in order to meet the national needs in timber and non-timber forest products and services for public, personal and commercial uses.* *1.1 Increase area and diversity of national forest resources.* *1.2 Promote growing of multi-purpose trees in all farming systems*	• *Carry out an inventory of spaces to reforest* • *Carry out a study to identify appropriate species for planting in the identified areas* • *Develop specific reforestation and afforestation programs* • *Develop 416 nurseries(198,325 trees each) with a total 83,502,000 trees*

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management, forest resources will play increased roles in national economy and biodiversity conservation and current benefits from forests enjoyed by contemporary generations will be enhanced to ensure that the wellbeing of future generations is not compromised.	*1.3 Avail improved seed and other germplasms* *1.4 Introduce, promote and support innovative financing* *1.5 Mechanisms such as ecotaxes, trusts, payment for environmental services, carbon trade, etc.* *2. To manage forests to optimize their economical as well as ecological functions such as soil erosion control, climate regulation and biodiversity conservation in a sustainable manner.* *2.1 Improve management of forest resources towards sustainability* *2.2 Develop management plans for state forests* *2.3 Promote value addition technologies to wood and non-wood forest products* *2.4 Reduce wood energy consumption* *2.5 Foster and facilitate national trade and export of forest products* *3. To provide institutional support to forestry actors in order to improve the quality of products and services rendered by these actors.* *3.1 Scale-up forestry extension and education to schools and other communities* *3.2 Strengthen forestry and agro-forestry research* *3.3 Strengthen regional and international cooperation in forestry* *3.4 Promote women and youth involvement in forestry activities that generate income* *3.5 Strengthen the policy and legal framework of forestry activities* *3.6 Improve information management system in order to foster better planning and M&E for forest management*	• *Reforest 46 390 ha of government and peoples land* • *Prepare and plant trees on every world tree day on 2000 ha and maintain them* • *Carry out a study to identify suitable agro forestry trees for planting in various farming systems* • *Support farmers in establishing and maintaining 1000 nurseries each with 153,000 trees* • *Mobilize farmers to plant agro forestry trees in their farming system* • *Reward best farmers practicing agro forestry.* • *Liaise with land centre and RADA to ensure that land titles are offered to farms with plants as the law requires* • *Import high quality forestry and agro forestry seeds suitable to Rwanda* • *Support ISAR/Forest Research Service to use biotechnology to multiply agro forestry and forestry seedlings.* • *Train and support farmers to engage in agro forestry and forestry seeds business* • *Develop a cabinet paper (concept note) on this* • *Develop the necessary legislation* • *Develop a project for carbon trade , eco-taxes, trusts and environmental services* • *Support the implementation of the District Forestry Plan* • *Train authorities and technicians in the use of the plans* • *Develop a national forestry protection plan* • *Form provincial commissions and local evaluation committees on forestry management* • *Equip the forestry protection department for efficient fight against damages to forests at the district levels* • *Identify and characterize state forests* • *Localize and map state forests* • *Elaborate exploitation plan for state forests* • *Carry out a study to identify national needs in wood processing and the required treatment infrastructure* • *Establish one modern wood processing and treatment unit per province* • *Sensitize the private sector operators on reusing wood by-products, taking into account the gender aspect* • *Support private sector to add value to bamboo products* • *Identify and disseminate appropriate alternative energy sources to wood energy* • *Promote the use of improved techniques for charcoal making* • *Mobilize and Support 100 families per sector to use improved energy stoves.*

Policy and Goals	*Strategies/ Targets*	*Strategic areas and priorities*
		• *Provide incentives to technologies that save wood energy* • *Carry out to identify and develop exportable and importable tree species* • *Promote existing wood by products recycling to economic operators* • *Provide incentives to investors with viable export forest products* • *Mobilize and support school going children and youth organizations to grow and conserve trees* • *Sensitize and build capacity of farmers and private sector to promote farm forestry* • *Support farmers groups to establish and manage tree nurseries for commercial purposes* • *Develop training programs and field frontline extension agents* • *Develop and disseminate brochures to farming households on forestry and agroforestry* • *Support research for development of suitable agro forestry seeds* • *Support the training of scientists in forestry and agro forestry* • *Carry out non-native adaptability tests /providence trials, one at each district* • *Lobby and support universities /higher institutions of learning to do research in forestry and agro forestry* • *Participate in international and regional foray on forestry and agro forestry* • *Ratify and implement international treaties on forestry and agro forestry* • *Develop and implement joint regional forestry and agro forestry projects.* • *Negotiate with ICRAF and AFRENA to scale up projects in Rwanda* • *Sensitize women and youth to plant wood lots for sale* • *Undertake skills training and apprenticeship in wood processing* • *Organize women and youth to plant and manage trees in public areas such as schools and health institutions* • *Establish agro forestry seedling selling units in each district* • *Support and train NAFA staff to effectively carry out their duties* • *Hold stakeholder planning and M& E meetings at provincial and District levels* • *Encourage and Support Local NGOs and CBOs to promote community forestry* • *Carry out an inventory of all stakeholders in the forestry sector and constitute a forum.* • *To sensitize institutions on reforestation and agro-forestry policy and laws* • *Finalize the new forest legislation* • *Elaborate regulations and procedures manuals* • *Collect and disseminate national statistics on forest plantations, management and wood products* • *Conduct a study on the contribution of the Forestry Sector to the National Economy*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
		• *Make use of the WISDOM model and conduct forest inventory and forest mapping* • *Carry out an agroforestry inventory (to assess the potential of agroforestry in the country)* • *Develop and update regularly a website for NAFA*
Rwanda National Export Strategy (NES) (2011) *Transform Rwanda into a globally competitive export economy*	*1. Market Opportunities* *2. Trade Facilitation & Promotion* *3. Monetary and fiscal policies that affect exporter incentives* *4. Business Environment* *5. Finance and investment* *6. Infrastructure* *7. Branding* *8. Leveraging technology* *9. Human capital development* *10. Gender, youth and environmental sustainability for competitiveness* *Sector Strategies:* *1. Tourism* *2. Tea* *3. Coffee* *4. Mining* *5. Business process outsourcing* *6. Horticulture* *7. Home decor and fashion*	***1. MARKET OPPORTUNITIES*** ***1.1** Negotiated market access advantages should be utilized and monitored.* ***1.2** Market entry strategies need to be developed.* ***1.3** Foreign policy and commercial interests need to be aligned.* ***2. TRADE FACILITATION & PROMOTION*** ***2.1** Targeted assistance to Rwandan businesses will be reinforced to build export capacity.* ***2.2** Centralized information systems connecting market opportunities with Rwandan products would help exporters sell internationally.* ***2.3** Facilitate businesses meet export standards.* ***2.4** Improve packaging facilities for value addition.* ***2.5** Non-tariff barriers to trade can be further reduced.* ***2.6** Cross-border trade and re-exports can be further facilitated.* *3.* ***MONETARY AND FISCAL POLICIES THAT AFFECT EXPORTER INCENTIVES*** ***3.1** Monetary policy might better support exports.* ***3.2** Tariffs and trade policy can be leveraged to increase the competitiveness of Rwanda's exports.* ***3.3** Developing sound industrial policies (taxes, tax expenditures, and subsidies) that efficiently enable growth and production for foreign markets.* ***4. BUSINESS ENVIRONMENT*** ***4.1** Processes for tax compliance can be clarified and streamlined.* ***4.2** Rwanda should continue improving the regulatory environment directly affecting businesses.* ***5. FINANCE & INVESTMENT*** ***5.1** Increase lending levels to meet the demands of the commercial sector.* ***5.2** Accessibility of finance for exporters.* ***5.3** Financing can be made more accessible through a consolidated SME Development Fund.* ***5.4** Increase the level and quality of investment in productive sectors.* ***5.5** Develop financial mechanisms to support high-risk/high-reward ventures that would boost exports.* *6.* ***INFRASTRUCTURE*** ***6.1** A more consistent and widespread energy supply is needed.* ***6.2** Energy supply needs to be provided at a lower cost in order to compete internationally.* ***6.3** Roads in Rwanda need on-going maintenance and upgrading.*

Policy and Goals	***Strategies/ Targets***	***Strategic areas and priorities***
		6.4 *Air, rail and water (Lake Kivu), need to be developed further in order to reduce the overall costs of transport.* *7.* ***BRANDING*** ***7.1*** *Rwanda's brand is not well established internationally and suffers from unwanted associations.* ***7.2*** *Ensure that sectors become brand champions for Rwanda.* ***7.3*** *Develop a brand that resonates with diverse stakeholders.* ***7.4*** *"Made in Rwanda" should become a recognizable phrase worldwide.* ***7.5*** *Manage Rwanda's global brand image.* *8.* ***LEVERAGING TECHNOLOGY*** ***8.1*** *Increase the skill base for innovation and high productivity.* ***8.2*** *Improve access to networks of productivity.* *9.* ***HUMAN CAPITAL DEVELOPMENT*** ***9.1*** *Improve Government Agencies" capacity to facilitate private sector export.* ***9.2*** *The skills gap within the export labour market must be addressed.* ***9.3*** *Technical and Vocational Education Training (TVET) needs further support.* ***9.4*** *Promotion of Business development skills among cooperatives and SMEs.* *10.* ***GENDER, YOUTH & ENVIRONMENTAL SUSTAINABILITY FOR COMPETITIVENESS*** ***10.1*** *Mitigate the effects of trade on the environment.* ***10.2*** *Agriculture needs to be environmentally responsible.* ***10.3*** *Disadvantaged groups can contribute more to export growth.* ***10.4*** *Collect relevant data on gender disparities, female empowerment, and youth.* ***10.5*** *Foster entrepreneurship and apprenticeship amongst the youth in order to drive exports going forward.* ***SECTOR STRATEGIES*** ***1. TOURISM*** ***1.1*** *Perception of Rwanda as a destination: brand and customer service.* ***1.2*** *Rwanda is too dependent on gorilla tourism.* ***1.3*** *High cost of coming to Rwanda.* ***2. TEA*** ***2.1*** *Improve yield and quality of green leaf.* ***2.2*** *Improve the quantity and quality of made tea.* ***2.3*** *Reduce the cost of production.* ***2.4*** *Target markets with diversified value-added products through developed distribution channels.* ***3. COFFEE*** ***3.1*** *Production levels need to increase.* ***3.2*** *Improve operational efficiency of washing stations.* ***3.3*** *Improve business environment for coffee exporters.*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
		3.4 *Improve domestic and international contract enforcement capacity in coffee.* ***4. MINING*** ***4.1*** *Professional skills can improve.* ***4.2*** *Knowledge of reserves can be increased.* ***4.3*** *Mineral audit trails can be improved.* ***4. 4*** *Opportunities exist for value addition.* ***4.5*** *Kigali Mineral Campus could provide a full array of services for the region.* ***5. BUSINESS PROCESS OUTSOURCING*** ***5.1*** *A major constraint to the progress of the BPO cluster is the lack of a strong domestic ICT and business skills base.* ***5.2*** *Infrastructure deficiencies, particularly in ICT, create an unfavourable business environment for domestic service providers and international investment.* ***5.3*** *Rwandan service providers face challenges accessing working capital and funding for growth.* ***5.4*** *The growth of start-up firms is hampered by their inability to bid successfully on government contracts.* ***6. HORTICULTURE*** ***6.1*** *Production quantities are low.* ***6.2*** *Government institutions can help increase export quality.* ***6.3*** *A path to organic production and certification is needed.* ***6.4*** *Finance can be more accessible.* ***6. 5*** *Value addition and export trials can be further encouraged.* *7.* ***HOME DÉCOR AND FASHION*** ***7.1*** *Developing artisans' knowledge about market preferences.* ***7.2*** *Generating international demand for home décor and fashion items from Rwanda.* ***7.3*** *Sensitising government, donors and other stakeholders to the potential of the „craft" industry in Rwanda.* ***7.4*** *Export platforms need to compete in niche markets.* ***7.5*** *Technical know-how of artisans needs improvement.* ***7.6*** *Branding, marketing, presentation and packaging need support.* ***7.7*** *Need to develop export-financing mechanisms customized for the handicraft sector.* ***7.8*** *Targeted initiatives are required to develop nascent industries.*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
Rwanda National Coffee Strategy 2009 – 2012 (2008)	• *Increasing the amount of fully washed coffee but recognizes that ordinary coffee should also continue to be produced as only good quality cherries should be fully washed in order to maximize profitability.* • *Increasing Rwanda's capacity to fully wash cherries efficiently and profitably.* • *Exports could reach US $115 million by 2012 with implementation of key actions to increase production by 75% and the amount of fully washed coffee to 19,000 tons.* • *These actions should also have a strong impact on poverty through higher revenues to coffee farmers and to the rural area in general.*	1. *Improving distribution, application, monitoring and evaluation of inputs including seedlings, fertilizers and pesticides* **2.** *Establishing a voluntary turnaround program to support improved management of washing stations that have the potential to become profitable* 3. *Improving sales and distribution mechanisms and coordination through building the capacity of private exporters* **4.** *Developing a thorough knowledge of the state of the industry and the coffee producing areas by undertaking a national coffee census and GIS study* 5. *Implementing value addition activities, including toll roasting in China and the Middle East and partnership with distribution partners (e.g. Marks & Spencers)*
Revised Tea Strategy for Rwanda (2008) *By 2012 Rwanda can reach total export revenues of US$70 million per year and at the same time almost double the average revenue for tea farmers.*	A. *Migration from $32m bulk tea exports to $70m targeted sales of branded teas* B. *Strong economic impact through higher tax revenues and poverty reduction* C. *Rwanda will seek to emulate Sri Lanka's post-privatisation success* D. *Rwanda will pick elements from best practice to build regulatory & support roles*	A. *Raise yields to increase tea growers' income and export revenues* B. *Invest in factories to raise production capacity* C. *Improve quality to address bulk market price decline* D. *Develop a gradual migration path to a higher-value product* E. *Create a Rwandan tea brand to signal quality*
National Strategy and Action Plan for the conservation of biodiversity in Rwanda (2003)	1. *Improved conservation of protected areas and wetlands* a. *Improved protection and management of protected areas and wetlands* b. *Improved knowledge of the biodiversity of protected areas and wetlands* 2. *Sustainable use of the biodiversity of natural ecosystems and agro-ecosystems* a. *Conservation of genetic biodiversity of native plant and animal species;* b. *Sustainable use of biological resources of natural ecosystems;* c. *Sustainable use of agro-biodiversity;* d. *Development of an environmentally sustainable and economically viable tourism.* 3. *Rational use of biotechnology* a. *improved access to and transfer of biotechnology* b. *risk-free use of biotechnology* 4. *Development and strengthening of policy, institutional, legal and human resource frameworks* a. *improvement of policy and legal frameworks for sustainable conservation of biodiversity*	• *Development and implementation of land use and management plans for each protected area;* • *Involvement of the population living around in the conservation of protected areas;* • *Development of a master plan for the use and management of wetlands.* • *Inventory and characterization of the components of the biodiversity of protected areas and wetlands;* • *Regular monitoring of the state of the biodiversity of protected areas and wetlands.* • *inventory of native endemic and/or less known species of economic importance and characterization of their genetic diversity* • *in-situ and ex-situ conservation of native genetic heritage* • *development of alternatives to the use of biodiversity (e.g. alternative of energy, fishery aimed at poverty reduction)* • *research and promotion of appropriate technologies for rational use of biological resources* • *improved performance of native varieties and species* • *promotion of sustainable traditional production systems* • *prevention of introduction of intrusive species, control and eradication of non-native species likely to threaten ecosystems and native species*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
	b. building of institutional and human resource capacities for sustainable conservation of biodiversity *c. strengthening regional and international cooperation for conservation and sustainable use of biodiversity.* *5. Equitable sharing of benefits derived from the use of biological resources.* *a. Strengthening of the rights of grassroots communities for the control and sustainable use of biological resources*	• *development of mechanisms for checking the importation and dissemination of genetic material capable of having harmful effects on biodiversity, particularly on agro-biodiversity.* • *development of ecotourism oriented infrastructure* • *promotion of small and medium scale diversified and environmentally viable tourist activities* • *Definition and implementation of mechanisms for the transfer and exchange of biotechnology.* • *improved knowledge of advantages and risks of biotechnology* • *development of national procedures and measures for the assessment and management of risks caused by genetically modified organisms* • *development and updating of policies related to the conservation of biodiversity and the creation of an enabling environment for their implementation* • *development of an integrated policy and legal framework for the conservation and sustainable use of biodiversity and equitable sharing of benefits derived from biological resources.* • *establishment of an integrated system of information, formal and informal education and communication for the conservation and sustainable use of biodiversity;* • *promotion of a conservation and biodiversity management-focused integrated research-development;* • *establishment and strengthening of community management structures of biological resources;* • *strengthening of partnership and formation of networks of actors for the promotion of the conservation of biodiversity and sustainable use of biological resources.* • *strengthening of regional cooperation for the conservation of protected areas and wetlands* • *strengthening of links among the parties, the states and their specialized institutions for the promotion of technical and scientific cooperation related to biodiversity* • *national capacity building for access, use and exchange of information through the clearing house mechanism* • *establishment and strengthening of mechanisms at the national level for the mobilization of the necessary financial resources for the implementation of the Convention on Biodiversity.* • *Increased benefits derived by the grassroots communities through the exploitation of biological resources* • *Establishment of mechanisms for monitoring and control by the grassroots communities on the exploitation of biological resources*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
Five-year Strategic Plan for the Environment and Natural Resources Sector 2009-2012 (2009) *"to ensure the optimal and sustainable utilization of natural resources for economic development and poverty reduction in Rwanda by providing enabling framework, economic incentives, partnerships and capacities for action."*	***Overall objective*** *To ensure that environment and natural resources are utilised and managed productively in support of equitable and sustained national development in line with the EDPRS targets and Vision 2020 aspirations.* ***Specific objectives:*** *1. To promote equitable, productive and sustainable use and management of land resources by controlling land degradation, enhancing security of tenure and improving productivity and administration through technological and market-based systems;* *2. To ensure that the country's water resources are conserved and sustainably managed in an integrated and equitable manner for the continued and balanced support to economic, social and ecological needs at local, national and transboundary levels;* *3. To ensure adequate and sustainable supply of forest and biomass resources to meet the growing multiple demands for food, fibre, fodder, fuel as well as environmental services, by increasing forest and tree cover, improving utilisation efficiency and promoting alternatives to wood and non-wood forest and tree products;* *4. To promote productive, equitable and environmentally friendly utilisation of the country's mineral and other earth resources, by promoting efficient and value-adding technologies, raising awareness and skills of key actors about the consequences of unsustainable mining, and options for sustainable minerals exploitation;* *5. To restore, conserve and sustainably manage key ecosystems to ensure continued and enhanced integrity and functioning of Rwanda's diverse ecosystems in terms of productive and regulatory services provided at local, national and international levels;* *6. To promote sustainable development by raising awareness of and integrating environment and natural resource management principles and techniques across all key social and productive sectors of the EDPRS;* *7. To strengthen policy and legislative frameworks for sustainable management of environment and natural resources, by harmonising policies, legal and regulatory instruments within/ across sectors and with regional and international frameworks; as well as putting in place incentives for effective implementation and oversight;* *8. To increase human and institutional capacity, at national and decentralised entities, within civil society and private sector, as well as community levels, for effective planning, coordination, implementation and monitoring of ENR activities.*	*Strategic interventions in the ENR sector and across other key sectors:* *1. Promote sustainable land management by consolidating land tenure and land use reform in both urban and rural areas* *a. Reforming the Land tenure and land administration* *b. Land use planning and sustainable land management;* *2. Promoting integrated water resources management (IWRM)* *a. Institutional & legal framework* *b. Assessment and monitoring* *c. Assessment of Water balance* *d. Watershed & water catchment* *3. Rehabilitating critical degraded ecosystems* *a. Afforestation and reforestation programmes in districts, targeting:* *i. bare hills, drought-prone areas and other fragile landscapes;* *ii. public land in all districts, sectors and cells, including that held by institutions such as schools, research institutions, disciplined forces (prisons, police, army);* *iii. farm forestry (private wood lots), institutional forests/ woodlots;* *iv. ornamental forestry – homesteads, along roads, designated urban green spaces;* *b. Rehabilitation of existing natural and planted forests through enrichment planting; silivicultural operations; and forestry protection mechanisms, as in critical micro-watersheds;* *4. Intensifying and sustaining forestry and agro-forestry activities* *5. Improving the Mining sector* *6. Mainstreaming ENR sustainability* *7. Promoting environmentally sound and sustainable macroeconomic management* *8. Strengthening institutional capacity for effective sector coordination at national and decentralised levels*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
Water and Climate Development Program (WACDEP): Towards water security and climate resilience in Eastern Africa *Report of the Workshop of Launching the Implementation of WACDEP in Eastern Africa 24-25 July 2012, Bugesera, Rwanda (AMCOW, GWP)*	***Main objectives*** *of the workshop were to:* *• Bring together key project stakeholders and partner institutions to have a common understanding of WACDEP proposed activities, and build ownership for project objectives and results;* *• Discuss and agree on the modalities of project implementation and execution;* *• Agree on the work plan for immediate and medium term activities of the project,;* *• Exchange information and knowledge among various stakeholders from the two countries on the status of climate change and water security in Bugesera catchment part of Kagera River Basin.* *The following are the outputs resulted from the workshop:* *• Better understanding of planned activities, and better sense of ownership by key project implementing partners* *• Information on key stakeholders and their activities in Bugesera shared, with the expectation for further strengthening partnership and collaboration among different stakeholders in addressing climate change and water related issues.* *• Agreed WACDEP work plan and modalities of project implementation*	***Major Recommendations:*** ***General*** *1. Give more emphasis for activities in Bugesera catchment than national activities. Allocate more project funds to activities on the ground to influence and supplement local level actions and practices to make them more climate resilient and water sensitive.* *2. Strengthen documenting and sharing of information and knowledge (on climate change impacts and measures for resilience) among various stakeholders* *3. Contribute towards harmonizing policies, laws and enforcement mechanisms related to climate change adaptation and water security in Burundi and Rwanda.* *4. Give emphasis for identifying and documenting existing challenges, impacts, best practices and opportunities for scaling up/out* *5. Strengthen national dialogue in countries to promote knowledge sharing, awareness and ownership by all project stakeholders.* *6. Need to strengthen technical capacity to manage available water resources in both countries* ***Outputs from Group Works*** ***A. Group Work I****: Identifying intervention activities at Bugesera catchment level* ***a.*** *key challenges related to water security and climate resilience by communities in Bugesera include* **climate change, mountainous and rugged topography, and deforestation** *b. possible interventions in response to challenges identified above (2012-2015): afforestation, use of water storage, increase irrigation system, and zero grazing practice,* *c. Specific locations and sites (in Bugesera catchment) identified for ground activities are: on Burundi side on Bugabira, Busoni, Kirundo and Ntega; and on Rwanda side, Kamabuye, Rweru and Ngeruka.* *d. institutions to be involved during implementation: Rwanda (Ministries for agriculture, water and environment, districts, sectors); and Burundi (Ministries for agriculture, water and environment, Province, Communes)* *e. Roles /contributions of stakeholders to project implementation* *•* ***National level****: political and technical support* *•* ***District level****: community mobilization, implementation and ownership* *•* ***Communities:*** *ownership, labour and local resources* *f. Expectations from the WACDEP project in terms of supporting or complementing the existing or planned activities in Bugesera* *• Gathering all studies made by different actors into one document* *• carrying out a specific and comprehensive study for the entire catchment* *• financing the innovative community based activities* *g. project management structure and role of local government and*

Policy and Goals	Strategies/ Targets	Strategic areas and priorities
		communities *• align project activities with district's development plans, mobilize communities, implement and monitor progress* ***B. Identifying WACDEP intervention activities at national level (Burundi and Rwanda)*** *a. Activities that WACDEP could support at national level to strengthen existing frameworks for water security and climate resilience in Burundi and Rwanda:* *• There is no specific document for water security and climate resilience though issues are mentioned in various national documents such as the IWRM policies and Plans and NAPAs. WACDEP could support countries to review existing policy instruments and harmonize them* *b. WACDEP support for developing water-related climate adaptation investment strategies:* *• There are documents and reports in various institutions i.e. REMA, IGEBU, MEEATU, LVBC /EAC etc. that could provide information on climate change. WACDEP would support in gathering information from these institutions in regard to climate change resilience situation in the two countries* *c. WACDEP support for investment project preparation:* *• Both countries have capacity to prepare projects but are constrained by procedures of accessing funds. WACDEP could contribute in resource mobilization process.* *d. WACDEP support to national and sector planning and decision-making processes to mainstream water security and climate resilience issues into national plans* *• Work with ministries of water and environment, focal points of climate change to advance issues* *• Use CWPs to facilitate the process of dialogue with government, especially with Ministries of finance and planning* ***C. WACDEP Project management and resource mobilization*** *• Clearly define roles of different stakeholders at different levels while enhancing collaboration between them* *• Involve local communities, including youth and women during the implementation through grouping them in associations and cooperatives* *• Identify active stakeholders and on-going and planned projects in Bugesera, and plan to work in synergies instead of duplicating and overlapping* *• Link project implementation with district/commune development plans for maximizing resource utilization, and ownership and sustainability* *• Approach potential donors for further resource mobilization such as AFDB, GIZ, USAID, WB, EU, Netherlands, CTB* *• Approach them through CNCA (Coordination nationale des Aides) and MINECOFIN (Ministère de l'Economie et des Finances)*

Strategic areas in relation to policies and strategies of Tanzania

Policy and Goals	Strategies	Strategic areas and priorities
National Irrigation Policy (2010) *Ensure Sustainable availability of irrigation water and its efficient use for enhanced crop production, productivity and profitability that will contribute to food security and poverty reduction*	• Accelerate investment in the irrigation sector by both public and private sector players; • Ensure that Irrigation Development Funds are with a legal status; • Promote efficient water use in irrigation system; • Ensure reliable water for irrigation so as to facilitate optimization, intensification and diversification of irrigated crop production including pasture and aquaculture.	• Improve both the hardware and software aspects of the traditional irrigation systems for achieving a reliable irrigation water supply and raising the water utilisation efficiency • Promote reliable irrigation water supply and high water use efficiency for increased production, productivity and profitability • Support the improvement of traditional water harvesting infrastructures and software • Promote the development of small, medium and strategic large scale water storage structures and/or inter-basin transfers of water • Ensure optimal expansion of area under irrigated agriculture for commercial irrigation farming by the private sector • Increase crop yields and production per unit volume of water and per unit area under • Irrigation through sustainable, economically viable and ecologically sound crop protection measures in irrigated agriculture. • capacitate institutions whose performance is effective and efficient in irrigation development and management in the country
District Irrigation and Water Harvesting Support (Mainland) 2005 *Respond to the opportunity to improve agricultural production through support to the expansion of irrigated area, the improvement of irrigation technology, land management and improvement of public sector capacity to manage small scale irrigation development.*	1. To expand the area under irrigation and increase the efficiency of irrigation or water harvesting infrastructure; 2. To build capacity among irrigation users to fully realize the economic and social benefits of irrigation systems; 3. To build public and private sector capacity to establish and manage irrigation schemes; 4. To improve the environmental sustainability of irrigation systems developed by the programme and address social issues arising out of their establishment; 5. To assist irrigation users to identify and access marketing outlets and mobilize resources to improve related market infrastructure.	• Develop and rehabilitate irrigation and water harvesting infrastructure • Provide agricultural services • Capacity building in irrigation management • Institutional improvement to the Division of Irrigation Technical Services (DITS); • Strengthening local government authority capacity • Improve linkages between irrigation schemes and market infrastructure • Proposed schemes identified in Nyaisozi, Nkenge Rwamgango districts in the Kagera region

Policy and Goals	Strategies	Strategic areas and priorities
Medium Term Expenditure Framework Forward Budget for 2012/2013 to 2016/2017	to facilitate sustainable management and development of surface and underground water resources through integrated principles that meets social and economic needs, facilitate the provision of clean, safe and adequate water supply and sanitation services to the people	• Services improved and HIV/AIDS infections reduced; • Enhanced water resources management for socio economic development and sustainable environment; • All social groups in rural, urban and peri-urban areas access adequate, safe and clean water; and sanitation services; • Management and development of water resources; • Implementation of rural water supply and sanitation programme; • Implementation of on-going water projects and facilitating the Urban Water Authorities to • control water leakages and rehabilitate water supply infrastructures
Tanzania Development Vision 2025	*High Quality Livelihood* *Peace, Stability and Unity* *Good Governance* *Well Educated and Learning Society* *Strong and Competitive economy*	• Creation of wealth and its distribution in society must be equitable and free from inequalities h and its distribution in society must be equitable and free from inequalities • Enjoy peace, political stability, national unity and social cohesion in an environment of democracy and political and social tolerance. • Good governance should have permeated the national socio-economic structure thereby ensuring a culture of accountability, rewarding good performance and effectively curbing corruption and other vices in society. • Education and knowledge are critical in enabling the nation to effectively utilize knowledge in mobilizing domestic resources for assuring the provision of people's basic needs and for attaining competitiveness in the regional and global economy
Tanzania - Environmental Management Act, 2004	• Every person shall have a right to clean, safe and healthy environment • Environmental Management Plans for National Protected Areas • Applicant for water use permit issued under the relevant laws governing management of water resources, abstraction and use of water, shall be required to make a statement on the likely impact on the environment due to the use of water requested • Promote the use of renewable sources of energy by creating incentives for the promotion of renewable sources of energy; • Environmental impact assessment study needed for projects undertaken for a type specified in Act and regulations • Strategic Environmental Assessment needed where a hydro-electric power station or a major water project is planned	• The right to clean, safe and healthy environment include the right of access by any citizen to the various public elements or segments of the environment for recreational, educational, health, spiritual, cultural and economic purposes. • A river, riverbank, lake, or lakeshore and shoreline can be declared a protected area and restrictions imposed for the protection of the river, riverbank, lake or lakeshore and shorelines from environmental degradation. • There is an obligation to return water after its use to the body of water from which it was taken and to ensure that water that is returned to any specified source is not polluted; • Promote renewable sources of energy such as hydro-electricity projects • Ensure that Environmental impact assessment study is carried out for projects with major changes in land use such as major water projects, dams, bulk water supply systems, hydro-electric power stations • Ensure that Strategic Environmental Assessment is carried out where a hydro-electric power station or a major water project is planned

Policy and Goals	Strategies	Strategic areas and priorities
National Water Sector Development Strategy 2005 to 2015 *Reaching a high quality livelihood through sustainable development and management of water resources*	**Institutional Framework** An institutional framework is established providing for effective and efficient IWRM, and which clearly identifies the roles and responsibilities of the relevant organisations and stakeholders at (i) all levels **Resource Assessment** A nation-wide inventory and status (ii) of available and potential surface and groundwater resources and their utilisation is available. **Water Resources Planning** Effective and equitable planning for the use of water resources is carried out on an integrated multi-sectoral basis. **Alternative Resource Development** Alternative technologies for the development of water resource availability are developed for use in (iii) appropriate situations. **Environmental Protection and Conservation** (iv) Increased environmental protection and conservation measures contribute to the sustainability of all aspects of water development, management and use.	**Institutional Framework** • Prepare, agree and implement an initial plan for the establishment of the transitional framework. • Prepare organisation development requirements for final organisations. • Prepare and agree an implementation plan for the final framework. • Develop operational, administrative and financial procedures. **Resource Assessment** • Establish mechanisms for acquiring and monitoring water use and demand. • Establish sustainable data collection and publication systems at appropriate management levels. • Assess the useful storage and life of existing and possible future dams. • Develop river basin models and decision systems. • Develop and implement regular water resources assessment programmes. **Water Resources Planning** • Prepare criteria for differing water resources priorities at different levels. • Determine and prioritise requirements of all users. • Establish participatory planning procedures for use at the different levels. • Prepare integrated basin and national water resources management plans. **Alternative Resource Development** • Identify and research possible alternative resource technologies and their use. • Establish the criteria for the selection and use of alternative technologies. • Prepare plans and promote the introduction of suitable alternative technologies. **Environmental Protection and Conservation** • Identify and monitor conditions in environmentally • susceptible locations. • Develop and implement programmes for catchment restoration, protection and management. • Design and implement public awareness and community involvement in conservation. • Determine environmental flow requirements for ecosystems for all key rivers. • Establish guidelines and mechanisms for EIAs and their enforcement.
	Water Quality and Pollution Control Water resources of acceptable quality are maintained to meet agreed objectives and standards on the basis of a river classification system supported by measures to ensure sustainability. **Conservation and Demand Management** Water needs of all socio-economic sectors are met on a sustainable basis through efficient use of water conservation measures, and management of demand through awareness raising and the setting of water charges on an economic basis. **Water Utilisation and allocation** Implementation of a responsive, effective and sustainable water resources utilisation and allocation	**Water Quality and Pollution Control** • Set water quality targets linked to water resource classification system. • Develop and implement water quality monitoring programmes and prepare water quality maps. • Prepare and implement a system of discharge standards and permits to protect receiving rivers. • Develop and operationalize procedures for monitoring discharges and enforcing pollution control legislation. • Identify areas with naturally occurring elements in water and disseminate findings on remedial measures. **Conservation and Demand Management** • Determine and implement user fees, charges, and restrictions that can be imposed to manage demand. • Conduct research and promote technologies and mechanisms that conserve water. • Prepare and operationalize guidelines and regulations for demand management and water

Policy and Goals	Strategies	Strategic areas and priorities
	system based on social and economic priorities whilst maintaining minimum reserves for the protection of eco-systems.	conservation. • Develop and implement efficiency monitoring programmes of water uses across sectors. • Prepare and implement water conservation measures awareness programmes **Water Utilisation and allocation** • Establish a water resource classification system based on quality and quantity. • Develop water allocation criteria, procedures and guidelines for river basins. • Review and regularise existing water rights and users based on criteria. • Prepare and implement awareness campaign on water allocation procedures.
	Trans-boundary Waters A strategy, framework and need requirements for utilisation of transboundary water resources for all relevant basins for socio-economic development in collaboration and coordination with riparian states is in place **Disaster Management** Mechanisms to provide advance warning of possible disasters and have contingency plans and resources available to minimise the impact of natural and other disasters are in place. **Legislation** A strong and effective legal and regulatory framework for the sustainable management of water resources is in place.	**Trans-boundary Waters** • Develop and strengthen local capacity to secure and utilise trans-boundary water resources. • Promote technical collaboration on research, data collection, and information exchange. • Promote joint inter-state catchment management. • Participate in relevant trans-boundary organs, commissions, committees **Disaster Management** • Prepare and agree disaster response organisational structures. • Prepare, finance and implement disaster advance warning systems. • Develop disaster contingency plans and procedures and train personnel in their use. • Develop dam safety measures to mitigate the impacts of floods, droughts. **Legislation** • Review all current statutory and customary legislation related to WRM. • Identify duplication or overlap with other relevant legislation and clarify the respective legal responsibilities. • Draft new legislation to meet future requirements for IWRM, with stakeholder consultations. • Seek parliamentary approval to legislation.
Lessons Learnt Report on Wetlands Management 2005	Investigate the buffering capacity, to determine the economic potential of wetlands ecosystems and develop management strategies in order to maintain long term environmental protection of Lake Victoria	• identify the high priority issues in relation to wetlands management of the lake in collaboration with relevant stakeholders • Classification of Lake Victoria wetlands based on buffering capacity that was done in 2001 should be refined • Economic Valuation of Buffering Services provided by Lake Victoria Wetlands should be carried out. • efforts to introduce sustainable farming in the floodplains should be scaled up and using more scientific approach • Develop and implement wetlands management strategies to guide better wetlands utilization and conservation
Tanzania Agriculture And Food Security Investment Plan (TAFSIP) 2011-12 To 2020-21	• Provide a good management plan of the available water catchments in order to have sustainable irrigation development; • undertake research on irrigation and drainage where the findings will be applied in the improvement of irrigation interventions;	• Enhance water resources assessment capabilities and measurement networks; • Strengthen the water resources assessment and monitoring system; • Develop mechanisms for acquiring water use and water demand information from water users; • Establish water resources databases and disseminate information; • Promote the use of data for water resource management decision-making; and • Define broad goals and long, medium and short-term objectives by basin.

Policy and Goals	Strategies	Strategic areas and priorities
	• address the concept of equity access to water or irrigated lands and decision making.	
National Strategy For Growth and Reduction of Poverty (NSGRP) 2005	• Achievement of sustainable and broad-based growth • Increased agricultural growth • Improved food availability and accessibility at household level in urban and rural areas. • Reducing income poverty of both men and women in rural areas • Provision of reliable and affordable energy to consumers	• Increase number of irrigation schemes and development of more efficient use of water schemes • Increase area under irrigation and promote water use efficiency in irrigation schemes and encourage utilization of low cost technologies • Promote rainwater harvesting incorporating small, Rainwater harvesting medium and strategic large -scale dams and reservoirs. • Ensure improved access to reliable water supplies for livestock development through promotion of small -scale rainwater harvesting Increase access to reliable water as a resource for economic production with the aim of increasing the contribution of water in GDP • Ensure regular and re liable supply of essential utilities including energy, water and sanitation in urban areas. • Ensure sustainable natural resource use to ensure energy supplies are maintained (forests, water catchments and charcoal industry). • Develop and promote utilization of indigenous energy resources and diversification of energy sources.

Strategic areas in relation to policies and strategies of Uganda

Policy and Goals	Strategies	Strategic areas and priorities
Water for Production Strategy and Investment Plan 2009 *To promote development of cost-effective and sustainable water supply and water management for increased production and contribution to the modernisation of the agricultural sector in Uganda with a focus on poverty reduction and minimal environmental impacts*	• Strengthened infrastructure in support of increased production of goods and services. • WRM acknowledged to be a key factor in the nation's energy supply. • Low sustainability of the installed infrastructure are linked to the capacity for planning and implementation at district level since the district level • Government is firmly committed to the privatisation process and promotion of private involvement in service provision	• Issue guidelines for water resource allocation, extraction and utilisation, water use management and O&M to assist the stakeholders and encourage private investments in Water for Production. • Promote private involvement in service provision as part of privatisation process • Promote decentralisation and management at the lowest appropriate level • Acknowledge structural gender inequalities by increasing support, training and empowerment to vulnerable groups such as female subsistence farmers
National Development Plan 2010/11 to 2014/15	**Hydropower** Increase power generation capacity through construction of large hydropower plants and thermal power plants through public and private investment **Water for Production**	**Hydropower** • Complete Bujagali hydropower dam construction. This is expected to increase power generation capacity by 250 MW. • Construct Karuma hydropower plant to generate 700 MW. • Study, design and construct Ayago hydropower plant to generate 700 MW. • Study, design and construct Arianga hydropower plant to generate 400 MK. • Construct Isimba hydropower dam to generate approximately 130 MK. • Build a thermal power plant (700 MK as part of the refinery) to utilise Uganda's oil resources. • Design and construct solar thermal plants to generate 200 MK. • Study, design and build Geo thermal plants to generate 100 MK. • Increase the co-generations capacity to 150 MK from wood, waste, crop and garbage. • Construct Muzizi, Kikagati, Nshongyenzi, Waki and other mini hydropower projects. • Complete the construction of Mpanga, Nsheruka and Nyagak mini hydropower plants. **Water for Production** • Increase area under irrigation from the current level of 14,418 hectares to 22,000 hectares. • Develop public irrigation schemes • Promote micro-level irrigation • Strengthen the PPP in construction and maintenance of irrigation schemes • Rehabilitate and maintain the functionality of the existing 5 irrigations schemes of Kibimba, Doho, Mubuku, Olweny and Agor • Increase supply water in the cattle corridor from the current 36% to 50% and those outside the cattle corridor from 21% to 30% through construction of valley dams and valley tanks and setting up reliable O&M structures and systems

Policy and Goals	Strategies	Strategic areas and priorities
		• Increase water supply systems for rural industries to facilitate agro-processing and other industrial activities. • Construct and maintain functionally of 3 Bulk water supply schemes for multipurpose use. Set up appropriate operation and maintenance system
Water and Environment Sector Performance Report 2010	**Wetland Resources Management** Ensure the sustainable conservation and management of wetland resources to optimize the socio-economic and ecological benefits to local, national and international communities as stipulated in the National Wetlands Policy 1995 and the Wetlands Sector Strategic Plan 2001-2010. **Forests Management** An integrated forest sector that achieves sustainable increases in the economic, social and environmental benefits from forests and trees by the people of Uganda, especially the poor and vulnerable **Water Resources Management** To manage and develop the water resources of Uganda in an integrated and sustainable manner in order to provide water of adequate quantity and quality for socio-economic needs for both the present and future generations **Water for Production** To promote development of cost-effective and sustainable water supply and water management for increased production and contribution to the modernisation of the agricultural sector in Uganda with a focus on poverty reduction and minimal environmental impacts	**Wetland Resources Management** • Enhancing knowledge and understanding of ecological processes and socio-economic values of wetlands for informed decision making using the National Wetland Information Systems (NWIS) - partially operational. • Developing and maintaining a functional national Wetland Information System to support effective planning and decision making. - partially operational • Strengthening public and stakeholder awareness and participation in Wetlands Management • Developing and maintaining the institutional framework for wetlands management • Ensuring that appropriate wetlands policy and legislation are in place and enforced • Strengthening planning and management of wetland systems (at district levels) and improving planning, management and wise use of wetland resources at community level • Protecting characteristics and functions of vital wetlands. **Forests Management** • Farm Income Enhancement and Forest Conservation • Plantation development to encourage tree planting by private tree growers and the National Forestry Authority. • Reduced Emissions from forest Destruction and Degradation awareness-raising project. • Community Tree Planting Project **Water Resources Management** • Water resources monitoring, assessment and information management (quantity and quality) - Drafting of Hydro-climatic Study, the Low Flow Study and the Flood Analysis Study being completed. • Water resources planning and regulation • Water resources management policy, practice and advice **Water for Production** • Develop the following guidelines and strategies to guide all stakeholders on management of facilities: • Operation and maintenance for WFP facilities • Capacity building strategy • A framework for the management system for water for production equipment • Information, education and communication materials
	Water Supply to Towns "Provision of sustainable water and sanitation services to the population and economic activities in the urban areas of Uganda."	**Water Supply to Towns** • Pro-poor funding and expansion of supply to low income urban dwellers • Private-Public Partnerships • Effective funding mechanism for small towns' investments • Effective mechanism for O&M back-up support

Policy and Goals	Strategies	Strategic areas and priorities
		• Harmonization of tariffs • Separation of operations and assets management in larger towns • Commercialising services in Larger Towns
National Irrigation Master Plan For Uganda (2010-2035)	"Poverty Alleviation and Economic Growth as a result of the sustainable realisation of the country's irrigation potential mitigating the effects of climate change and contributing to the transformation of Uganda society from a peasant to a modern and prosperous country"	• Increasing household incomes and social equity • Enhanced human capital development and increased availability and quality of gainful employment • Productive use of expanded irrigation service infrastructure as a result of new build and enabling economic instruments and incentives • High economic water use efficiency at basin level
Climate Change Vulnerability Assessment, Adaptation Strategy and Action Plan for the Water Resources Sector in Uganda 2010	• Climate Change adaptation and priorities and interventions in water resources and water service delivery identified and refined continuously within an IWRM, risk and vulnerability framework • Institutional framework for CCA consolidated • Capacity building of institutions implemented • Water resources and water service delivery adequately supports primary growth and complementary sectors under changing climatic conditions • Water resources management and water and sanitation service delivery adequately supports social sectors under changing climatic conditions • Improved flood and drought management • Contributions made to efficiency of enabling sectors under changing climatic conditions • International cooperation on climate change adaptation through existing fora	• Consolidate cooperative, cross-sectoral climate change committees and units. Agree and establish institutional roles and responsibilities. • Prepare needs assessment and Implement Capacity building of institutions. Raise awareness through identified target groups at community level • Support agriculture where water for irrigation or for application during dry spells is needed • Improve livestock watering facilities • Regulate lake levels for optimal hydropower production • Regulate lake levels to assist fisheries • Contribute to an enabling environment for aquaculture • Support sector efforts through providing permits, conservation and protection of water resources which are of significance for Forestry, Tourism and Navigation • Support health sector through water quality management • Improved water supply and sanitation through water safety planning, design standards, source protection and good practices • Analyse flood risks and design preparedness, monitoring and other interventions before, during and after the flood event • Analyse drought events and design preparedness and mitigation interventions • Strengthen capacity and capability of respective Departments on water resources management and predictions • Supported Environment and ecosystems health and Disaster risk management through IWRM • International cooperation on climate change adaptation through existing fora
Water Act 1997 *Promote the rational management and use of the waters of Uganda*	• Progressive introduction and application of appropriate standards and techniques for the investigation, use, control, protection, management and administration of water resources; • Coordination of all public and private activities which may influence the quality, quantity, distribution, use or management of water resources and, Coordination, allocation and delegation of responsibilities among Ministers and public authorities for the investigation, use, control,	• Processes to ensure harmonised water resources management and matters connected therewith should be provided for to meet country and communal interests. Integrated management of land, water and related resources is needed. • Mechanization of agriculture, including irrigation, will be the best option to ensure food security. Irrigated agriculture will require conversion of large areas of the Basin's wetlands and marshlands to agriculture; • Establish clear Institutional/Legal Arrangements and Capacity Building and Stakeholder Engagement • Build capacity and expertise among practitioners in the water sector in IWRM

Policy and Goals	Strategies	Strategic areas and priorities
	protection, management or administration of water resources; • Promote the provision of a clean, safe and sufficient supply of water for domestic purposes to all persons; • Allow for the orderly development and use of water resources for animals, irrigation, industrial, commercial and mining uses, energy, navigation, fisheries, preservation of flora and fauna and recreation in ways which minimize harmful effects to the environment; • Control pollution and to promote the safe storage treatment, discharge and disposal of waste which may pollute water or otherwise harm the environment and human health.	• Provision of Urban and Rural Water to reach targets of 75% of the population in rural areas and 100% of the urban population • ·Surface water based systems – for large cities including impoundment reservoirs and river diversions • ·Groundwater based systems (boreholes, shallow wells and springs) – for most of the urban centres where resource is available. • Facilitating of opportunities, easy business conditions and access to markets in Mining, Industry and Trade for the Kagera Basin entrepreneurs to improve the economic situation of the Kagera River Basin. • Implement large-scale expansion of marshlands irrigation and plains irrigation • Interventions are required to slow down and possibly reverse the deteriorating trend in water quality. These include measures to address poverty and population growth, improving land-use planning and strengthening soil conservation practices, constructing more domestic and industrial wastewater treatment works and improving the operations of existing works, strengthening water quality management legislation and management institutions.
National Water Policy 1999 *Promotes the principle of integrated water resources management as a means for ensuring sustainable management and utilization of Uganda's water resources*	• Manage and develop the water resources of Uganda in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs of the present and future generations with full participation of all stakeholders; • Ensure sustainable provision of safe water within easy reach and hygienic sanitation facilities, based on management responsibility and ownership by the users, to 75% of the population in rural areas and 100% of the urban population by the year 2000 with an 80-90% effective use and functionality of facilities • Promote development of water supply for agricultural production in order to modernize agriculture and mitigate effects of climatic variations on rain fed agriculture • Cooperate on transboundary water resources management issues and promote decentralization of water management functions	• Processes to ensure harmonised water resources management and matters connected therewith should be provided for to meet country and communal interests. Integrated management of land, water and related resources is needed. • Improve monitoring and information systems • Improve information on groundwater • Integrate water use from groundwater and surface water • Develop and implement appropriate adaptation and mitigation measures. • The potential building of dams will provide opportunities to mitigate climate variability • Provision of Urban and Rural Water to reach targets of 75% of the population in rural areas and 100% of the urban population • Mechanization of agriculture, including irrigation, will be the best option to ensure food security. Irrigated agriculture will require conversion of large areas of the Basin's wetlands and marshlands to agriculture. • Improve delivery of extension services to develop appropriate technology • Strengthening existing capacity and system of data collection, processing, storage and dissemination of transboundary water resource data; • Development of protocols for information exchange and sharing; • Strengthening capacity of national and regional hydrological agencies for data analysis, information management and dissemination; • Formulation of data quality control mechanism.
National Environmental Management Policy 1994 *Set the overall goal, objectives and key principles for*	1. Conservation & restoration of ecosystems, biodiversity; ecological process. 2. Public awareness; local participation in environment actions; 3. Farming systems & land-use practices to conserve/enhance productivity.	1.1 Conserve, preserve and restore ecosystems and maintain ecological processes and life support systems, especially conservation of national biological diversity; 1.2 Determine and ensure an adequate flow regime for ecological functioning 1.3 Interventions geared towards the use of appropriate farming practices and technologies are of priority

Policy and Goals	Strategies	Strategic areas and priorities
environmental management; *Provide broad policy framework for harmonization of sectoral and cross-sectoral policy objectives, principles and strategies;* *Transform existing environmental management systems to establish an integrated and multi-sectoral approach to resource planning and management;* *Promote positive behavioural/attitudinal change in resource use;* *Establish an effective monitoring and evaluation system as well as an environmental impact assessment process and standards mechanisms;* *Provide for an effective information management system to facilitate collection, storage, analysis and dissemination of environmental information.*	4. Sustainable management: of forest & wildlife resources and rangelands (within capacity); 5. Sustainable management of fisheries and other aquatic resources; 6. Sustainable management use of traditional/alternative energy sources.	2.1 Raise public awareness to understand and appreciate linkages between environment and development, 2.2 Ensure individual and community participation in environmental improvement activities. 2.3 Integrate environmental concerns in all development policies, planning and activities at national, district and local levels, with full participation of the people; 3.1 Optimize resource use and achieve a sustainable level of resource consumption. 3.2 Improve livestock feeding facilities and water provision 4.1 Recognise and prioritise the essential role of trees in people's livelihoods, and in the reversal of the land degradation. 5.1 Monitor productivity of the national water systems, conservation of local fish species, restocking lakes and rivers, controlling water hyacinth, increasing aquaculture 6.1 Investigate different sources of energy. 6.2 Develop a number of key energy projects as a matter of priority. 6.3 Implement opportunities for water resource development and hydropower generation
National Policy for the Conservation and Management of Wetland Resources(1995) *Curtail the rampant loss of wetland resources and*	• No drainage of wetlands unless more important environmental management requirements supersede; • Sustainable use to ensure that benefits of wetlands are maintained for the foreseeable future; • Environmentally sound management of wetlands to ensure that other aspects of the environment	• No drainage of wetlands unless more important environmental management requirements supersede; • Sustainable use to ensure that benefits of wetlands are maintained for the foreseeable future; • Ensure equitable distribution of wetland benefits; • Application of environmental impact assessment procedures on all activities to be carried out in a wetland to ensure that wetland development activities are well planned and managed; • Protect important biodiversity hotspots, protected areas and wetlands which provide important and unique ecosystems that need to be protected.

Policy and Goals	Strategies	Strategic areas and priorities
ensuring that benefits from wetlands are sustainable and equitably distributed to all people of Uganda	are sustained; • Sustain key ecological functions of wetlands in relation to water as maintenance of the water table, reduction of extreme flows, sediment trap, prevention of erosion downstream of wetlands, source of water supply, and prevention of pollution (nutrient and toxin retention).	
Strategy for National Agricultural Development Horizon 2010	1. Provision of water for Agriculture. 2. Conservation of Natural Resources 3. To increase awareness of farmers on all aspects of increased sustainable agricultural production, prevention of post-harvest losses and food 4. To enable fishing communities to actively participate in fisheries management and to reduce illegal fishing practices security.	• Supply more water for humans and livestock, and train farmers in aspects of water harnessing and harvesting for agriculture. • Construction and Renovation of valley dams/tanks. • Construct more water and soil conservation structures; enforce laws to reduce soil erosion. • Higher levels of sustainable production awareness. Increased emphasis on agriculture as a business. • Increased food production trends and food availability. • Restocking lakes and rivers with fish, controlling water hyacinth, increasing aquaculture.
National Forestry Policy (2000) *Watershed protection forests will be established, rehabilitated and conserved*	Promote the rehabilitation and conservation of forests that protect the soil and water in the Uganda's key watersheds and river systems. 5. Develop and promote guidelines on the management of riverside forests; 6. Develop accompanying regulations to the provisions of the National Environment Statute (1995), the Water Statute (1995) and others relating to watershed management, soil conservation and the protection of riverbanks and lakeshores; 7. Develop and promote awareness, educational and community mobilization programmes to promote good integrated land use practices in hilly areas and protect watersheds from degradation.	• Recognise and prioritise the essential role of trees in people's livelihoods, and in the reversal of the land degradation. • Cooperation across the Basin states - research, training, tree improvement, knowledge sharing • Increase productivity: Introduction and dissemination of affordable technologies • Increase the range of trees that can provide the required goods and services. • Implement a major Agroforestry programme across the entire Basin, as integral to and backed up by land restoration programmes. • Set up of seed banks and nurseries. Provision of free seedlings, planning and technological advice. • Reducing the needs for timber through provision of alternative sources of energy – and also through improvements to cooking and heating technologies. • Introduce major improvements in forestry and agricultural extension services. • Knowledge and awareness – schools programmes. Capacity building of stakeholders.
Energy Policy for Uganda (2002) *Meet the energy needs of Uganda's population for social and economic development in an environmentally sustainable manner*	Establish the availability, potential and demand of the various energy resources in the country;	• Investigate different sources of energy. • Establish the availability, potential and demand of the various energy resources in the country
Water for Production Strategy and Investment Plan 2009	• Strengthened infrastructure in support of increased production of goods and services.	• Reduce poverty in Uganda, through provision and management of adequate and sustainable water supply for increased productivity, to stimulate economic development and to provide food security

Policy and Goals	Strategies	Strategic areas and priorities
To promote development of cost-effective and sustainable water supply and water management for increased production and contribution to the modernisation of the agricultural sector in Uganda with a focus on poverty reduction and minimal environmental impacts	• WRM acknowledged to be a key factor in the nation's energy supply. • Low sustainability of the installed infrastructure are linked to the capacity for planning and implementation at district level since the district level • Government is firmly committed to the privatisation process and promotion of private involvement in service provision	• In-formed decision-making by the water users on Demand Responsive Approach (DRA) • Local governments and water users must emphasise cost-efficiency of investments when assessing proposals for support and funding • Sustainability aspects must include the technical, institutional, environmental, economic and social dimensions • Issue guidelines for water resource allocation, extraction and utilisation, water use management and O&M to assist the stakeholders and encourage private investments in Water for Production. • Promote private involvement in service provision as part of privatisation process • Promote decentralisation and management at the lowest appropriate level • Acknowledge structural gender inequalities by increasing support, training and empowerment to vulnerable groups such as female subsistence farmers
The Uganda Wildlife Policy (1999) *Promote the long term conservation of the country's wildlife and biodiversity in a cost effective manner which maximizes the benefits to the people of Uganda*	• Protect areas with high levels of biological diversity that are representative of the major habitats of Uganda • Include the private sector, communities, NGOs, and others in policy implementation and the management of the country's natural resources	• Protect areas with high levels of biological diversity (indigenous forests, wildlife) • Include the private sector, communities, NGOs, and others in policy implementation and the management of the country's natural resources
Energy Policy for Uganda (2002) *Meet the energy needs of Uganda's population for social and economic development in an environmentally sustainable manner*	1. Establish the availability, potential and demand of the various energy resources in the country; 2. Increase access to modern affordable and reliable energy services as a contribution to poverty reduction; 3. Manage energy-related environmental impacts. 4. Environmental considerations shall be given priority whereby energy suppliers and users shall protect the environment by complying to set environmental protection guidelines and standards	• Investigate different sources of energy. • Develop a number of key energy projects as a matter of priority. • Implement opportunities for water resource development and hydropower generation • With economic development intimately tied to the growth in energy production, it is imperative that a number of key energy projects be developed as a matter of priority. • Improve energy governance and administration;
National Land Use Policy (2007) *Achieve sustainable and equitable socio-economic development through optimal land management and*	1. Ensuring adequately planned land use systems that provide for orderly and sustainable urbanization, industrial and infrastructural development; 2. Adopt improved agriculture and other land use systems that will provide lasting benefits for Uganda; 3. Promote land use activities that ensure	• Apply measures to improve land-use planning • Strategic interventions to conserve the soil. • Promotion of sustainable land use practices including terracing, ridging, use of cover crops and contour land protection bands.

Policy and Goals	Strategies	Strategic areas and priorities
utilization.	sustainable utilization and management of environmental, natural and cultural resources for national socio-economic development; 4. Update and harmonize all land use policies and laws and strengthen institutional capacity at all levels of the government.	• Promote land use activities that ensure sustainable utilization and management of environmental, natural and cultural resources for national socio-economic development; • Build institutional capacity at all levels of the government • Ensure integrated approach towards land use planning. • Coordinate activities of all stakeholders in land use planning
National Industry Policy (2008) *Build the industrial sector into a modern, competitive and dynamic sector fully integrated into the domestic, regional and global economies.*	Exploit and develop natural domestic resource-based industries such as Agro-processing, focusing on processing, leather and leather products and value addition in niche exports,	• Ensure that economic development activities be undertaken within the carrying capacity of the environment if its provision of services and goods are to be maintained. • Provide energy services and infrastructure to rural agro-processing industries
National Fisheries Policy (2000) *Guide the sustainable management and exploitation of fisheries resources in Uganda*	Aquaculture is highly emphasized for increasing fish production so as to have a balance between fish supply and demand	• Promote feed-based technologies and best management practices throughout the aquaculture value-chain • Promote inland fisheries with improved fisheries management
National Health Policy (1999) *Stipulates the need of better sanitation services to the people of Uganda*	The war against poor sanitation needs to be intensified so as to maintain the so far attained gains. Prioritize the support to local governments and authorities so as to improve sanitation and general hygiene.	• Integrate sanitation projects with other relevant projects to ensure achievements of MDG targets. • Provide basic sanitation in urban and rural areas.

Annexure B:
Basin Countries Comment on the Draft Vision and Objectives

Basin Countries' Visions and Comment on the Draft Vision and Objectives

Basin countries' Visions

Each of the member States has their own National Water Policies and Vision 2025 for growth and development, which includes the utilization the water resources of the Kagera Basin. These are listed below:

- **Burundi**

The Burundi Government's vision for the water sector is a "*state where water is available in quantity and quality sufficient to meet the needs of present and future generations and used efficiently and equitably for sustainable socio-economic development without compromising the Environment*". The key objectives for the water sector are to ensure:

- Availability of water resources for today and tomorrow.
- Equitable access to good quality water.
- Use of water for sustainable socio-economic development.
- A viable and sustainable environment.

In particular the Burundi Vision 2025 seeks to achieve:

- *properly established water management;*
- *better managed and exploited water resources, which will play a role in development and not be an environmental handicap (droughts and floods) for the country;*
- *environmental protection, using the polluter-pays principle;*
- *sanitation master plans are prepared and regularly updated;*
- *safe rural and urban areas.*

- **Rwanda**

The vision of the Rwanda Water Resources Management Policy is: "*A water resources sub-sector governed by a policy, legal and institutional framework that promotes sustainable use of water resources and which contributes meaningfully to the socio-economic development of Rwanda*". In order to achieve this vision, the water sector needs to ensure a proper framework for managing water resources in Rwanda that allows:

- *Sustainable use of water resources; and*
- *Significant socio-economic development of the Country.*

In particular the Rwanda Vision 2025 *"seeks to fundamentally transform Rwanda into a middle-income country by the year 2020."* In particular reference to water *"All Rwandans will have access to safe drinking water. Water resource management will be rationalized, integrated and in harmony with the national land-use master plans in all water dependent domains."* The Vision identifies, *inter alia,* the following specific targets:

- *reducing agricultural population from 90 per cent in 2000 to 75 per cent in 2010 and 50 per cent by 2020;*
- *Increasing non-agricultural jobs from 200,000 in 2000 to 500,000 in 2010 to 1,400,000 by 2020.*
- *Waste management: At least 80% of the Rwandan population will have easy access to adequate waste management systems and will have mastered individual and community hygiene practices.*
- *By 2020, the rural and urban areas will have sufficient sewerage and disposal systems.*

- **Tanzania**

The main aim of the Tanzania National Water Policy, 2002, is to provide a comprehensive framework for sustainable development and management of the Nation's water resources, in which an effective legal and institutional framework for its implementation will be put in place. The National Water Policy has the following overall objectives:

- *to address cross-sectoral interests in water use, watershed management and participatory integrated approaches in water resources planning, development and management;*
- *to lay a foundation for sustainable development and management of water resources through changing roles of the Government from service provider to that of coordination, policy and guidelines formulation and regulation;*
- *to ensure full cost recovery in urban areas and cost sharing in rural areas with considerations for provision of water supply services to vulnerable groups through various instruments including lifeline tariffs; and*
- *to ensure full participation of beneficiaries in planning, construction, operation, maintenance and management of community based water supply schemes in rural areas.*

Tanzania's Development Vision 2025 "*aims at achieving an absence of abject poverty and attaining a high quality of life for all people by 2025*." Water supply, sanitation and water resource management are key elements to achieving the vision. Intrinsic to this, are the objectives of equity of access, water management capacity, and proper maintenance of water and sanitation systems, use of environmentally sound technologies, and effective water tariffs, billing and revenue collection mechanisms. Further objectives include:

- *Creation of wealth and its distribution in society must be equitable and free from inequalities.*
- *Enjoy peace, political stability, national unity and social cohesion in an environment of democracy and political and social tolerance.*
- *Good governance should have permeated the national socio-economic structure thereby ensuring a culture of accountability, rewarding good performance and effectively curbing corruption and other vices in society.*
- *Education and knowledge are critical in enabling the nation to effectively utilize knowledge in mobilizing domestic resources for assuring the provision of people's basic needs and for attaining competitiveness in the regional and global economy.*

- **Uganda**

The Uganda National Water Policy "*promotes the principle of integrated water resources management as a means for ensuring sustainable management and utilization of Uganda's water resources*." The objectives of the water policy, *inter alia*, are to:

- Manage and develop the water resources of Uganda in an integrated and sustainable manner, so as to secure and provide water of adequate quantity and quality for all social and economic needs of the present and future generations with full participation of all stakeholders;
- Ensure sustainable provision of safe water within easy reach and hygienic sanitation facilities, based on management responsibility and ownership by the users, to 75% of the population in rural areas and 100% of the urban population by the year 2000 with an 80-90% effective use and functionality of facilities; and
- Promote development of water supply for agricultural production in order to modernize agriculture and mitigate effects of climatic variations on rain fed agriculture.

The Uganda Vision 2025 calls for "*Sound management and sustainable utilisation of water and environment resources for the betterment of the population of Uganda*" and "*To promote and ensure* *the rational and sustainable utilisation, development and effective management of water and environment resources for socio-economic development of the country*."

Basin Countries' Comment on the Draft Vision and Objectives

The Consultant tabled a draft Vision for discussion at the Consultancy Workshop held at Gisenyi, Rwanda on 13 July 2012. The draft Vision tabled was:

"Kagera, Water for life, harmony and prosperity".

The group from ***Burundi*** preferred their revised Vision coined: ""Kagera Integrated Water Resources Management for Human Sustainable Development".

The group from ***Rwanda*** accepted the Draft Vision without change.

Attendees from ***Uganda*** preferred to see a timeline in the Vision, recommending that "2032" be added to the Vision.

Attendees from ***Tanzania*** were of the opinion that the Draft Vision tabled was too general and that it seemed more like a slogan. Their preferred vision was: "Sustainable management and development of water resources for social and economic development". Their proposed revised vision was compiled to address the following key issues:

- Sustainable management of water resources;
- Access to clean and safe water for domestic use;
- Poverty reduction; and
- Water for economic development.

Taking all the above comments into account, the proposed revision vision is:

"Shared and sustainable use of Kagera water resources for life, food, peace and prosperity"

Basin countries' preferences of Strategic Basin Objectives

At the workshop, the attendees split into working groups by country and commented on the draft Strategic Objectives as follows:

The group from **Burundi** recommended the following revised strategic objectives:

- Common management of Kagera water resources among riparian countries;
- Cooperative framework among riparian countries' governments on transboundary water resources;
- Involvement of stakeholders including vulnerable groups and women in water management;
- Improvement of Technical Information and Communication (TIC) regarding knowledge resources.

The group from **Rwanda** recommended the following:

- Regional co-operation and decentralised implementation for the integrated and coordinated management and development of water resources in the Basin;
- Achieving higher levels of rural, economic and social development, (incorporating) productivity, youth employment and within accountable governance;
- Small-scale, community-level renewable energy;
- Facilitate trade within the Basin by member states;
- Committed, incentive-based, community stewardship and re-investment;

- Enhancing capacity building, technology and information-sharing;
- Committed and sustainable environmental management at community and economic levels, incorporating concepts/principles of payment for ecosystem services, and reward for community stewardship.

The group from **Uganda** were of the opinion that the objectives were not written as objectives and needed rewriting. They also felt that for the 2nd objective, the definition of "higher" was not clear and needed to be better defined. They recommended the following:

- To ensure integrated and coordinated transboundary water resources development/ management;
- To improve levels of economic and social development;
- To ensure committed sustainable environmental / natural resources management and equitable use;
- To ensure enduring capacity building and information sharing enhancements.

The group from **Tanzania** recommended the following:

- Integrated and coordinated water resources development/ management;
  Key issues to be addressed:
  - *Integration and coordination of stakeholders in the Basin through different projects and programs.*
- Achieve higher levels of economic and social development.
  Key issues to be addressed.
  - *Availability of water for Agriculture, Mining and transportation.*
  - *Insure accessibility of clean and safe water for domestic use.*
- Committed sustainable environmental and natural resources management.
- Create an enabling environment for private investors.
- Ensure capacity building and information sharing.
  Key issues to be addressed.
  - *Training*
  - *Availability of working tools.*
  - *Experience and knowledge sharing among stakeholders.*

Annexure C:
Projects selected for screening as potentially bankable projects in the Kagera Basin

Annexure C

- Projects where the key rationale is hydropower
- Larger dams (water supply, irrigation, some hydropower)
- Smaller dams
- Irrigation schemes not requiring dam construction
- Additional water resource projects

PROJECTS WHERE THE KEY RATIONALE IS HYDROPOWER

1. KAKONO DAM & HYDROPOWER PROJECT (Kagera River) - TANZANIA

The Kakono Dam would be a significant concrete structure on the Kagera River, downstream of the proposed Rusumo Falls hydropower project. The dam's primary function would be for the generation of hydroelectric power, but the additional irrigation of about 50 000 ha of downstream alluvial lands has been identified, along with a fisheries industry. This dam site was first identified as having potential in a UNDP Study in 1976. The Rusumo Falls and Kakono Dam schemes together make up the most important hydropower opportunities in the Kagera Basin.

The dam site is low down on the Kagera River in Tanzania. The dam wall would be 35m high. The capacity is negligible in relation to flow in the river. Further studies are required but the project was identified in the Strategic/Sectoral Social and Environmental Assessment of Power development Options (SNC Lavalin 2007) as a 'necessary and sound investment'.

1. SOURCES OF INFORMATION

A prefeasibility study of the Kakono Project was undertaken for the UNDP in 1976 and both the Kagera Monograph (2008) and the Kagera Integrated River Basin Management and Development Strategy recommend the development, as does the SSEA of 2005. The sources of information are limited as follows:

- Norconsult AS and Electrowatt, April 1976: Prefeasibility Studies Kagera River Hydropower Developments Rusumo Falls Hydropower Project, Kishanda Valley Hydropower Project, Kakono Dam Hydropower Project: Burundi – Rwanda – United Republic of Tanzania: United Nations acting for UNDP.
- SNC Lavalin, February 2005: Strategic/Sectoral, Social and Environmental Assessment (SSEA) of Power Development Options in the Nile Equatorial Lakes Region, Synopsis Report, Stage 1 – Burundi, Rwanda and Western Tanzania, NBI, NELSAP, The World Bank.
- SNC Lavalin, February 2007: Strategic/Sectoral, Social and Environmental Assessment (SSEA) of Power Development Options in the Nile Equatorial Lakes Region, Final Report, Volume 1, Main Report, NBI, NELSAP, The World Bank.
- BRL Ingenierie, 15 July 2008: Kagera River Basin, Transboundary Integrated Water Resources Management and Development Project Kagera River Basin Monograph: NBI, NELSAP, Kagera Transboundary Integrated Water Resources Management and Development Project.
- SWECO, May 2010: Development of Kagera Integrated River Basin Management and Development Strategy: NBI, NELSAP, Kagera Transboundary Integrated Water Resources Management and Development Project.

2. PROJECT DESCRIPTION / STATUS

The Kakono Dam project would provide hydropower generation (53 MW) and the possibility of irrigation (potentially > 50 000 ha).

The details of the project have not been updated since the 1976 study.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The objective of the current Kagera River Basin Management Project is to establish a sustainable framework for the management of the water resources of the Kagera River Basin in order to prepare for sustainable development oriented investments that will improve the living conditions of people while protecting the environment.

The primary potential purpose of the Kakono project would be to provide hydropower to be distributed via the regional grid. Distribution networks and users were not defined in the project planning documents.

4. RATIONALE AND CONTEXT FOR PROJECT

Together with the Rusumo Falls scheme the Kakono Dam would provide for a large proportion of the hydropower that could be generated most economically in the Kagera Basin. These two projects offer some of the best opportunities for hydropower generation in the region.

There is an urgent need for electric power in the Basin countries and the year round flow in the Kagera River with minimal storage would provide significant firm and secondary energy.

5. PREPAREDNESS FOR IMPLEMENTATION

This technical potential for this project has been identified but further technical, social, and environmental studies would have to be undertaken.

6. LOCATION

The Kakono hydroelectric project site is located in a relatively undeveloped area of Tanzania, on the Kagera River near the Ugandan border, approximately 90 km from the mouth of the Kagera River into Lake Victoria and about the same distance from the city of Bukoba. Kakono is the furthest downstream potential hydropower site on the Kagera River offering multi-purpose development opportunities and is located as shown in **Figure 1**.

7. REPLICABILITY

The project is unique however the hydropower equipment and run of river operation would be similar to that for the proposed hydropower scheme at Rusumo Falls.

8. BENEFIT SHARING

Power sharing will depend on the future development of regional power lines beyond Tanzania and Uganda and also to Rwanda and Burundi.

The hydropower scheme could be constructed as a stand-alone scheme however the dam offers irrigation opportunities by gravity and the price of electricity indicated in the Basin Monograph was based on the assumption that the capital cost of the dam would be shared.

Figure 1: Location of Proposed Kakono Dam on Kagera River in Tanzania 90 km Upstream of Lake Victoria

9. TECHNICAL DESCRIPTION OF PROPOSED DAM

The project would comprise the following:

- The proposal is for a 35 m high concrete gravity or earth fill dam on the Kagera River in Tanzania. The site is only 90 km from the mouth of the Kagera River.
- The height of the dam would be 35 metres, with 26 m of head for generation at a 53 MW hydropower station to provide secondary energy of approximately 182 GWh/year and firm energy of 165 GWh/year.
- The reservoir would extend for 40 km upriver, and would have a surface area of 15 km^2.
- Although a large structure the dam is viewed as a "run-of-river" dam, channelling the water for hydropower but also providing a useful facility for diversion for irrigation.
- Being on the Kagera River the MAR feeding into the dam includes the entire flow of the Basin and the dam would fill in a few days.

The Kagera River Valley below the site contains more than 50,000 ha of alluvial soils suitable for the development of irrigated agriculture. The reservoir created by the dam could command much of the irrigable area, and the remainder could be served by pumped supplies using energy from the hydropower plant.

10. BENEFITS

This Project is intended to primarily supply hydropower but offers opportunities for the irrigation of more than 50 000 ha. Given the large volume of flow in the river irrigation facilitated by the dam would be limited by available land in the Bukoba District, rather than the availability of water.

It is possible that irrigation benefits could be provided to nearby Uganda. The Kakono Dam is also likely to provide a very good fisheries opportunity.

11. IMPACTS

Detailed impact studies must still be undertaken.

Environmental

- It is anticipated that flow regime changes would be limited with limited downstream impacts.
- The project would flood part of the Minziro Forest Reserve. The plant could provide daily peaking, with consequent downstream flow and level variations over 75% of the year.

Socio-economic

- The reservoir would be located in a medium population density area and could involve significant resettlement. Several potential irrigation areas near Kyaka exist.
- A fisheries industry could be developed in the dam basin.

12. SUSTAINABILITY

Financial, social and environmental sustainability issues will need to be assessed.

13. RISKS

No risks were identified but being on the main stem of the Kagera River impacts would require special attention.

14. DURATION AND FUNDING

The estimated construction period would be about three years; however it would take at least 10 years to complete all feasibility studies, environmental assessments and to implement construction.

In 1976 total costs were estimated to be $41 million whereas total costs were estimated in 2005 to be USD 86 million, including capital, indirect and environmental mitigation works. In 2005 the average cost of energy was estimated to be 3.2 US cents/kWh assuming that 50% of the capital cost of the dam is assigned to irrigation. . The 2005 estimate above is very low compared with the relative values of the 1976 and 2008 estimates for Rusumo Falls which have been used to provide the updated estimate cost for the current report.

15. ADDITIONAL INFORMATION REQUIRED

This study still requires:

- Prefeasibility study to review previous prefeasibility study.
- Feasibility study
- Detailed studies and preparatory actions
- Works: dam and associated infrastructure
- Environmental and social management plan
- Resettlement plan

16. RECOMMENDATIONS

The prefeasibility study is to be followed by a feasibility study if favourable.

2. KISHANDA VALLEY HYDROPOWER (Kagera River) – TANZANIA

The Kishanda Valley Hydropower Project would divert the flow of the Kagera River downstream of Lake Rushwa in Tanzania. The flow would pass successively through an arm of Lake Rushwa, then into a reservoir in the valley of the Kishanda River created by a dam built at Murongo. This reservoir would extend 60 km up the Kishanda River. A hydropower station with a capacity of about 180 MW would be located close to Bugare where the flow would be returned to the Kagera River.

The 1976 pr e-feasibility s tudy has not been up dated and t he pr oject h as not been g iven f urther consideration on account of the significant environmental impacts.

1. SOURCES OF INFORMATION

- Norconsult AS and Electrowatt, April 1976: Prefeasibility Studies Kagera River Hydropower Developments Rusumo Falls Hydropower Project, Kishanda Valley Hydropower Project, Kakono Dam H ydropower P roject: B urundi – Rwanda – United R epublic of Tanzania: U nited N ations acting for UNDP. (These studies are now over 30 years old and they have not been updated.)
- Kagera Basin Organization Development Programme. Volume 3. Energy, February 1982

2. PROJECT DESCRIPTION / STATUS

Several power development options generating up to 180 MW were investigated to exploit the hydroelectric pot ential t he lower r eaches of K agera River w here it dr ops m ore than 1 00 m bet ween 120 and 90 km upstream of the river mouth. These were studied by Norconsult/Electrowatt (1976) as part of a study that included Rusumo Falls.

On ac count of en vironmental c oncerns ex pressed a t t he t ime t he pr oject h as not be en s ubject t o additional studies since the 1976 pre-feasibility study.

3. OBJECTIVES (purpose of the development)

Hydropower would be generated and water could also be diverted to irrigate a large area for economic development of the region. Power would be distributed to all four basin countries via a connection to the regional grid.

4. PROJECT RATIONALE AND CONTEXT

This i s one of s everal h ydropower d evelopment opt ions t o ex ploit t he h ydroelectric pot ential of t he Lower Kagera. The driver of the project was the regional demand for electricity generation.

5. PREPAREDNESS FOR IMPLEMENTATION

The pr e-feasibility of 197 6 has not be en u pdated. T he s cale and t he l ocation (near t he K agera National Park) of such hydropower development would require a thorough assessment of environmental and social impacts.

6. LOCATION

A weir downstream of Lake Rushwa would divert the flow of the Kagera River into the Kishandra River Valley which joins the Kagera where the level is about 120 lower. The flow would pass successively pass through an arm of Lake Rushwa, then into a reservoir in the valley of the Kishanda River created by a dam built at Murongo. This reservoir would extend 60 km up the Kishanda River. An open cut channel and pressure tunnel would deliver the flow to the Bugare hydropower station utilizing some 94 m of available head (103 m before losses).

Figure 1: Locality of the Kishanda Valley hydropower project

7. REPLICABILITY

Not replicable.

8. BENEFIT SHARING

The Kishanda project would provide improved regulated flows for possible additional irrigation in the Kyaka areas would the Kakono scheme further downstream. There is potential for irrigation of 160 km² at Kyaka, and further opportunities further downstream. These are outlined in the 1976 report by Norconsult/Electrowatt and in the 1982 report for the KBO. The 1976 report refers to pre-feasibility level studies of the Kyaka irrigation project as part of the same study.

9. TECHNICAL DESCRIPTION

Downstream from Rusumo Falls the Kagera River trends north through swamp and lake terrain for 200km to the Uganda Border, falling only about 15m in the reach, and then enters a deep, narrow gorge and trends easterly for 100km to Kakono, cutting across the grain of the country around the northern end of Kishanda Valley and falling 120m in the reach in its decent to the Lake Victoria Basin. The Kishanda Valley Project is an off-channel diversion scheme to short-circuit the flow of the Kagera Valley through a power station near Bugare, upstream of Kakono, thereby exploiting 100m or more of the head differential of 134m between tail water at Rusumo falls and Kakono at the entrance to the

Lake Victoria basin. As such, the various works comprising the project span the breadth of the Kishanda valley within the loop of the Kagera, a straight line distance of 33km between Lake Rushwa and Bugare.

Hydrology:

Mean discharge of Kagera River		=	187 m³/s
Design discharges:	Intake works and power station	=	200m³/s
	Spillway, diversion during construction	=	900m³/s

The main features of the project are:

Kagera weir – a low grated structure across the Kagera River, 25km downstream from Lake Rushwa, dimensioned to maintain an operating pool between about elevation 1281.5 and 1284m. This represents about the maximum range of pool level and the highest pool level that can be considered to satisfy ecological constraints, and the minimum range and lowest pool level that can be maintained for economic development of the project.

Lake Rushwa diversion – an open cut channel, 3 km in length with a design capacity of about 200m³/s linking the north arm of Lake Rushwa with the valley of the Kishanda River.

Murongo Dam – a zoned embankment structure in the downstream reach of the Kishanda valley to impound water in the valley to elevation 1284m. The dam will be essentially a crossing structure or plug in the valley and will have no function in the regulation of the pool level of the impounded water.

Kishanda reservoir – the reservoir created by the Murongo Dam will extend about 60km upstream in the Kishanda valley to point about 20km south of the Lake Rushwa inlet with an arm extending 15km eastward from the main valley to within about 12.5km of the Kagera River at Bugare. At maximum pool the reservoir will have a water surface area of about 115km² and will contain about 1200 million m³ of water. Live storage between the minimum pool at elevation 1281.5 and maximum pool at elevation 1284m will be about 300 million m³, equal to about 23 days of throughput under normal operation. Thus, the reservoir would function mainly as a conveyance work, as the live storage would be insufficient even for inter-seasonal regulation of flow.

Bugare Inlet and Tailrace Tunnel – an open cut channel 6km long and 100 m² pressure tunnel 6.5km long to link the eastern arm of the Kishanda reservoir with the Bugare station through a maximum head of 103m. Friction head loss in the tunnel at maximum flow would be about 9m resulting in a maximum effective head of about 94m.

Bugare Power Station – an underground power house with design discharge of 200m³/s, and an installed capacity of 207MW. This will be capable of generating 500 GWh/year of guaranteed energy. Tail water will discharge at el. 1181m into a 550m long free flowing tailrace tunnel and thence into a channel to the Kagera River.

Installed capacity was estimated at 180 MW and corresponding annual energy of 1,087 GWh (Norconsult) and at 207 MW firm energy of 500 GWh (KBO).

10. BENEFITS

The Kishanda project would provide improved regulated flows for possible additional irrigation in the Kyaka areas would the Kakono scheme farther downstream. There is a potential for 160 km² of irrigation at Kyaka, and further opportunities further downstream. These are outlined in the 1976 report by Norconsult/Electrowatt and in the 1982 report for the KBO. The 1976 report refers to pre-feasibility level studies of the Kyaka irrigation project as part of the same study.

11. IMPACTS *(environmental, socio-economic)*

Environmental

The project would have a high environmental/social risk, and thus has been screened out by the SSEA. The primary reason is the diversion of significant flows out of the Kagera River over an extended distance, and flooding of the Kishanda River valley by the proposed reservoir. The Akagera National Park in Rwanda and the presence of extensive wetlands of importance to the regional biodiversity in Tanzania and Rwanda would also be of international concern.

Socio-economic

Unknown

12. SUSTAINABILITY (Financial, Technical, Social, Environmental)

Unknown

13. RISKS

Risks are assumed to be high due to magnitude of project and changes to the environment.

14. DURATION AND FUNDING

No information available. No costing has been undertaken, nor any funding sourced.

15. ADDITIONAL INFORMATION REQUIRED

This study would still require:

- Review of pre-feasibility study
- Feasibility study
- Detailed studies and preparatory actions
- Works: dam and associated infrastructure
- Environmental and social management plan
- Resettlement plan

16. RECOMMENDATIONS

Not recommended for further investigation

3. RUSUMO FALLS HYDROPOWER (Kagera River) - RWANDA, BURUNDI, and TANZANIA

The 61.5 MW Rusumo Falls Run-of–River Hydroelectric Project on the Kagera River would provide an average supply of 46 MW of electricity via interconnected national grids, still to be developed, to benefit Burundi and Rwanda and to supply the western mining provinces of Tanzania.

The feasibility study of the Rusumo Run-of-River scheme is currently (2012) being undertaken by *SNC Lavalin* as this 61.5 MW scheme would not displace any people and would have minimal impact on the environment but would still provide significant benefits generating average power of 46 MW, and providing firm energy of 254 GWh/a, secondary energy of 147 GWh/a and average energy of 401 GWh/a. In 2012 it was estimated that the scheme would cost US$340 million and the transmission lines an additional US$100 million. It was also estimated that the project would be commissioned in 2017.

1. SOURCES OF INFORMATION

The sources of information for the most recent studies of the Rusumo Hydropower Project are as follows:

- SNC Lavalin International, October 2008: Regional Rusumo Falls Hydroelectric and Multipurpose Project, Consultancy Services for Feasibility Study of the Generating Plant and Related Project Area, Preliminary Design, Volume 1, Executive Summary (Final)
- SNC-Lavalin (2011), "Rusumo Falls Hydroelectric Power Development Project Power Generation Plant Final Feasibility Study Phase 1 RAP and LADP", Report for NELSAP, May 2011.
- SNC-Lavalin (2012), "Rusumo Falls Hydroelectric Power Development Project Power Generation Plant Final Feasibility Study", Final Feasibility Design Report for NELSAP, February 2012.
- BRL Ingenierie, 22 June 2012: NBI, NELSAP, Nile Equatorial Lakes Multi-sector Investment Opportunity Analysis, Draft Situational Analysis Report, Main Report.

2. PROJECT DESCRIPTION / STATUS

The Rusumo Falls Hydropower Project would utilize the significant year round flows in the Kagera River and the head available at the Rusumo Falls to generate hydropower. The preliminary design phase study assessed three alternatives, two reservoir options with full supply levels of 1325.0 masl and 1323.5 masl, and one Run-of-River option. The reservoir options were assessed from technical, economic, social and environmental points of view and the option with a full supply level of 1323.5 masl was selected for the final feasibility design phase. This scheme would provide favourable hydropower benefits and was assessed to have significantly lower social and environmental impacts than the option with a full supply level of 1325.0, although these impacts would still be severe. This 1323.5 m lower level option would not affect the level of Lake Rweru but inundation would still affect a large number of people and a very significant area of cultivated land.

In assessing the then preferred 1323.5 masl option under the full feasibility and basic design study it was determined that the number of people affected by the project would be 31,000. This number has subsequently been raised to 40,000-45,000 affected people.

The significant socio-economic impacts of the 123.5 masl option led to the selection of the Rusumo Falls Run-of-River scheme because it would have minimal environmental and social impacts. The feasibility study of the Run-of-River scheme is currently (2012) being undertaken by SNC Lavalin.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

On March 31, 2006, the Energy Ministers of Burundi, Rwanda and Tanzania signed a Joint Project Development Agreement (JPDA) for the preparation stage of the Regional Rusumo Falls Hydroelectric and Multipurpose Project. The Coordination Unit of the NELSAP was designated as the Secretariat of the Project Implementation Unit.

In June 2007, the NBI / NELSAP retained *SNC-Lavalin International Inc.* to provide consultancy services to conduct the feasibility studies for the construction of hydroelectric installations, including the assessment of the Project's environmental and social impacts.

The purpose of this regional Project would be to generate power at reasonable cost to supply the growing electricity demands in Burundi, Rwanda and Tanzania.

4. RATIONALE AND CONTEXT FOR PROJECT

The Project supports the broader Kagera Basin development goal, which is to improve livelihoods in the region through sustainable development in the Basin. With economic development intimately tied to growth in energy production, it is imperative that a number of key basin energy projects be developed. An obvious energy option for the Kagera Basin is hydropower, which has significant potential for development. The continued dependence on this source of energy would be ensured through the relative abundance of water in the region and would provide the backbone of any energy expansion and planning for the foreseeable future. Electricity sharing is currently less than one per cent of the total energy production in the region, and this can be increased significantly.

5. PREPAREDNESS FOR IMPLEMENTATION

A feasibility study for the Run-of-River scheme is currently being undertaken and the project has already been selected for implementation. The financing arrangements, detailed design, tendering and construction are scheduled to be completed within the next 5 years. The provision of the power lines that would serve the scheme would follow a similar program.

6. LOCATION

The Rusumo Falls are located on the Kagera River, about 2 km downstream of the confluence of the Ruvubu and Nyabarongo Rivers, at the border between Rwanda on the left bank (Eastern Province) and Tanzania. The site of the proposed dam is situated about 100 metres upstream of the international bridge that crosses the Kagera River at Latitude 2^0 38' South and Longitude 30^0.78' East. The alternative Run-of-River scheme would be at the same site. The location is shown in **Figures 1 and 2.** The hydropower station would be located on the right bank in Tanzania (Ngara District, Kagera Province).

7. REPLICABILITY

The project is unique to the Rusumo Falls site however the lessons learned through the opportunities that it would provide for closer cooperation and sharing the electricity generated between the countries could be utilised for other hydroelectric projects.

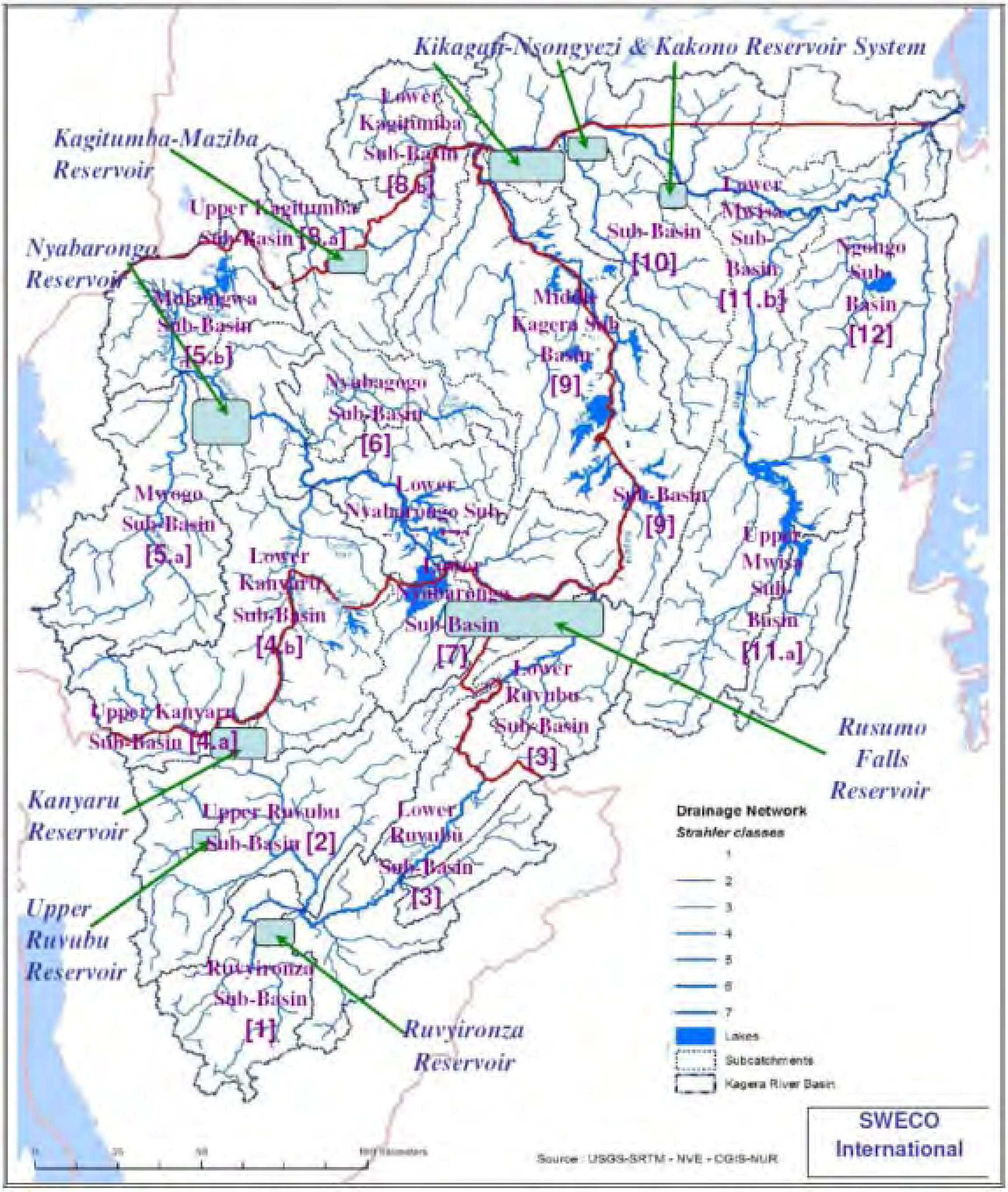

Figure 1: Location of Rusumo Falls (Source, SWECO International, 2010)

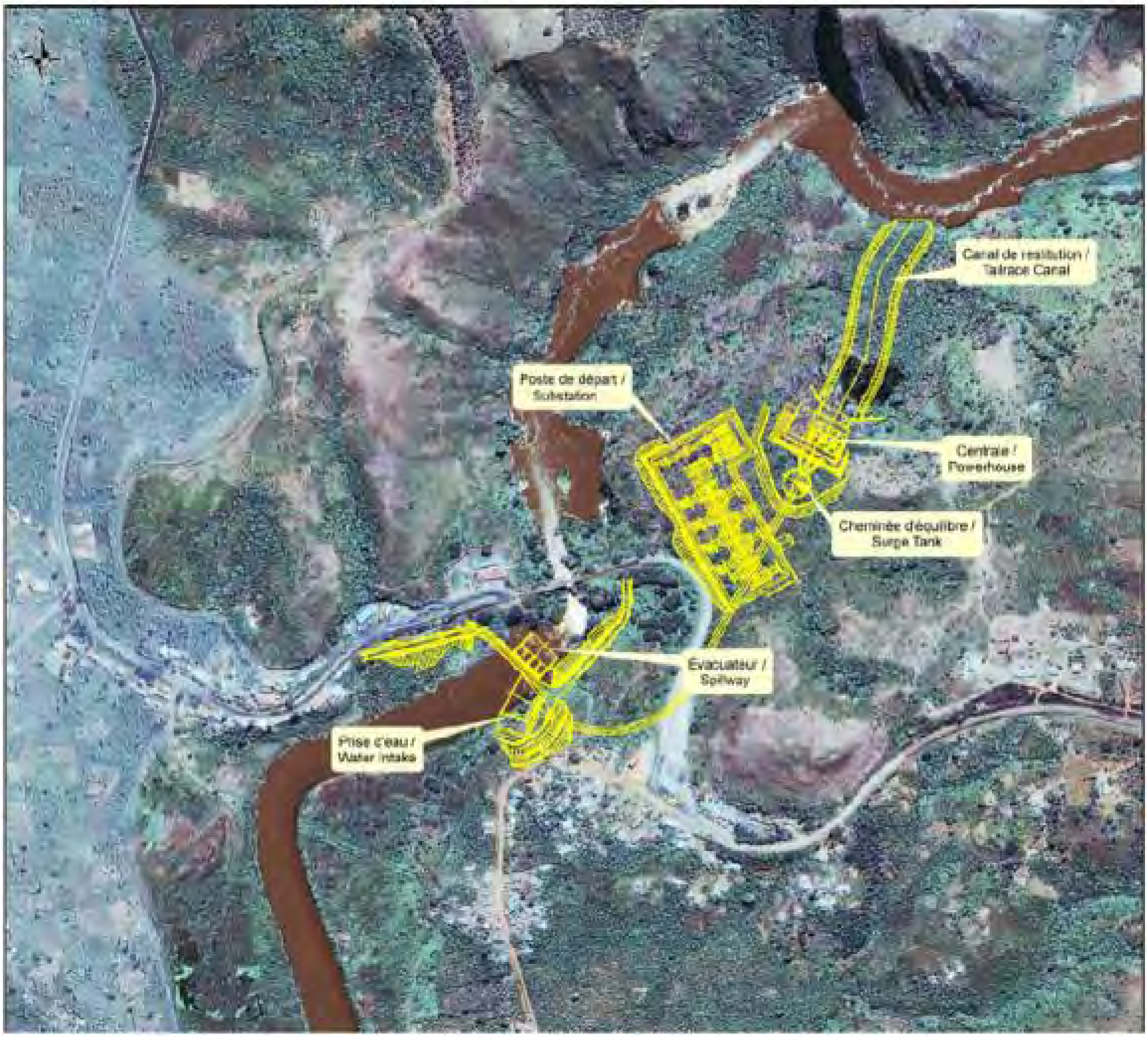

Figure 2: Location of Proposed Hydropower Scheme at Rusumo Falls

8. BENEFIT SHARING

The electricity generated would be shared by Rwanda, Burundi and Tanzania through integrated national grids and power sharing agreements.

At district level the scheme would provide power to the western mining provinces of Tanzania which are currently not connected to the national grid.

Rusumo Falls is strategically placed in the region: a) to strengthen the backbone electrical transmission system required for the benefits of regional power planning to be enjoyed by all parties and b) to meet the new loads from mines that are being opened in the region.

The construction of the Run-of-River Scheme at Rusumo Falls would have little or no impact on downstream flows.

9. TECHNICAL DESCRIPTION OF THE PROPOSED SCHEMES

The Run-of-River scheme would comprise a diversion weir, a headrace tunnel, a 61.5 MW power station and a tailrace canal as shown in **Figure** 2. The project generate average power of 46 MW, providing firm energy of 254 GWh/a, secondary energy of 147 GWh/a and average energy of 401 GWh/a. This scheme would cause little or no inundation upstream. In 2008 the capital cost was estimated to be US $217 million.

Transmission Facilities

A feasibility study and detailed engineering design for four power transmission lines between Burundi, DRC, Kenya, Rwanda and Uganda to strengthen existing and new interconnections between the NEL countries and other regional grids was completed in October 2007. This transmission grid would enable power from the Rusumo Falls hydropower project to be shared equally between the three partner countries of Burundi, Tanzania and Rwanda. The transmission lines are expected to promote power access, reliability and trade between the three countries.

10. BENEFITS

The Rusumo Falls Hydropower project would supply hydropower which would be shared by Burundi, Tanzania and Rwanda. The power available would depend on the scheme that is constructed.

11. IMPACTS

The proposed Rusumo Hydropower Scheme would have a positive impact on the populations in the area by creating economic and employment opportunities and encouraging local economic development by bringing electricity to the region. This would lead to improvements in infrastructure and living conditions in village communities. The results of a stakeholder opinion survey have confirmed the desire for local development in the area.

This run-of river scheme would not cause any inundation that would impact on local communities however the scheme would probably have a slight effect on daily flows in the river downstream.

12. SUSTAINABILITY

The scheme would provide long term power to the region at reasonable cost.

13. RISKS

There would be the risk of slightly increased wear of the turbines on account of the sediment transported by the river flow. This might necessitate that the turbine runners would need to be replaced earlier than for many schemes. However wear could probably be mitigated by the correct choice of materials.

There would be virtually no sediment deposition for this run-of-river scheme.

14. DURATION AND FUNDING

Duration

The following implementation programme for the implementation of the Rusumo Falls Run of River of River scheme was presented at the meeting of NELSAP for the NBI in November 2012:

- Appointment of Owner's Engineer — March 2013
- World Bank Board approval — June 2013
- Construction to Start — December 2013
- Commissioning — 2017

Funding

At the same NELSAP meeting held in November 2012 the following project cost estimate was tabled:

• Civil and Mechanical	US$154 million
• Mechanical and Electrical	US$126 million
• Socio-Economic and Environmental Mitigation	US$23 million
• Engineering, Administration and Supervision Costs	US$37 million
TOTAL PROJECT	**US$340 million**
• Transmission Lines including Engineering etc.	US$100 million
TOTAL	**US$440 million**

15. ADDITIONAL INFORMATION REQUIRED

After completion of the feasibility study and subject to the agreement of the affected countries the scheme could proceed to detailed design followed by construction.

16. RECOMMENDATIONS

Implement if results of current feasibility study are favourable, which seems likely.

4&5. NSONGYEZI HYDROPOWER PROJECT 65MW & 85MW (Kagera River) - UGANDA & TANZANIA

The Nsongyezi Project would comprise a dam and hydropower station situated in the lower reaches of the Kagera River where it forms the border between Uganda and Tanzania. The primary function of the development would be the generation of hydroelectric power. The power station would have an installed capacity of 65 to 85 MW, and could supply power to Uganda, Tanzania, Rwanda and Burundi via interconnections with the national grids, as well as providing rural electrification to the communities located in the vicinity of the Project.

This site has been identified but interest has not yet reached the pre-feasibility stage. A pre-feasibility study is recommended.

1. SOURCES OF INFORMATION

The only source of information is the Terms of Reference for the Feasibility Study of Nsongyezi Hydropower Project, by SWECO, issued in February 2010. There is no indication that any further studies have been conducted.

2. PROJECT DESCRIPTION / STATUS

Status: Identified site but interest has not yet reached the pre-feasibility stage.

3. PROJECT OBJECTIVES

Regional hydropower generation

4. PROJECT RATIONALE AND CONTEXT

The demand for power is Basin-wide. This need is well presented in the Kagera Monograph and in the SWECO ToR (SWECO, 2010). It is assumed that provided power generated by the larger proposed hydropower stations can be linked to the regional distribution network, ten no further rationales is necessary. Individual projects would need to be evaluated comparatively for cost: benefit.

5. PREPAREDNESS FOR IMPLEMENTATION

The project site has been identified but no further studies appear to have been done.

6. LOCATION

The Nsongyezi Dam Site is located on the Kagera River, near Kibwera (Uganda) and Kijumbura (Tanzania), at the border between Uganda on the left bank (Isingoro District) and Tanzania on the right bank (Karagwe District).

The site of the proposed dam on the Kagera River is located at Latitude 1°00’ South and Longitude 30°45’ East. The proposed dam site is situated downstream of a fall in the river but at relatively narrow section which would provide lower construction costs for a large range of dam heights.

Figure 1: Locality of the Nsongyezi Project

7. REPLICABILITY

The project is unique to the Nsongyezi situation. However the lessons learned through the opportunities that it would provide for closer cooperation and sharing the electricity generated between the countries could be utilised for other hydroelectric projects.

8. BENEFIT SHARING

This Project is intended to supply power to Uganda, Tanzania, Rwanda and Burundi, via interconnections with the national grids, as well as to provide rural electrification to the communities located within the vicinity of the Project.

9. TECHNICAL DESCRIPTION

Details of the dam and potential hydropower generation for the alternative 65MW and 85MW schemes are provided in the table below. The power station would be shared by Uganda and Tanzania.

Transmission facilities would be required to connect the hydroelectric power plant to the regional power grid (Burundi, Rwanda, Tanzania and Uganda),

At Project level there would need to be a joint utility/institution for the co-management of power generation and distribution to national utilities.

Summary of key Nsongyezi Hydropower Project data:

Description	Maximum Water Level	
	1250masl	**1260masl**
Hydrology		
Mean discharge of Kagera River	199m³/s	
Design Discharges		
Diversion during construction	500m³/s	
Spillway	870m³/s	
Reservoir		
Reservoir surface area	700ha	1900ha
Maximum pool level for regulation	1250masl	1260masl
Minimum pool level for regulation	1247masl	1257masl
Active Storage	18 million m³	47 million m³
Project Works		
Dam		
Crest elevation	1253masl	1263masl
Crest length (about)	430m	490m
Maximum height above river bed	41m	51m
Spillway crest elevation	1246masl	1256masl
Power House		
Power Head	31m	41m
Tail water elevation	1218masl	1218m
Energy		
Installed capacity	65 MW	85MW
Average annual energy	280 GWh	370GWh

(These approximate estimates have been obtained from the identification level of study)

10. BENEFITS

The scheme would supply power to the Basin Region.

11. IMPACTS

Socio-economic and environmental impacts are still to be determined.

12. SUSTAINABILITY *(Financial, Technical, Social, Environmental)*

Requires assessment

13. RISKS

Risks still require assessment.

Other projects on the Kagera River might affect the planning and operation of this project. Projects should be considered conjunctively.

14. DURATION AND FUNDING

Project duration and source of funding are still to be determined

15. ADDITIONAL INFORMATION REQUIRED

This could be a very important project and a pre-feasibility study is recommended.

16. RECOMMENDATIONS

Implement 39MW scheme. See write-up “7. Nsongyezi Hydropower Project (39mw) - Uganda” below.

6. NSONGYEZI HYDROPOWER PROJECT (39MW) – UGANDA

The Nsongyezi Hydropower Project is located on the Kagera River approximately 65 km south of the city of Mbarara and 13 km downstream of the proposed Kikagati project site. The scheme has a maximum installed capacity of 39MW and a mean annual production of approximately 309 GWh/annum. Based on very approximate estimates the scheme might cost about US$160 million (not including compensation) and could be completed in about 7 years.

1. SOURCES OF INFORMATION

- Email correspondence from Inge Stølen. *SV: Kagera BDP: Draft Strategic Planning Report - version for e-mailing* (10/16/2012)

2. PROJECT DESCRIPTION / STATUS

The Nsongyezi HPP, located approximately 65 km southern from the City of Mbarara comprises a dam with the height of about 20 meters and a 39 MW power station incorporated within the dam body. The Nsongyezi reservoir is approximately 12 km long and it reaches the tail water at the upstream located HPP Kikagati. According to a Master Plan, the Nsongyezi HPP will represent a step in the cascade of several planned hydropower projects which will eventually utilize the hydropower potential of the middle and lower course of Kagera River.

Nsongyezi HPP with its assumed installed capacity of approximately 39 MW is expected to add about 300 GWh/year to the electric networks of Uganda and Tanzania. Once the plant has been constructed and commissioned it will contribute to overall coverage of the increasing demand in power supply in both countries.

3. OBJECTIVES (purpose of the development)

The main objective of this project is the provision of hydropower.

4. PROJECT RATIONALE AND CONTEXT

Tronderenergi have considered multiple hydro power projects in Uganda to fulfil their goal of implementing 100 MW of small scale hydropower to contribute to the increasing power demand in the country. The Nsongyezi HPP represents a good project with high utilization of the water resource and limited environmental and social impact.

5. PREPAREDNESS FOR IMPLEMENTATION

Tronderenergi are in the process of concluding the feasibility study for the project. Data in this description may be altered in the investment decision process and/or in the tender document development process.

6. LOCATION

Nsongyezi Hydropower Project is located on the Kagera River approximately 65 km south of the city of Mbarara and 13 km downstream of the proposed Kikagati project site. The right bank gently rises above the river bed, while on the left side the natural slopes are somewhat steeper. There are existing traffic roads at both sides/countries which provide direct access just above to the project site. The valley of the river is rather wide, whereas the riverbed is of a steps-shaped form with few rapids and flat inclination in between.

It would be appropriate for both the Kikagati and the Nsongyezi plants to be operated by the same organization, as the operation of the upstream plant would significantly impact the operation of the downstream plant. Also from a development point of view there is scale benefit for the projects to be implemented jointly. However, there would be no absolute connection between implementation of the projects.

The position of the project site is 0° 50' 59.47"S; 30° 44' 44.851" E as shown on **Figure 1**.

Figure 1: Locality of the Nsongyezi Hydropower project

7. REPLICABILITY

Tronderenergi are planning to implement a similar project 13 km upstream in the Kagera River, the Kikagati HPP project

8. BENEFIT SHARING

No agreements have been made for this project, as the project is in an early phase, but it is assumed that there would be a similar Power Sales and Adhering arrangement to that for the Kikagati project.

9. TECHNICAL DESCRIPTION

The right bank gently rises above the river bed, while on the left bank the natural slopes are somewhat steeper. There are existing roads on both sides of the river, i.e. in both Uganda and Tanzania, which provide direct access to the river and to the project site. The river valley is wide, whereas the riverbed is stepped, with a few rapids separated by a level reach. The project consists of the following main components:

- 20 m high concrete weir on the Kagera River;;
- Power intake structure, integrated within the weir block;
- Open air-type powerhouse, placed adjacent to the dam structure;
- Three vertical Kaplan turbines of the total installed capacity of approx. 39 MW;
- Tailrace channel approximately 50 m long;
- Open-air switchyard located on the Ugandan side;
- 35 km transmission line to operate at 132 kV, connecting the power plant to the national grid of Uganda at the Mirama Hills substation;
- Access roads to the plant.
- Mean annual production approximately 309 GWh.

10. BENEFITS

The Purpose of this project would be to provide hydropower.

11. IMPACTS *(environmental, socio-economic)*

The Social and Environmental study has not yet been completed, so the full social and environmental impacts have yet to be determined. So far Tronderenergi have identified the need to relocate some households and to provide compensation for some cultivated areas. The number of affected households will most likely be the limiting factor in determining the final size of this project. A RAP will probably be developed in due time. There are also archaeological sites in the area that would need to be addressed.

12. SUSTAINABILITY *(Financial, Technical, Social, Environmental)*

The feasibility study will determine whether the project is sustainable.

13. RISKS

One of the risks would be a failure to achieve commitment and agreement from authorities in Uganda and Tanzania. Cross border processes for such projects are not standardized, and differences in the national legislation of the two countries affected could delay and ultimately stop the project. Communication between national authorities has been minimal to non-existent, and this poses a risk to the project.

Also, the payment situation is critical. Last year payment difficulties were experienced at one of Tronderenergi projects in Uganda. This has made financing of power projects in Uganda more problematic. The consumer risk is considered the highest risk for such projects in East Africa.

The handling of the archaeological sites in the vicinity of the project area is also a risk.

14. DURATION AND FUNDING

No information was provided on the duration or funding and the following estimates should be considered accordingly.

Duration

Assuming that the feasibility study will be completed in 6 months, that it would take 1 year to resolve the compensation and archaeological impacts, and allowing a 1 year for the procurement of funds, 18 months for design and 3 years for tendering and construction, then the project could probably be completed after about 7 years.

Funding

The funding requirements have not been determined. However based on very approximate costs it is estimated that the scheme would cost about US$160 million not including compensation for inundation.

15. ADDITIONAL INFORMATION REQUIRED

Feasibility study

16. RECOMMENDATIONS

Complete feasibility study to determine whether scheme is feasible.

7. NYABARONGO DAM & 20 MW HYDROPOWER PROJECT (Nyabarongo River) - RWANDA

In a 2012 China National Electric Engineering Co. Ltd undertook a feasibility study of the Nyabarongo project which would comprise a 48 m high concrete face rock-fill dam on the Nyabarongo River about 30 km northwest and downstream of Kigali. The dam would have a capacity of 363 million m^3. A 20 MW hydropower station would generate about 133.8 GWH/a, utilizing 1986 million m^3/year (91.27%). The dam would also supply 60.1 million m^3/annum water for agricultural use and supply 19 million m^3 to augment the water supply to Kigali. This water would have to be pumped back upstream.

According to the 2012 CNEEC feasibility study the total investment is estimated at US$ 170 million, the total construction period is four years and the financial internal rate of return was 11.4 %.

According to the 2008 Korean feasibility study the dam would have significant social impacts, inundating 1500 ha of cultivated lands, 6000 houses, 61 km of roads, and 4 bridges.

If the scheme were to proceed then further studies of the social and environmental impacts would be required. The feasibility study should be updated to include a review of the river flows, detailed geotechnical investigations, and a further review of the impacts and benefits.

1. SOURCES OF INFORMATION

The most recent source of information is the China National Electric Engineering Co. Ltd Feasibility Study of Water Resources Development in Nyabarongo River of July 2012 (CNEEC, 2012). A similar study was done by the Korea Water Resources Corporation's Feasibility Study of 2008 for MINIERA Rwanda. The SWECO Management and Development Strategy Study of May 2010 recommended this project for further technical and financial viability studies. There is another hydropower scheme currently under construction on the Mwogo River, a tributary of the Nyabarongo River, with information sourced via Wikipedia:

- China National Electric Engineering Co. Ltd (CNEEC), July 2, 2012, Feasibility Study of Water Resources Development in Nyabarongo River in Rwanda (Nyabarongo II Project)
- Korea Water Resources Corporation, September 2008: Feasibility Study of Water Resources Development in Nyabarongo River in Rwanda, Rwanda MINIERA (Ministry of Natural Resources), Korean International Cooperation Agency.
- SWECO, May 2010: Development of Kagera Integrated River Basin Management and Development Strategy: NBI, NELSAP, Kagera Transboundary Integrated Water Resources Management and Development Project.
- Wikipedia, 2012: Nyabarongo Hydropower Station under construction …

2. PROJECT DESCRIPTION / STATUS

The 2012 Feasibility Study by CNEEC of the Nyabarongo Dam project investigated a multipurpose dam to develop 20 MW of hydropower, to supply water for irrigation, and to augment the supply to the City of Kigali. Cost estimates were determined for the dam and hydropower scheme but not for the power lines, pipelines and water treatment works, whereas separate cost estimates were prepared to optimise the layout of the irrigation scheme. .

The 2012 CNEEC study compares results with a 2008 Korean study which proposed a 17 MW hydropower capacity.

Nyabarango Dam was one of the hydropower projects selected by the 2010 SWECO study for further studies to prove its technical and financial viability.

Another dam, with a 27.5 MW hydropower station, and confusingly known as the Nyabarango Hydropower Project, is currently (2012) being constructed for the Rwandan Government on the River Mwogo, a tributary joining the Nyabarongo River about 70 km downstream of Kigali. This scheme has an anticipated commissioning date in 2014. The coordinates positioning this power station are: 2° 15' 36.00"S, 29° 36' 0.00"E. The estimated cost is US$110 million. This scheme, will feed into Rwanda's national power grid.

The positions of these two dams, relative to each other and to Kigali, are shown in **Figure 1**:

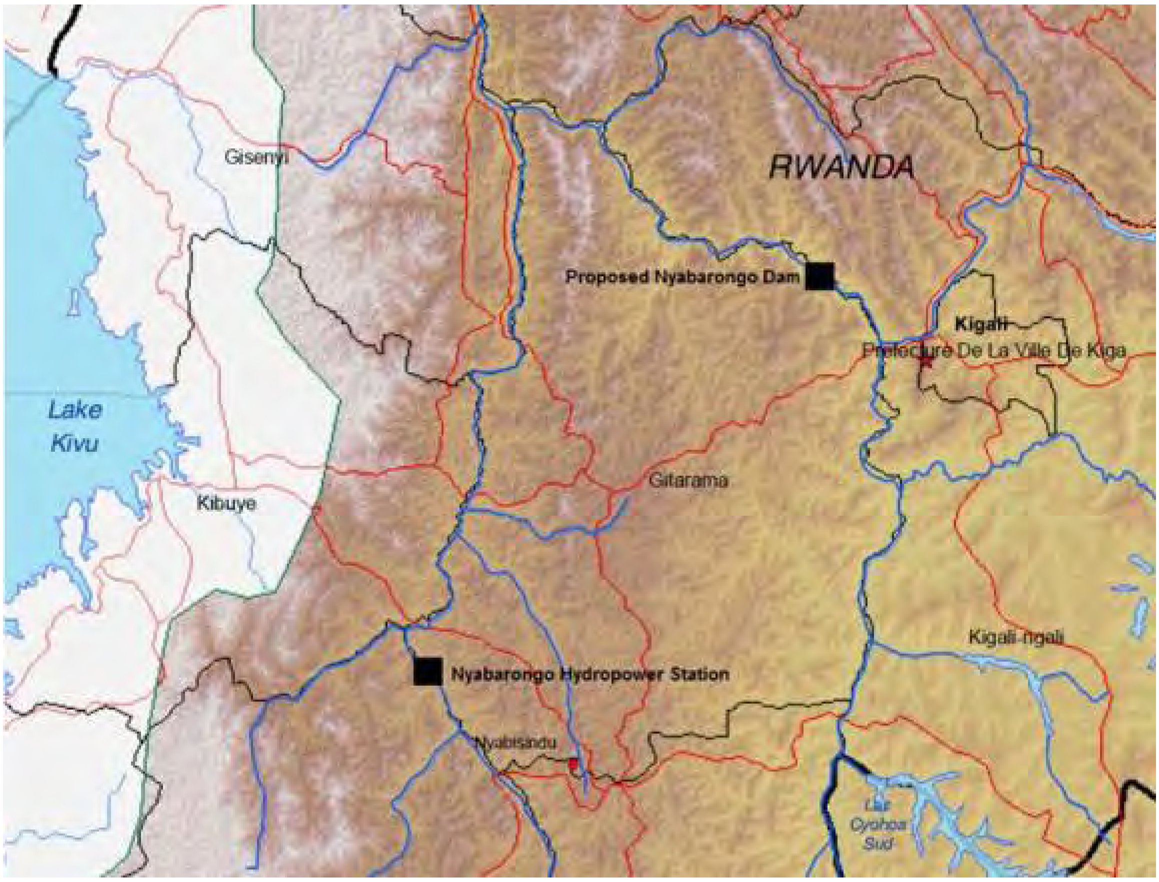

Figure 1: Positions of proposed new Nyabarango Dam and of Nyabarango Hydropower Project currently under construction on the Mwogo River

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

According to the CNEEC study the proposed Nyabarongo Dam was sized to meet Government's interest in power generation and water supply. The main purposes identified were hydropower generation, municipal supply to Kigali, & the provision of agricultural irrigation water.

The purpose of the 2008 feasibility study was to select the most suitable of three sites for a dam on the Nyabarongo River and to undertake a feasibility study of the selected scheme to supply water for irrigation, for urban use in Kigali, and for hydropower generation. The Development Strategy prepared by SWECO in 2010 utilised information from the Korean Water Resources Corporation's study.

4. RATIONALE AND CONTEXT FOR PROJECT

Even though Rwanda has enough water resources to meet its needs, only 54% of the Rwandan population is connected to a drinking water system. The objective of the Government is to achieve 100% connection by 2020. Although there are sufficient raw water sources, supplies to Kigali are inadequate and only half of the needs for the City are currently provided. The water deficit in Kigali is estimated at approximately 30 000m^3/day at present, growing to 50 000m^3/day in 2020.

Agriculture in Rwanda represents approximately 40% of GDP and involves >80% of the country's population, yet national food security is tenuous, with production unable to feed the population entirely. This puts Rwanda at risk to rainfall variability and climate change. Erosion has also resulted in soils of declining productivity.

Electricity is supplied to only 6% of the population. Power shortages hinder national human and industrial development.

Water supply and power from the multi-purpose Nyabarongo Dam would meet some of these requirements.

5. PREPAREDNESS FOR IMPLEMENTATION

Two feasibility studies have been undertaken for very similar projects close to each other on the Nyabarongo River.

The 2012 CNEEC feasibility study still has visible gaps in information and these will have to be filled in.

In November 2012 the Energy Water and Sanitation Authority of Rwanda called for proposals for consulting services for a feasibility study of the multipurpose NYABARONGO II development project.

6. LOCATION

The CNEEC study after considering river tendencies, hydrology, meteorology, topography, geological conditions, the size of the project, benefits and inundation, has recommended Gitaba in the Kigali Province as the dam site for this project. The geographical co-ordinates for this dam site are: 1°S51´42.80", 29°E53´35.61".

The Korean Water Resources Corporation's study had recommended a nearby site at 1°51'33"S and 29°53'29"E.

7. REPLICABILITY

The Nyabarango Dam, which would also produce hydropower, would follow on and add to the Nyabarongo (Mwogo) 27.5 MW hydropower scheme currently under construction on the Mwogo River, a tributary of the Nyabarango River, and due for completion in 2014. Design and operational aspects of this second dam could in all probability be replicated from the dam on the Mwogo River, and common elements used in similar schemes across the Region.

8. BENEFIT SHARING

There may be opportunity for the hydropower to be exported to other basin countries if a regional electricity transmission network is developed.

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

The CNEEC feasibility study proposes the following dam:

- Catchment area: 5,750 km^2
- MAR: 69 m^3/s

- Construction: Concrete face rock-fill dam (due to a lack of fly ash and considering the practical situation of local supply of cement in Rwanda). This is also cheaper than a concrete gravity dam.
- Maximum dam height 48 m
- Crest elevation: 1411 masl
- Crest length: 210 m
- Storage Capacity: 363.4 million m³.
- Effective Storage capacity of 221.1 million m³
- Total installed power generation capacity: 20 MW (two 10 MW Kaplan Generators/
- Annual generation: 133.8 GWh

The 2008 Korean feasibility study proposed a 48 m high concrete gravity dam with a crest length of 228 m, storage capacity of 363 million m³ of storage planned for anticipated siltation, A 17 MW hydropower station comprising two 8.5 MW turbines and generating 135.6 GWh/annum. 16 GWh/annum of this would be used to pump the water to 2160 ha of the 8150 ha to be irrigated. (Note that the CNEEC study only found 2612 ha of irrigable land).

10. BENEFITS

The 2008 study indicated that a 17 MW hydropower installation could generate 136 GWh/a, which would be sold. About 16 GWh/a of this would be used for pumping of water for irrigation. Unit hydropower investment would be ~1.5 mill USD / GWh.

According to the CNEEC study, if installed capacity is 20 MW, annual generation reaches 133.8 GWh; the total investment is $170 million, or $200.22 million USD if including irrigation investment.

The CNEEC study determined that the multipurpose dam could supply water as follows:

- Power Generation: 20 MW, 133 GWh/a
- Municipal water (water supply to Kigali): 18.0 mill m³/year (~300 000 people at 150 l/c/d or 1.6 million at 30 l/c/d)
- Agricultural water: 60.1 mill m³/year (2612 ha)
- River maintenance flow: 45.0 m³/s (1,419.1 million m³/year)

11. IMPACTS

Environmental

- During operation: Deterioration of water quality is expected if fertilizers or agricultural chemicals are used recklessly and/or excessively. The eutrophication by excessive inflows such as nitrogen and phosphorus leads to excessive algae.
- The change of underwater ecosystem according to the environmental changes of the river.
- The impoundment would have a moderate impact on the flow regime in the Nyabarongo River below the dam.
- A significant reach of river would be inundated by the reservoir. Approximately 1500 ha of land in the reservoir basin are currently under cultivation, and this would be lost.

The 2008 study indicated the reservoir would have significant impacts due to inundation (as indicated below).

Socio-economic

- 6000 houses
- 60.6 km of gravel roads (44.1 km national and 16.5 km community)
- 4 road bridges (2 national and 2 community)
- 1000 ha of rice
- 400 ha bananas

- 50 ha sugarcane
- Coffee plantations

The CNEEC study also estimates the inundation of about 6 000 homesteads if a dam is filled to 1408.5 masl. This would result in very high relocation costs and have severe social repercussions. The net area of arable land is also only in the order of 1000 ha due to losses resulting from inundation.

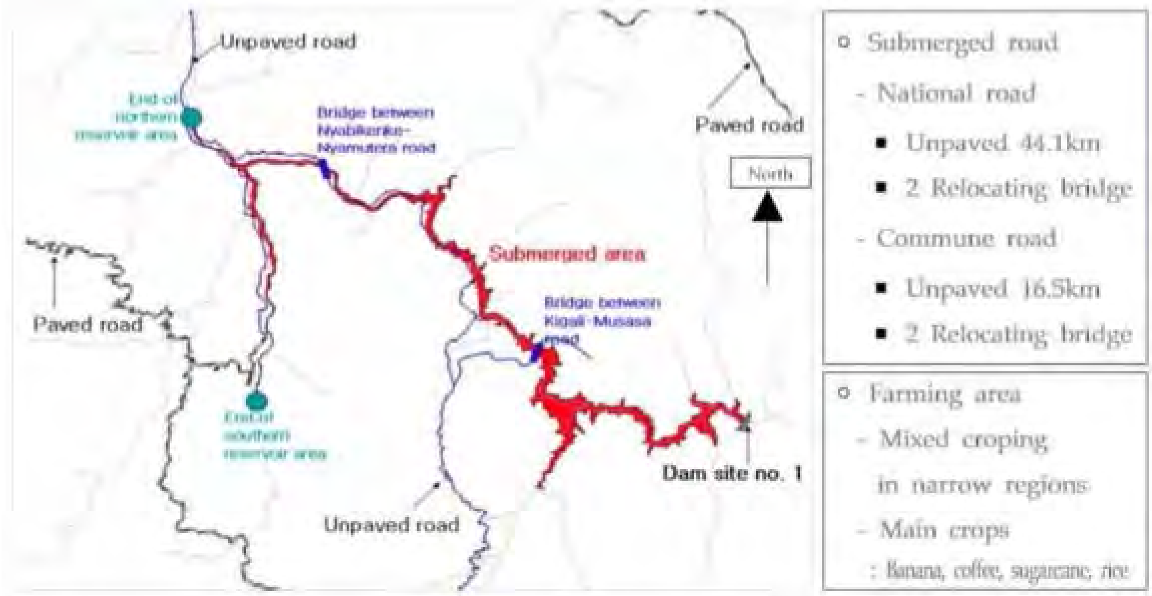

Figure 2: Submerged Road & Farming Area for the recommended dam site (CNEEC 2012)

12. SUSTAINABILITY

The Nyabarongo River carries a high silt load and siltation of about 79 million m^3 would take place over 25 years. Total storage of 363 million m^3 would be provided with effective storage of 221 million m^3 and dead storage of 142 million m^3 providing a fully effective reservoir life of about 45 years.

13. RISKS

- The significant social impacts of relocation are a major concern.
- Reservoir sedimentation may present a significant limit on the long-term effectiveness of the dam.

14. DURATION AND FUNDING

According to the 2012 CNEEC feasibility study the total investment is US$ 170 million for dam and hydropower infrastructure and a further $30 million for irrigation infrastructure. The total construction period was estimated at four years, and the financial internal rate of return at 11.4%.

Total costs were estimated in the 2008 Korean feasibility study to be US$ 149 million, including capital, resettlement and environmental mitigation costs. The estimated construction period would be about 3 years. (The CNEEC study estimated a build time of 4 years).

Design for the Nyabarongo multi-purpose dam would be finished in 2 years from year 1. Construction will take 5 years, starting from year 3.

15. ADDITIONAL INFORMATION REQUIRED

Social and environmental impact assessment

Further technical studies (hydrology, geotechnical)

16. RECOMMENDATION

There is sufficient water and this dam could potentially be implemented.

Risks to the project that must first be resolved include:

- The political and financial implications of having to relocate 6 000 households
- The irrigation water requirement, and net area that could potentially be put under irrigation
- Alternative sources of water for Kigali that could render Nyabarongo unnecessary
- Finalised costs.

8. RUVYIRONZA DAM AND HYDROPOWER (Ruvyironza River) - BURUNDI

The Ruvyironza Dam is a large dam proposed for the Kagera Region as part of the NELSAP supported Kagera River Basin Management Project. The dam site is on the Ruvyironza River in southern Burundi.

The current proposal is for a 59 m high composite earth fill dam with an estimated reservoir storage capacity of 373 million m^3. The primary purposes of the project are to generate hydropower, and to provide local communities with water for domestic use and irrigation.

This dam project was ranked 2nd out of nine identified large dam developments in the Kagera basin.

1. SOURCES OF INFORMATION

Preliminary technical information and initial screening of social and environmental impacts for the proposed Ruvyironza Dam are presented in a draft report entitled Detailed Identification Studies for the Potential Large Dams in the Kagera Basin prepared by Eng. Dr. Henry K Ntale and submitted to NELSAP in October 2012. The information presented here has been extracted from this report.

2. PROJECT DESCRIPTION / STATUS

The Ruvyironza project would focus on the construction of a large dam, primarily for hydropower generation. The current proposal is for a 59 m high composite earth fill dam with an estimated reservoir storage capacity of 373 million m^3 and an installed power generation capacity of 27.5 MW.

An Initial Environmental and Social Evaluation (IESE) and technical investigation of nine dams in the Kagera basin including the Ruvyironza Dam was prepared by Eng. Dr. Henry K Ntale as part of the report on potential large dams in the Kagera Basin (October 2012). This study provided updated technical information for the project, quantified the potential demands, identified potential social and environmental impacts, and developed initial cost estimates for the proposed dam construction.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The primary purpose for the project would be the generation of hydropower with water also provided for domestic consumption and irrigation downstream of the dam.

4. RATIONALE AND CONTEXT FOR PROJECT

The Ruvyironza Dam project is one of eight potential dam sites identified in earlier rapid identification studies for further investigation and appraisal through NELSAP.

5. PREPAREDNESS FOR IMPLEMENTATION

An Initial Environmental and Social Evaluation (IESE) and scoping level technical evaluation and provisional cost estimate has been completed. A detailed Environmental and Social Impact Assessment (ESIA), awareness campaigns, and a full feasibility study are required. Potential funding sources must also still be identified.

6. LOCATION

The Ruvyironza site is located in central Burundi on River Ruvyironza about 15 km north of the town of Gitega and about 9 km upstream from the Ruvyironza-Ruvubu confluence (Figure 1). The coordinates of the proposed dam site are -3° 19' 38.22" (South) and 29° 55' 52.5" (East.) The final positioning of the dam is not certain on account of the lack of agreement between two local affected communities concerning possible sites.

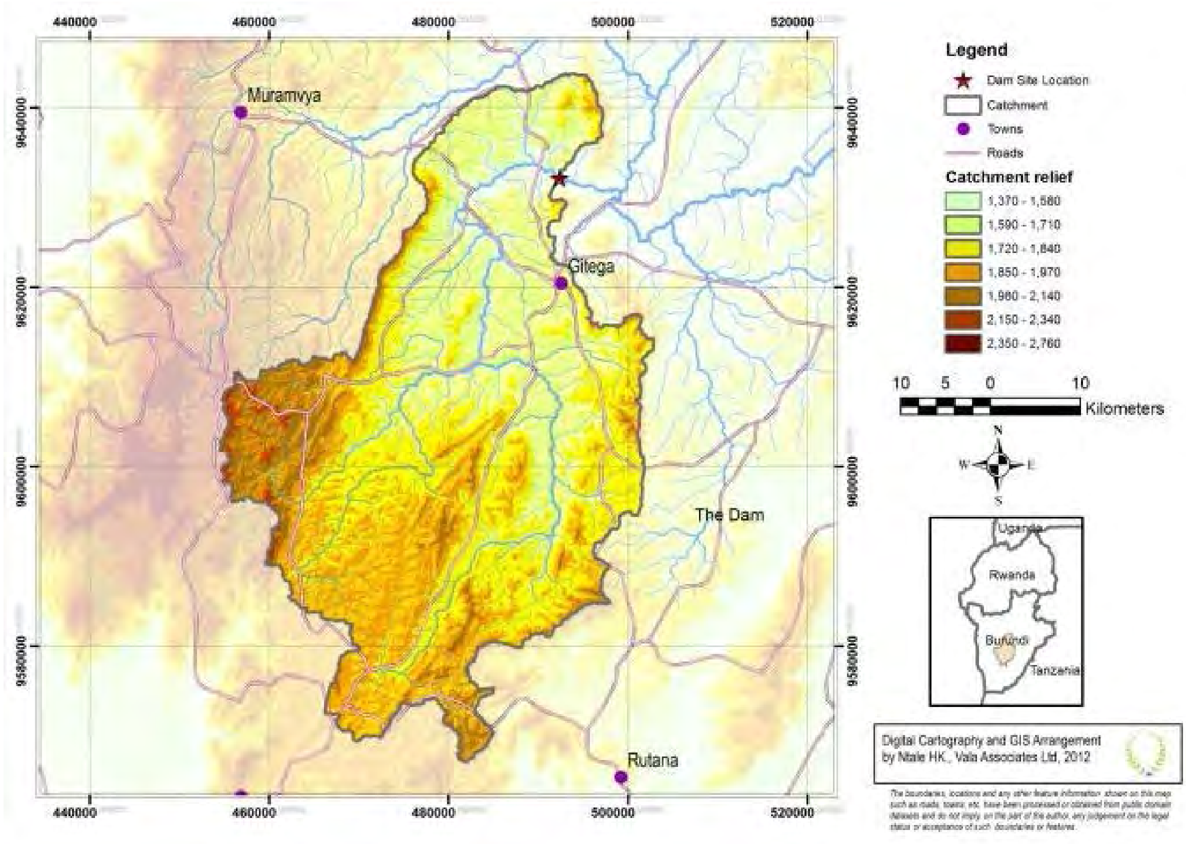

Figure 1: Proposed location and catchment area for the Ruvyironza Dam in Burundi

7. REPLICABILITY

The proposed scheme would be unique however there may be a number of aspects that are likely to be similar for the nine large dams that are being investigated and could probably be replicated at other dams.

8. BENEFIT SHARING

The project would only benefit Burundi.

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

Using a 30m digital elevation model (DEM) of the area, reservoir elevation-area and elevation-volume curves were prepared. The resulting curve shows that the inundation area would increase sharply with elevation up to an elevation of 1529 m masl. After this, the curve rises gently meaning that small increases in elevation result in large increases in the inundated area. Setting the required reservoir volume was based on the required storage to offset the deficit between inflow and outflow during the driest months, among other considerations. During the 3 or 4 drier months river flows can drop to 20-

30% of the mean flow. A total of two months storage was set as the minimum that should be met by the Ruvyironza reservoir. Taking dead storage into consideration, a reservoir elevation of 1528 masl would be sufficient to meet this requirement at the proposed dam site.

The proposed design is for a composite earth filled dam with the following characteristics:

- Catchment area: 2000 km^2
- Mean annual runoff: 788 million m^3/annum
- Wall Height : 58.9 m
- Crest length: 626 m
- Storage Capacity: 372.6 million m^3
- Surface area: 15 km^2
- Hydropower Capacity (Site 2): 27.5 MW

Two possible locations of the power stations were considered:

- Site 1: this would be located at the dam site for which the maximum available head is 57 m
- Site 2: this would be located 4 km downstream of the dam site just before the intake to the currently existing power dam located just before the Ruvyironza joins the River Ruvubu. The maximum available head at this site is 100 m.

While Site 2 clearly has the greater hydropower potential, the relative merits and demerits of the two proposed power station options should be explored during the feasibility study for the project.

10. BENEFITS

The primary purpose of the project would be the generation of hydropower for users at local and district level however to make full use of the power available the scheme should at least supply the national grid of Burundi.

The project would also provide water for irrigation and domestic water supplies.

The recommended hydropower installation capacity for the Ruvyironza Dam is 27.5 MW with the hydropower station located at Site 2, approximately 4 km downstream of the dam. The power plant has the potential to produce 241 GWh of energy per year which is enough to supply about 268,000 houses and over 1.6 million people.

The estimated total populations that could benefit from domestic water supply from the Ruvyironza project in 2012 and 2062 were estimated at 264,531 and 1,002,303 people respectively. The annual associated water demands would be 3 Mm^3/annum and 11 Mm^3/annum for 2012 and 2062, respectively.

The Ruvyironza site is not very suitable for irrigation immediately downstream of the dam. The downstream valley is generally narrow with relatively steep slopes. However, the released waters could be used to irrigate approximately 15,000 ha located further downstream of the confluence with River Ruvubu. The command area would be located downstream of the tailrace of the proposed power house and could support approximately 30,000 farmers and provide food for about 150,000 people. The annual water demand for irrigation would be about 74 Mm^3/annum.

11. IMPACTS

The IESE identified only a few potential impacts particular to this project other than those normally associated with a project of this scale. A full ESIA would be required as part of a complete feasibility study.

Environmental

- Even with a relatively large structure such as this the overall impact on downstream flow in the Kagera River and on inflows into Lake Victoria would be negligible.
- Impacts on environmental flow requirements of the Ruvyironza River would have to be assessed and operating rules would have to be developed to mitigate potential environmental impacts.
- There are no identified protected areas in the vicinity of the site.
- The impact on biodiversity is likely to be minimal.

Socio-economic

- No areas of cultural significance that would need to be preserved have been identified
- Some local farmlands will be flooded and may require the resettlement of people. The reservoir would inundate approximately 15 km^2 and could potentially require the resettlement of 8,500 people.
- A section of the Gitega - Ngozi highway would be flooded by the reservoir and that section of the road would have to be relocated around the new lake.
- The dam would impact on the existing small power generation plant downstream that supplies energy to the Mission at Mugera and its institutions.

12. SUSTAINABILITY

The Ruvyironza Dam project was ranked 2nd out of the nine potential large dams in the Kagera basin evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria during the IESE.

13. RISKS

No risks were identified.

14. DURATION AND FUNDING

The estimated cost for the construction of the proposed Ruvyironza Dam and associated power station given in the IESE is US $ 132 million (2012).

This amount excludes operational costs and the costs for the construction and operation of the required infrastructure for the irrigation and rural water supply distribution systems.

The further studies, design and construction of a dam of this size could take as long as 9 or 10 years. At this stage of study, the duration and source of funding for this project have not been investigated.

15. ADDITIONAL INFORMATION REQUIRED

Draft terms of reference (TOR) have been prepared for feasibility studies and the ESIA for the nine large dam projects identified in the Kagera Basin.

16. RECOMMENDATIONS

Project should progress to feasibility study if pre-feasibility study is favourable.

8. KIKAGATI Run of River HYDROPOWER PROJECT – UGANDA

The Kikagati run of river Hydropower project is located on the Kagera River in Uganda close to the Tanzanian border. It was originally constructed in the 1940's, but was bombed during civil war. Total installed capacity will be 16 MW, mean annual production is estimated to be about 115 GWh.

1. SOURCES OF INFORMATION

- Email correspondence from Inge Stølen. *SV: Kagera BDP: Draft Strategic Planning Report - version for e-mailing* (10/16/2012)
- Wikipedia (2012*), Kikagati Power Station.* [Online]. Available from: http://en.wikipedia.org/wiki/Kikagati_Power_Station. (10/22/2012)

2. PROJECT DESCRIPTION / STATUS

During the 1940's a 4 MW run of the river hydroelectric plant was built on the Kagera River at Kikagati in south west Uganda on the border between Uganda and Tanzania. However, the 4 MW hydroelectric plant ceased operation in the 1970's and was subsequently stripped of all usable equipment and materials.

In 2008 the Norwegian Investment Fund for Developing Countries (Norfund) and TrønderEnergi AS expressed an interest in the proposed new 10 MW Kikagati Hydroelectric Project and undertook several reviews to take advantage of the full potential for development of the scheme. The review of the potential of the site resulted in a decision to proceed with a 16MW hydropower station.

Kikagati Hydropower Project area is located in Kikagati Sub-county, Isingiro District, Southwestern Uganda (Map Reference: 1: 50,000 – scale topographic sheet 86/3 (Chezho Valley), series Y732).

The project area is reached via the Kampala - Masaka - Mbarara Highway, a distance of approximately 267 km to Mbarara from Kampala. The old Kabale road (193 km long and still murram surfaced) via Isingiro town passes Kikagati after a distance of approximately 77 km from Mbarara.

The proposed 'low head' 'run of the river' Hydroelectric Project will be constructed on the site of the earlier 2 x 8 MW hydroelectric power plant. The proposed new plant will comprise:

- A river weir approximately 170 m total length and of maximum height 11.5 m incorporating a gated spillway and flushing sluice,
- Intake structure with hydro-mechanical equipment and power canal,
- Fine trash racks and gates at intake for turbine generator units,
- Powerhouse,
- Two 8MW bulb turbine generator units and associated auxiliary plant, and
- Two main transformers, switchyard and connection to the two REA 33 kV transmission lines.

3. OBJECTIVES (purpose of the development)

The main objective of this project is the provision of hydropower.

4. PROJECT RATIONALE AND CONTEXT

The Kikagati Power Company is considering a number of hydro power projects in Uganda to fulfil its goal of implementing 100 MW of small scale hydro power projects to contribute to the increasing power demand in the country. The Kikagati hydropower project represents a good project with minimal environmental and social impact.

5. PREPAREDNESS FOR IMPLEMENTATION

Feasibility study was completed by a previous developer. Tender documentation has been developed and the tender process has been completed.

6. LOCATION

Kikagati Hydropower Project station is located on the [Kagera River](), along Uganda's International border with the Republic of Tanzania. (Wikipedia) The Project area is located in Kikagati Sub-county, Isingiro District, Southwestern Uganda (Map Reference: 1: 50, 000 – scale topographic sheet 86/3 (Chezho Valley), series Y732) (Inge Stølen).

The approximate coordinates of the power station are: 1° 01' 48"S, 30° 40' 48.00"E. (Wikipedia)

Figure 1: Locality of Kikagati Hydropower project

7. REPLICABILITY

The Kikagati Power Company intends to implement a similar project 13 km downstream on the Kagera River, the Nsongyezi hydropower project.

8. BENEFIT SHARING

The project will bring economic development to the local communities through employment opportunities for locals and business opportunities for local businesses. There is also a plan to provide power to the Murongo village on the Tanzanian side of the river.

9. TECHNICAL DESCRIPTION

The proposed new 'low head' 'run of the river' Hydroelectric Project will consist of 2 x 8MW hydroelectric power plant. The proposed new plant will comprise:

- A river weir of approximately 170 m total length and with a maximum height of 11.5 m, incorporating a gated spillway and flushing sluice
- Intake structure with hydro-mechanical equipment and power canal
- Fine trash racks and gates at intake for turbine generator units
- Powerhouse
- Two 8 MW bulb turbine generator units and associated auxiliary plant, and two main transformers, switchyard and connection to the two REA 33 kV transmission lines.
- Total installed capacity will be 16 MW, mean annual production is estimated to be about 115 GWh/annum.

10. BENEFITS

The Purpose of this project would be to provide hydropower. The PPA is with UETCL in Uganda, but there is a Power Sales and Sharing Agreement negotiated between UETCL and Tanesco, securing a 50% sharing of the joint resource. There is also the benefit of bringing electricity to the Murongo village and a more stable power supply for the local community on the Ugandan side.

11. **IMPACTS** (environmental, socio-economic)

Environmental

- Very limited environmental impact, as the water would be diverted into a short canal (150 meters) and released into the river immediately downstream.

Socio-economic

- Little impact to local community, but some lands and crops on the river banks would be inundated for which compensation would have to be paid and new lands substituted.

12. **SUSTAINABILITY** (Financial, Technical, Social, Environmental)

Financial

The project would be financially sustainable if the Ugandan Feed-In-Tariff is increased to a normal level or if the suggested GET-FiT subsidy program comes into place.

Social

There would be limited negative impacts on local community due to inundation. There would also be the usual noise and dust issues during construction, but a plan is in place to minimize this.

13. RISKS

There is a risk of failure to achieve a commitment and agreement from the authorities in Uganda and Tanzania. Cross border processes for such projects are not standardized, and differences in national legislation in the two countries could delay and possibly even stop the project. There has been very limited communication between national authorities and this poses a risk to the project. Also, the payment situation is critical. During the previous year payment difficulties were experienced with the authorities in Uganda. This has made financing of power projects in Uganda more problematic. This is considered the highest risk for such projects in East Africa.

14. DURATION AND FUNDING

Duration

Construction time is estimated to be 30 months and assuming that the procurement of funding will take 12 months and the design 18 months, then the scheme could commence operation in about 5 years.

Funding

Funding is confidential and has not been finalised. However based on very approximate costs it is estimated that the scheme would cost about US$60 million not including compensation for inundation.

15. ADDITIONAL INFORMATION REQUIRED

Additional information on the proposals for the long term operation and maintenance of the project and the recovery of income would be useful for consideration of other projects.

16. RECOMMENDATIONS

The project should be implemented.

10. MAZIBA GORGE POWER STATION (SHPP MAZIBA) (Nyakizumba River, tributary of the Muvumba River) – UGANDA

The Maziba Gorge Power Station was commissioned in 1963 with an original installed capacity of 500 kW. In 1994 the installed capacity of the Small Hydropower Plant (SHPP) was upgraded to 1 MW.

The SHPP Maziba power plant had to shut down, and has been out of operation since 2001. Problems in operation included sedimentation, unattended repairs, deficient maintenance, various failures in the electro-mechanical equipment, and more.

Recently, the ownership of the power station was transferred to the Uganda Electricity Distribution Company Ltd (UEDCL) and currently it is among the assets under concession to UMEME Distribution Company for a period of 20 years.

The purpose of this project is to upgrade the existing 1 MW non-operational plant to an operational 1.18 MW hydropower station to provide electricity as a back-up for Kabale town and to the national energy grid.

1. SOURCES OF INFORMATION

The latest source of information is the Lahmeyer International GmbH, March 2010, Lot 1: SHPP Maziba Upgrade-Modernization-Rehabilitation Feasibility Study, Final Report.

2. PROJECT DESCRIPTION / STATUS

Maziba Gorge Power Station – Small Hydro Power Plant or Maziba SHPP - was commissioned in 1963 with an original installed capacity of 500 kW (2 x 250 kW Francis turbines). In 1994 the installed capacity of the SHPP was upgraded to 1 MW with the provision of an additional 1 x 500 kW Francis turbine.

Since 2001 SHPP Maziba has been out of operation. The power plant had to shut down mainly as a consequence of silt accumulation in the water conduits. Other difficulties preceding this included, inter alia, sedimentation of the reservoir, unattended repairs, deficient maintenance, and various failures of the electro-mechanical equipment.

3. OBJECTIVES

The purpose of this project is to upgrade the existing 1 MW non-operational plant to an operational 1.18MW hydropower station to provide electricity as a back-up for Kabale town and to the national energy grid.

4. PROJECT RATIONALE AND CONTEXT

Initially the purpose of the Maziba SHPP was to supply power to Kabale town and surroundings, which were not connected to the national energy grid. After the construction of a 33 kV line from Kasese to Kabale, the power station became a standby facility to provide power during outages, load shedding, system maintenance and faults.

Recently, the ownership of the power station was transferred to the Uganda Electricity Distribution Company Ltd (UEDCL) and currently it is among the assets under concession to the UMEME Distribution Company for a period of 20 years.

Within the Programme *Efficient and Sustainable Energy Supply*, the Ministry of Energy and Mineral Development (MEMD), supported by the German Kreditanstalt fuer Wiederaufbau (KfW - a bank for Reconstruction and Development) - is undertaking improvements to re-activate the hydropower station. The feasibility study for the rehabilitation, modernization and upgrading commenced in 2008 and was completed in March 2010.

5. PREPAREDNESS FOR IMPLEMENTATION

This Project has had a full Feasibility Study. As it is a rehabilitation and modernisation programme there are few if any social and environmental issues of concern (the consultants have proposed only improvements on the current situation) and the project can be considered implementation ready. Implementation time was estimated in the feasibility study to be 22 months after appointment of a contractor.

6. LOCATION

The Maziba SHPP is located along the Nyakizumba River, a tributary of the Muvumba River, in the Kabale District, south western Uganda, approximately 7 km from the border of Rwanda. Maziba SHPP is 20 km southeast of Kabale town and 430 km southwest of Kampala. The site can be accessed from Kabale via the Mbarara highway through a 12 km gravel road starting at 6km East from Kabale town.

Project coordinates: 1.309789761°S, 30.0988326°E or 30°5'55.78"E, 1°18'35.24"S

Figure 1: Locality of the Maziba hydropower project

7. REPLICABILITY

Site specific

8. BENEFIT SHARING

Electricity supply by the Maziba SHPP would be back-up plant for Kabale and for energy supply to the national grid.

9. TECHNICAL DESCRIPTION

The following table shows the existing technical status:

Installed capacity	**2 x 250 kW Francis horizontal axis** **1 x 500 kW Francis horizontal axis**
Obtained max. capacity:	**850 kW** (according to generating records)
Net head:	**41 m** (estimated)
MAP:	**980mm**
Catchment size:	**776 km^2**
Average flow	**4.5 m^3/s**
Design discharge (current):	**2.6 m^3/s** (based on generation records / calculations)
Dam	**Gravity dam, 2 spillways, width 44 m, height 5.5 m**
Canal Shape:	**Rectangular, length 640 m, 2 overflows**
Forebay	**Concrete tank, trash racks, 2 sliding gates**
Penstocks	**1 steel penstock diam. 0.7 m, 1 steel penstock diam. 0.8 m**
Powerhouse	**Stonework, metal sheet roof, 3 aggregates installed**
Generation: MWh / year	**no systemized data available**

According to the Lahmeyer International GmbH study, three alternatives were evaluated:

- Alternative 1: Maximizing installed capacity **(1.66 MW)**
- Alternative 2: Minimizing rehabilitation costs **(0.85 MW)**
- Alternative 3: Optimizing rehabilitation of available structures and costs **(1.18 MW)**

Given that all three alternatives were technically feasible, the selection of the most appropriate option for r ehabilitation was m ade on t he b asis of t he ec onomic anal ysis. T he C onsultant s elected t he rehabilitation planning required for Alternative 3, with a design flow of Qd = 3.6 m^3/s and an installed capacity of 1.18 MW.

The new upgrade plant would operate on a run-of-river basis, with partial use of the limited remaining storage capacity of the reservoir. According to the Lahmeyer feasibility study the dam has lost almost all of i ts c apacity d ue t o siltation (from 86 500 m^3 to 11 00 0m^3). S top-logs will be p laced in bo th spillways to provide an estimated storage capacity in the reservoir of 11 000m^3.

The following table shows some of the proposed technical data:

Net Head	**39.26m**
Design Flow	**$3.6m^3/s$**
Turbine minimum flow requirement	**$0.61\ m^3/sec$**
Installed Capacity	**1.18MW**
Average Energy Production	**6.751 GWh/annum**
Expected operational time	**98%**
Sediment basin	**To be constructed**
Fish pass	**To be constructed**

10. BENEFITS

The Maziba SHPP project would supply electricity to Uganda's national grid.

11. IMPACTS

Environmental

There would be no additional environmental disruption and the proposed addition of a fish ladder would improve the situation (fish biology). Allowance would also be made for a minimum ecological flow rate of $0.17m^3/s$. which is a definite improvement on the previous operating rule which made no such allowance. There would be relatively small impacts on the natural river flows unless the limited storage is used to enable peak power generation.

Socio-economic

Sedimentation has led to the existing reservoir being almost entirely filled with sediment and as this land is used by local farmers it has been proposed that the silt should not be removed and that the Maziba SHPP should be operated as a Run of River scheme.

12. SUSTAINABILITY

If the SHPP is operated as planned it should prove financially sustainable through sales of power to the national grid. A portion of generated funds should be ring-fenced for Operation and Maintenance.

The original Maziba SHPP proved unsustainable due to sedimentation and lack of maintenance. The proposal for the rehabilitated scheme includes a 12-year maintenance plan, which is sensible under the circumstances.

Technical sustainability will depend on maintenance and on regular removal of sediment close to the intake.

13. RISKS

The existing Maziba SHPP was closed down as a result of siltation and mismanagement. The rehabilitated scheme would remain at risk unless these capacity and management problems are resolved.

14. DURATION AND FUNDING

The estimated capital costs of civil works and generating equipment (2010) were €1,147,151 and €807,127 Euro respectively.

Lahmeyer International GmbH predicted that the Maziba SHPP would take 22 months to implement after appointment of the contractor.

15. ADDITIONAL INFORMATION REQUIRED

This project would require the following:

- Studies by a biologist of fish migration to plan the proposed fish pass.
- Contractual arrangements for the sale of power to the national grid.
- An environmental and social management plan
- Design and construction

16. RECOMMENDATIONS

The operation of the project should be monitored to learn from this example of a small hydropower scheme.

11. RURAMBA SMALL HYDROPOWER PLANT (Mwogo River) - RWANDA

The Ruramba small hydropower plant (SHPP) on the Mwogo River is one of 12 potential small hydropower developments identified by Digitech consultants of Kigali. The site is located in the Southern Province of Rwanda, Nyaruguru District, Ruramba Sector. The objective of the proposed plant is to provide hydropower to local communities. A 35m high dam wall with a headrace canal of 1060m is planned to create a head of 115.76m. Estimated size of power instalment is 3.42MW. Estimated capital cost for the Ruramba small hydropower plant is USD $13,440,000.

Feasibility and design for the Ruramba hydropower plant is on-going and will be completed by June 2013, construction to start directly. Duration of construction will be 3 years.

1. SOURCES OF INFORMATION

The following is the only source of information:

- Digitech, July 2012. Pre-Feasibility Study for Ruramba Small Hydropower Plant, Final Report.

2. PROJECT DESCRIPTION / STATUS

Digitech Solutions Ltd has identified 12 sites potential for the development of small hydropower plants in Rwanda. The Ruramba small hydropower plant is one of these 12 identified projects.

A pre-feasibility study has been undertaken.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The objective of the Ruramba Hydropower plant is to provide hydropower, with distribution through the national grid, although immediate beneficiaries are identified as to local communities.

4. RATIONALE AND CONTEXT FOR PROJECT

It is expected that rural power supply will make an important contribution to the achievement of the Millennium Development Goals (MDGs) in Rwanda, with sustainable access to modern energy services fostering economic and social development and bringing improvements in the quality of life.

The Ruramba small hydropower plant would contribute 3.42MW towards a target of 90MW that Digitech Solutions Ltd has planned through its proposed hydropower development programme by 2017.

5. PREPAREDNESS FOR IMPLEMENTATION

The pre-feasibility study has selected a favoured option (with a dam of capacity equivalent to the MAR) rather than a run-of-river scheme. This project is now at detailed feasibility stage. Study would be finished May 2013.

6. LOCATION

The Ruramba Small Hydropower Plant is located in the Southern Province of Rwanda, Nyaruguru District Ruramba sector. The site is on the Mwogo River. The power plant coordinates are: 29°31'24.49"E, 2°32'7.79"S

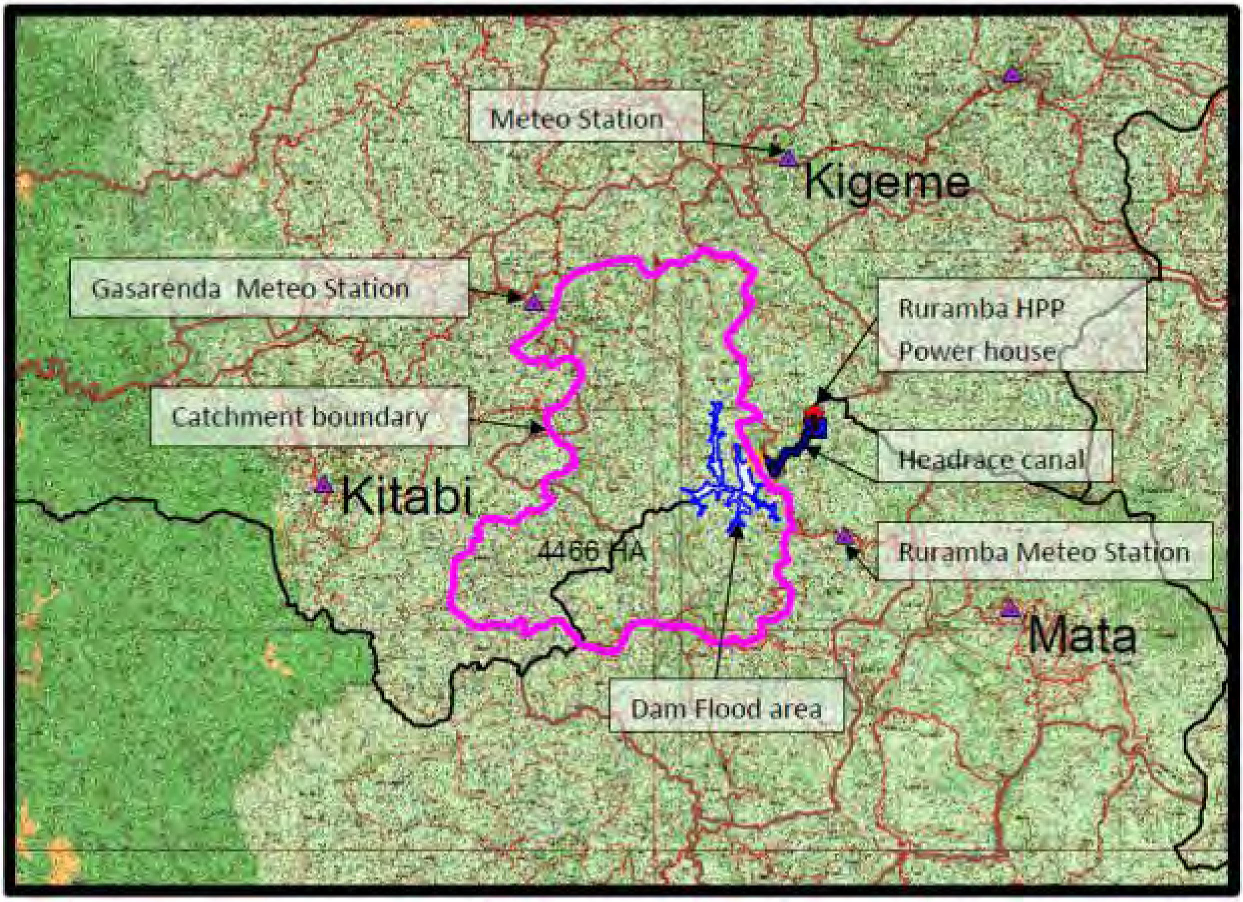

Figure 1: Locality of the Ruramba small hydropower plant

7. REPLICABILITY

Twelve small hydropower plants are being investigated by Digitech Solutions. Experience is most certainly transferable.

8. BENEFIT SHARING

The Ruramba Hydropower project would benefit local communities through power supply.

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

Hydrological data at proposed dam site:

Catchment area	**44.66 km²**
MAP	1400mm
MAR	18.7572 million m³/a
Dry season flow (used in power calc.)	0.81 m³/s

Four design options were considered:

Option	Dam or weir construction	Reservoir storage capacity ($10^3 m^3$)	Headrace canal length (m)	Gross head (m)	Power production (MW)	Access road length (km)
Option 1	Weir	0	650	96.88	0.57	2.78
Option 2	**Dam**	**17,153,700**	**1,060**	**115.76**	**3.42**	**3.48**
Option 3	Dam	13,665,000	2,220	116.12	2.92	3.8
Option 4	Dam	14,850,000	1,910	112.36	3.00	3.47

Considering higher power output and shorter headrace canal and shorter road construction, which would lower capital costs, option 2 was the one chosen.

Dam features for Option 2:

Dam wall height	**35 m**
Reservoir average height of water	15 m
Reservoir area	1.14 km^2
Headrace canal length	1060 m
Net Head	115.76 m
Estimated volume of water	17,153,700 m³
Possible flow rate produced by Reservoir during 3 months dry season	2.21 m³/s
Dry season flow rate	0.81 m³/s
Total flow rate for power production during dry season	3.02 m³/s
Estimated power production during dry season	3.42 MW

Main infrastructure:

- The Dam infrastructure (including related facilities) for water retention and control,
- the Headrace canal for water conveyance from the dam to forebay,
- Forebay comprising the stilling basin for water settling before entering the penstock, the intake to toward the penstock, the spillway and canal emptying /cleaning (drainage) system,
- Penstock to carry water from forebay to turbines,
- The Powerhouse hosting turbines, electro & mechanical (E&M) Equipment.

Additional infrastructure:

- An Access road alongside the headrace canal continuing down to the power house,
- Houses for site Engineers and eventually facility for temporary stay for support staff,
- A Drinking Water supply system for Power house and residential area, this system will only be 1.7 km long with storage facility at near the residential area.

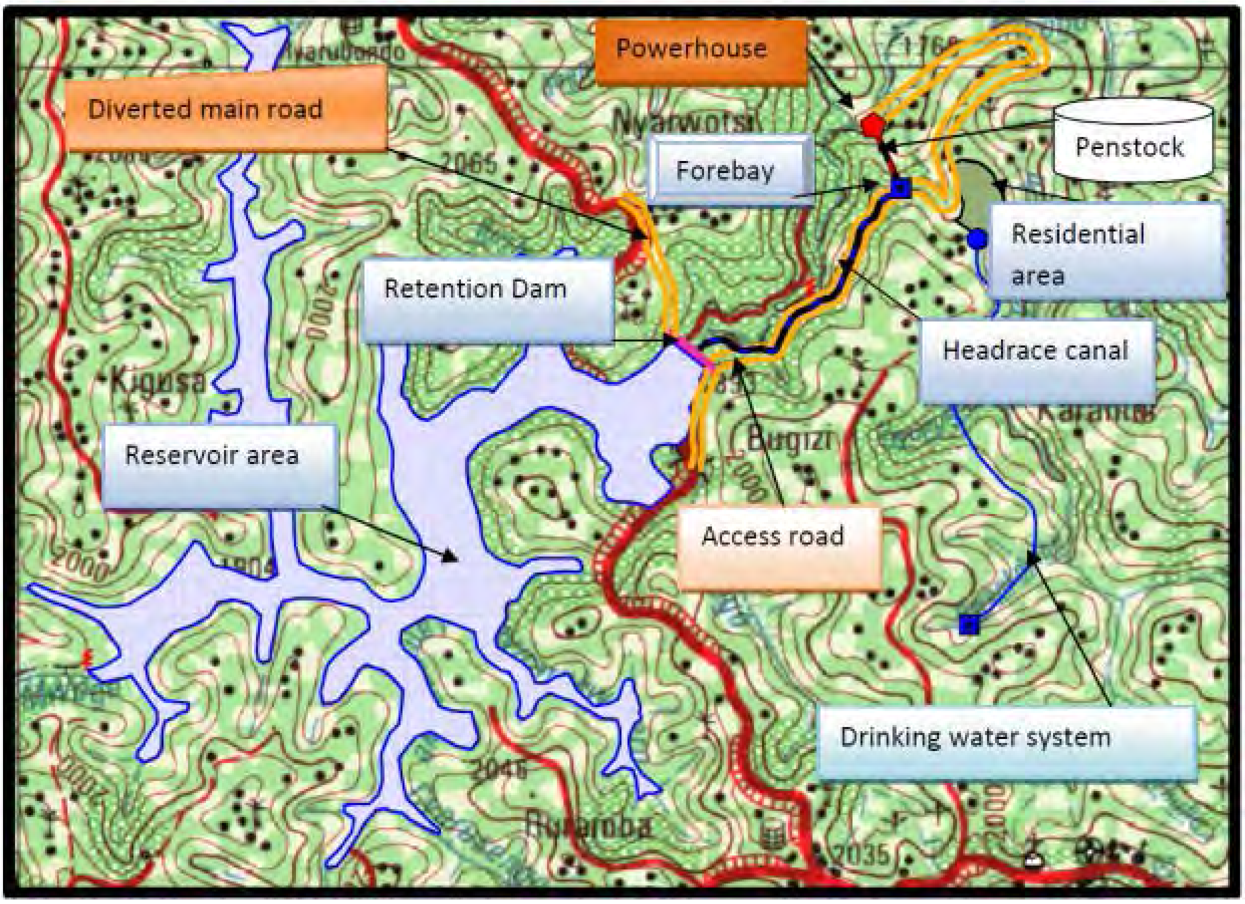

Figure 2: Ruramba Hydropower Plant Facilities General layout

10. BENEFITS

The Ruramba hydropower plant would provide electricity for lighting and household purposes, but it also allows for mechanization of many farming operations, such as water pumping, hoisting grain for storage and other various agro-processing activities.

11. IMPACTS

Impacts were not specifically covered in the pre-feasibility study.

Environmental

The capacity of the dam is equivalent to the MAR in the river. Impacts on ecological flows can be expected, notably through changes to seasonal low rates with less water being released in the wet season and far more in the dry season (3.02 m^3/sec when a minimum flow rate is 0.81m^3/sec). These impacts can be managed but mitigation may reduce anticipated power output.

Socio-economic

No homes will be inundated - no resettlement will be required.

Some woodlots and tea plantations will be inundated, with expropriation and compensation necessary.

12. SUSTAINABILITY

This project should cover O&M costs through the sale of electricity and should be ring-fenced for this purpose. The supply of power should be viewed as a service with significant downstream benefits to the economy, but not as a profit centre in itself.

The sustainability of the project is entirely dependent on consistent operations and maintenance against the highest standards.

Sedimentation of the dam reservoir must be assessed with regard to effective lifespan.

13. RISKS

The development is in a steep-sided catchment. Erosion and sedimentation were not highlighted as a problem in the Digitech study but photographs show the catchment to be quite degraded and this must be evaluated as a severe risk.

Management capacity and long-term maintenance must be supported and funded.

14. DURATION AND FUNDING

The total cost of the Ruramba Hydropower Plant infrastructure, including auxiliary facilities and 3.48 km transmission line, is quoted at USD $13,440,115

15. ADDITIONAL INFORMATION REQUIRED

- Determination of Environmental Flows requirements
- Environmental and socio-economic Impact studies.
- Investigation into risks of erosion and sedimentation

16. RECOMMENDATIONS

Construction to proceed shortly.

LARGER DAMS

WATER SUPPLY, IRRIGATION, SOME HYDROPOWER

1. CYANUZI-KAGOGO DAM (Kagogo River) - RWANDA

The Cyanuzi-Kagogo Dam is one of eight large dams proposed for the Kagera region as part of the NELSAP supported Kagera River Basin Management Project. Information is derived primarily from the Inception Report prepared by Eng. Dr. Henry K. Ntale and submitted to NELSAP on 20 February 2012. Whilst this dam site has been identified as having potential, the dam is still in the earliest stages of feasibility assessment. Further studies are underway.

This proposal is for a large dam, with a wall height of 25 m and a capacity of 39.5 million m^3, sited on the Kagogo River in south-eastern Rwanda.

1. SOURCES OF INFORMATION

The objective of the Kagera River Basin Management Project is to establish a sustainable framework for management of water resources of Kagera River Basin, in order to prepare for sustainable development oriented investments that will improve the living conditions of people while protecting the environment.

The most recent sources of information supporting the proposed Cyanuzi-Kagogo Dam are as follows:

- NELSAP: Kagera River Basin Management Project, Terms of Reference for Consultant for Detailed Identification of Potential Large Dams in the Kagera River Basin.
- Dr Henry K. Ntale, 20 February 2012: Detailed Identification Studies for Potential Large Dams in the Kagera Basin, Inception Report, NELSAP, Kagera River Basin Management Project.

2. PROJECT DESCRIPTION / STATUS

This proposal is for a large dam, with a wall height of 25 m and capacity of 39.5 million m^3, sited on the Kagogo River in south-east Rwanda. Whilst the site has been identified for further investigation and appraisal, a small dam with a capacity of only 1 million m^3, was recently constructed on the same site and would be submerged by this far larger project. According to the Large Dams Study Inception Report, MINAGRI officials are reluctant to lose this new dam, which provides water for the irrigation of rice and some flood attenuation.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The identification study states that the primary potential use of the project would be hydropower and water supply (both domestic and irrigation). The dam would also have value in flood control.

4. RATIONALE AND CONTEXT FOR PROJECT

The Cyanuzi-Kagogo project is one of eight potential dam sites identified in earlier rapid identification studies for further investigation and appraisal through NELSAP.

5. PREPAREDNESS FOR IMPLEMENTATION

This project has been identified as having potential but all further technical, social, and environmental studies have still to be undertaken. Pre-feasibility studies should by now have been completed as part of the NELSAP ToR, but reports are not yet available.

6. LOCATION

The dam site is situated at 30.591°E, 2.249°S on the Kagogo River in the Kirehe District, in the South-East of Rwanda as shown in **Figure 1**. The Kagogo is a tributary of the Kagera River and would have negligible impact on these flows.

7. REPLICABILITY

There are a number of aspects related to the construction of this dam that are likely to be similar for all of the eight large dams that are being investigated under the Kagera River Basin Management Project.

8. BENEFIT SHARING

This is one of eight proposed large dams, five of which are in Burundi, one shared between Burundi and Rwanda, one shared between Uganda and Rwanda, and this dam entirely serving Rwanda.

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

- The proposal is for a dam on the Kagogo River with a capacity of 39.5 million m^3.
- The catchment area of the Kagogo River at this point is given as 278.95 km^2.
- MAR is estimated to be 64 million m^3/a.
- The height of the dam would be 25 m, and crest length of the wall 450 m.

10. BENEFITS

The dam would provide water for irrigation and for hydropower. The full benefits of this project and the additional infrastructure that would be required have not yet been adequately quantified but will be addressed as part of the feasibility study.

This is a densely populated and heavily utilised landscape, with plots too small to provide the inter-seasonal grain yields required for subsistence living. Irrigation water would increase productivity and improve the livelihoods of thousands of small farmers.

Figure 1: Sites of Proposed Large Dams in the Kagera Basin. The Cyanuzi-Kagogo Dam is in on the Kagogo River in south-east Rwanda

11. IMPACTS

Impacts still require full assessment and only a rapid assessment has been undertaken.

Environmental

- The Inception Report provides no information on the impacts of inundation by the reservoir.
- The preservation of the existing infrastructure below the existing dam would have to be considered.
- There is little natural vegetation and therefore the dam will have little impact on biodiversity.
- River flows would be affected.

Socio-economic

- Some households were relocated as a consequence of the existing dam and it is likely that a number of additional households would have to be relocated. It is important that these households become beneficiaries of the project.
- There do not appear to any significant infrastructure works (roads, bridges etc.) that would be inundated by the dam.
- Neither do there appear to be any areas of cultural significance that would need to be preserved.

12. SUSTAINABILITY

Financial, social and environmental sustainability issues are being assessed as part of the continuation of the current study in terms of the NELSAP ToR.

13. RISKS

The soils on steep slopes are predominantly fertile volcanic soils, but they are fragile and vulnerable to deterioration and/or erosion which could result in siltation of the dam.

The MINAGRI officials may oppose the construction of a larger dam that would submerge the existing dam and effectively nullify this investment.

14. DURATION AND FUNDING

The detailed studies, approvals, design and construction of a dam of this size would take at least 10 years. At this stage of study, the duration and source of funding for this project have not been investigated. No costing has yet been undertaken.

15. ADDITIONAL INFORMATION REQUIRED

The Terms of Reference for the 'Identification of eight large dams study' requires the following additional work to be done:

(i) A preliminary socio-economic analysis
(ii) Environmental and social scoping
(iii) Preliminary hydrological studies
(iv) Preliminary technical design
(v) Preliminary economic / financial analysis

(vi) Ranking
(vii) ToR for feasibility studies for each of the sites

From the scheduling of the NELSAP ToR these studies should by now be complete or approaching completion.

2. KAGITUMBA-MAZIMBA DAM (River Muvumba) UGANDA and RWANDA

The Kagitumba-Mazimba Dam is one of eight large dams proposed for the Kagera Basin as part of the NELSAP supported Kagera River Basin Management Project. The dam site is on the Muvumba River, close to the Uganda-Rwanda border. The proposal is for a large concrete dam, with a wall height of 20 meters and a reservoir capacity of 25 million m^3. The estimated cost of the dam and hydropower scheme is US $ 32.1 million.

The anticipated primary use is for hydropower with three possible options for locating the power station and generating 11 MW and up to 102 GWh/annum, although this option has many technical challenges. Water would also be provided for irrigation and domestic supply in Uganda and potentially in Rwanda.

The Kagitumba-Maziba scheme was ranked 5th out of the nine potential large dams in the Kagera basin evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria during the Initial Environmental and Social Evaluation and technical review completed in October 2012.

1. SOURCES OF INFORMATION

Updated technical information and initial screening of social and environmental impacts for alternative Kabuyanda dams is presented in the draft report entitled Detailed Identification Studies for the Potential Large Dams in the Kagera Basin prepared by Eng. Dr. Henry K Ntale and submitted to NELSAP in October 2012. The information provided in that report is summarised below.

2. PROJECT DESCRIPTION / STATUS

The proposed Kagitumba-Mazimba site is located on the Muvumba River, close to the Uganda-Rwanda border. The proposed dam would be a large dam concrete dam, with a wall height of 20 meters and a reservoir capacity of 25 million m^3. The anticipated primary use would be for hydropower with additional benefits of water provided for irrigation and domestic consumption.

An Initial Environmental and Social Evaluation (IESE) and technical evaluation of nine dams in the Kagera basin including the Kabuyanda Dam was prepared by Eng. Dr. Henry K Ntale as part of the report on potential large dams in the Kagera Basin (October 2012). This study provided updated technical information for the project, quantified the potential demands, identified potential social and environmental impacts, and developed initial cost estimates for the proposed dam construction.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The project would be a multipurpose scheme to provide hydropower, domestic water supply and irrigation in Uganda and Rwanda.

4. RATIONALE AND CONTEXT FOR PROJECT

The Kagitumba-Mazimba project is one of eight potential dam sites identified in earlier rapid identification studies for further investigation and appraisal through NELSAP.

5. PREPAREDNESS FOR IMPLEMENTATION

An IESE, scoping level technical evaluation and provisional cost estimate have been completed. A detailed Environmental and Social Impact Assessment (ESIA), awareness campaigns, and a full feasibility study with detailed design are required.

Funding must still be sourced.

6. LOCATION

The site for the proposed Kagitumba dam is located on River Nyakizumba near Maziba Town in Kabale District, South Western Uganda and a few kilometres upstream of the border with Rwanda (Figure 1). The Kagitumba site is approximately 19 km upstream of the site for the proposed Muvumba dam located across the border in Rwanda.

The coordinates of the proposed dam site are -1° 18’ 54.36” (South) and 30° 5’ 25.26” (East.)

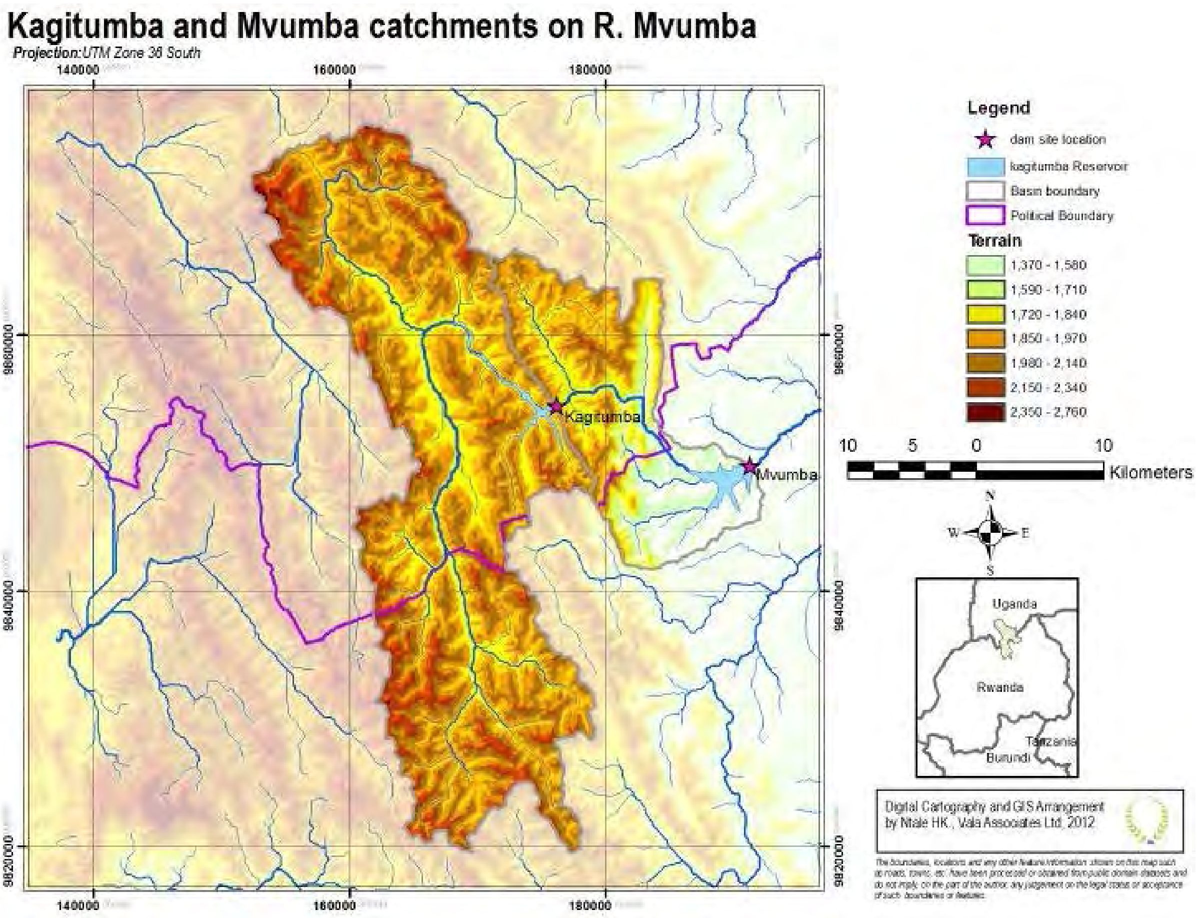

Figure 1: Location of proposed Kagitumba and Muvumba Dams and catchment areas

7. REPLICABILITY

The proposed scheme is unique however there are a number of aspects that are likely to be similar for the eight large dams that are being investigated and could probably be replicated at other dams.

8. BENEFIT SHARING

This dam is close to the border of Rwanda and Uganda but on the Muvumba River in Uganda. The benefit would be power generation for Uganda. Irrigation potential on the Ugandan side of the border is quite limited because of the steep terrain while increasing the command area into Rwanda would result in complications related to managing trans-national irrigation schemes.

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

The current proposal is therefore for a concrete gravity dam with a full supply level of 1,787 masl and the following characteristics:

- Catchment area: 712 km^2
- Mean Annual Runoff (MAR): 150 Mm^3/annum
- Height of dam wall: 20 m
- Storage capacity: 25 million m^3
- Wall crest length: 177 m
- Spillway crest length: 28 m
- Reservoir surface area: 2.24 km^2
- Reservoir fetch: 9 km

Previous studies investigated full supply levels of 1,801 masl, 1,795 masl and 1,793 masl but these were not selected on account of the large numbers of people that would be displaced.

10. BENEFITS

The primary purpose of the dam would be hydropower production while a secondary purpose would be irrigation and domestic water supply.

Three possible locations for a power station have been proposed.

- Site 1: Located at the dam site for which the maximum available head is 17 m
- Site 2: Located 600 m downstream of the dam site and supplied by a canal with a maximum available head of 57 m
- Site 3: Located 9 km downstream of the dam site. The head at this site would be 257 m with considerable advantages in terms of the power produced but would require a long head race canal and crossings of three valleys.

Site 3 has the potential to generate 11 MW and 102 GWh of energy per year which could supply about 113,000 houses and over 680,000 people.

The relative merits and demerits of the 3 power station options should be explored during the feasibility study stage given the potential technical challenges.

There is potential to irrigate 178 ha below the dam in the Ugandan which could support 356 farmers and provide food for about 1780 people. The annual water demand for irrigation would be about 0.9 Mm^3/annum. There would also be potential to for irrigation in Rwanda.

The total populations that could benefit from water supplied by the Kagitumba-Maziba project in 2012 and 2062 were estimated to be 46,728 and 225,716 people with demands of about 0.5 Mm^3/annum and 2.5 Mm^3/annum respectively.

11. IMPACTS

The proposed reservoir would inundate approximately 2.8 km^2 of land and would require the resettlement of approximately 751 people with the other impacts as follows:

Environmental

- Impacts on downstream riverine environment have yet to be assessed but would be significant given the size of the dam in relation to the MAR.
- The overall impact on downstream flow in the Kagera River and on inflows into Lake Victoria would be negligible.
- There is little natural vegetation in the reservoir basin and therefore the dam would have little impact on biodiversity.
- The nearby Akagera Park would not be affected.

- *Socio-economic*
- No areas of cultural significance that would need to be preserved have been identified.
- Farmed land and plantations along the banks of the Muvumba River would be flooded.
- Existing villages would be flooded and would need to be relocated.

12. SUSTAINABILITY

The Kagitumba-Maziba scheme was ranked 5th out of the nine potential large dams in the Kagera Basin that were evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria.

13. RISKS

No risks were identified.

14. DURATION AND FUNDING

The total capital cost for the construction of the dam and power station located at Site 3 (i.e. 9 km downstream of the dam and providing the greatest potential for hydropower generation) were estimated to be US $32.1 million.

The required detailed studies, approvals, design and construction of a dam and associated power plant of this size would take at least 10 years.

At this stage of study, the duration and source of funding for this project have not been investigated. .

15. ADDITIONAL INFORMATION REQUIRED

Draft terms of reference have been prepared for feasibility studies and Environmental and Sustainability Impact Assessments (ESIA) for the nine large dam projects identified in the Kagera Basin.

3. KAKANJA DAM (Kabuyanda River) - TANZANIA

The Kakanja Dam would technically be a “small” dam with a height of 14.0m, but would have a large storage capacity of 72 million m³. The length of the dam crest would be 520 m, the reservoir surface area 22.1km², and reservoir fetch 15.6 km. The dam would provide water for irrigation, livestock and domestic use. For comparative purposes in this study the Kakanja Dam has been grouped with the “larger dams” due to its large capacity for a dam with a wall height of less than 15 m.

The Kakanja Dam would be located on a permanent stream near Kakanja village, in Karagwe district, Tanzania.

The dam has been screened as a prospective project.

1. SOURCES OF INFORMATION

The latest source of information is the draft version of Consulting Services for Development of Tools and G uidelines f or C limate A daptation Ma instreaming i n Water I nfrastructure D evelopment - Screening for an Infrastructure Project, dated April 2012.

2. PROJECT DESCRIPTION / STATUS

This project is only at the first screening stage and has not yet had a pre-feasibility study. This would be the next step. A user needs survey is required.

3. OBJECTIVES (purpose of the development)

The obj ectives of t his dam ar e for l ocal ec onomic development, w ith t he d am pr oviding water f or irrigation, livestock and domestic use.

4. PROJECT RATIONALE AND CONTEXT

This development would fulfil a local opportunity.

5. PREPAREDNESS FOR IMPLEMENTATION

This project has only been screened with regard to a potentially suitable site.

Pre-feasibility s tudies, E IA, E SIA, a wareness c ampaigns, and a f ull f easibility s tudy with d etailed design are still required.

Funding must still be sourced.

Preparedness for implementation is therefore very low.

6. LOCATION

The K akanja dam i s l ocated on a permanent s tream at c oordinates Lat itude -1.4182, Lo ngitude 30.9143 at Kakanja village, in Karagwe district, Tanzania.

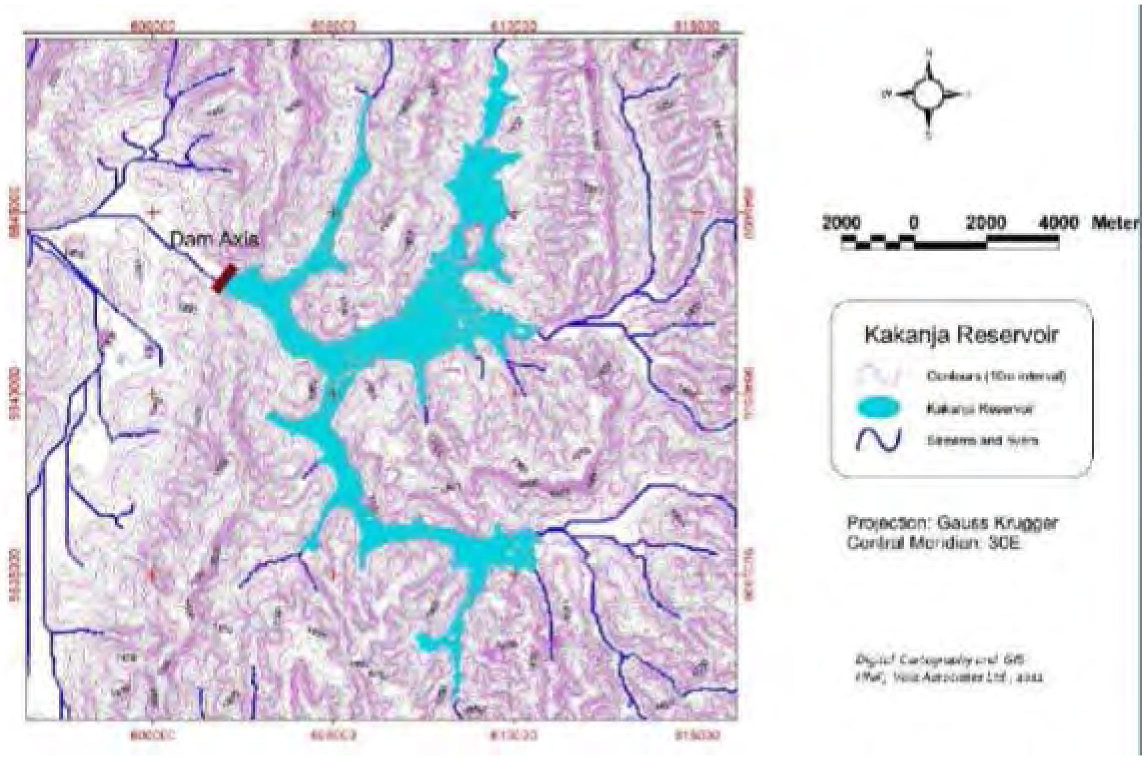

Figure 1: Kakanja Dam, Karagwe District, Tanzania

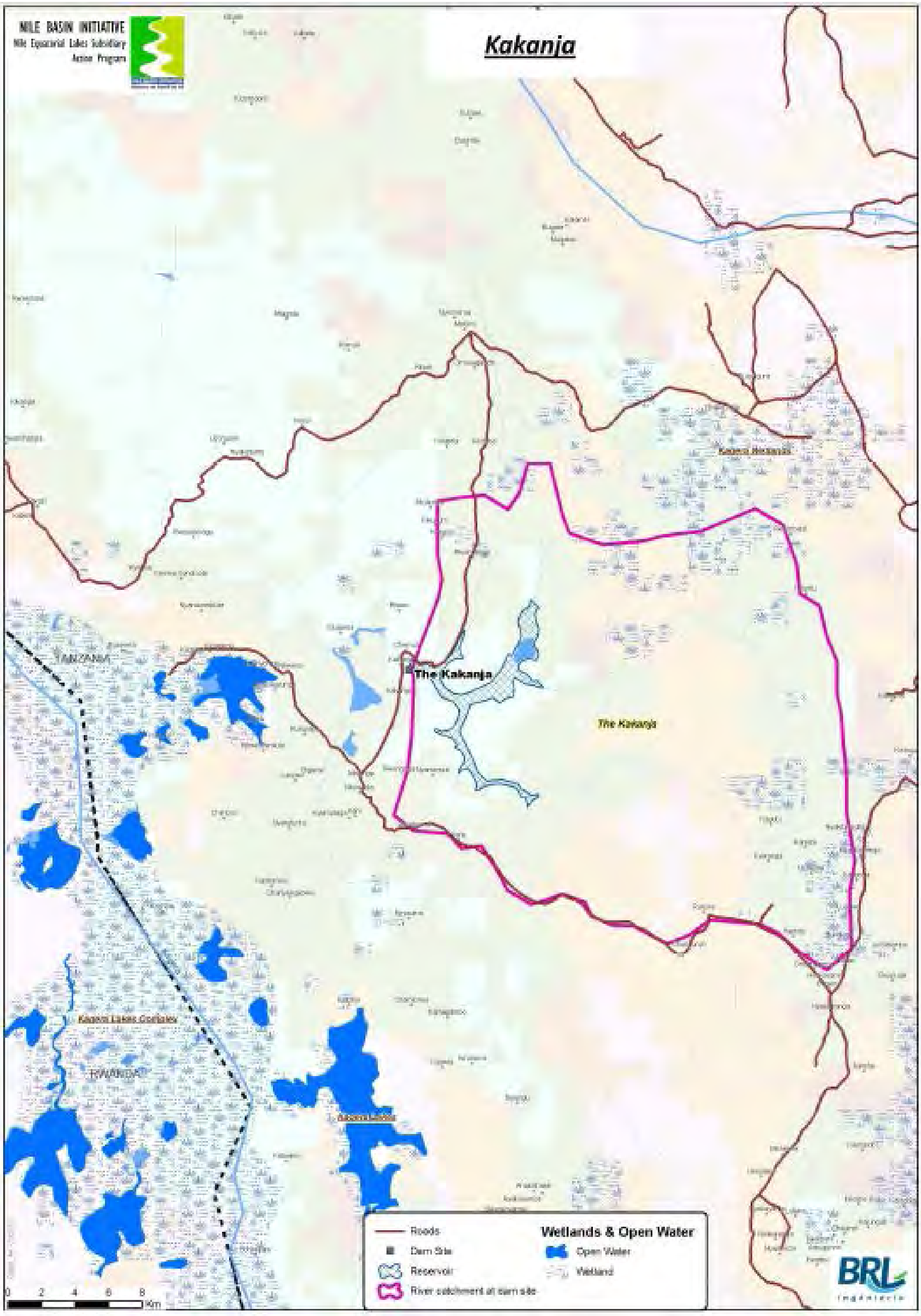

Figure 2: Locality of Kakanja Dam

7. REPLICABILITY

The scheme would be similar to a number of the Smaller Dam projects that are being investigated to provide local benefits.

8. BENEFIT SHARING

This dam is intended as a local development option in Tanzania.

9. TECHNICAL DESCRIPTION

This is a large dam for a wall of this size with a capacity of 72 million m^3.

- Height of dam 14.0m
- Storage capacity 72 million m^3
- Wall crest length 520 m
- Reservoir surface area 22.1 km^2
- Reservoir fetch 15.6 km
- Construction - earth fill embankment.
- Catchment area / MAR – still to be determined

10. BENEFITS

The dam would provide water for irrigation, livestock and domestic use. Two smaller rivers also flowing into the Kabuyanda valley offer further opportunities for development.

11. IMPACTS

The valley areas of the reservoir basin are largely undeveloped however there are banana plantations on the hill slopes that would be inundated by the proposed reservoir. There are no settlements in the proposed reservoir basin.

Environmental

The dam would have a large surface area and result in loss of a large area of natural vegetation. It is a shallow dam with an average depth of 3 metres and high evaporative losses can be expected.

Socio-economic

The area to be inundated by the Kakanja is sparsely populated, with no known settlements within the reservoir area. Most of the valley to be flooded is not used for cropping however grazing land would be lost. Some banana plantations would be flooded and these farmers would need to be relocated or compensated.

12. SUSTAINABILITY *(Financial, Technical, Social, Environmental)*

Unknown

13. RISKS

- Hydrology is not known and would need to be assessed in terms of the river's ability to supply a dam of this size.
- This is a shallow reservoir with large surface area and low runoff from a relatively dry area. Evaporative losses would be high.

14. DURATION AND FUNDING

No costing has been undertaken, nor any funding sourced.

A small to medium sized dam of this nature would take a minimum of 7 to 8 years, and more likely 10 years to study and implement.

15. ADDITIONAL INFORMATION REQUIRED

A user needs assessment should be undertaken.

16. RECOMMENDATIONS

Project should progress to feasibility study pending results of current prefeasibility study.

4. KANYARU DAM (KANYARU MULTIPURPOSE PROJECT) also known as the AKANYARU DAM (Kanyaru River) - RWANDA & BURUNDI

The Kanyaru Dam is one of nine large dams proposed for the Kagera Region as part of the NELSAP supported Kagera River Basin Management Project. A dam site was identified as having good potential (Ntale, 2012) and a feasibility study has apparently now (December 2012) been launched (EWSA / FICHTNER) looking at two possible dam options. Information for inclusion in this assessment is not available from this study and the site and specifications proposed by Dr Ntale are used in this assessment. The dam site is on the Kanyaru River on the Burundi-Rwanda border.

The potential uses would be primarily for irrigation, coupled with rural domestic supply and hydropower. The dam proposed by Ntale (2012) has a 52 metre high wall, and is expected to generate about 14.5 MW of hydropower and supply irrigation water for approximately 12,500 ha downstream.

The Governments of Burundi and Rwanda have jointly decided to pursue this project as it would provide benefits to be shared by both countries. This project was ranked the most favourable of the potential nine large dam developments in the Kagera Basin by Dr H. Ntale in a prefeasibility assessment report to NELSAP in October 2012.

1. SOURCES OF INFORMATION

Updated technical information and initial screening of social and environmental impacts for the Kanyaru dam is presented in a draft report entitled Detailed Identification Studies for the Potential Large Dams in the Kagera Basin prepared by Eng. Dr. Henry K Ntale and submitted to NELSAP in October 2012.

2. PROJECT DESCRIPTION / STATUS

The Kanyaru project would comprise a moderately sized dam for irrigation, water supply and some hydropower generation. An Initial Environmental and Social Evaluation (IESE) and technical evaluation of nine dams in the Kagera basin including the Kanyaru Dam was prepared by Eng. Dr. Henry K Ntale as part of the report on potential large dams in the Kagera Basin (October 2012). This study provided updated technical information for the project, quantified the potential demands, identified potential social and environmental impacts, and developed initial cost estimates for the proposed dam construction.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The primary potential use of the project is irrigation coupled with hydropower generation.

4. RATIONALE AND CONTEXT FOR PROJECT

The Kanyaru Dam project is one of nine potential dam sites identified by earlier rapid identification studies for further investigation and appraisal through NELSAP.

5. PREPAREDNESS FOR IMPLEMENTATION

An Initial Environmental and Social Investigation (IESE), scoping level technical evaluation and provisional cost estimate have been prepared.

A detailed Environmental and Social Impact Assessment (ESIA), awareness campaign, and a full feasibility study are required.

Funding must still be sourced.

6. LOCATION

The Kanyaru site is situated at 2° 46’ 35.4” South and 29° 49’ 10.32” East, on the Kanyaru River at the Burundi-Rwanda border (Figure 4. 4-1). The site is located in Gisagara District, one of the eight Districts that make up the southern province of Rwanda, in Kyimana Village, Mukindo Sector. The site borders the Republic of Burundi to the south.

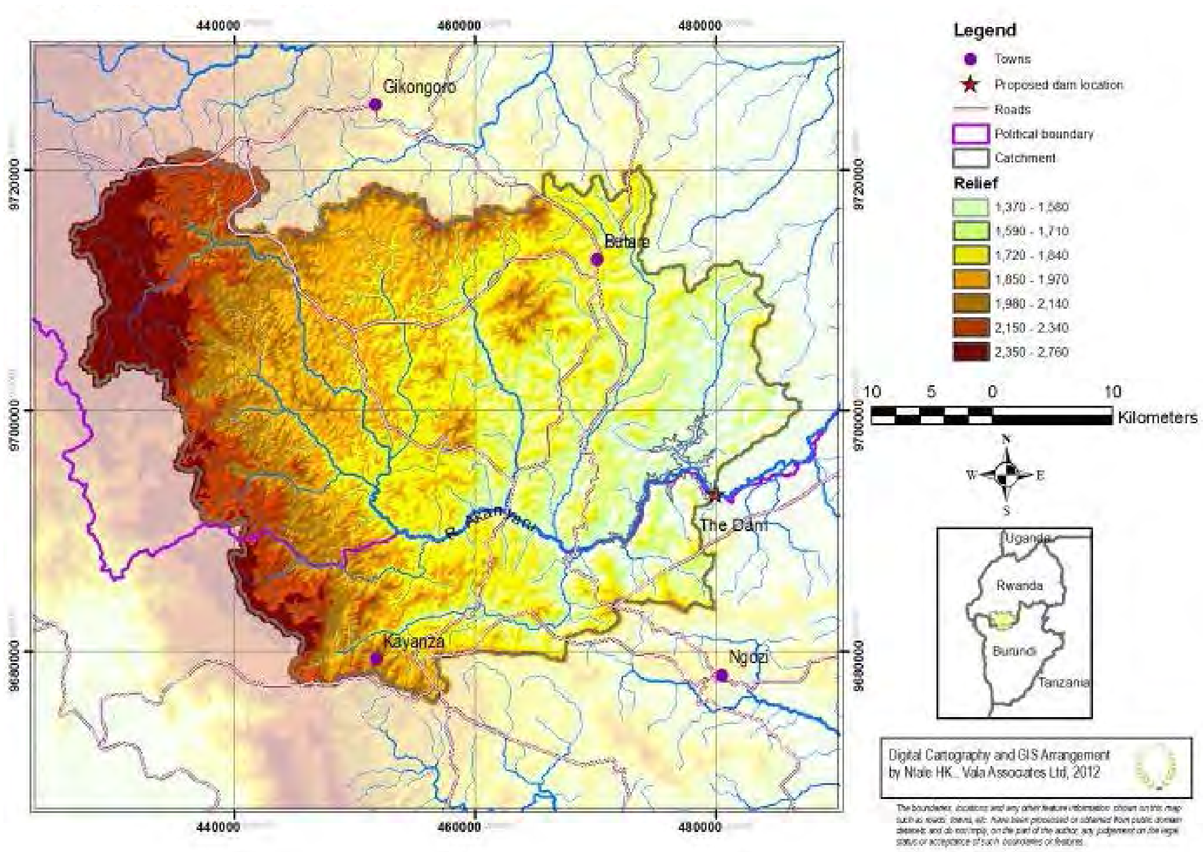

Figure 1: Kanyaru Catchment and location of proposed dam

7. REPLICABILITY

This is a unique scheme although there are a number of aspects are likely to be similar for all of the large dams now being investigated that could be replicated at other dams.

8. BENEFIT SHARING

This dam site is located on the border between Burundi and Rwanda. The Governments of Burundi and Rwanda have jointly decided to pursue this project as it provides benefits to be shared by both countries.

The irrigation and drainage component of the project comprises areas within Rwanda and Burundi, and especially the Kanyaru marshland shared between the two countries. The area covers lands adjacent to the banks of Kanyaru River within the following administrative boundaries:

- Western Ngozi (Burundi)
- Western Kirundo (Burundi)
- Eastern Gisagara (Rwanda)
- Eastern Nyanza (Rwanda)
- Western Bugesera (Rwanda)

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

(Note: This is a larger dam than envisaged in Dr Ntale's Inception Report (2012). It also appears to be significantly larger than that currently listed in the Energy, Water and Sanitation Authority (EWSA) website, and in a 1995 Japanese report (NEWJEC), for which the power output would have been in the order of 4MW).

From the Ntale (2012) study: Taking into consideration the runoff at the site and the site geometry, the optimum full supply level of the reservoir was estimated to be 1,412m masl.

The proposed dam would be a rock fill dam with the following characteristics:

- Catchment area: 1727 km^2
- Mean annual runoff: 826 million m^3/annum
- Wall Height : 52 m
- Crest length: 513 m
- Spillway crest length: 50 m
- Storage Capacity: 333.9 million m^3
- Surface area: 19 km^2
- Reservoir fetch: 10 km
- Power generation capacity: 14.5 MW and 127 GWh/a

10. BENEFITS

This project would have the following benefits:

- The provision of power to Burundi and Rwanda via interconnections with the national grids, as well as rural electrification to the communities in the vicinity of the Project;
- The dependable supply of water for irrigation downstream; and
- The control of floods that would otherwise inundate farmlands.

The population that could benefit from water supplied by the proposed Kanyaru Dam in 2012 and 2062 would be about 614,202 and 2,340,902 people respectively. The corresponding annual water demands would be about 7 million m^3/annum and 26 million m^3/annum for 2012 and 2062, respectively.

The proposed Kanyaru Dam would be well located to provide water throughout the year for irrigation of the existing farms in the Akanyaru valley. The potential area that could be irrigated is 12,479 ha that could support approximately 24,948 farmers and provide food for about 124,740 people. The annual water demand for irrigation would be about 62 million m^3/annum.

The proposed hydropower station at the Kanyaru site has the potential to produce 127 GWh of energy per year which is enough to supply about 140 000 houses and 850,000 people.

11. IMPACTS

An area of about 19 km^2 would be inundated by the proposed Kanyaru reservoir requiring the potential resettlement of about 8,500 people. The IESI identified no significant impacts particular to this project other than those normally associated with a project of this scale. A full ESIA would be required as part of a complete feasibility study.

Environmental

- Impacts on hydrology have yet to be assessed. The overall impact on downstream flow in the Kagera River and on inflows into Lake Victoria could be mitigated if suitable operating rules were developed for the environmental flow requirements.
- The dam and reservoir would have little impact on biodiversity although some swamp areas and marshlands (papyrus) would be flooded.

Socio-economic

- No areas of cultural significance that would need to be preserved were identified.
- Farmed land and plantations along the banks of the Kanyaru River would be flooded.
- The reservoir could require the resettlement of about 8,500 people.

12. SUSTAINABILITY

The Kanyaru Dam was ranked as the most favourable of the nine potential large dams in the Kagera Basin that were evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria during the IESI.

13. RISKS

Potential conflicts could occur between the different users of the dam and cooperation would be required between the governments of Rwanda and Burundi.

14. DURATION AND FUNDING

The estimated capital cost of the dam and associated works is US $ 92 million (2012). This amount excludes the costs of the infrastructure for the irrigation and rural water supply distribution systems.

Further studies, design and construction of a dam of this size could take as long as 10 years. The EWSA / FICHTNER study is apparently due to be completed within one year from now and suggests a four year construction period.

At this stage sources of funding for this project have not been investigated.

15. ADDITIONAL INFORMATION REQUIRED

Draft terms of reference (TOR) for a feasibility study and for an ESIA have been prepared for the nine large dam projects identified in the Kagera basin.

16. RECOMMENDATIONS

Project should progress to feasibility study pending results of current prefeasibility study. Support EWSA / FICHTNER feasibility study if already underway.

5. MUVUMBA DAM (Muvumba River) - RWANDA (NYAGATARE WATER RESOURCES DEVELOPMENT PROJECT)

The Nyagatare Water Resources Development Project has at its centre the construction of a large dam (109 million m^3) on the Muvumba River at Nyagatare in the eastern region of Rwanda. This would be a multi-purpose dam primarily for the provision of rural domestic water supply and irrigation with a small amount of hydropower that could be used to pump water to a treatment plant and four clean water storage reservoirs for domestic supply. The dam is a major infrastructure project envisaged by the Government of Rwanda. The dam is seen as being both in the national interest and in bringing significant benefits to Nyagatare.

1. SOURCES OF INFORMATION

M&E Associates Ltd in association with REAL Contractors s.a.r.l prepared a pre-feasibility report in 2007/08 aimed assessing the best option for the implementation of the Nyagatare Water Resources Development Project, also known as the Muvumba Dam project. The final report for the Pre-feasibility Study was released in September 2008.

Updated technical information, provisional cost estimates, and initial screening of social and environmental impacts for the Muvumba dam are presented in a draft report entitled Detailed Identification Studies for the Potential Large Dams in the Kagera Basin prepared by Eng. Dr. Henry K Ntale and submitted to NELSAP in October 2012.

There are many differences in these two reports that must be reconciled during the feasibility study.

2. PROJECT DESCRIPTION/STATUS

The proposed dam is viewed as a major potential infrastructure project by the central Government of Rwanda. The Government's initiative was influenced by national interest, but it is also perceived that the dam would bring significant benefits to Nyagatare.

The Nyagatare Water Resources Development Project has at its centre the construction of a large dam (191 million m^3) on the Muvumba River at Nyagatare in the eastern region of Rwanda. This would be a multi-purpose dam, firstly for the provision of water to domestic users and livestock, but also for irrigation and limited hydropower.

An Initial Environmental and Social Evaluation (IESE) and technical evaluation of nine dams in the Kagera basin including the Kabuyanda Dam was prepared by Eng. Dr. Henry K Ntale as part of the report on potential large dams in the Kagera Basin (October 2012). This study provided updated technical information for the project, quantified the potential demands, identified potential social and environmental impacts, and developed initial cost estimates for the proposed dam construction.

There are a number of differences in the figures provided in these two reports. For example differences in the MAR, reservoir storage capacity, command area and cost estimates for the dam construction. It is important that these differences are reconciled during the feasibility study.

3. PROJECT OBJECTIVES

The project objectives for developing storage are as follows:

- water supply, for domestic use and livestock watering,
- Water conservation
- Flood and flow regulation in the Muvumba Valley

- Introduction of aquaculture
- Stimulation of tourism
- Limited hydropower supply

4. PROJECT RATIONALE AND CONTEXT

The Government of Rwanda has recognized the need to increase national primary (agricultural) productivity and has set the moderate target for 100 000 ha of land under irrigation. The Nyagatare District is less densely populated than most of the country, and has suitable terrain for irrigation. The Eastern Region has a bi-modal annual rainfall pattern (April and December) but experiences inter-seasonal droughts. The area has been used primarily for livestock farming (mostly cattle) and is not yet intensively cropped. The area is earmarked as suitable for resettlement and is already a focus for immigration from elsewhere in the country. The population is likely to grow very quickly – and with it the need for agricultural opportunity and for domestic water supply suggested for a population of 300 000. Government funded irrigation schemes aim to ensure that the land can support the growing population.

5. PREPAREDNESS FOR IMPLEMENTATION

A pre-feasibility study was completed in 2008. An IESE, scoping level technical evaluation and provisional cost estimate have recently been completed (October 2012).

A detailed Environmental and Social Impact Assessment (ESIA), awareness campaigns, and a full feasibility study are required.

Funding must still be sourced.

6. LOCATION

The Muvumba River arises in Uganda. Further downstream it joins the Kagitumba River, which in turn flows into the Kagera River. The proposed dam location is on the river Muvumba in Rwanda is near the town of Nyagatare (Figure 1). The Muvumba site is approximately 19 km downstream of the site for the proposed Kagitumba Dam located across the border in Uganda. The coordinates of the proposed dam site are -1° 21' 26.46 (South) and 30° 13' 48.6" (East.).

The rural-domestic supply of water would be mainly required upstream of the dam, whilst irrigation would take place in the Muvumba Valley downstream.

7. REPLICABILITY

This would be a major infrastructure project promoted by the Government of Rwanda. Whilst unique there would be many lessons for future infrastructure development (dam, water supply and irrigation).

8. BENEFIT SHARING

This large project would be aimed at serving a significant portion of Rwanda, covering almost 50% of the Eastern Region and extending almost as far as the border with Uganda. Benefits would be limited to Rwanda but the scheme would allow for an increase in settlement, reducing overall pressure on the land.

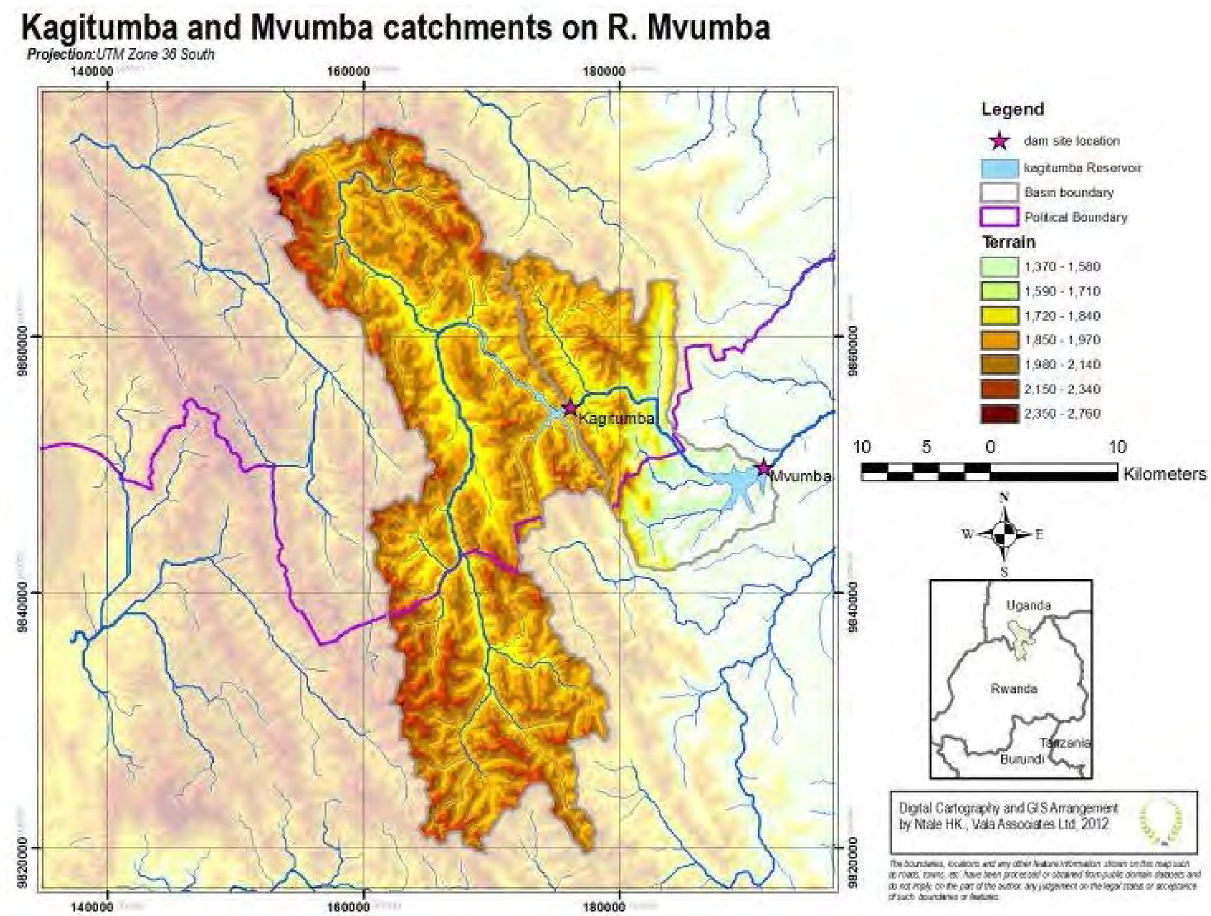

Figure 1: Location of proposed Kagitumba and Muvumba dams and catchment area

9. TECHNICAL DESCRIPTION

The proposed design would be for an earth fill dam with the following characteristics:

- Catchment area: 956 km2
- Mean annual runoff: 198 million m^3/annum
- Wall Height : 43m
- Crest length: 1300m
- Spillway crest length: 30m
- Storage Capacity: 109 million m^3
- Surface area: 7 km^2
- Reservoir fetch: 4 km

Power generation

With a head of 40 m, it would be possible to harness some hydropower at the site and it was proposed that power station would comprise 2 turbines each with a rated power of 1.5 MW. The proposed power station would generate approximately 2.9 MW or 25 GWh per year and would have the potential to supply about 28 000 houses and over 170,000 people. Some of the power generated would be needed to pump the water for domestic use.

Water supply system (domestic and livestock)

Much of the rural-domestic water demand would be upstream of the dam. The estimated population that could be served in the immediate vicinity of the Muvumba Dam (Muvumba and Ngarama) would be 30,000 in 2012 increasing to 118,500 by 2062. If the distribution system was to be extended to serve all of Nyagatare then potentially an estimated total human and livestock population of up to 655,000 could be served. This would require significant infrastructure development including four distribution reservoirs at an elevation of approximately 1550 masl from where the water would be gravity fed to the population and livestock areas. The infrastructure needs would be as follows:

a) Water treatment works of capacity 40,000 m³/day,
b) Treated water pumping station, total capacity 1.5 megawatts,
c) Pumping lines to reservoirs, of diameter DN400, and total length 90km,
d) Storage reservoirs, 4 each of capacity 10,000 m^3

Energy for pumping water up to the additional storage reservoirs would be provided through hydropower from the release of environmental flows and irrigation water from the dam.

Irrigation scheme

Availability of water all year around would enable the valley residents to engage in more profitable agriculture. The potential command area that could be supplied directly from the reservoir would be about 2198 ha in Byumba Province. The provision of a canal could supply irrigation water to an additional area of about 6 200 ha further downstream. The proposed infrastructure would include a 45 km long main irrigation canal. Two major branches would serve the valleys of Rwikubo and Rwentuha from the main canal. These branches would cross the Muvumba River, preferably by inverted siphons. The canal would terminate at Rugarama, the northern point near the Uganda-Rwanda Border. The canal capacity of 2,7m³/s would allow for the delivery by gravity of sufficient water for supplementary irrigation.

10. BENEFITS

This primary aim of this scheme would be to supply water for domestic use, livestock watering and irrigation. The project benefits would cover all sectors of life in Nyagatare, and could extend beyond the district to cover nearly 50% of the eastern region. Livestock and agricultural practices would need to be modernized to make best use of the available water and the district would become a destination for major resettlement for the country.

Other benefits include:
- Flood control downstream of the dam
- Security of energy supplies (although most or all of the energy generated would be required for pumping water for domestic use.
- Significant employment opportunities would be created during construction
- Improved road access would support development
- Opportunities would including tourism associated with the new lake

11. IMPACTS

A total area of 7 km^2 would be inundated by the Muvumba reservoir, and about 1,435 people in the Muvumba Commune area would have to be resettled. The IESE identified no other significant impacts particular to this project other than those normally associated with a project of this scale. A full ESIA would be required as part of a complete feasibility study.

Environmental
- Irrigation would have a negative impact on water quality through the leaching of fertilizers in return flows to the Muvumba River.

- There would be loss of indigenous vegetation in the dam basin.
- There are a number of potentially very significant and unknown environmental impacts that would require greater attention and mitigation before any development.
- The influx of people to the area would inevitably put the receiving environment under greater pressure.

Socio-economic

- The Rurengye Bridge would be submerged.
- New road infrastructure would be developed – a positive impact.
- Opportunity would be provided for significant immigration into the area.
- 1080 hectares of agricultural cropland would be lost along with livelihoods for 11 000 people. (Note that the Nyagatare Local government indicated that only 500 people would be affected – a large discrepancy to be resolved).

12. SUSTAINABILITY

- This would be a Government funded project aimed at providing livelihoods and increased productivity as part of a national imperative.
- The project has been given a design life of 30 years.
- The Muvumba River catchment does not appear to be heavily degraded, with sedimentation therefore a lesser threat to sustainability of the dam.
- No other sustainability threats have been reported.

The Muvumba Dam project was ranked 5th out of the nine potential large dams in the Kagera basin evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria.

13. RISKS

This is traditionally cattle farming country and there may be conflicts between cattle owners and subsistence and irrigation farmers.

14. DURATION AND FUNDING

Project duration is still to be determined. The need to accurately determine the hydrology of the Muvumba River could extend implementation by 1-2 years. Total implementation of a project of this size could take 10 years,

The 2008 prefeasibility study of M and E Associates estimated investment costs for all project components to be € 223,382,500 (US$ 290 million) with €107 million (US$ 140 million) for the dam and the balance for distribution infrastructure, purification works, irrigation canals etc. Some of these costs could be phased in over a period of time so as to match the demand.

The annual maintenance costs were estimated to amount to about € 1,782,750 per year. These would have to be funded either from the government budget or from user fees charged or a combination of the both.

The methods and resources for the operation of the system would require crucial institutional decisions on operational matters (government or private sector operation, staffing levels, sustainable salaries and terms payable to staff), power tariffs chargeable, government subsidy, etc.

The main project revenues would be user fees charged to the beneficiaries for the services rendered. These would include tariffs charged for domestic and livestock water supply, and tariffs charged for irrigation use.

The intention to prepare the district as a major resettlement area for the country may override the normal financial considerations.

In 2012 the cost for the dam and associated power station was updated by Dr. Henry K Ntale to US$ 103.3 million as part of the IESE and technical review. This estimate was for the earth embankment dam and excluded the costs for the distribution systems for rural-domestic use and irrigation.

15. ADDITIONAL INFORMATION REQUIRED

- A feasibility study is now required.
- There are a number of discrepancies between the data provided in the prefeasibility study and the IESE. One discrepancy is the number of people directly impacted by the dam through loss of homesteads and farmland. This would have to be resolved. Other discrepancies include the number of people likely to benefit from the scheme and estimated irrigation command area.
- The hydrology of the catchment is uncertain and there are significant differences in the MAR estimated in the prefeasibility study and the IESE. The consultants found very few records although there are some gauging station sites. The hydrology should be reviewed before final designs are prepared possibly including calibration of the gauging station sites.
- Draft terms of reference for feasibility studies and ESIA have been prepared for the nine large dam projects identified in the Kagera Basin.

16. RECOMMENDATIONS

Project should progress to feasibility study pending results of current prefeasibility study.

5. UPPER RUVUBU DAM (Upper Ruvubu River) – BURUNDI

The Upper Ruvubu Dam is one of the large dams proposed for the Kagera Region as part of the NELSAP supported Kagera River Basin Management Project. The dam site is high on the Ruvubu River in Burundi.

The current proposal is for a 45.5 m high concrete gravity dam with an estimated reservoir storage capacity of 110 million m^3. The dam will be used primarily to supply water for irrigation and rural domestic supply with some hydropower generation for local communities.

This dam project was ranked 3rd out of nine identified large dam developments in the Kagera basin.

1. SOURCES OF INFORMATION

Preliminary technical information and initial screening of social and environmental impacts for the Upper Ruvubu dam is presented in a draft report entitled Detailed Identification Studies for the Potential Large Dams in the Kagera Basin prepared by Eng. Dr. Henry K Ntale and submitted to NELSAP in October 2012. The information presented here has been extracted from this report.

2. PROJECT DESCRIPTION / STATUS

The Upper Ruvubu project is focused on the construction of a large dam, for irrigation, water supply and some hydropower generation. The current propose is for a 45.5 m high concrete gravity dam with an estimated reservoir storage capacity of 110.3 million m^3.

An Initial Environmental and Social Evaluation (IESE) and technical evaluation of nine dams in the Kagera basin including the Upper Ruvubu Dam was prepared by Eng. Dr. Henry K Ntale as part of the report on potential large dams in the Kagera Basin (October 2012). This study provided updated technical information for the project, quantified the potential demands, identified potential social and environmental impacts, and developed initial cost estimates for the proposed dam construction.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The purpose of the Upper Ruvubu project is to boost community development through the provision of water supplies for irrigation, rural-domestic use, and some hydropower.

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4. RATIONALE AND CONTEXT FOR PROJECT

The Upper Ruvubu Dam project is one of eight potential dam sites identified in earlier rapid identification studies for further investigation and appraisal through NELSAP.

5. PREPAREDNESS FOR IMPLEMENTATION

An Initial Environmental and Social Investigation (IESE) and scoping level technical evaluation and provisional cost estimate has been completed. A detailed Environmental and Social Impact Assessment (ESIA), awareness campaigns, and a full feasibility study are required. Potential funding sources must also still be identified.

6. LOCATION

The proposed dam site is located on the Upper Ruvubu River at -3° 3’ 8.64 (South) and 29° 43’ 6.12” (East) near G ahombo T own in Kayonza Province, B urundi (Figure 1) . The s ite i s l ocated approximately 4.5 km downstream of the proposed site for the Mbarara dam.

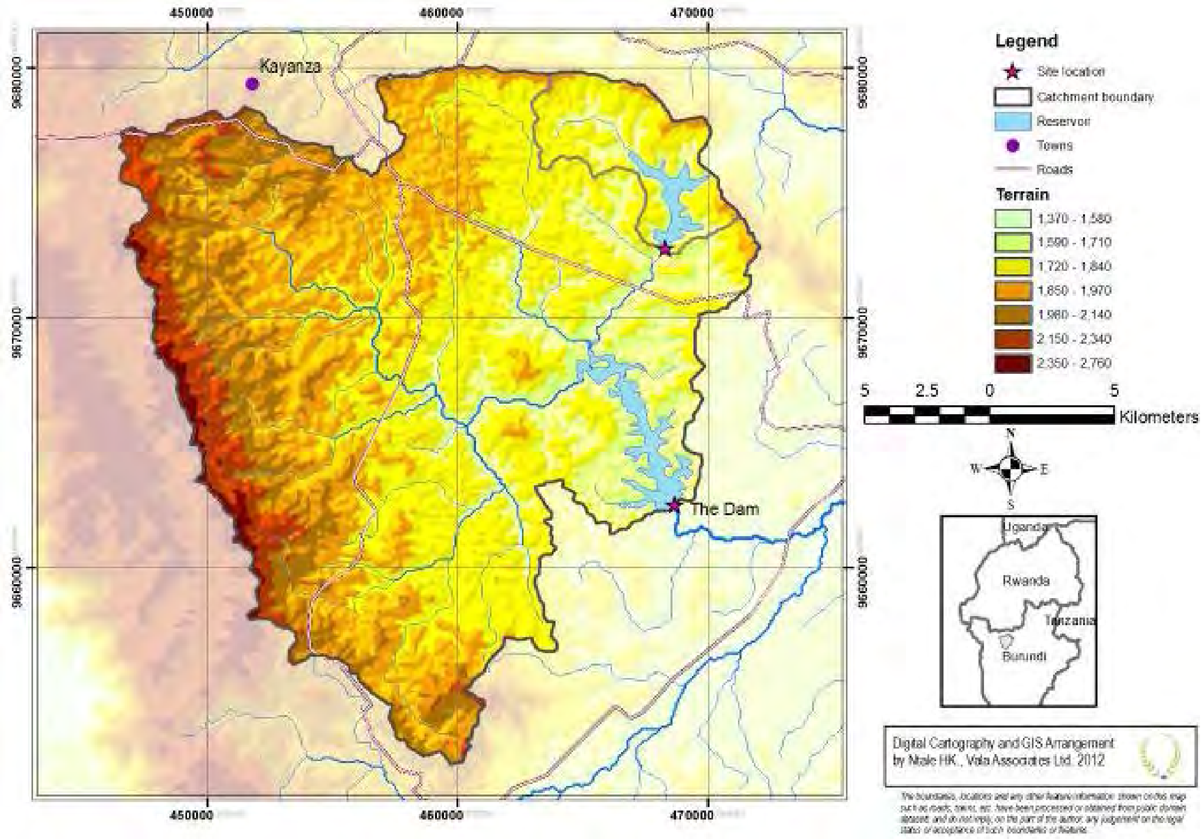

Figure 1: Proposed location and catchment areas for the Upper Ruvubu and Mbarara dams.

7. REPLICABILITY

The proposed scheme would be unique; however a number of development aspects are likely to be similar f or t he eight large dam s t hat ar e bei ng i nvestigated, a nd ap proaches c ould pr obably be replicated at these other dams.

8. BENEFIT SHARING

The proposed dam would only benefit Burundi.

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

The proposed dam is a concrete gravity dam with the following characteristics:

- Catchment area: 440 km^2
- Mean annual runoff: 239 million m^3/annum
- Wall Height : 45.5 m
- Crest length: 480 m
- Storage Capacity: 110.3 million m^3
- Surface area: 6.8 km^2
- Hydropower Capacity: 3.6 MW

10. BENEFITS

The project would supply water for irrigation and domestic use and some hydropower could be developed for local consumption and to provide power for pumping of rural domestic water.

The irrigation command area for the Upper Ruvubu reservoir totals some 8137 ha. The irrigable belt has an average width of 1.5 km and a length of 25 km. The command area can support 16,275 farmers and provide food for about 81,374 people. The annual water demand for irrigation would be about 41 Mm^3/annum.

The total population that could benefit from water supply from the Upper Ruvubu project in 2012 and 2062 was estimated at 154,613 and 585,824 people respectively. The annual water demands would be 1.7 Mm^3/annum and 6.4 Mm^3/annum for 2012 and 2062, respectively.

The proposed power station associated with the dam would be equipped with two 1.8 MW Kaplan turbines. This scheme has the potential to produce 31 GWh of energy per year which is enough to supply about 35,000 houses and over 209,000 people.

11. IMPACTS

The IESE identified no significant impacts particular to this project other than those normally associated with a project of this scale. A full SEIA is required as part of a complete feasibility study.

Environmental

- The impact on the flow in the Kagera River and into Lake Victoria would likely be negligible.
- Impacts on environmental flows in the Ruvubu River will have to be assessed.
- There are no identified protected areas in the vicinity of the site.
- The impact on biodiversity is likely to be low.

Socio-economic

- No areas of cultural significance that would need to be preserved have been identified.
- It is probable that local farmlands will be flooded and communities will have to be relocated.

12. SUSTAINABILITY

The Upper Ruvubu Dam project was ranked 3rd out of the nine potential large dams in the Kagera basin evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria during the IESE.

13. RISKS

None identified.

14. DURATION AND FUNDING

The estimated cost for the construction of the Upper Ruvubu Dam and associated works including the power generating capacity is US $ 70 million (2012). This excludes operational costs and the costs for the construction and operation of the required infrastructure for the irrigation and rural water supply distribution systems.

The further studies, design and construction of a dam of this size could take as long as 9 or 10 years. At this stage of study, the duration and source of funding for this project have not been investigated.

15. ADDITIONAL INFORMATION REQUIRED

Draft t erms of r eference (TOR) hav e be en pr epared f or feasibility s tudies and E SIA h ave bee n prepared for the nine large dam projects identified in the Kagera basin.

16. RECOMMENDATIONS

Project should progress to feasibility study pending results of current prefeasibility study.

SMALLER DAMS

Dams are classified as "smaller" dams primarily on dam capacity, rather than adhering to the International Commission on Large Dams classification of dams with a wall height of <15m. Some dams with lower walls have huge capacity and other larger dams are in reality quite "small". Dams with a wall height of < 15m ***or*** *with a capacity <30 million m^3 have been considered as "smaller" dams for comparative screening.*

1. BIGASHA DAM (Bigasha River) - UGANDA Also known as the OMUMUKURA DAM

In 2011 NELSAP commissioned the feasibility study for four small multipurpose dams, with one in each of the four countries of the Kagera River Basin. The Bigasha Dam in Western Uganda is one of these dams. The latest feasibility study, completed by Tractebel Engineering S.A., was released October 2012. Other dams are:

- Karazi dam - Tanzania
- Taba-Gakomeye - Rwanda
- Buyongwe – Burundi (also referred to as Kiremba Dam)

Bigasha Dam is estimated to cost about US$37 million and would supply water for about 170 000 persons, 800 ha of irrigation and also livestock and aquaculture. The scheme could be implemented in about 5 years.

1. SOURCES OF INFORMATION

Information on the Bigasha Dam has been extracted from the following documents prepared for NBI-NELSAP:

- Tractebel Engineering S.A., November 2012, Feasibility studies for 4 small multipurpose dams in the Kagera River Basin, Feasibility Study Report – Third draft report about Bigasha site in Uganda
- Newplan, 2012. Draft Environment and Social Impact Assessment (ESIA) Bigasha Dam, Newplan Limited Consulting Engineers and Planners (undated but post-June 2012).
- Newplan, 2012. Developing Resettlement Policy Frameworks (RPFs) for four (4) proposed small multipurpose dams at Bigasha, Buyongwe, Karazi, and Taba-Gakomeye in the Kagera River Basin: Volume iii-A: Preliminary Resettlement Action Plan for Bigasha Site – Draft no. 2 (September 2012)
- TRACTEBEL ENGINEERING S.A., October 2012. Feasibility studies for 4 small multipurpose dams in the Kagera River Basin, Feasibility Study Report – Draft report about Bigasha Dam in Uganda.
- TRACTEBEL ENGINEERING S.A., September 2012, Feasibility Studies for 4 small multipurpose dams at Kiremba, Taba-Gakomeye, Omumukura and Karazi in the Kagera River Basin, Draft Version.
- Feasibility Studies of 4 Small Multipurpose Dams at Kiremba, Taba-Gakomeye, Omumukura, and Karazi in the Kagera River Basin: Second Interim Report by Tractebel Engineering – Coyne and Bellier – May 2012

2. STATUS OF THE PROJECT

Bigasha is one of four small dams (of less than 15m height) selected by the NBI for feasibility study, one in each of the four Kagera Basin countries. The 3rd draft feasibility study has been released - November 2012.

The Bigasha site has seen detailed study with a comprehensive feasibility study including hydrology, geotechnical survey, user needs survey, and design aspects.

Additional research includes a draft ESIA and Resettlement Action Plan (RAP).

3. PROJECT OBJECTIVES

The Bigasha Dam site is situated in the upper reaches of the ephemeral Bigasha River that flows only in the rainy seasons and has no surface flow for at least four months of the year. The dam would serve to stimulate the agricultural economy by providing irrigation water for the wide and largely undeveloped valley floor downstream of the dam site, and would be an important source of water for both rural and urban domestic use – notably for the town of Isinjiro, where rapid growth is anticipated. Aquaculture would be an additional use.

It will not be feasible for the dam to provide hydropower.

4. RATIONALE AND CONTEXT

The Bigasha Dam site has been selected as an opportunity for development in the Kagera Basin in Uganda, from an initial long-list of 130 possible sites in the Basin. Equivalent development opportunities have also been identified in the other three basin states. The purpose of the Bigasha Dam would be to bring much needed development through improved access to water for local communities.

5. PREPAREDNESS FOR IMPLEMENTATION

A comprehensive draft feasibility report has been prepared for the Bigasha Dam project. ESIA and Resettlement Action Plan reports have also been completed.

A decision regarding implementation can be made on the basis of these studies.

6. PROJECT AREA AND LOCALITY MAP - BIGASHA

The dam site is located on the Bigasha River in the lower Kagera River Basin. The site is in Ngarama sub county, Bukanga County, in Isingiro District of the Western Uganda Region near the border of Tanzania, as shown in **Figure 1**. The coordinates for the axis of the proposed dam shown in **Figure 2** are as follows:

WGS 84 (DD)		Bank
Longitude	**Latitude**	
30,89597 E	-0,94423 S	**Right**
30,89832 E	-0,95016 S	**Left**

The Bigasha River is a seasonal tributary of the Kagera River. The Bigasha River is dry at least four months of each year.

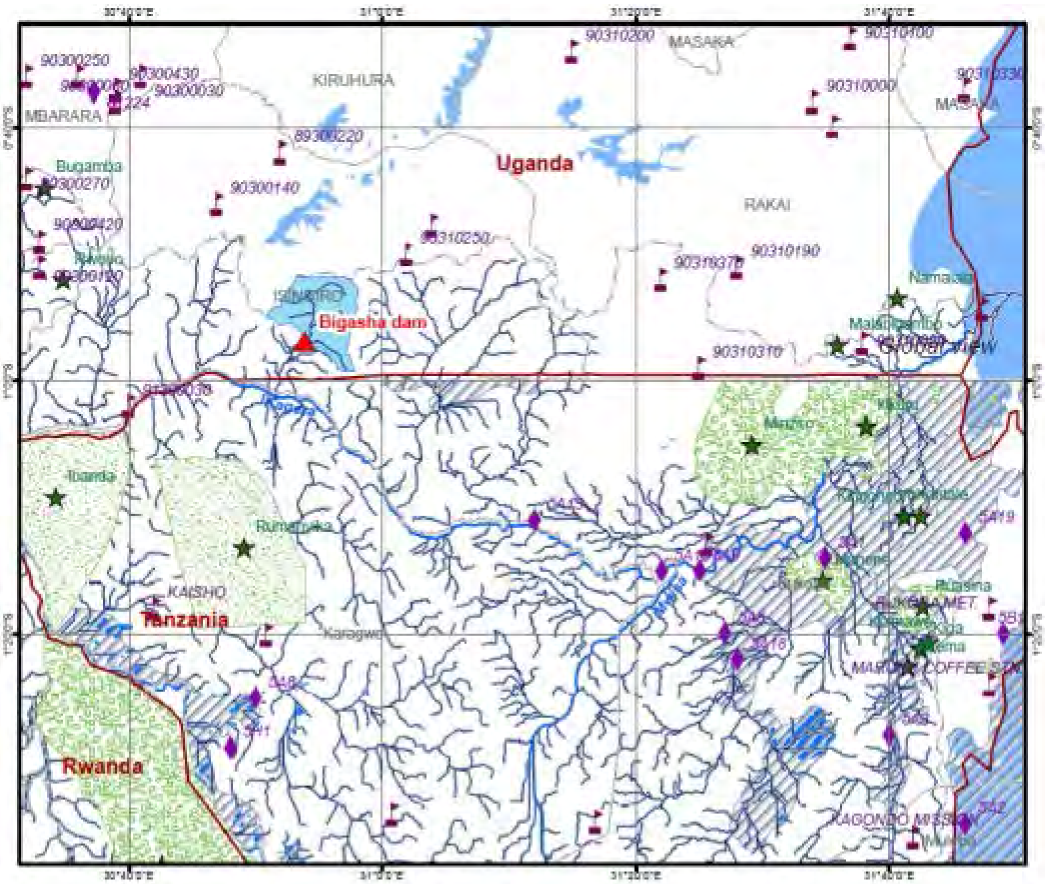

Figure 1: Location of Proposed Bigasha Dam

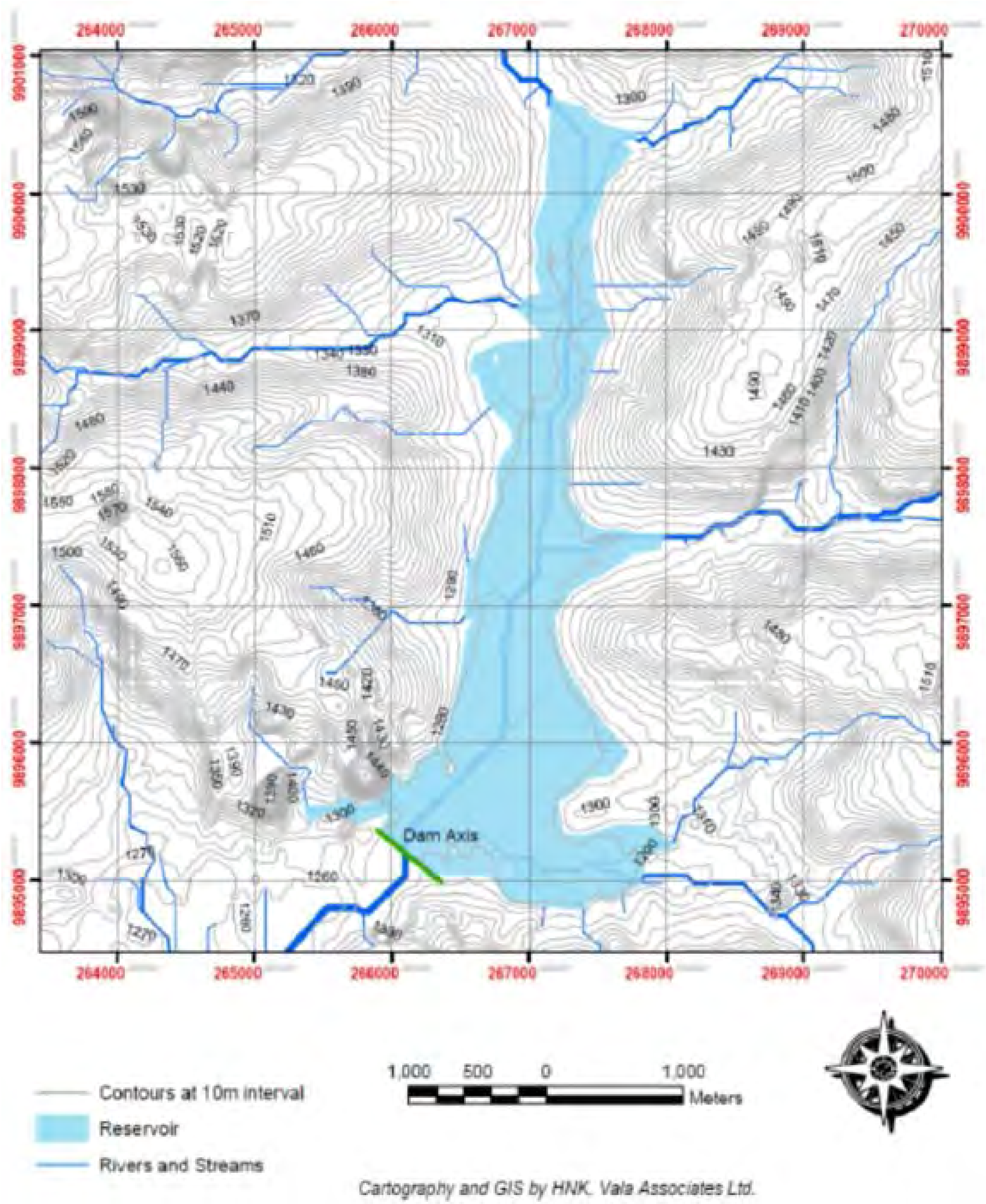

Figure 2: Reservoir Basin of proposed Bigasha Dam

7. REPLICABILITY

Each dam project proposed under this programme is unique. Diversion weir irrigation schemes have been proposed as preferred options in place of two of the four dams investigated (Taba-Gakomeye in Rwanda and Buyongwe in Burundi).

8. BENEFIT SHARING

The Bigasha Dam offers only local benefits. However the intention of implementing four projects in each of the four basin countries would be to share in the benefits of the Kagera Basin's water, and in possible funding streams sourced for this purpose.

9. TECHNICAL DESCRIPTION OF PROPOSED BIGASHA DAM

According to Tractebel Engineering S.A the recommended dam design characteristics are as follows:

- MAR (seasonal flow): 10 million m^3
- Contributing catchment area: 101 km^3
- Dam Type: Earthfill embankment
- Dam height: 12 m
- Full Supply Level (FSL): 10 m
- Dam crest length: 610.16 m
- Storage capacity: 6.41 million m^3
- Reservoir surface area at FSL (full supply level): 1.45 km^2
- Reservoir surface area at MWL (max water level): 1.64 km^2
- Sedimentation: 0.063 million m^3/a (1%)
- Catchment sediment yield: 637 tons/km^2/a

This is a very much smaller dam than that proposed in pre-feasibility studies (Tractebel Engineering - Coyne and Bellier, May 2012). In this earlier assessment the MAR was estimated at 17 million m^3/annum and a dam with storage capacity of 19 million m^3 was planned. The new design proposal is more in keeping with the revised MAR.

The Kagogo Dam, upstream of the Bigasha Dam site, utilises the flow from 10% of the catchment – significantly reducing potential inflows at Bigasha.

The Bigasha River also flows across the border into Tanzania before joining the Kagera. International obligations and downstream impacts, including downstream opportunity costs, must be considered in making an implementation decision.

10. BENEFITS

Benefits for local development would include the provision of water to communities in the immediate vicinity for domestic use (including the growing town of Isinjiro), irrigation, and livestock watering. It is likely that small businesses would also develop around the dam, including aquaculture. The increased productivity that would be brought by the additional secure supply of water would improve food security. These benefits would be dependent on additional infrastructure, such as pipelines, pumps and irrigation canals also being provided. The marketing of additional produce and roads to facilitate transport to markets would also have to receive attention.

According to the October 2012 Tractebel report the net irrigated area is estimated at 430 ha whilst the ESIA report (Newplan) indicates a very large command area (>2000 ha) with a likely develop net area of between 800-1300 ha depending on the utilisation mix.

Currently water from the river is used primarily for domestic purposes and cattle watering. Future uses include the irrigation of maize, beans, potatoes and dried fruit. Rice is not considered a suitable crop due to its high water requirement. Fish farming, using ponds, has been identified by local communities as a future activity.

Tractebel Engineering S.A. quantified water demand as follows:

Table 1: Current and future estimated water demand – Bigasha Dam

Water Use Type	Water demand (m³/year)	
	2012	**2037**
Water supply demand (for people)	1,500,000 (pop 168 000)	7,740,000 (pop 415 000)
Irrigation demand	2,900,000	4,712,500
Livestock water demand	560,000	710,000
Aquaculture demand	440,000	1,450,000
Environmental requirement	0[1]	0
Total (m³/year)	**5,400,000**	**14,612,500**
Total (m³/s)	**0.17**	**0.46**

[1]Considered inadequate by Aurecon/WEMA

Salient features in this table are:

(i) The very rapid growth in population, more than doubling over the next 35 years – this particularly in the town of Isinjiro.

(ii) The failure to allocate any water to environmental flows. This is argued on the basis of the river being seasonal and without any natural flow for four months of the year. This would, however, be unacceptable to any donor / investor. Some provision must be made for downstream releases. The ESIA report suggests 10% of MAR, although recognising that this is a minimal amount. Aurecon/WEMA argues that 20% of MAR is a target that should be acceptable to international investors, this target being based on studies of similar projects.

(iii) Estimated demand for 2012 of 5.4 million m^3/annum could be met from the runoff received. However demands will soon outstrip supply and from the data available the dam will not come close to meeting needs in 2037, with requirements exceeding MAR by 50%.

(iv) It should be noted that no provision is made for hydroelectric power as the feasibility study has indicated that this would not be economically viable.

The Bigasha dam would provide the following benefits:

- Improved water supply for domestic use (water supply project)
- Irrigation water on 430 ha (or greater)
- Water for livelihoods (including aquaculture)
- It is estimated that 116,000 people would benefit from this project upon its implementation. According to the 3rd draft feasibility report from Tractebel, the objective is 23 600 households as beneficiaries.
- According to the 3rd draft feasibility report from Tractebel, For the livestock watering, the design has been produced for 151 000 livestock units with 20 water points, each one with a capacity of 7 000 litres.

11. IMPACTS

Environmental:

- The net water loss due to evaporation is estimated at 10.7% of the annual inflow. Thus, loss of water resources through evaporation would be an issue for the Project.
- An allowance of 10% of the MAR has been provided for environmental flows. The impact on the Kagera itself, and thus on Lake Victoria, would be minimal.
- The reservoir will flood a large vegetation area, estimated to be 145Ha at FSL (Full Supply Level)

Socio-economic

- Some resettlement will be required as a consequence of inundation, primarily due to the loss of lands used for cropping, and more especially for grazing. A resettling Action Plan has been compiled (Newplan 2012). It is estimated that about 200 people will be affected and will require either resettlement or compensation.
- No major infrastructure and cultural heritage site should be impacted by the Project.
- The Bigasha River flows into Tanzania and international obligations towards downstream users must be taken into account.

Newplan Limited Consulting Engineers and Planners have undertaken a full ESIA study. Environmental and social impacts with mitigation measures are discussed in chapter 7.

12. SUSTAINABILITY

- Additional infrastructure would have to be provided to distribute the water for domestic use, cattle watering and irrigation.
- It is probable that the on-going operation and maintenance costs and associated staff requirements would have to be funded by the government perhaps with some local contribution from the sale of water.

13. RISKS

- Potential conflict of interests between livestock development and future irrigation might arise.
- Downstream water requires by Tanzania (international obligations)
- Sedimentation risk has been mitigated by provision of sufficient dead storage. The catchment is not seriously degraded and there are no reported environmental risks that could threaten the project. With the proposed dam design, the outlet threshold has been set 6m above the minimum ground elevation, giving a dead storage is 1,76 million m³ representing more than 30 years of sediment storage.

14. DURATION AND FUNDING

Donor funding would be required and the duration for implementation for all of these dams would be of the order of 5 years: 1 year to obtain donor funds, 1 year for appointment of consultant, and 3 years for design and construction.

According to the 3rd draft feasibility report from Tractebel, the following summary presents the project costs:

Water Use Component	Capital Investment Costs US$ for the first stage	Capital Investment Costs US$ for the next stages	Capital Investment Costs US$ TOTAL
Dam	37 030 000		37 030 000
Irrigation	2 400 000	1 500 000	3 900 000
Potable Water Supply	17 535 000		17 535 000
Livestock Water Supply	2 397 000	959 000	3 356 000
Aquaculture	896 000	2 007 000	2 903 000
Sub-Total	**60 258 000**	**4 466 000**	**64 724 000**

15. ADDITIONAL INFORMATION REQUIRED

- Economic benefits

16. RECOMMENDATIONS (AURECON/WEMA)

Bigasha is a small dam, but with sufficient water to meet the immediate requirements of the proposed 430 ha of irrigation, livestock, and some added human needs demand (domestic use). The feasibility study makes it clear that the dam cannot provide for hydroelectric power.

International obligations must also be clarified and any concerns settled.

The Feasibility Study and associated studies (ESIA, Dam Safety and Resettlement Action Plan) are comprehensive, although it is the opinion that the impacts and benefits as outlined in the ESIA study (Newplan 2012) are not clearly presented.

This dam could be implemented within about 5 years on favourable evaluation of the feasibility study and the ESIA.

2. BUYONGWE DAM – BURUNDI (on the Buyongwe River, a tributary of the Kanyaru, close to the Rwandan border) Also known as the KIREMBA DAM

In 2011 NELSAP commissioned a feasibility study for four small multipurpose dams, with one in each of the four countries of the Kagera River Basin. The Buyongwe Dam in Burundi is one of these dams. The latest draft feasibility study, completed by Tractebel Engineering S.A., was released in October 2012. Other dams are:

- Bigasha Dam – Uganda (also known as the Omumukura Dam)
- Karazi Dam- Tanzania
- Taba-Gakomeye – Rwanda

The feasibility study recommends the domestic, irrigation, aquaculture and livestock water demands could be met without constructing a dam. The existing small hydropower scheme should be retained and developed.

1. SOURCES OF INFORMATION

Information on the Buyongwe Dam has been extracted from the following documents prepared for NBI/NELSAP:

- TRACTEBEL ENGINEERING S.A., November 2012, Feasibility studies for 4 small multipurpose dams in the Kagera River Basin, Feasibility Study Report – Third draft report about Buyongwe site in Uganda
- TRACTEBEL ENGINEERING S.A., October 2012, Feasibility studies for 4 small multipurpose dams in the Kagera River Basin; Feasibility Study Report – Draft report about Buyongwe site in Burundi
- TRACTEBEL ENGINEERING S.A., September 2012, Feasibility Studies for 4 small multipurpose dams at Kiremba, Taba-Gakomeye, Omumukura and Karazi in the Kagera River Basin, Draft.
- Feasibility Studies of 4 Small Multipurpose Dams at Karemba, Taba-Gakomeye, Omumukara, and Karazi in the Kagera River Basin: Second Interim Report by Tractebel Engineering – Coyne and Bellier – May 2012
- Environmental and Social Impact Assessment (ESIA) and Developing Resettlement Policy Frameworks (RPFs) for Four (4) Proposed Small Multipurpose Dams at Bigasha, Buyongwe, Karazi, and Taba-Gakomeye in the Kagera River Basin: Volume 1A: Draft Scoping Interim Report by Newplan Consulting Engineers and Planners - May 2012.

2. STATUS OF THE PROJECT

The originally identified Buyongwe dam on the Buyongwe River (watershed area 256km², MAR 86.7 million m^3/annum) was for an earthfill construction with a planned wall height of 14m, wall length of 440m, and storage capacity of about 9.5 million m³.

The more recent October 2012 Tractebel Engineering S.A. feasibility report determined the current (2012) water demand to be 0.97 m³/s and the future (2037) demand to be 1.72 m³/s. The Kiremba River has a guaranteed runoff of 1.8 m³/s, rendering the construction of a dam unnecessary as run of river supply can meet all requirements by means of a weir diversion.

The feasibility study concludes with a revised infrastructure proposal and plans for a run of river abstraction scheme.

3. PROJECT OBJECTIVES

The purpose of the Buyongwe Scheme would be primarily to provide access to water for domestic use (690 000 people) and the improved irrigation of rice. Aquaculture is another potential use, although of lower priority. Hydropower generation was amongst the original project objectives, but the alternative maintenance and possible expansion of a small upstream hydropower station is the preferred option.

4. RATIONALE AND CONTEXT

The Buyongwe Scheme was planned with the objective of alleviating poverty by providing improved access to water for local communities.

5. PREPAREDNESS FOR IMPLEMENTATION

The draft feasibility study was released in October 2012. This feasibility study recommends that the Buyongwe dam is not necessary and that all identified needs (including irrigation) can be addressed through run of river abstraction.

Detailed planning of the diversion structure, irrigation canal system (down to tertiary canal level), water supply distribution system, and upstream hydropower generation – including costing for all these elements, is included in the feasibility report.

6. PROJECT AREA AND LOCALITY MAP

According to the Terms of Reference the proposed dam would be located on the Buyongwe River a few kilometres downstream of the township of Kiremba, in Kiremba district, Ngozi Province of Burundi as indicated in **Figure 1**. The Buyongwe River is a tributary of the Akanyaru and Nyabarongo Rivers.

The coordinates of the axis of the dam shown in **Figure 2** are as follows:

Dam Axis coordinates				
WGS 84 (DD)		**UTM/WGS 84 (m)**		
Longitude	**Latitude**	**X**	**Y**	**Bank**
		UTM 35S		
29,95727	-2,81475	828822,05	9688466,04	**Right**
29,95579	-2,81842	828656,31	9688060,26	**Left**

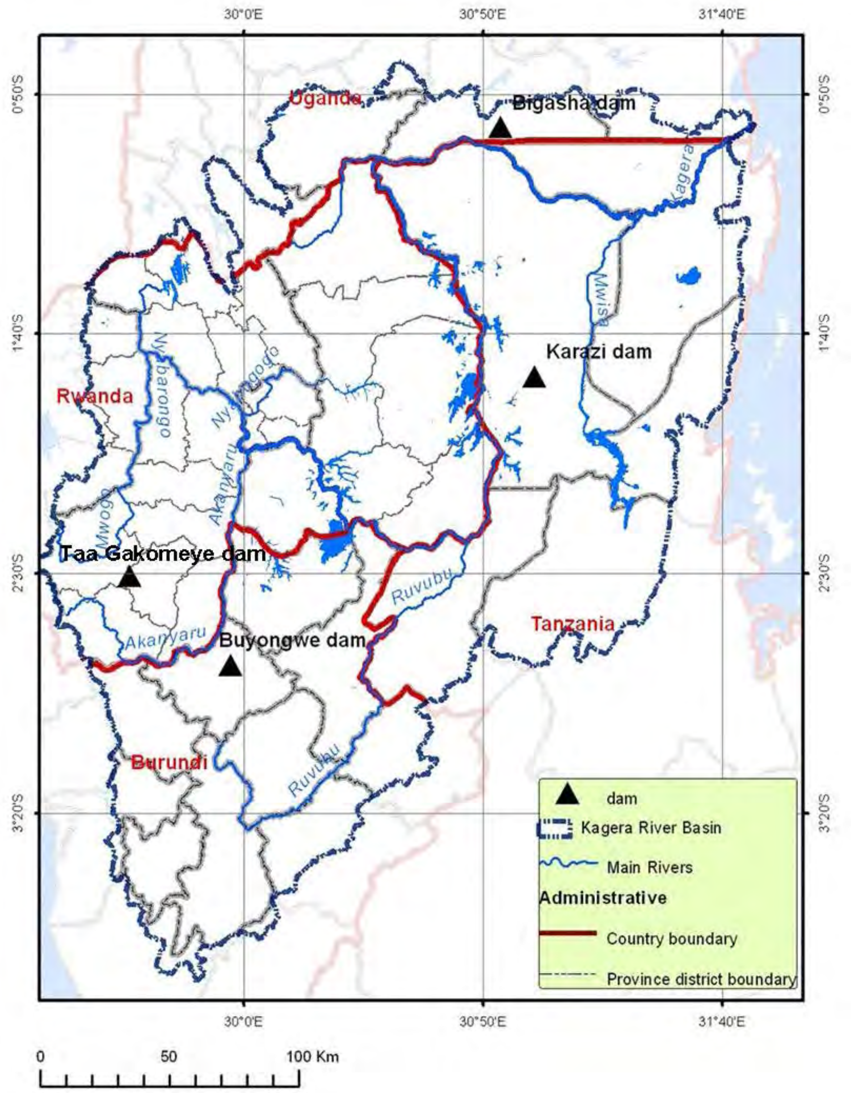

Figure 1: **Location of proposed Buyongwe dam / scheme**

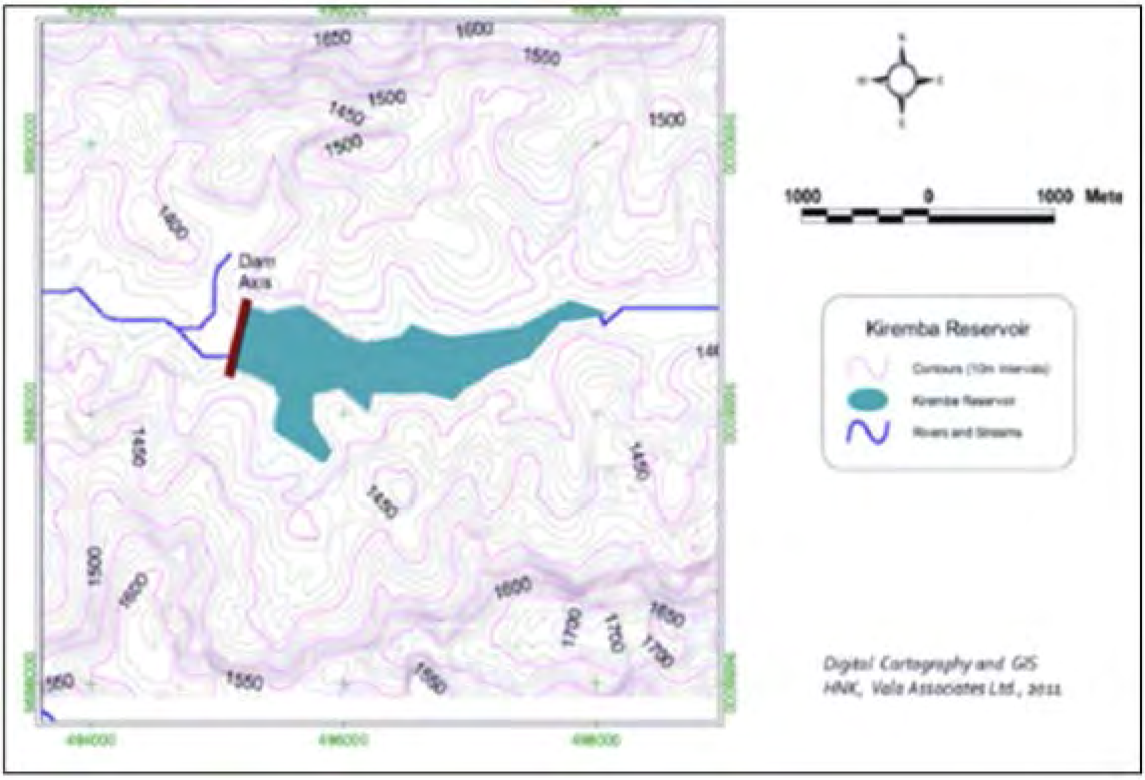

Figure 2: Reservoir Basin of the proposed Buyongwe dam

7. REPLICABILITY

This is a useful example of a feasibility study recommending that the proposed infrastructure in inappropriate and unnecessary and offering an alternative (a diversion weir supporting run of river use) outside the expectations of the terms of reference.

8. BENEFIT SHARING

The project offers local benefit for improved irrigation and domestic use.

9. TECHNICAL DESCRIPTION OF PROPOSED DAM / ALTERNATIVE RUN OF RIVER ABSTRACTION SCHEME

The catchment area is 256 km² in extent, with a mean annual rainfall of 1205 mm, and a Mean Annual Runoff of 86.63 million m^3/annum. The catchment is very heavily farmed and badly eroded and annual sedimentation is estimated to be 0.15 million m³. This would require a large volume of dead storage if a dam were constructed, adding to implementation costs.

Plans for a dam were as follows (Newplan ESIA Interim Scoping Report, May 2012):

- Structure: earth fill embankment
- Height : 14 m (12m FSL)
- Crest length: 440 metres
- Storage capacity: 9.52 million m³
- Reservoir surface area: 1.27 km²
- Reservoir fetch: 2.9 km

MAR of the Buyongwe River at proposed the dam site is 86.63 million m³ and flows are always greater than daily abstraction requirements.

Tractebel undertook an optimization exercise which showed that technically the optimal dam size (wall height) would be 24m, particularly if hydropower were to be prioritized, but not only would this flood the existing hydropower plant and site (even the 14 m wall and 12 FSL will flood the site) but there was also insufficient demand for the water that would be provided.

According to Tractebel (October 2012) the natural guaranteed discharge of the Buyongwe River is 1,80m³/s making it possible to provide all the current and future (2037) through run of river abstraction with the construction of only a small diversion weir and retention pond. Natural flow is sufficient all year round (even during the dry season) to satisfy the maximum water demand.

The original plan for a dam plan has therefore seen major revision in the feasibility study prepared by Tractebel Engineering which recommends that a dam is unnecessary and that all requirements can be met by means of a far small (and cheaper) run of river abstraction scheme. Irrigation distribution and O&M costs are nevertheless significant at USD 29 000/ha.

Tractebel have proposed:

(i) An irrigation scheme based on a diversion structure with overnight impoundment capacity

(ii) A water supply scheme, and
(iii) Improvements to the existing power plant.

Infrastructure includes a diversion structure 600 m downstream from the existing bridge. This would create a 7 ha pond with a capacity of approximately 100 000 m³, with a backwater effect up to the existing bridge. This volume will be used as a buffer to regulate the water level upstream of the intake and create a reserve to balance day withdrawal and night impoundment.

10. BENEFITS

Irrigation water can be provided for approximately 1000 ha. Rice is dominant crop and this is already irrigated across the valley bottom. The irrigation system would not provide significantly to new irrigated land, but would bring about better control, management and higher productivity of existing paddies. Beans and maize would be grown in rotation with rice.

Water could be supplied to 690 000 people, although this will require distribution infrastructure at a cost of USD100 million.

Tractebel Engineering S.A. (Oct 2012) quantified water demand as follows:

Water Use Type	Water demand (m³/year)	
	2012	2037
Water supply demand	12,310,000	21,742,000
Irrigation demand	7,980,000	19,600,000
Livestock water demand	260,000	320,000
Aquaculture demand	1,410,00	3,800,000
Environmental requirement	8,700,000	8,700,000
Total (m³/year)	**30,660,000**	**54,162,000**
Total (m³/s)	**0.97**	**1.72**

For energy supply, a small 65 kW hydropower plant, recently refurbished, is already in operation, supplying the local hospital. This could be doubled in capacity through the addition of a second turbine (there is more than sufficient water). The cost of this would be the loss of 10 ha of existing irrigation land due to the required diversion through the turbine.

11. IMPACTS

With dam

Environmental

- The annual sedimentation rate (1.4%) is significant, with sedimentation putting any reservoir structure at risk. Providing 7m of dead storage would allow a 24-year lifespan.
- Environmental flows have been planned at 10% of MAR. This may be insufficient for downstream river health.
- Water hyacinth is a potential risk.
- All land is already transformed – hence no loss of biodiversity

Socio-economic environment

- One of the main issues would be the loss of land, and consequent need for relocation of farmers, due to the reservoir. With a 14m high dam, 117 ha of cultivated land, 55ha of plantations and 24 buildings would be flooded by the reservoir at MWL. This would affect an estimated 430 households.
- For energy supply, a small hydropower plant, recently refurbished, is already in operation, supplying the local hospital. A dam with 12 m FSL would flood this plant.

Without dam:

Environmental

- The erosion of riverbanks could be an issue due to the Project with the high agricultural activities in the area. Sedimentation can be mitigated through regular flushing of the diversion structure impoundment.
- Significant water will be abstracted from the river, particularly as demands grow. This will have to be managed to ensure that the river retains its environmental flow and that downstream users, beyond the reach of the scheme, are not adversely affected.
- High levels of abstraction at times of low flows would significantly impact on environmental requirements – especially as demand increases.

Socio-economic environment

- The diversion structure will create an approximate 100 000 m³ and 7 ha pond, with a backwater effect up to the existing bridge. This volume will be used as a buffer to regulate the water level upstream the intake and create a reserve to balance day withdrawal and night impoundment. With the build canals, an estimation of 10ha could be estimated to be lost by the irrigation project. These lands are mainly agricultural land.
- It will not be necessary to implement a relocation action plan (RAP) but compensation for lost lands will be required.
- In case of the upgrading of the hydropower plant b adding a second hydropower turbine, a further 10ha of irrigation land would be lost.

12. SUSTAINABILITY

Financial

The lower cost of the diversion weir (as opposed to a dam) increases the chances of financial sustainability. Costing of irrigation indicates that this should provide economic returns. Water supply to people will only show a 10% recovery on capital and O&M through sales of water, but by computing all benefits (time saved, health etc.) the investment shows an economic return to the country and its people.

The proposed hydropower upgrade is in itself economically viable, but the loss of 10 ha of agricultural land could tip this balance.

Social

Improved incomes, economic activity should provide for social sustainability. Improved livelihoods (especially though domestic water supply) may result in population movement into the area, increasing social and environmental stresses.

Environmental

The catchment experiences a high level of degradation and sedimentation has been highlighted as a severe risk to a dam. Sustainability of the dam would depend on upstream catchment management. This is not an issue in the event of a diversion scheme being implemented.

13. RISKS

With a dam

(i) The catchment area is badly degraded and the river displays high levels of turbidity. Sedimentation would rapidly lead to loss of dam capacity, especially as given the relatively small reservoir planned. This could only be avoided through the simultaneous or earlier introduction of a catchment management programme aimed at managing surface runoff, agroforestry, natural vegetation management, and conservation farming practices.

(ii) The footprint area of the dam is densely farmed, almost exclusively with rice. The premise is that by adding to irrigation capacity, productivity will improve.

Run of River diversion scheme

(i) The above risks are eliminated.

14. DURATION AND FUNDING

Tractebel Engineering S.A. has undertaken a full Financial and Economic Analysis. See the feasibility study of October 2012.

Implementation of a dam would be of the order of 7-9 years given the current level of feasibility and ESIA investigation.

Table of estimated investment costs:

DEVELOPMENT	**DETAIL**	**COST**
Water supply	Distribution to 690 000 people	$ 110 million
Irrigation	Diversion s tructure, I mprove i rrigation perimeters w ith m ultiple di kes. C anal distribution to approx. 1000 ha	$ 13 million
Hydropower	Additional t urbine t o ups tream h ydropower plant	€ 730 000 (approximately 1 mill USD)

According t o t he 3rd draft f easibility s tudy f rom Tractebel t he f ollowing ar e t he capital c osts f or t he Buyongwe dam:

Water Use Component	**Capital Investment Costs US $ for the first stage**	**Capital Investment Costs US $ for the next stages**	**Capital Investment Costs US $ TOTAL**
Irrigation	13 020 000	10 830 000	23 850 000
Potable Water Supply	41 890 000	68 890 000	110 780 000
Livestock Water Supply	1 800 000	1 120 000	2 920 000
Aquaculture	7 370 000	10 850 000	18 220 000
Micro-Hydropower	940 000	0	940 000
Sub-total	**65 020 000**	**91 690 000**	**156 710 000**

15. ADDITIONAL INFORMATION REQUIRED

None

16. RECOMMENDATIONS (AURECON/WEMA)

Tractebel Engineering (Oct 2012) have recommended that the Buyongwe Dam should not be constructed as originally conceived, but rather replaced with a diversion weir and run of river abstraction point, providing for both domestic and irrigation water.

Aurecon/WEMA is fully in support of this recommendation.

3. GASHAYURA DAM (Gashayura River) – BURUNDI

The Gashayura Dam is another of the smaller "large" dams proposed for the Kagera Region as part of the NELSAP supported Kagera River Basin Management Project. The dam site is on the Gashayura River in central Burundi. This would be a multipurpose dam aimed at providing water for irrigation and domestic water supply. The current proposal is for a 19 m high earth embankment dam with an estimated reservoir storage capacity of 20.4 million m^3 which would cost US $17 million. The dam was ranked 7^{th} out of nine identified large dam developments in the Kagera Basin.

1. SOURCES OF INFORMATION

Preliminary technical information and initial screening of social and environmental impacts for the proposed Gashayura dam is presented in a draft report entitled *Detailed Identification Studies for the Potential Large Dams in the Kagera Basin* prepared by Eng. Dr. Henry K Ntale and submitted to NELSAP in October 2012.The information presented here has been extracted from this report.

2. PROJECT DESCRIPTION / STATUS

The Gashayura project is focused on the construction of a moderately sized dam primarily for irrigation and, water supply. Some hydropower could also be generated to provide the energy necessary for pumping water for domestic consumption.

An Initial Environmental and Social Evaluation (IESE) and technical evaluation of nine dams in the Kagera Basin including the Gashayura Dam was prepared by Eng. Dr. Henry K Ntale as part of the report on potential large dams in the Kagera Basin (October 2012). This study provided updated technical information for the project, quantified the potential demands, identified potential social and environmental impacts, and developed initial cost estimates for the proposed dam construction.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The purpose of the Gashayura project would be to boost community development through the provision of water supplies for irrigation and rural-domestic use.

4. RATIONALE AND CONTEXT FOR PROJECT

The Gashayura dam project is one of eight potential dam sites identified in earlier rapid identification studies for further investigation and appraisal through NELSAP.

5. PREPAREDNESS FOR IMPLEMENTATION

An Initial Environmental and Social Evaluation (IESE) and scoping level technical evaluation and provisional cost estimate have been completed. A detailed Environmental and Social Impact Assessment (ESIA), awareness campaign, and a full feasibility study are required.

Potential funding sources must also still be identified.

6. LOCATION

The Gashayura Dam site is situated on the Gashayura River in central Burundi (Figure 1).

The coordinates of the proposed dam site are 30° 9’ 7.8” East and 2° 56’ 13.86” South.

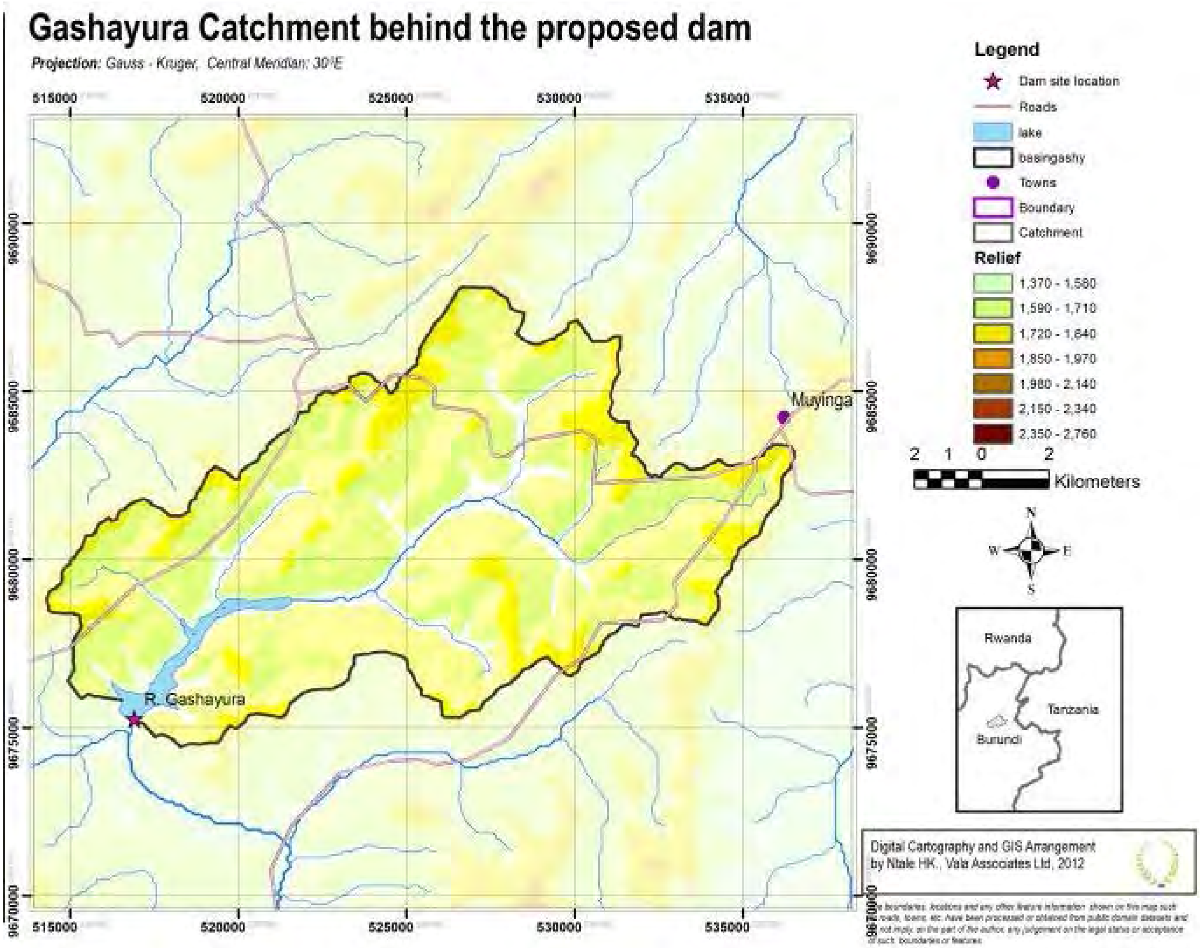

Figure 1: Proposed location and catchment area for the Gashayura Dam in Burundi.

7. REPLICABILITY

The proposed scheme would be unique however there may be a number of aspects that are likely to be similar for the nine large dams that are being investigated and could probably be replicated at other dams.

8. BENEFIT SHARING

The project would only benefit Burundi.

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

The proposed design is for an earth embankment dam with the following characteristics:

- Catchment area: 159 km^2
- Mean annual runoff: 81 million m^3/annum
- Wall Height : 19 m
- Crest length: 601 m
- Storage Capacity: 20.4 million m^3
- Surface area: 2.8 km^2

10. BENEFITS

The benefits of the proposed dam would primarily be water supply for domestic use and irrigation.

The Gashayura site is very suitable for irrigation of the valley immediately downstream of the proposed dam where there is intensive mixed farming activity. Availability of water all year around would enable the valley residents to engage in more profitable agriculture. The potential command area which could be irrigated directly from the Gashayura reservoir is approximately 1212 ha.

The estimated total population that could potentially benefit from water supplied from the Gashayura project in 2012 and 2062 are 169,135 and 640,847 people respectively. The associated annual water demands would be 2 Mm^3/annum and 7.1 Mm^3/annum for 2012 and 2062, respectively.

11. IMPACTS

The IESE identified only a few potential impacts particular to this project other than those normally associated with a project of this scale. A full ESIA would be required as part of a complete feasibility study.

Environmental

- The impact on flows in the Kagera River and into Lake Victoria would be negligible.
- Impacts on environmental flows in the Gashayura River will have to be assessed and mitigated through the development of operating rules that include environmental flow releases.
- There are no protected areas identified in the vicinity of the site.
- The impact on biodiversity is likely to be minimal.

Socio-economic

- No areas of cultural significance that would need to be preserved have been identified.
- The construction of the dam would result in the loss of marshlands currently used for cultivation.
- Local sand mining operations would also be impacted.

12. SUSTAINABILITY

The Gashayura Dam project was ranked 7th out of the nine potential large dams in the Kagera Basin which were evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria during the IESE.

13. RISKS

None identified.

14. DURATION AND FUNDING

The estimated cost of the construction of the proposed Gashayura Dam is US $ 17 million (2012).

This amount excludes operational costs and the costs for the construction and operation of the required infrastructure for the irrigation and rural water supply distribution systems.

A small to medium sized dam of this nature would take a minimum of seven years, and probably ten years to investigate and complete.

At this stage of study, the source of funding for this project has not been investigated.

15. ADDITIONAL INFORMATION REQUIRED

Draft terms of reference have been prepared for Feasibility Studies and for ESIA for the nine large dam projects identified in the Kagera Basin.

4. KABUYANDA DAM (Kabuyanda River) – UGANDA

Kabuyanda Dam site is located on the River Mishumba, in Isingiro District, Uganda. The proposed 20 m high dam would have a storage capacity of 10 million m³. The estimated capital cost of the dam is US $13.2 million. The reservoir would provide water for irrigation, livestock and domestic use. The Kabuyanda scheme was ranked 4th out of the nine potential large dams in the Kagera Basin evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria during an IESE and technical review that were completed in October 2012.

1. SOURCES OF INFORMATION

Updated technical information and initial screening of social and environmental impacts for the Kabuyanda dams is presented in a draft report entitled Detailed Identification Studies for the Potential Large Dams in the Kagera Basin prepared by Eng. Dr Henry K Ntale and submitted to NELSAP in October 2012.

2. PROJECT DESCRIPTION / STATUS

The proposed Kabuyanda dam is located on River Mishumba, in the Isingiro district of Uganda. The proposed 20 m high dam would have a storage capacity of 10 million m³. The reservoir would provide water for irrigation, livestock and domestic use.

An Initial Environmental and Social Evaluation (IESE) and technical evaluation of nine dams in the Kagera basin including the Kabuyanda Dam was prepared by Eng. Dr. Henry K Ntale as part of the report on potential large dams in the Kagera Basin (October 2012). This study provided updated technical information for the project, quantified the potential water demands, identified potential social and environmental impacts, and developed initial cost estimates for the construction of the proposed dam.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The objectives for this dam would be to support local economic development, with the dam providing water for irrigation, livestock and domestic use. It could also potentially provide some hydropower.

4. PROJECT RATIONALE AND CONTEXT

This development would fulfil a local opportunity.

5. PREPAREDNESS FOR IMPLEMENTATION

An Initial Environmental and Social Evaluation (IESE) and a scoping level technical evaluation and provisional cost estimate have been completed.

A detailed Environmental and Social Impact Assessment (ESIA), awareness campaigns, and a full feasibility study with detailed design would be required.

Funding must still be sourced.

6. LOCATION

Kabuyanda Dam site is located on the River Mishumba, at coordinates -0° 54' 26.04" (South) and 30° 35' 58.14" (East), where it leaves the Rwoho Central Forest Reserve and flows towards Kikagati areas in Isingiro District, Uganda as shown in **Figures 1 and 2.**

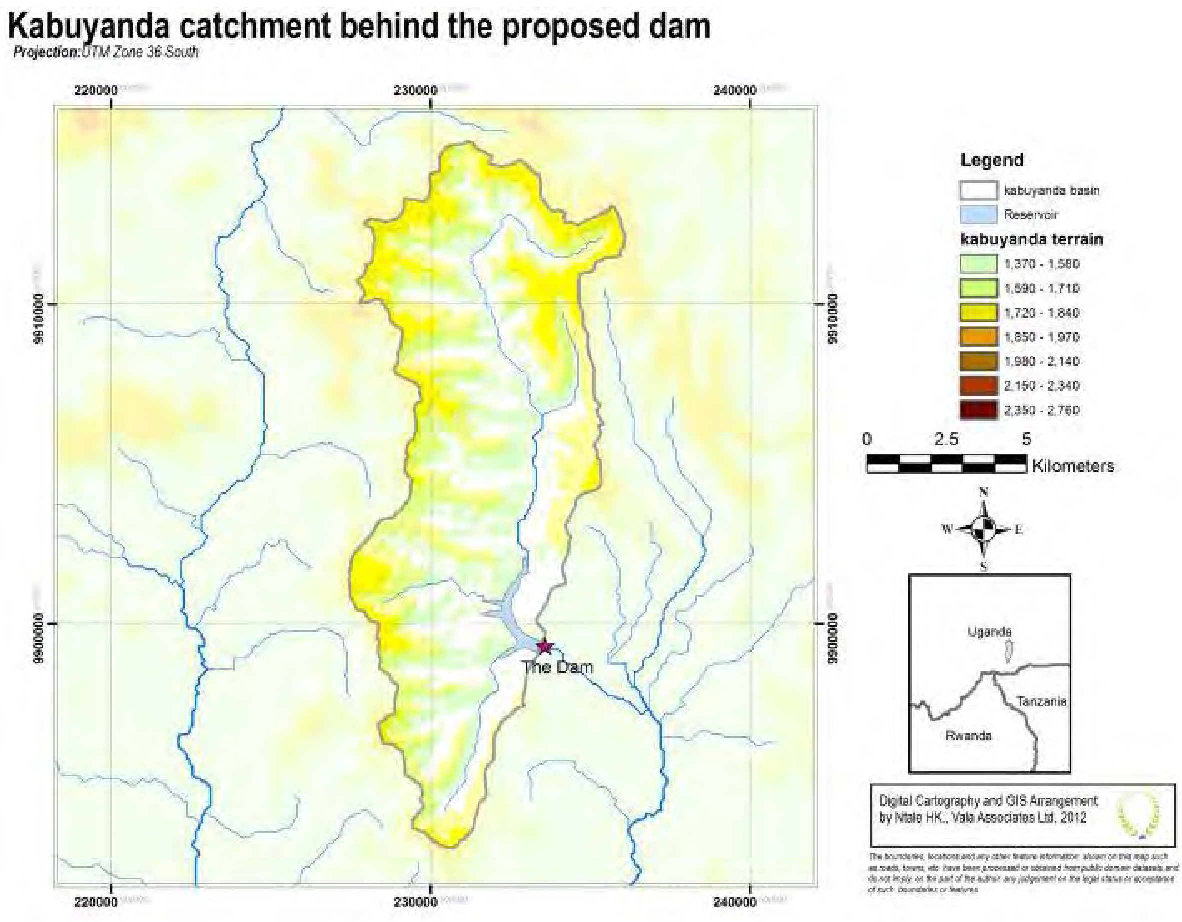

Figure 1: Location of proposed Kabuyanda dam and catchment

7. REPLICABILITY

The proposed scheme would be unique however there may be a number of aspects that are likely to be similar for the nine large dams that are being investigated and could probably be replicated at other dams.

8. BENEFIT SHARING

This dam would serve as a local development option in Uganda.

9. TECHNICAL DESCRIPTION

The proposed dam design is an earth dam with the following summary characteristics:

- Height of dam: 20 m
- Storage capacity: 10 million m³

- Wall crest length: 350 m
- Reservoir surface area: 1.18 km²
- Reservoir fetch: 2.8 km
- Catchment area: 109 km^2
- Mean Annual Runoff: 14 Mm^3/annum

10. BENEFITS

The estimated irrigation command area for Kabuyanda is about 1283 ha. This is the area that could be irrigated directly by the reservoir. However more 2,920 ha of irrigable land are available and could be irrigated if other feeding rivers could be diverted into primary irrigation canals. The command area could support 2500 farmers and provide food for about 12,700 people. The annual water demand for irrigation is about 6.4 Mm^3/annum.

A proposed 0.1 MW hydropower station at the Kabuyanda site has the potential to produce 1.0 GWh of energy per year which would be able to supply about 1,000 houses and over 6,000 people.

11. IMPACTS

Environmental

The entire catchment of the dam as well as the planned reservoir lies in the Rwoho Central Forest Reserve. Rwoho Central Forest Reserve is categorized as a secondary conservation forest in the National Forestry Nature Conservation Master Plan. There are no red-list species in the area. Of the 65 forests investigated in Uganda, Rwoho ranks 41st in overall biodiversity importance. Rwoho has one tree species unique to Uganda (Terminalia laxiflora) and one tree species endemic to the Albertine Rift (Grewia pubescens). Only a small proportion of the Forest Reserve would be inundated.

Socio-economic

The area to be inundated by the Kabuyanda reservoir is uninhabited, which would minimize compensation costs associated with the project. On the other hand there is a planned Clean Development Mechanism (CDM) project in the Rwoho Central Forest that might be impacted by the reservoir. The small-scale CDM A/R project is part of a cluster of 5 similar projects aiming to provide a new financing mechanism to overcome the current barriers to establishing timber plantations in Uganda and to allow communities to benefit from the CDM. The potential impacts on the communities benefiting from the CDM project need to be investigated.

There are a number of minor access roads that would be flooded by the reservoir and the impact on local communities would need to be assessed, as would the potential impacts on communities currently benefiting from the cultivation of papyrus reeds in the areas that would be flooded.

12. SUSTAINABILITY

The Kabuyanda Dam was ranked 4th out of the nine potential large dams in the Kagera Basin that were evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria.

13. RISKS

The dam has significant risk due to the fact that it is upstream of settlements in the river valley. If compared to the UK standards the dam would fall in hazard category B, for which the design discharge recommended would have a return period of 10,000 years.

14. DURATION AND FUNDING

- The estimated construction cost of the dam and associated works is US $ 13.2 million (2012).
- A small to medium sized dam of this nature would take a minimum of seven years, and probably ten years to investigate and complete.
- No funding sources have been identified.

15. ADDITIONAL INFORMATION REQUIRED

Draft terms of reference have been prepared for feasibility studies and ESIA have been prepared for the nine large dam projects identified in the Kagera basin.

16. RECOMMENDATIONS

Review Preliminary for pre-feasibility study

5. KARAZI DAM – TANZANIA

In 2011 NELSAP commissioned the feasibility study for four small multipurpose dams, with one in each of the four countries of the Kagera River Basin. The Karazi Dam in Tanzania is one of these dams. Other dams are:

- Bigasha dam -Uganda
- Taba-Gakomeye - Rwanda
- Buyongwe – Burundi

The feasibility study of Karazi Dam estimated the cost of the dam to be about US$18 million and the distribution infrastructure for domestic, irrigation, livestock and aquaculture about

US$36 million. The first phase scheme would supply about 24 000 households and irrigate about 500 ha.

1. SOURCES OF INFORMATION

Information on the Karazi Dam has been extracted from the following documents prepared for NBI-NELSAP:

- Tractebel, November 2012, Feasibility Study for Karazi within the Feasibility Studies for 4 Small Multipurpose Dams in the Kagera River Basin, Feasibility Study Report - Third Draft Version
- Feasibility Studies of 4 Small Multipurpose Dams at Karemba, Taba-Gakomeye, Omumukara, and Karazi in the Kagera River Basin: Second Interim Report by Tractebel Engineering – Coyne and Bellier – May 2012
- Environmental and Social Impact Assessment (ESIA) and Developing Resettlement Policy Frameworks (RPFs) for Four (4) Proposed Small Multipurpose Dams at Bigasha, Buyongwe, Karazi, and Taba-Gakomeye in the Kagera River Basin: Volume 1 A: Draft Scoping Interim Report by Newplan Consulting Engineers and Planners - May 2012

2. STATUS OF THE PROJECT

The Karazi Dam is one of four small dams (of less than 15m height) selected by the NBI for feasibility study, one in each of the four Kagera Basin countries. The study is at the feasibility stage, with a feasibility study report due in September 2012.

3. PROJECT OBJECTIVES

Pre-feasibility / scoping studies have been undertaken. The Karazi dam would create opportunity for improved livestock watering, irrigation, domestic use, and reservoir fisheries; however no studies of the potential benefits and associated infrastructure requirements have been undertaken.

4. RATIONALE AND CONTEXT

The purpose of the Karazi Dam would be to alleviate poverty by providing improved access to water for the local communities.

5. PREPAREDNESS FOR IMPLEMENTATION

According to the Terms of Reference, the Draft Feasibility Study Report is due in September 2012. A scoping study has been undertaken.

6. PROJECT AREA AND LOCALITY MAP – KARAZI

The dam site is located on the seasonal Karazi River, between Chabuhora and Kayungu villages in Nyakakika Ward, Nyabiyonza Division, Karagwe District in the north west corner of Tanzania as shown in Figure 1. This river is a tributary of the Kagera River. The coordinates for the axis of the proposed dam were recorded as follows:

WGS 84 (DD)		
Longitude	**Latitude**	**Bank**
31,01717	-1,82251	**Right**
31,0123	-1,82453	**Left**

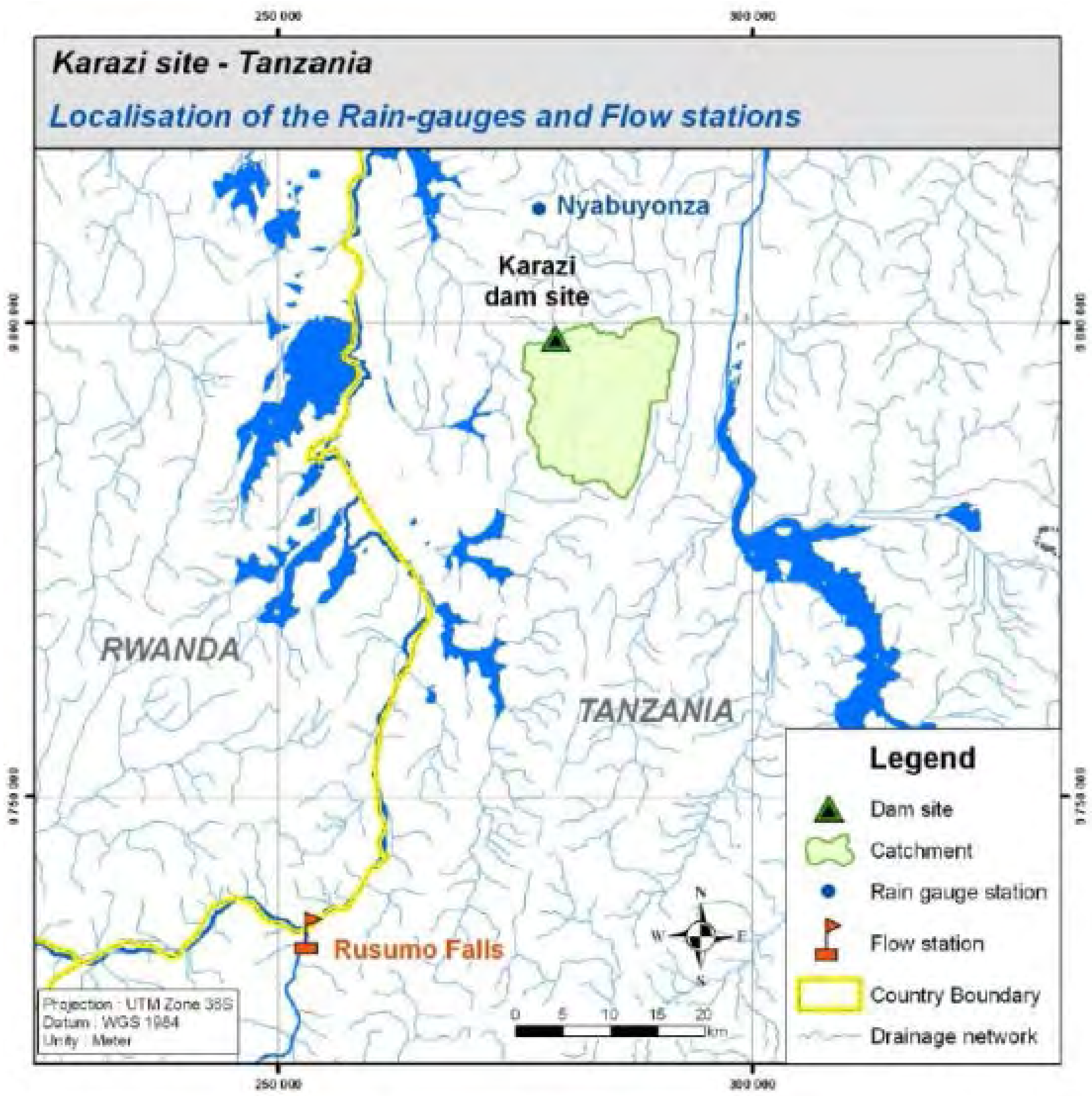

Figure 1:Location of proposed Karazi Dam

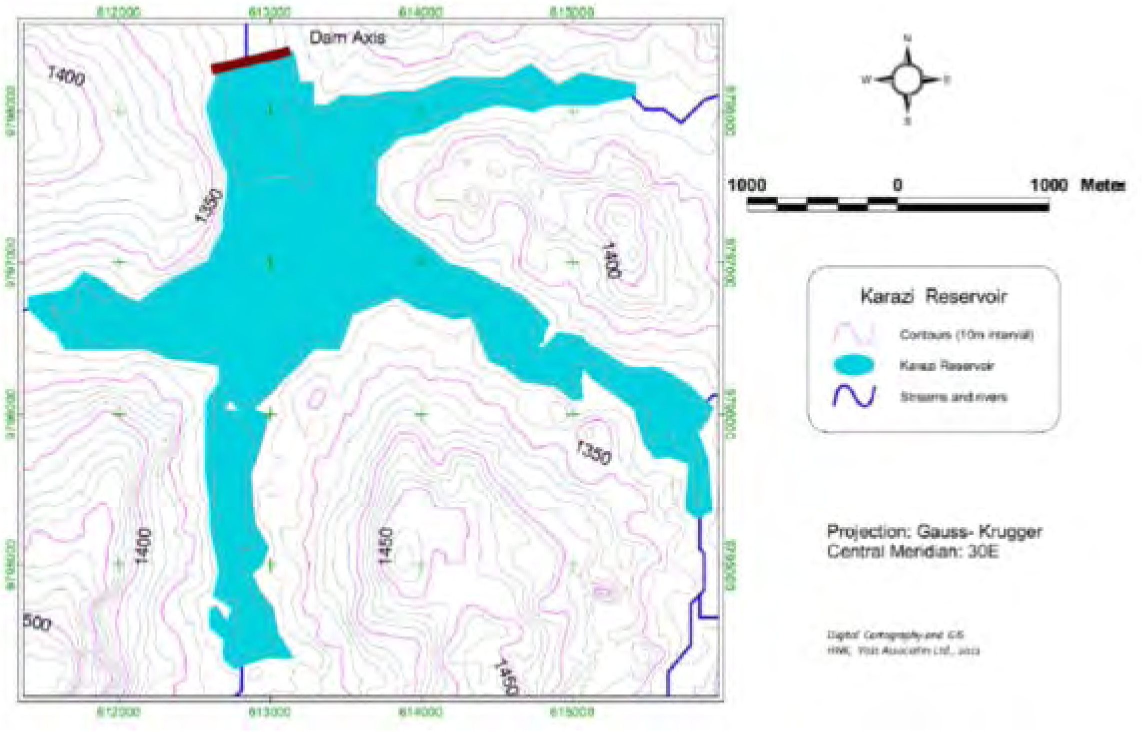

Figure 2: Reservoir Basin of proposed Karazi Dam

7. REPLICABILITY

With four dams, one in each of the four Kagera Basin countries, there would be scope for information sharing, learning and replication, although each project would be unique**.**

8. BENEFIT SHARING

The Karazi Dam offers only local benefit. However the intention of implementing four projects in each of the four basin countries is to bring an equitable spread of benefits.

9. TECHNICAL DESCRIPTION OF PROPOSED KARAZI DAM

- The catchment area is 213 km². The river is seasonal and un-gauged however the mean annual runoff was estimated to be 30 million m^3/annum.
- The proposal is for a 9.5 m high earth fill embankment dam with a crest length of 519 m.
- Storage capacity estimated at 9.2 million m³.
- Reservoir surface area of 2.7 km².

10. BENEFITS

The benefits of this project have not yet been adequately quantified and will have to be addressed as part of the feasibility study. Benefits to local development include the provision of water to communities in the immediate vicinity for domestic use, irrigation, and livestock watering. It is likely that small businesses will also develop around the dams, including aquaculture. The increased productivity that will be brought through additional secure water, will improve food security. These benefits are, however, dependent on additional infrastructure, such as pumps and irrigation canals also being installed. The marketing of additional produce and roads to facilitate transport to markets will also have to receive attention.

Water Use Type	Water demand (m³/year)	
	2012	2037
Water supply demand (people)	2,530,000 (125,000 persons)	6,153,000 (300,000 persons)
Irrigation demand	5,500,000 (500 ha)	11,000,000 (1000 ha)
Livestock water demand	650,000	900,000
Aquaculture demand	290,000	1,720,000
Environmental requirement	0	0
Total (m³/year)	**8,970,000**	**19,773,000**

11. IMPACTS

Environmental

- The dam would have negligible effect on flows in the Kagera River
- The reservoir would have a significant impact on flows in the river below the dam and particularly flooding. Given that this is a seasonal river this could be positive in that controlled releases could allow for extended low flows.
- Indigenous vegetation in the reservoir basin would be destroyed, and vegetation in the river channel below the dam would be modified
- The reservoir would attract large game such as elephants from the neighbouring Birigi Game Reserve.

Socio-economic environment:

- No villages or settlements appear to be affected by the Project, as there is no habitation in the Project area. This will need to be confirmed.
- The reservoir would inundate land currently used for grazing, and some banana plantations, cassava and maize cropping areas.
- There is no major infrastructure and no cultural heritage sites within the footprint of the dam.
- Access tracks used by the communities might be cut off by the reservoir.
- Large game such as elephants, attracted by the reservoir, may result in crop damage.

12. SUSTAINABILITY

- Additional infrastructure would have to be provided to distribute the water for domestic use, cattle watering and irrigation.
- It is probable that the on-going operation and maintenance costs and associated staff requirements would have to be funded by the government perhaps with some local contribution from the sale of water.

13. RISKS

- The catchment is not monitored and hydrology can only be estimated. From these estimates a dam of 30 million m^3 capacity is considered feasible – but this will have to be confirmed. Should runoff prove insufficient the dam would have to be downsized accordingly.
- There is potential for conflicts of interest between livestock development and future irrigation users. Irrigation areas will however be relatively small and it should be possible to accommodate the needs of both irrigators and livestock farmers.
- The catchment does not reflect a high level of degradation so sedimentation should not be an issue. There is no reported risk of site degradation through irrigation.

14. DURATION AND FUNDING

Donor funding would be required and the duration for implementation would be about 5 years: 1 year to obtain donor funds, 1 year for appointment of the consultant and 3 years for design and construction.

According to the 3rd draft feasibility study from Tractebel the following are the capital costs for the Karazi dam:

Water Use Component	Capital Investment Costs US $ for the first stage	Capital Investment Costs US $ for the next stages	Capital Investment Costs US $ TOTAL
Dam	17 980 000		17 980 000
Irrigation	5 332 000	6 004 000	11 336 000
Potable Water Supply	27 300 000		27 300 000
Livestock Water Supply	2 996 000	1 438 000	4 434 000
Aquaculture	672 000	1 824 000	2 496 000
Sub-total	**54 280 000**	**9 266 000**	**63 546 000**

15. ADDITIONAL INFORMATION REQUIRED

- The proposed feasibility studies should address the technical, economic, social and environmental feasibility of each proposed dam.
- Studies of the potential benefits and of the infrastructure and costs to provide such infrastructure should also be undertaken together with appropriate Social/Scoping/EIA studies.

16. RECOMMENDATIONS

This dam should be implemented if the evaluation of the Feasibility Study considers this to be favourable.

6. KAVURUGA DAM (Kavuruga River) – BURUNDI

The Kavuruga Dam is one of the smaller "large" dams proposed for the Kagera Region as part of the NELSAP supported Kagera River Basin Management Project. The dam site is on the Kavuruga River in eastern Burundi. This would be a multipurpose dam aimed at providing water primarily for irrigation and domestic water supply. The current proposal is for a 20m high earth embankment dam with an estimated reservoir storage capacity of 10.9 million m^3. This dam was ranked 9^{th} out of nine identified large dam developments in the Kagera basin

1. SOURCES OF INFORMATION

Preliminary technical information and initial screening of social and environmental impacts for the proposed Kavuruga Dam is presented in a draft report entitled *Detailed Identification Studies for the Potential Large Dams in the Kagera Basin* prepared by Eng. Dr. Henry K Ntale and submitted to NELSAP in October 2012.The information presented here has been extracted from this report.

2. PROJECT DESCRIPTION / STATUS

The Kavuruga project is focused on the construction of a moderately sized dam primarily for irrigation and, water supply. Some hydropower could also be generated and could be used to provide the energy necessary for pumping water for domestic consumption. There is, however, an existing 0.85 MW hydropower facility at Kayanza approximately 6 km downstream which limits the amount of irrigable area that can be served by the proposed dam.

An Initial Environmental and Social Evaluation (IESE) and technical evaluation of nine dams in the Kagera basin including the Kavuruga Dam was prepared by Eng. Dr. Henry K Ntale as part of the report on potential large dams in the Kagera Basin (October 2012). This study provided updated technical information for the project, quantified the potential demands, identified potential social and environmental impacts, and developed initial cost estimates for the proposed dam construction.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The purpose of the Kavuruga project would be to boost community development through the provision of water supplies for irrigation and rural-domestic use.

4. RATIONALE AND CONTEXT FOR PROJECT

The Kavuruga Dam project is one of eight potential dam sites identified in earlier rapid identification studies for further investigation and appraisal through NELSAP.

5. PREPAREDNESS FOR IMPLEMENTATION

An IESE, scoping level technical evaluation and provisional cost estimate have been completed. A detailed Environmental and Social Impact Assessment (ESIA), awareness campaigns, and a full feasibility study are required. Potential funding sources must also still be identified.

6. LOCATION

The Kavuruga dam site is situated on the Kavuruga River in eastern Burundi, not far from the Tanzanian border (Figure 1). It is located 1.5km northwest of Muramba Town, in Ntobwe Colline, Buhinyuza Commune, Muyinga Province. The coordinates of the proposed site are 30° 22' 15.42" East and 2° 55' 32.52" South.

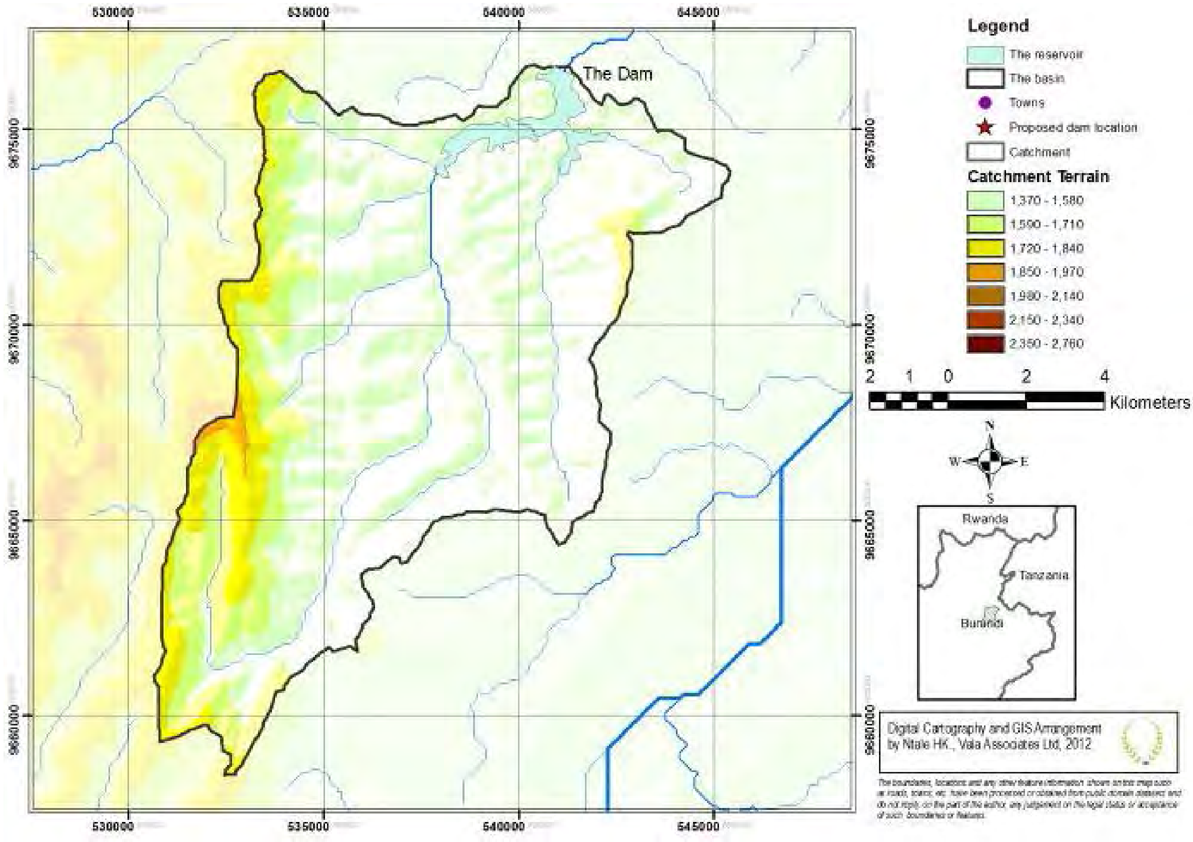

Figure 1: Proposed location and catchment for the Kavuruga Dam

7. REPLICABILITY

The proposed scheme would be unique however there may be aspects that are likely to be similar for other dams under investigation and could probably be replicated at other dams.

8. BENEFIT SHARING

The project would benefit only local communities in the vicinity of the project in Burundi.

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

The proposed design is for an earth embankment dam with the following characteristics:

- Catchment area: 136 km^2
- Mean annual runoff: 60 million m^3/annum
- Wall Height : 19.5 m
- Crest length: 340 m
- Storage Capacity: 10.9 million m^3
- Surface area: 1.9 km^2

10. BENEFITS

The benefits of the proposed dam are primarily water for domestic supply and irrigation.

The Kavuruga reservoir would contain enough water to irrigate 1230 ha. However, owing to the fact that there is a large reservoir 4.5km downstream of the site, the immediate available irrigable land downstream, of the site is reduced to only 452 ha. This is a serious constraint which must be given due consideration when further weighing the viability of this sub-project. The command area could support approximately 900 farmers and provide food for about 4,500 people. The estimated annual water demand for irrigation would be about 2.3 Mm^3/annum.

The total population that can benefit from water supply from the Kavuruga project in 2012 and 2062 was estimated at 47,764 and 180,978 people respectively. The annual water demands would be 0.5 Mm^3/annum and 2 Mm^3/annum for 2012 and 2062, respectively.

The proposed dam was not considered to have significant hydropower potential.

11. IMPACTS

The IESI identified only a few potential impacts particular to this project other than those normally associated with a project of this scale. A full ESIA is required as part of a complete feasibility study.

Environmental

- The impact on flows in the Kagera River and into Lake Victoria will likely be negligible.
- Impacts on environmental flows in the Kavuruga River will have to be assessed and mitigated through the development of operating rules that include environmental flow releases.
- There are no protected areas identified in the vicinity of the site.
- The impact on biodiversity is likely to be minimal.

Socio-economic

- No areas of cultural significance that would need to be preserved have been identified
- The construction of the dam would result in the loss of marshlands currently used for cultivation.
- Local sand mining operations would also be impacted.
- A local access road would likely be flooded by the reservoir.
- The construction of the dam would interfere with existing community water sources downstream.

12. SUSTAINABILITY

The Kavuruga Dam project was ranked 9^{th} out of the nine potential large dams in the Kagera basin evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria during the IESI.

13. RISKS

No specific risks were identified.

14. DURATION AND FUNDING

The estimated cost for the construction of the proposed Kavuruga Dam is US $ 12.4 million (2012).

This amount excludes operational costs and the costs for the construction and operation of the required infrastructure for the irrigation and rural water supply distribution systems.

The further studies, design and construction of a dam of this size could take up to 9 years. At this stage of study, the duration and source of funding for this project have not been investigated.

15. ADDITIONAL INFORMATION REQUIRED

Draft terms of reference (TOR) have been prepared for feasibility studies and for Environmental and for ESIAs for the nine large dam projects identified in the Kagera basin.

16. RECOMMENDATIONS

Review preliminary study for decision whether to proceed with the pre-feasibility study.

7. MBARARA DAM (Mbarara River) – BURUNDI

The Mbarara Dam is the smallest of eight large dams proposed for the Kagera Region as part of the NELSAP supported Kagera River Basin Management Project. The dam site is on the Mbarara River in Burundi. The primary potential purposes of the project would be to supply hydropower and irrigation. The proposed dam would be a 19 m high earth embankment dam with a reservoir storage capacity of about 9.9 million m³. The primary use would be for irrigation and rural-domestic supply.

1. SOURCES OF INFORMATION

Updated technical information and initial screening of social and environmental impacts for the proposed Kanyaru Dam is presented in a draft report entitled Detailed Identification Studies for the Potential Large Dams in the Kagera Basin prepared by Eng. Dr. Henry K Ntale and submitted to NELSAP in October 2012.

2. PROJECT DESCRIPTION / STATUS

The proposed Mbarara Dam is a relatively small “large” dam in the Ngozi province in Burundi to be used primarily for irrigation. The current proposal is for a 19 m high earth embankment dam with an estimated reservoir storage capacity of 9.9 million m^3.

An Initial Environmental and Social Evaluation (IESE) and technical evaluation of nine dams in the Kagera basin including the Mbarara Dam was prepared by Eng. Dr. Henry K Ntale as part of the report on potential large dams in the Kagera Basin (October 2012). This study provided updated technical information for the project, quantified the potential demands, identified potential social and environmental impacts, and developed initial cost estimates for the proposed dam construction.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The primary potential use of the project is irrigation. Hydropower production at this site would not be viable, besides there is a much better hydropower site 4.5 km downstream at the Upper Ruvubu site.

4. RATIONALE AND CONTEXT FOR PROJECT

Poverty and the need for water services and irrigation supply are key drivers for this project.

The proposed Mbarara Dam project is one of eight potential dam sites identified in earlier rapid identification studies for further investigation and appraisal through NELSAP. Local communities do not have piped water sources and the only sources of water are marshlands, including the Mbarara marshland.

The marshland at the proposed dam site has been reclaimed for cultivation of sweet potatoes, maize and some sections have tobacco. These crops are all for domestic consumption. The site was originally developed by the Catholic Relief Services (CRS) through construction of irrigation channels and a protected well. A facility for the communities to wash clothes was also constructed. When project support ended in 2008, the communities were unable to maintain the canals and at present a number of them are malfunctioning.

5. PREPAREDNESS FOR IMPLEMENTATION

An IESE and scoping level technical evaluation and provisional cost estimate were prepared by Dr Ntale. A detailed Environmental and Social Impact Assessment (ESIA), awareness campaigns, and a full feasibility study are required. Potential funding sources must also still be identified.

6. LOCATION

The site is situated at Latitude 2° 57’ 34.26’’S and Longitude 29° 42’ 54.24’’E, in Burundi on the Mbarara River in the district of Gahambo, Kinyonga village, Ngozi province as shown in **Figure 1**.

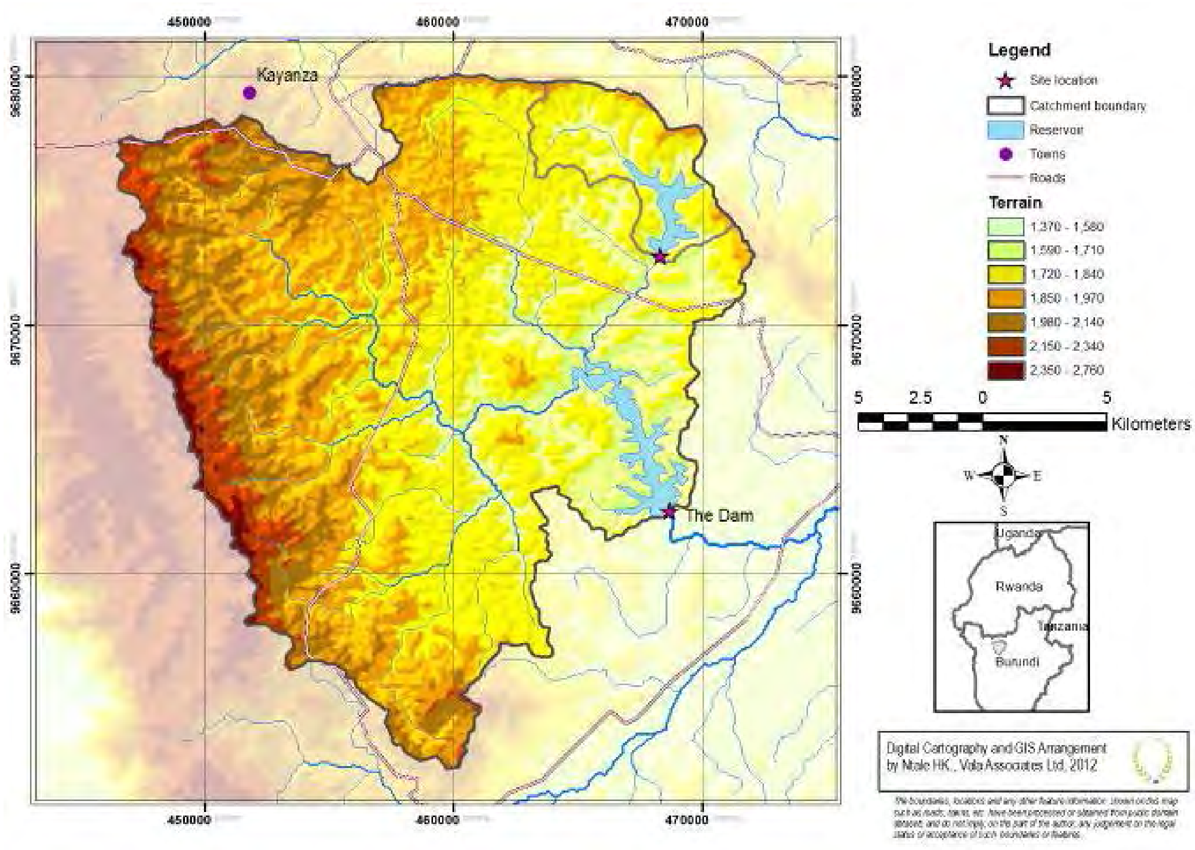

Figure 1: Proposed location and catchment areas for the Upper Ruvubu and Mbarara

7. REPLICABILITY

The proposed scheme would be unique; however a number of development aspects are likely to be similar for the eight large dams that are being investigated, and approaches could probably be replicated at these other dams.

8. BENEFIT SHARING

The proposed dam would benefit Burundi only.

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

The proposed dam would be an earth embankment dam with the following characteristics:

- Catchment area: 31 km^2
- Mean annual runoff: 17 million m^3/annum.
- Wall Height : 19 m
- Crest length: 350 m
- Storage Capacity: 9.9 million m^3
- Surface area: 1.6 km^2

10. BENEFITS

This project is intended to supply local communities with water for domestic use and water for irrigation. It is not considered a viable source of hydropower.

The Mbarara site is very suitable for irrigation immediately downstream of the dam. There is intensive mixed farming in the Mbarara valley. Availability of water all year around would enable the valley residents to engage in more profitable agriculture. The potential area that could be irrigated from the Mbarara reservoir is 490 ha. The command area would be limited by the proposed reservoir of the downstream Upper Ruvubu site; otherwise the proposed Mbara Dam could irrigate 1 258 ha. The reduced command area could support 978 farmers and provide food for about 4,889 people. The estimated annual water demand for irrigation would be about 2.4 Mm^3/annum.

The total populations that could benefit from water supply from the Mbarara project in 2012 and 2062 were estimated to be 79,783 and 302,295 people respectively. The annual water demands would be 0.9 Mm^3/annum and 3.3 Mm^3/annum in 2012 and 2062 respectively.

11. IMPACTS

Approximately 10 km^2 would be inundated by the proposed Mbarara reservoir. This would include some marshlands and crop lands but it should not be necessary to relocate people.

The IESE identified no significant impacts particular to this project other than those normally associated with a project of this scale. A full ESIA would be required as part of a complete feasibility study.

Environmental

- Given the small size of the catchment, the impacts on the local hydrology may be severe and require operating rules to be developed that include allowances for environmental flow releases
- The overall impact on downstream flows in the Kagera River and on inflows into Lake Victoria would be negligible
- The impact on the hydrology of the proposed Upper Ruvubu dam would need to be investigated.
- There are no protected areas in the vicinity of the site.
- Anticipated impacts on biodiversity would be minimal.

Socio-economic

- No areas of cultural significance that would need to be preserved were identified.
- Local farmlands (bananas, sweet potatoes, etc.) and some woodlots would be flooded.
- Some local community roads might be impacted by the reservoir.

12. SUSTAINABILITY

The Mbara Dam project was ranked 8th out of the nine potential large dams in the Kagera basin evaluated in terms of reservoir capacity, water/earth ratio, irrigation command area, hydropower potential, water supply, cost and environmental criteria during the IESE.

13. RISKS

No significant risks were identified.

14. DURATION AND FUNDING

The estimated cost of the construction of the proposed Mbarara Dam and associated works would be US $ 11 million (2012). This excludes operational costs and the costs of construction and operation of the required infrastructure for the irrigation and rural water supply distribution systems.

The feasibility study, ESIA, funding, design and construction of this medium-sized dam could take up to eight years.

At this stage of study, the duration and source of funding for this project have not been investigated.

15. ADDITIONAL INFORMATION REQUIRED

Draft terms of reference (TOR) have been prepared for feasibility studies and the ESIAs for the nine large dam projects identified in the Kagera basin.

16. RECOMMENDATION

The Mbarara Dam and Upper Ruvubu Dam should be considered as offering only one development option between them and should be evaluated together.

8. MUNYANGE-VUMBI DAM (River Buyongwe) – BURUNDI

Munyange-Vumbi Dam site is located on River Buyongwe – a tributary of River Kanyaru, in the Kagera Basin, on the border between Munyange and Vumbi districts, in Burundi. The proposed 14 m high dam would have a storage capacity of 6.81 million m³, embankment length of 560 m, reservoir surface area of 0.95 km², and reservoir fetch of about 2.1 km. The dam has relatively low risk due to the fact that it will be located in a rural area without inhabitants in the river valley. The dam would provide water for irrigation, livestock and domestic use.

Screened as a prospective project

1. SOURCES OF INFORMATION

The latest source of information is the draft version of Consulting Services for Development of Tools and Guidelines for Climate Adaptation Mainstreaming in Water Infrastructure Development - Screening for an Infrastructure Project, release in April 2012.

2. PROJECT DESCRIPTION / STATUS

This project is only at the first screening stage and has not yet had a pre-feasibility study. This would be the next step. A user needs survey is required.

3. OBJECTIVES

The objectives of this dam are for local economic development, with the dam providing water for irrigation, livestock and domestic use.

4. PROJECT RATIONALE AND CONTEXT

This development fulfils a local opportunity

5. PREPAREDNESS FOR IMPLEMENTATION

This project has only been screened with regard to a potentially suitable site.

Pre-feasibility studies, EIA, ESIA, awareness campaigns, and a full feasibility study with detailed design are still required. Funding must still be sourced.

Preparedness for implementation is therefore very low.

6. LOCATION

Munyange-Vumbi dam site is located on River Buyongwe, a tributary of River Kanyaru, at coordinates Latitude -2.7710, Longitude 30.0971 on the border between Munyange and Vumbi districts, in Burundi as shown in **Figures 1 and 2**.

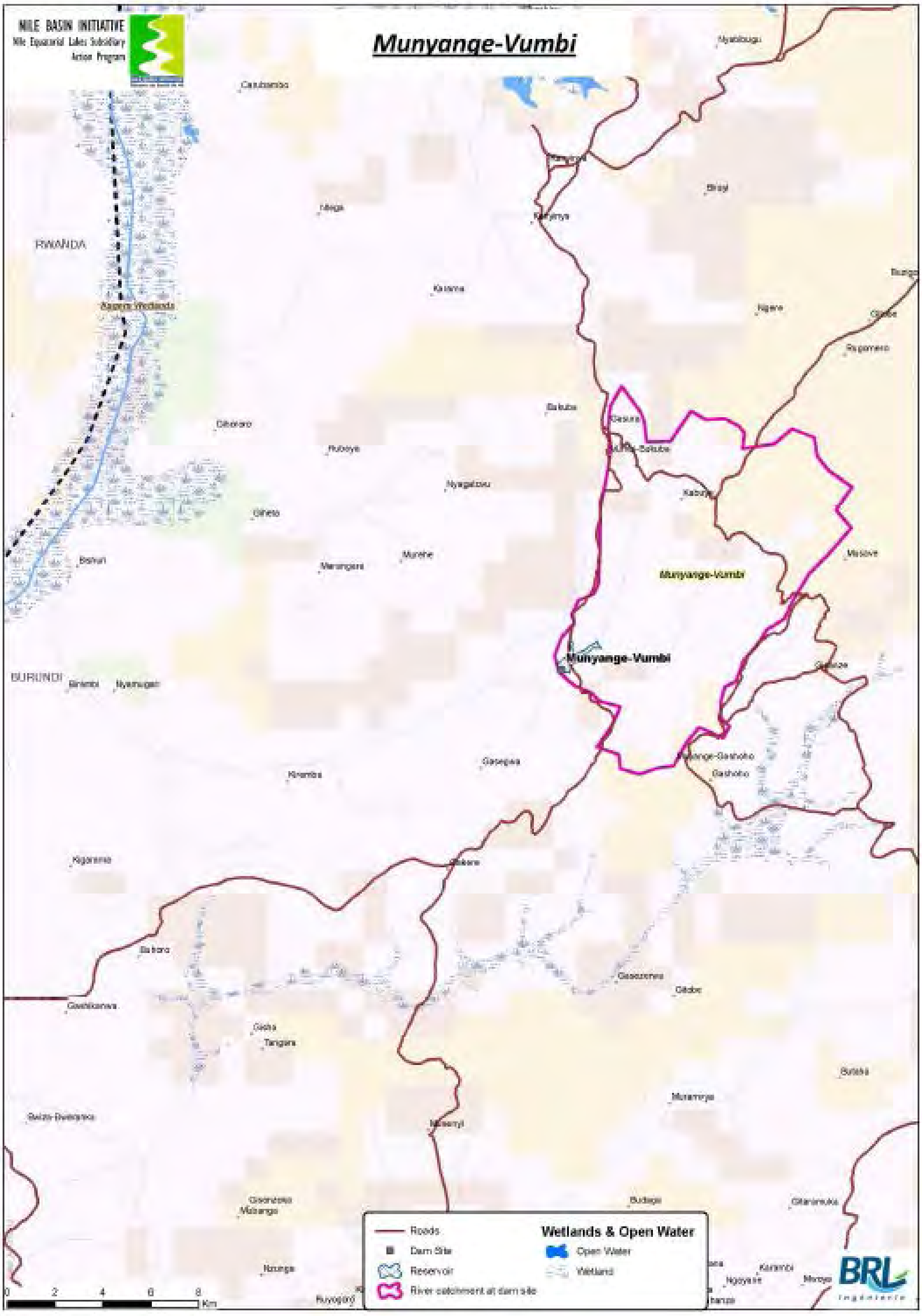

Figure 1: Locality of Munyange-Vumbi Dam

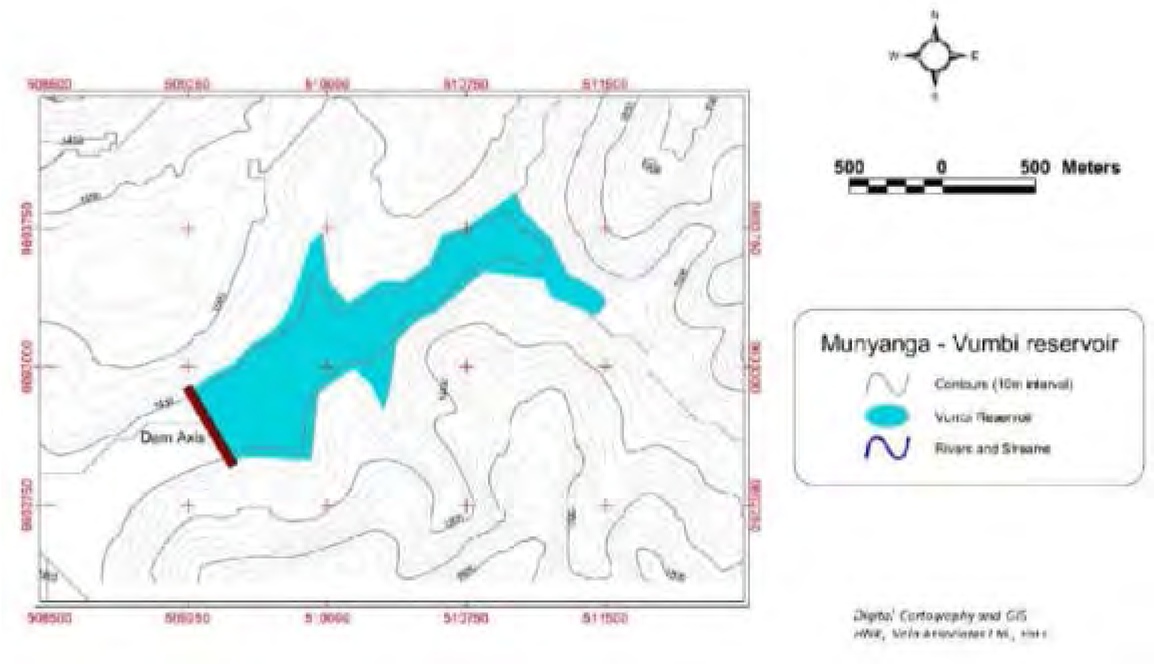

Figure 2: Munyange-Vumbi Dam on the Buyongwe River

7. REPLICABILITY

Undetermined

8. BENEFIT SHARING

This dam is intended as a local development option in Burundi. Equivalent dams have been proposed in Uganda and in Tanzania, although the Tanzanian Dam would impound more water.

9. TECHNICAL DESCRIPTION

- Height of dam 14.0m
- Storage capacity 6.81 million m³
- Wall crest length 560 m
- Reservoir surface area 0.95 km²
- Reservoir fetch 2.1 km
- Catchment area / MAR - still to be determined

10. BENEFITS

The dam would provide water for irrigation, livestock and domestic use.

11. IMPACTS

Environmental

Undetermined

Socio-economic

The area to be inundated by the Munyange-Vumbi reservoir is relatively uninhabited.

The dam has relatively low risk due to the fact that it will be located in a rural area without inhabitants in the river valley. If compared to the UK standards the dam will fall in hazard category D, for which the design discharge recommended would have a return period of 150 years. Spillway discharge design would have to take account of this.

12. SUSTAINABILITY *(Financial, Technical, Social, Environmental)*

Undetermined

13. RISKS

No significant risks identified. The dam is in a relatively sparsely populated area.

14. DURATION AND FUNDING

- No costing has been undertaken, nor any funding sourced.
- A small to medium sized dam of this nature would take a minimum of seven years, and more probably ten years to research and complete
- According to the 3rd draft feasibility study from Tractebel the following are the capital costs for the Karazi dam:

Water Use Component	Capital Investment Costs US $ for the first stage	Capital Investment Costs US $ for the next stages	Capital Investment Costs US $ TOTAL
Dam	17 980 000		17 980 000
Irrigation	5 332 000	6 004 000	11 336 000
Potable Water Supply	27 300 000		27 300 000
Livestock Water Supply	2 996 000	1 438 000	4 434 000
Aquaculture	672 000	1 824 000	2 496 000
Sub-total	**54 280 000**	**9 266 000**	**63 546 000**

15. ADDITIONAL INFORMATION REQUIRED

- User needs assessment

16. RECOMMENDATIONS

Review preliminary study for decision whether to proceed with the pre-feasibility study.

9. TABA-GAKOMEYE DAM (On tributary of the Mwogo River) – RWANDA

In 2011 NELSAP commissioned the feasibility study for four small multipurpose dams, with one in each of the four countries of the Kagera River Basin. The Taba-Gakomeye Dam in Rwanda is one of these dams. Other dams are:

- Bigasha Dam -Uganda
- Karazi Dam- Tanzania
- Buyongwe Dam – Burundi

The dam was originally planned to supply the domestic, irrigation, livestock and aquaculture water demands of about 8.6 million m^3/annum in 2012 and 13.9 million by 2037. The distribution infrastructure cost estimate is US$31.8 million. If a dam is constructed this would cost US$10.1 million. The feasibility study however recommended that the focus of the dam should change to that of flood attenuation, to protect downstream investments.

1. SOURCES OF INFORMATION

Information on the Taba-Gakomeye Dam has been extracted from the following sources/documents prepared for NBI-NELSAP:

- Kagera BDP Consultancy stakeholder workshop in Bujumbura, November 2012.
- Tractebel Engineering S.A., November 2012, Feasibility studies for 4 small multipurpose dams in the Kagera River Basin, Feasibility Study Report – Third draft report about Taba-Gakomeye site in Uganda
- Feasibility Studies of 4 Small Multipurpose Dams at Karemba, Taba-Gakomeye, Omumukara, and Karazi in the Kagera River Basin: Second Interim Report by Tractebel Engineering – Coyne and Bellier – May 2012
- Environmental and Social Impact Assessment (ESIA) and Developing Resettlement Policy Frameworks (RPFs) for Four (4) Proposed Small Multipurpose Dams at Bigasha, Buyongwe, Karazi, and Taba-Gakomeye in the Kagera River Basin: Volume 1 A: Draft Scoping Interim Report by Newplan Consulting Engineers and Planners - May 2012

2. STATUS OF THE PROJECT

The Taba-Gakomeye Dam is one of four small dams (of less than 15m height) selected by the NBI for feasibility study, one in each of the four Kagera Basin countries.

The draft feasibility study of the scheme was completed in November 2012 and it was recommended that the function of the dam be changed to that of flood control.

3. PROJECT OBJECTIVES

While the primary function of the dam would be flood control, the scheme could create opportunity for domestic use, irrigation, livestock watering, and aquaculture. This however depends on the willingness of the operator to lessen the functionality of the dam for flood control.

4. RATIONALE AND CONTEXT

The dam was originally evaluated as a dam to alleviate poverty by providing improved access to water for the local communities. It was also considered as a run-of-river scheme, but the final recommendation is that the purpose of the dam be revised.

5. PREPAREDNESS FOR IMPLEMENTATION

The draft feasibility study has been completed.

6. PROJECT AREA AND LOCALITY MAP

The dam site is located on the boundary of Taba and Gakomeye villages in Nyanza District, Southern Province in Rwanda. The dam site is situated on a tributary of the Mwogo River as shown in **Figures 1 and 2**. The coordinates for the axis of the proposed dam were recorded as follows:

Dam Axis coordinates					
Site	**WGS 84 (DD)**		**UTM/WGS 84 (m)**		
	Longitude	**Latitude**	**X**	**Y**	**Bank**
			UTM 35S		
Alternative	29,58863	-2,51664	787871,98	9721548,18	**Left**
Alternative	29,58991	-2,51817	788014,08	9721378,61	**Right**
TOR	29,60145	-2,5073	789300,68	9722578,77	**Left**
TOR	29,60286	-2,50993	789457,01	9722287,46	**Right**

Figure 1: Location of proposed Taba-Gakomeye Dam

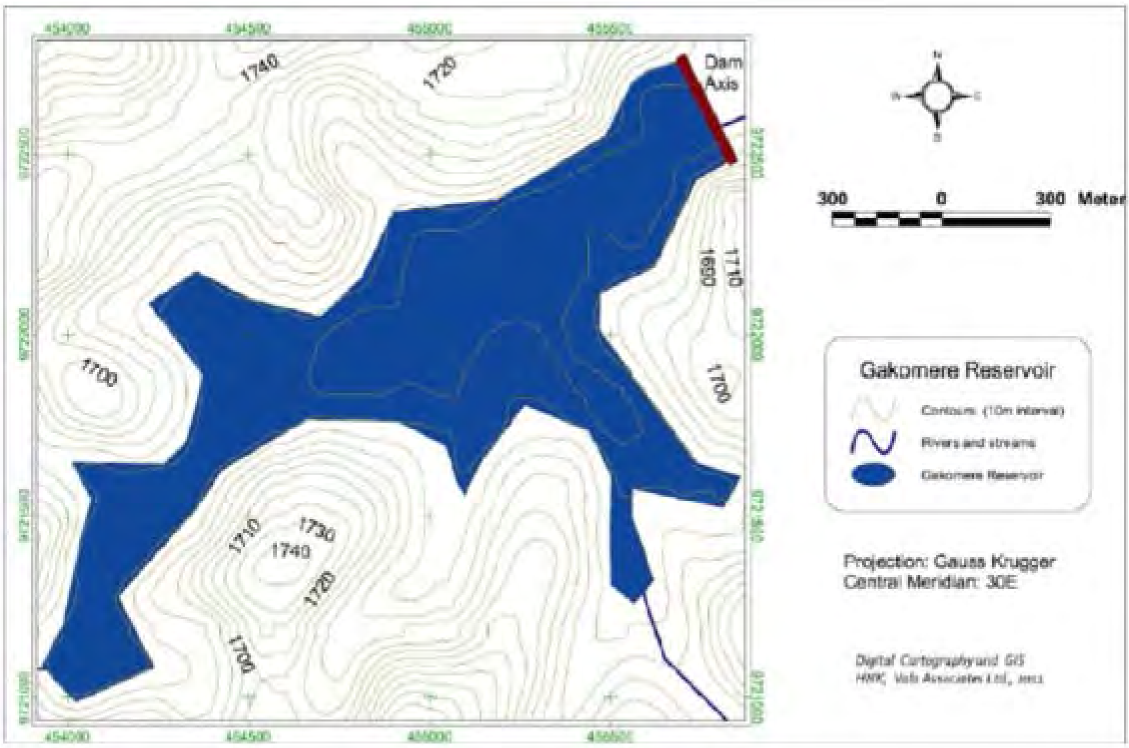

Figure 2: Reservoir Basin of the proposed Taba-Gakomeye Dam

7. REPLICABILITY

With four schemes, one in each of the four Kagera Basin countries, there would be scope for information sharing, learning and replication, although each project would be unique**.**

8. BENEFIT SHARING

The Taba-Gakomeye scheme offers only local benefit. However the intention of implementing four projects in each of the four basin countries is to bring an equitable spread of benefits**.**

Tractebel Engineering S.A. (Oct 2012) quantified water demand as follows:

Water Use Type	**Water demand (m^3/year)**	
	2012	**2037**
Water supply demand	2,820,000	5,710,000
Irrigation demand	294,000	390,000
Livestock water demand	410,000	510,000
Aquaculture demand	1,100,00	3,300,000
Environmental requirement	3,940,000	3,940,000
Total (m^3/year)	**8,570,000**	**13,850,000**
Total (m^3/s)	**0.27**	**0.44**

9. TECHNICAL DESCRIPTION OF PROPOSED DAM

It was originally proposed that an earth fill embankment dam be constructed as indicated below, however the feasibility study has shown that the water demands could be met without constructing this dam:

- Height approximately 14m and crest length 355 metres.
- Storage capacity estimated at 8.1 million m^3.
- Reservoir surface area of 1.0 km^2.
- Reservoir fetch of 2.4 km.
- The catchment area is 102 km^2. The river is perennial with a mean annual runoff of about 39.4 million m^3/annum

At the Basin Development Plan workshop in Bujumbura it was mentioned that the Taba-Gakomeye dam would also be utilized as a flood protection dam.

This is a hilly catchment with steep slopes, very prone to erosion and showing a high level of land degradation through soil erosion. The land is very intensely utilised.

10. BENEFITS

The benefits and costs of this project have been adequately quantified by the feasibility study. The scheme would initially irrigate about 92 ha increasing to 122 ha and would initially serve 216 000 people increasing to 468 000 persons.

The study showed that the site is not viable for hydropower.

11. IMPACTS

If a dam is constructed which is not recommended by the feasibility study then the potential impacts would be as follows:

Environmental

- The project will have no perceptible impact on the water resources of the Kagera River.
- The hill slopes in the catchment area for the Taba-Gakomeye Dam are highly eroded and erosion is likely to continue. This would result in siltation of the dam over time.
- Local river flows will be impacted as will nearby wetlands;
- The project will not impact directly on any protected area. It must however be verified that the Nyungwe Forest will not be influenced, as it is in the Project District;

Socio-economic environment

- The major impact will be the loss of agricultural land in the reservoir area.
- Some homesteads would be flooded, although not many. Relocation plans would be required.
- Sand mining along the riverbanks within the dam footprint area will come to an end. Upstream sand mining should also be discouraged due to resultant sedimentation.
- Two tracks (trails) and a small bridge would flooded by the dam. Alternative access routes would have to be provided.
- The possible impact on other irrigation projects relying on run of river water should be investigated. Where possible development should be expand on these existing activities.

12. SUSTAINABILITY

- Additional infrastructure would have to be provided to distribute the water for domestic use, cattle watering and irrigation.
- It is probable that the on-going operation and maintenance costs and associated staff requirements would have to be funded by the government perhaps with some local contribution from the sale of water.

13. RISKS

The risks would be small if a dam is not constructed as is recommended by the feasibility study; however a dam would have the following potential risks:

(i) The catchment area is badly degraded and the river displays high levels of turbidity. Sedimentation would rapidly lead to loss of dam capacity within a very few years, especially as this is a relatively small reservoir. This puts the sustainability of the dam in jeopardy. The risk could be mitigated through the simultaneous introduction of a catchment management programme aimed at managing surface runoff, agroforestry, natural vegetation management, and conservation farming practices.

(ii) The valley bottom, or footprint area of the dam, is intensely farmed. The flooding of existing agricultural land may bring community opposition to the development. Given that an area several times larger will become available for irrigation, it is important that those who will be losing existing livelihoods become beneficiaries.

14. DURATION AND FUNDING

Donor funding would be required and the duration for implementation for all of these dams would be of the order of 9 years: 2 years for appointment and feasibility study of infrastructure, 2 years for appointment of EIA consultant and EIA, 1 year to obtain donor funds, 1 year for appointment of consultant, and 3 years for design and construction.

According to the 3rd draft feasibility study from Tractebel the project should proceed without the dam for which the capital costs would be as follows:

Water Use Component	Capital Investment Costs US $ for the first stage	Capital Investment Costs US $ for the next stages	Capital Investment Costs US $ TOTAL
Irrigation	5 534 000		5 534 000
Potable Water Supply	21 930 000		21 930 000
Livestock Water Supply	1 797 000	1 120 000	2 917 000
Aquaculture	2 554 000	6 532 000	9 086 000
Sub-total	**31 815 000**	**7 652 000**	**39 467 000**

A 14 m high dam with a crest length of 265 m was estimated to cost US$10.1 million.

15. ADDITIONAL INFORMATION REQUIRED

The study addressed the requirements and the cost of the distribution infrastructure.

16. RECOMMENDATIONS

The feasibility study provides sufficient information to decide whether to proceed with this project. It has been decided that the project will proceed with the objective of flood control, i.e. only requiring a dam to be constructed. Opportunity however exists to use the scheme for multiple purposes.

IRRIGATION SCHEMES NOT INVOLVING DAM CONSTRUCTION

1. BUGESERA IRRIGATION SCHEME – RWANDA & BURUNDI

This proposal is for a multi-national irrigation and watershed management project in catchments shared by Rwanda and Burundi within the Kagera Basin. The proposal is based primarily on information contained in the Project Appraisal Report of Bugesera Natural Region Rural Infrastructure Support Project (PAIR): Multinational Rwanda – Burundi. The project will benefit a cross-border region astride Rwanda and Burundi and particularly areas around Lakes Rweru and Cyohoha and the Kanyaru marshlands which are shared by both countries, as well as their watersheds.

1. SOURCES OF INFORMATION

Two key sources are the PAIR report (referenced below) and the Summary Strategic Environmental and Social Impact Assessment report, by Michel A. Bouchard and J.B. Gashagaza. November 2008.

2. PROJECT DESCRIPTION/ STATUS

Grant funding for the project was approved in September 2009 by the African Development Bank, through the African Development Fund, at USD 30 million. Effective start date was 1 April 2010, and planned completion date 30 June 2015.

3. PROJECT OBJECTIVES

The overall objectives of the Bugesera Natural Region Rural Infrastructure Support Project (Bugesera PAIR) are to reduce poverty and improve food security in the Bugesera region by increasing agricultural production.

Specific objectives are:

(i) The protection and development of lake and marshland watersheds
(ii) The development of irrigation and drainage networks for land-locked marshlands
(iii) The construction of lake-watered hillside irrigation facilities
(iv) Provision of rural infrastructure with the rehabilitation of 100 km of rural access road
(v) The establishment of a Joint Project Coordination Unit and strengthening of national structures in charge of implementation

4. RATIONALE AND CONTEXT

The Bugesera Natural Region suffers chronic food insecurity due to high population, the scarcity of land and severe soil erosion. To reverse the trend and create conditions for cross-border sustainable development, it is necessary to develop rural infrastructure to boost agricultural production while preserving and conserving its natural resources. This requires planned, coordinated and joint development actions by both countries as addressed by the Bugesera PAIR project.

5. PREPAREDNESS FOR IMPLEMENTATION

It is assumed that implementation is currently underway and on schedule.

A Strategic Environmental and Social Impact Assessment was completed in 2008. Implementation was to have commenced on 1 April 2010. No reported information on progress.

6. LOCATION

The project impact area is the cross-border region astride Rwanda and Burundi and particularly around Lakes Rweru and Cyohoha and Kanyaru marshlands, which are shared by both countries, as well as their watersheds. The location is shown in **Figure 1**.

Figure 1: Locality of the Bugesera Irrigation Project

7. REPLICABILITY

The project will enhance the experience both countries have acquired in managing marshlands by strengthening the capacity of government departments and farmers' cooperatives.

8. BENEFIT SHARING

Both Rwanda and Burundi draw approximately equal benefit from the project.

a) The water resources of Lakes *Cyohoha* and *Rweru* and of the *Kanyaru* marshland are shared resources and must be used in a coordinated manner;

b) Water and soil conservation works can only be efficient if they are carried out on all the watersheds concerned and thus on both sides of the border.

9. TECHNICAL DESCRIPTION

- The project seeks to **protect watersheds** over a total surface area of about 8 000 ha around Lakes Rweru and Cyohoha as well as marshlands. Approximately 4000 ha fall within each country. Protecting and developing the watersheds will further help to check erosion and allow for more intensive cultivation of graded terraces.
- The project will **develop an irrigation and drainage network** on three land-locked marshlands in Burundi (2000 ha) and one marshland in Rwanda (1500 ha). To maximize returns from these marshlands, the size of irrigation networks will be such that the schemes would be put under cultivation during both the rainy and dry seasons.
- The project will **develop irrigation facilities in small hillside areas** watered by lakes; an area of 1 000 ha around Lake Rweru for Rwanda, and 500 ha around Lakes Cyohoha and/or Rweru in Burundi.

  The project will also:
- Develop production (distribution of selected seeds, integration of cattle and goat rearing with irrigated farming;
- Rehabilitate 100 km of rural access roads (50 km in each of the two countries);
- Set up storage and processing facilities, and construct buildings.

10. BENEFITS

Benefits are aimed firstly at local agricultural users but also at the wider environment and downstream water resources, through the protection of watersheds.

Users in a poor and over-populated area will have significantly increased irrigation opportunities with associated income benefits and increased food security.

An estimated 834 000 people will benefit directly or indirectly from the positive outputs of this project. The increase in agricultural activities and output will help to create more job opportunities, increase incomes and reduce poverty. Nutritional status should improve with the increased availability of various foodstuffs. The conduct of works (marshland development, rural access roads, etc.) and increased output will lead to the creation of new opportunities for the development of trade in farm produce and inputs, and hence to an overall improvement of the region's economy. Land reform initiatives should also bring benefits.

Key performance indicators

The main performance indicators (a reflection also of benefits), for the project are:

(i) Raised levels of income;
(ii) Reduced prevalence of malnutrition;
(iii) Production of cereals, legumes, market garden produce and milk;
(iv) Hectares protected against erosion;
(v) Hectares of marshlands developed;
(vi) Hectares of hillsides irrigated; and
(vii) Kilometres of rural access roads developed.

11. IMPACTS

This project is classified under Environmental and Social Category I. It was the subject of a Strategic Environmental and Social Impact Assessment (SESIA) that was reviewed by the African Development Bank's (ADB) relevant departments and its summary published on the ADB's website on 31/12/2008.

The project shows mostly positive economic implications, the social effects mainly positive and negative residual environmental effects relatively minor.

Environmental

The main environmental impacts are erosion during the phases of implementation of facilities or development, possible disruptions to fisheries resources, natural and water quality of lakes, loss of biodiversity and loss of habitat of papyrus, pressure on water and woodland resources, and the pollution of surface waters through the increased use of agrochemicals.

Socio-economic

The project will entail neither displacement nor require resettlement of the population of the project area.

12. SUSTAINABILITY

Financial

Beneficiaries will be organized into associations with project sustainability contingent on the beneficiaries bearing irrigation costs. A system will be set up for the collection of levies to finance maintenance activities.

Technical

The project will organize a specific training programme for the pump operator (irrigation network manager) of each association to strengthen their technical capacity especially in the maintenance of water pumping equipment.

In schemes of this nature where productivity is quite high, maintenance costs will be moderate because the sites to be irrigated are near water and the difference in height between the water body and the plots to be irrigated is not much.

To ensure the sustainability of the infrastructure the project will closely monitor hillside pump irrigation, which is not widely used in the two countries. An irrigation specialist is to be recruited in each of the two countries to support the authorities and beneficiaries for the proper management of irrigation networks and better organization of irrigators,

The maintenance of rural access roads will be entrusted to the road maintenance programme of each country. The stretch of road envisaged under this project is short (50 km per country).

Social

Technical and institutional training will be provided. Social impacts are all viewed as positive.

Environmental

A plan will be required for the long-term maintenance of the watersheds.

13. RISKS

No perceived risks

14. DURATION AND FUNDING

Total project cost is estimated at USD 45.8 million. Grant funding of USD 30 million was granted by the African Development Bank in 2009. PAIR activities were scheduled to begin in 2010, with completion in June 2015.

15. ADDITIONAL INFORMATION REQUIRED

Progress reporting is urgently required.

16. RECOMMENDATIONS

This project should be studied at feasibility level.

2. NGONO IRRIGATION SCHEME (Kagera Mouth) - TANZANIA

Five potential irrigation schemes have been evaluated within the Lake Victoria Basin of Tanzania, with a scoping report was carried out in 2008 by P Droogers and W Bastiaanssen. The Ngono Valley Irrigation Scheme is the only one of these schemes within the Kagera Basin. The most recent study is a pre-feasibility study by Gibb International, September 2012. This scheme aims at improving livelihoods, the conservation of watersheds, improving agricultural production and alleviating poverty.

The study is being implemented by the NBI / NELSAP with funds from the World Bank Nile Basin Trust Fund (NBTF) and the Nile Equatorial Lakes Water Resources Development Project.

1. SOURCES OF INFORMATION

Previous studies on irrigation and agricultural development within the valley that have been sourced are:

- H.P Gauff, K.G Consulting Engineers (1974). Feasibility Study on the Ngono Multipurpose Project.
- Norconsult A.S and Electro-Watt Engineering Services (1976). Kagera Development Phase II studies.
- P Droogers and W Bastiaanssen (2008). Scoping study on five potential irrigation schemes in Tanzania: Mara Valley, Bugwema, Isanga Valley, Manonga-Wembere, and Ngono Valley. Water Watch Report 2008.
- Gibb International Consultants (May 2012). Interim report for the pre-feasibility study for an Irrigation Development and Watershed Management Project in the Lake Victoria Basin in Tanzania.
- Gibb International Consultants (Sept 2012). Draft final pre-feasibility study for an Irrigation Development and Watershed Management Project in the Lake Victoria Basin in Tanzania.

2. PROJECT DESCRIPTION / STATUS

The Ngono Valley Irrigation Project, located in the Kagera Basin Tanzania, is an irrigation scheme that aims at alleviating poverty and improving livelihoods through agricultural production, and at the conservation of watersheds. This is one of five irrigation projects being evaluated in Tanzania under NELSAP, but the only project within the Kagera Basin.

A feasibility study was undertaken in 1974 and further studies in 1976 but these are long out of date.

A recent new pre-feasibility study has been completed (Sept 2012). This focussed on land suitability, water resources assessment, water requirements, environmental considerations and institutional aspects.

3. OBJECTIVES

The project aims at supplementing on-going initiatives by the Government of Tanzania towards:

- Reducing poverty
- Improved agricultural production/food security;
- Improved livelihoods
- Conservation of the Watersheds

The Nile Equatorial Lakes Region will also benefit from increased food security and improved water quality.

4. PROJECT RATIONALE AND CONTEXT

This is one of five irrigation projects identified for evaluation by the NBI / NELSAP.

5. PREPAREDNESS FOR IMPLEMENTATION

A consultant (Gibb International) completed Stage 1 activities for the five irrigation areas identified by NBI/NELSAP with the preparation and submission of the Final Inception report in January 2012.

A pre-feasibility study by Gibb International for the Ngono Valley Irrigation Scheme was completed in September 2012. The report includes investigations into: Revised scheme sites; Site options; Technical design; Crop selection; Environmental and Socio-Economic studies; Duration and Funding etc.

6. LOCATION

The Ngono Valley irrigation Scheme is located in the Bukoba Rural and Missenyi Districts of Kagera Region. The valley occupies an area of about 35,000ha between Lake Ikimba in Bukoba Rural District, the Kagera River in the north, the Kyaka-Katoro road to the west and the hilly areas in the east and north-east as delineated during the pre-feasibility Inception Study by Gibb International.

The Scheme area is situated approximately 31km from Bukoba town and 8 km from Bunazi, the Missenyi District Headquarters, via the Bukoba – Kyaka – Bunazi highway as shown in **Figures 1 and 2**.

The coordinates of the boundary of the potential area		
Irrigation area	**Latitude**	**Longitude**
Potential irrigation area	N9875067 and N9839270	E323770 and E360297

The area is covered by a good road network including the Bukoba – Kyaka tarmac road in the north, and the Bukoba – Katoro – Kyaka murram road that runs along the eastern, southern and western borders. Most roads in the area can be used throughout the year.

Figure 1: The Ngono Valley with Lake Ikimba in Bukoba Rural District to the South (Source: P Droogers and W Bastiaanssen, 2008).

According to the pre-feasibility report, already identified sites (previous studies) were re-assessed and new sites identified in both the Ngono and Mara development plan areas were added to compensate for the area lost through the dropping of the Isanga Valley and Manonga–Wembere Schemes (the Mara, Isanga and Manonga-Wembere schemes are all outside the Kagera Basin).

During the re-assessment and identification exercise, it was discovered that flooding and high groundwater tables are a feature of parts of sites that had already been identified in the Ngono Valley, along with parts of other areas that were also considered to have potential. Both flooding and groundwater table control would have to be addressed to allow more land to go under irrigation.

The Ngono Multi-Purpose Project Feasibility Report of 1974 proposed construction of a dam across Ngono East River downstream of Kalebe Bridge to rehabilitate and irrigate swampy areas downstream. Together with irrigation, a tunnel through a saddle on the eastern side of the Ngono reservoir was incorporated to produce hydropower.

Gibb International Consultants are in agreement that this earlier proposal (irrigation with the Kalebe dam), if adopted, would lead to development of significant additional area within the Ngono Valley than if the dam were not to be built. It is recognized that the dam would be costly and that the additional land comes at a very high cost per ha, but is seen as having the following advantages:

- Securing additional area for reclamation and development of up to 7,000ha downstream of Kalebe Dam due to flood control and lowering of the groundwater table;
- Gravity intake is possible for most areas of the valley downstream;
- There will be additional benefit from electricity generation (hydropower). This needs to be evaluated further at feasibility stage.

Gibb International (Sept 2012) therefore put forward two options as follows:

Option 1 Development without Kalebe dam

- Total area of potential irrigation – 5805ha

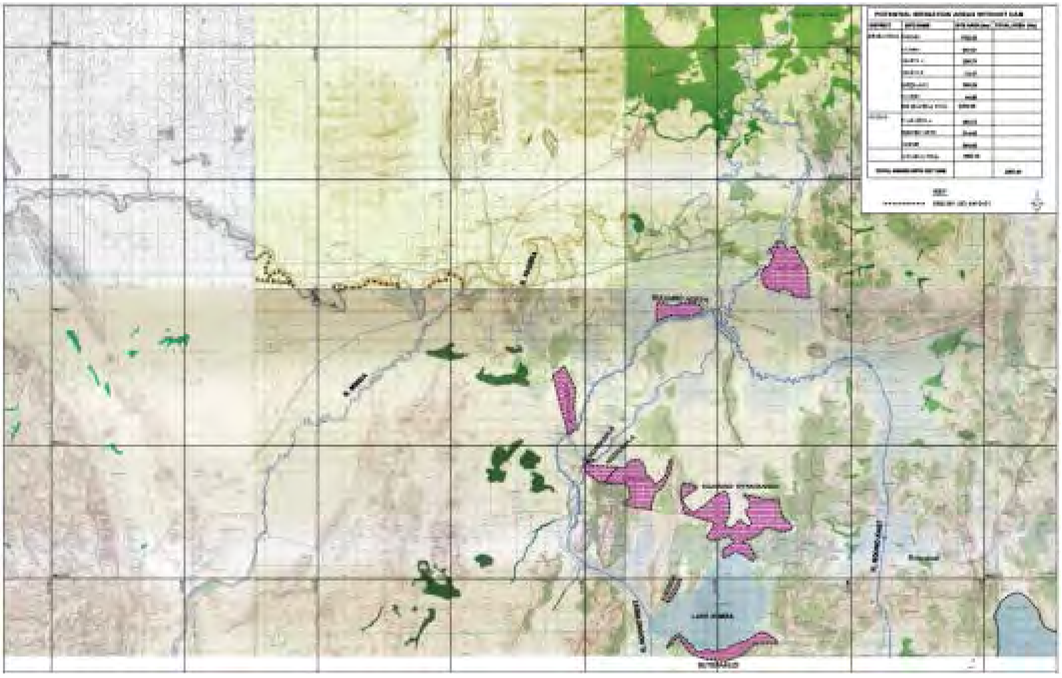

Figure 2: Development without Kalebe dam (Source: Gibb International, 2012).

Option 2 Irrigation development with Kalebe dam

- Total area of potential irrigation – 13,630 ha

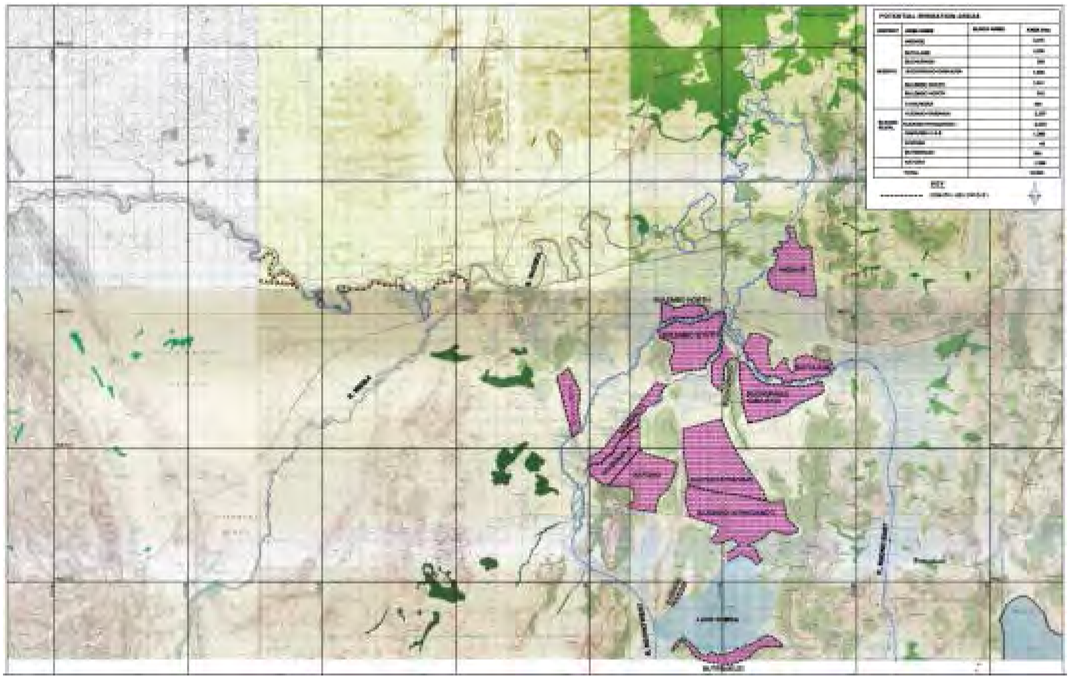

Figure 3: Irrigation development with Kalebe dam

7. REPLICABILITY

The Ngono Valley irrigation scheme is one of five similar potential projects under investigation. Lessons learnt from the Ngono Valley project will be applicable to the study, design and implication of other similar projects.

8. BENEFIT SHARING

The Ngono Irrigation Scheme is a subset of a larger initiative aimed at bringing water for irrigation to the Lake Victoria Basin. All of the five identified schemes are in Tanzania, with only the Ngono Scheme in the Kagera Basin. The scheme has been planned to distribute benefits reasonably equally across two districts within the Ngono Valley, with gross irrigation areas of 5,087 ha in Missenyi District and 3,582 ha in Bukoba Rural District at Interim stage (May 2012.) At Pre-feasibility stage the proposed irrigation areas are 6,086 ha in the Missenyi District and 7,544 ha in the Bukoba Rural district.

9. TECHNICAL DESCRIPTION OF THE PROPOSED IRRIGATION SCHEME

Irrigation Potential:

Preliminary assessment out of the Interim May 2012 Gibb International report indicates that the target of 8 000 ha is available for irrigation although only with the addition of the Kalebe Dam. With improved drainage and damming it would be possible to irrigate 13 630 ha.

The Gibb International Study divides the irrigation potential into 2 options, as discussed under heading *6. Location:*

Option 1: Development without Kalebe dam: Total area of potential irrigation – 5 805ha

Option 2: Irrigation development with Kalebe dam: Total area of potential irrigation – 13 630 ha

Water resources and availability:

The potential water sources for irrigation include:

- Ngono River (Ngono East, Ngono West/Rubare)
- Lake Ikimba

According to the Interim Gibb International report (May 2012), preliminary hydrological analysis has been done for the Ngono River, which is the main source of water irrigation sites within the valley. The 80% probable flow is 10.17m³/sec. The analysis will have to be re-examined once additional data becomes available.

Technical design:

Chapter 11 of the Gibb International pre-feasibility study discusses the preliminary technical design of most project features, including:

- Main Intake sites (pump and gravity);
- Approach channel and delivery pools;
- Conveyance and distribution systems (canal or pipe);
- In-field irrigation system;
- Drainage system;
- Related structures.

Preliminary dam studies have also been done for Kalebe Dam and reservoir:

- A 15 m high dam (Crest length in the order of 520m) across Ngono east River downstream of Kalebe Bridge as proposed earlier;
- 4,250m tunnel.

The above will lead to:

- Reclamation of the area downstream of Ngono West and Ngono East, compensating for previously identified areas at Isanga and Manonga now considered unsuitable;
- Management of the problem associated with high groundwater levels at Kijjongo – Nyakigando and Kiijongo- Kabajuga;
- Control over of flooding in the Ngono Valley;
- Generation of hydropower (about 1.1MW).

Crop Selection and Location:

Crop categories and crop selection is presented in the Gibb report with appropriate agronomic practices prepared for these crops.

In the Gibb International study paddy is allocated all land dictated as suitable in terms of soil type and topography. This is 20 % of the total area – 1 035 ha for Option 1 and 2 325 ha for Option 2.

The remaining area has been distributed as follows for upland crops:

- Food crops 51%;
- Oil crops 20%;
- Vegetables 12%;
- Fruits 6%;
- Industrial 11%

10. BENEFITS

From the socio-economic survey, 92.2% of the respondents in the project areas welcomed the project.

Some of the benefits anticipated by the community include:

- Improved lifestyle;
- Better agricultural practices;
- Improved local and regional economy;
- Infrastructural development;
- Food security;
- Land reclamation through reduced flooding;
- Employment opportunities;
- Markets for farm produce.

From the Sept 2012 pre-feasibility study there is considerable existing crop agriculture and livestock (dairy) activity. Agricultural yields will however be far be higher with the introduction of irrigation and improved agronomic practices. Production without the addition of the dam will be about half what it would be if the dam is added.

Crop area, yield total tonnage production and figures for gross margin are tabulated in the pre-feasibility study for the irrigation scheme with and without the dam option.

11. IMPACTS

Environmental

In the Gibb International Interim Report (May 2012), the following environmental impacts were listed:

- There will be no significant impact on flows in the Kagera River.
- The impact on environmental flows in the Ngono River must be determined.
- High input agriculture could lead to deterioration in water quality due to return flows.
- The most critical environmental consideration is that drainage water from the area flows directly in Lake Victoria and runoff irrigation return flows could bring added pollutants to the lake waters (fertilisers and pesticides).

In the subsequent pre-feasibility study (September 2012) the following environmental impacts were listed:

- Construction Camps
- Wayleaves and Land Acquisition
- Impacts of Water Abstraction
- Recharge of Irrigation Water into the Environment
- Change in Land Use
- Impacts on Vegetation Cover
- Increased Risk of Soil Erosion
- Impacts on Soil Fertility
- Degradation of Irrigated Land
- Impacts of Use of Agrochemicals

Socio-economic

Socio-economic impacts were listed in the pre-feasibility study as:

- Impacts on Human Health
- In-Migration into the Project Area
- Increased demand for Housing and Public Utilities
- Urbanisation and Informal Settlements

12. SUSTAINABILITY

Social, environmental, and economic sustainability

This work has not yet been done.

13. RISKS

Risks have not been identified but should be assessed after proper impact assessments have been undertaken. One inferred risk lies in the clash of interests between stock farmers and crop farmers.

14. DURATION AND FUNDING

In the Gibb International Pre-feasibility study (Sept 2012), capital cost for the investment options are as follows:

- Option1 Tshs 78 billion **(USD 51 million)**
- Option2 Tshs 380 billion **(USD 243 million)**

- Operations and maintenance costs were given as $309 296 for Option 1 and $1 303 645 for Option 2. (The O&M cost is given as being for 15 years)

A five year implementation schedule is suggested in the pre-feasibility study:

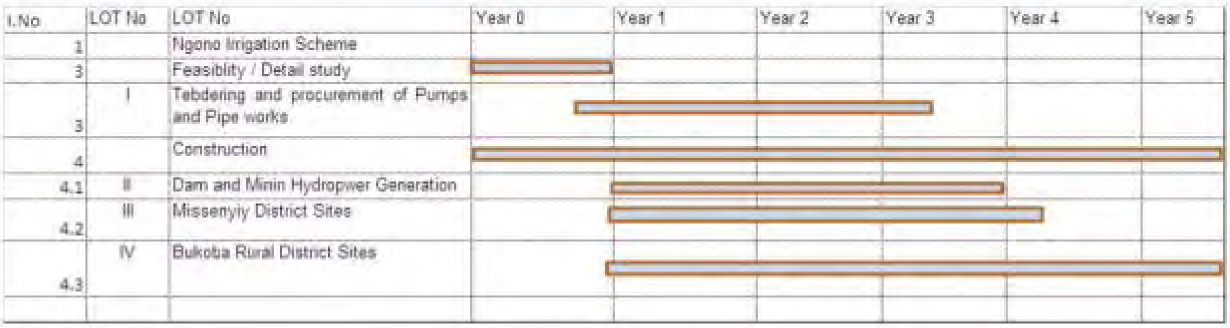

Figure 4: Implementation schedule

15. ADDITIONAL INFORMATION REQUIRED

- The environmental and socio-economic assessments in the pre-feasibility study are very sketchy and more work will have to be done.
- Assessment of potential to generate hydropower should Kalebe Dam be built.
- Whilst considerable work has been put into crop production and dollar output reports this must still be put into a sustainability context.

16. RECOMMENDATIONS

Pursue

3. NYANZA-23 HILLSIDE IRRIGATION (Mwogo River) – RWANDA

Nyanza Hillside Irrigation project i s l ocated in t he S outhern pr ovince of t he N yanza D istrict in Rwabicuma sector - 80 km from Kigali and 14km from the city of Nyanza. The project would irrigate 390Ha using water from the Mwogo River.

Construction of t he Nyanza hillside i rrigation pr oject w ill s tart s oon. C ontract neg otiations ar e underway.

1. SOURCES OF INFORMATION

The following report was the only study made available for this assessment:

- G. Karavokyris & Partners Consulting Engineers S.A. with P. Antonaropoulos & Associates S.A., April 2012, *Feasibility Study for Nyanza-23 & Gatsibo-8, and Additional Final Design for Nyanza-23 LWH Sites*

It is expected that earlier investigations will have information on social and environmental impacts and more information on benefits derived.

2 PROJECT DESCRIPTION / STATUS

A project bringing 390 ha under irrigation using water from the Mwogo River

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

Local agricultural development utilising the water resource – for local development and national food security

4. RATIONALE AND CONTEXT FOR PROJECT

The N yanza-23 project i s one of t he f our Lan d H usbandry, Water H arvesting and H illside Irrigation (LWH) P rojects, t he f inal des ign of w hich was as signed by MINAGRI t o t he j oint v enture of G . Karavokyris & Partners S.A. and Z&A P. Antonaropoulos & Associates S.A. After the implementation of the first phase of the initial contract for the above studies, which included the review of dams and irrigation s ystems s tudies f or t he s ame pr ojects c arried o ut e arlier b y Dr A zene B ekele-Tessema, significant modifications were proposed and introduced for two out of the four projects (Nyanza-23 and Gatsibo-8), of w hich t he most i mportant ar e t he m ove of t he d am ax is t o n ew l ocations an d t he selection of new command areas.

Very detailed information i s pr ovided f or t he t echnical aspects of t he N yanza Irrigation S cheme – although with no information on the actual impoundment.

Stakeholders include the LWH sector of MINAGRI, the World Bank, and the Dam Review Panel.

5. PREPAREDNESS FOR IMPLEMENTATION

Feasibility study submitted.

6. LOCATION

The project area is located in the Southern province of the Nyanza District in Rwabicuma sector - 80 km from Kigali and 14km from the city of Nyanza.

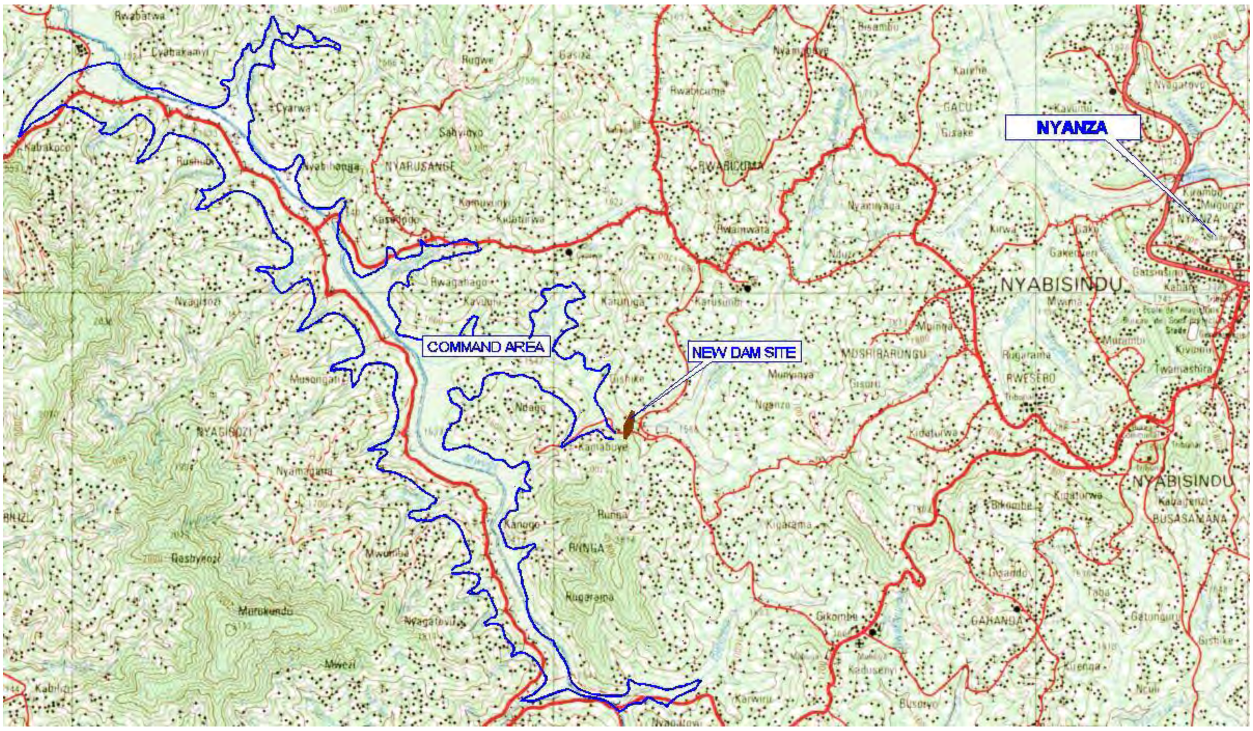

Figure 1: Locality of the Nyanza irrigation project

7. REPLICABILITY

Under the Land Husbandry, Water Harvesting and Hillside Irrigation (LWH) Programme.

8. BENEFIT SHARING

Benefit would be for local communities but proximity Nyanza and Kigali will benefit national food security.

9. TECHNICAL DESCRIPTION OF THE PROPOSED Scheme

No information is provided on the impoundment in the Mwogo River. It is assumed that water is abstracted from a run of river impoundment.

The command area is 470.7 ha, on both banks of the Mwogo River. The actual irrigation area has been determined at 390.5 ha.

The average annual water requirement is estimated at 1 331 382 m^3/annum with a requirement over only four months of the year. In a dry year (1:5 yr cycle) this increases to 2 225 333 m^3/annum, and in a very dry year cycle (1: 10 years) to 2 809 977 m^3/annum, with the requirement to irrigate extending over 10 months.

Different distribution alternatives were examined in the feasibility phase. The irrigation system adopted is a main network of canals with the secondary network comprising of pipes.

The command area lies to the left and right of the Mwogo River, with a gross command area of 470.70 ha out of which 390.50 ha is the net irrigable area.

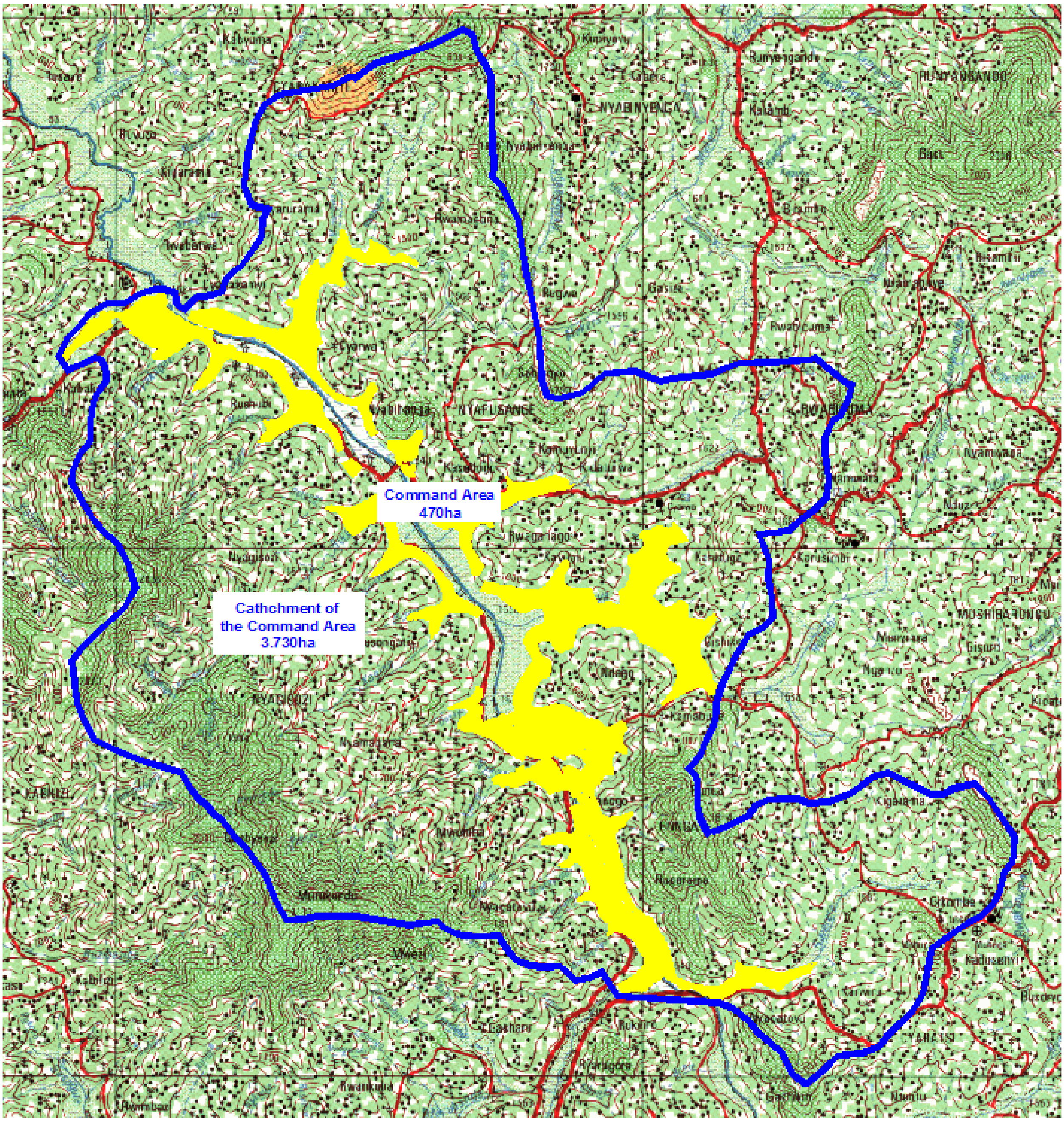

Figure 2: Catchment and command area

The c ommand ar ea has been s eparated in 1 0 par ts. A s pecific flow c orresponds t o eac h part, equivalent t o t he net ar ea. D epending o n t he number of bl ocks, t he num ber of t erraces and t he average size of each terrace the flow can cover the needs of a specific number of terraces during one day of irrigation. For details for area and flow requirements for each part refer to the report.

Following the feasibility study where all the alternatives were examined, it was decided that a system with canals for the main transfer network and pipes for the secondary should be designed.

The main network is designed with a peak duty of 0.95 litres per second per hectare.

10. BENEFITS

The Nyanza irrigation project would provide 390.50 ha of irrigation potential.

11. IMPACTS

No information available

12. SUSTAINABILITY

No information available

13. RISKS

No Risk identified

14. DURATION AND FUNDING

No information on budget or funding is available.

Construction works are planned by the consultant for a period of 12 months. Construction of the Nyanza hillside irrigation project will start soon. Contract negotiations are underway.

Water Use Component	Capital Investment Costs US $ for the first stage	Capital Investment Costs US $ for the next stages	Capital Investment Costs US $ TOTAL
Dam	5 530 000		17 980 000
Irrigation	21 930 000	6 004 000	11 336 000
Potable Water Supply	1 800 000		27 300 000
Livestock Water Supply	2 996 000	1 438 000	4 434 000
Aquaculture	672 000	1 824 000	2 496 000
Sub-total	**54 280 000**	**9 266 000**	**63 546 000**

15. ADDITIONAL INFORMATION REQUIRED

Environmental and Social Impact Assessment (ESIA)

16. RECOMMENDATION (AURECON/WEMA)

This irrigation scheme is promoted by MINAGRI and has reached the final stages of detailed design after what appears to be an extended development and consultation process. The water requirement is in the order of 2 million m^3/annum and this should be added into the overall accounting for Kagera Water Use.

Provided the Mwogo River carries sufficient water at this point and no downstream users are going to be seriously disadvantaged by this upstream abstraction, there is no reason why this project should not be encouraged to proceed.

4. RURAMBA IRRIGATION SCHEMES – RWANDA

Ruramba irrigation scheme would provide a net area 310 ha of hillside and marshland irrigation. The project is located in Ruramba Sector of Nyaruguru District as well as in Tare and Kamegeri Sectors of Nyamagabe District. The only available report is a proposal study by Digitech released July 2012.

NOTE: Although this scheme was evaluated separately here it has been evaluated further in conjunction with the Ruramba SHPP.

1. SOURCES OF INFORMATION

The following report is the only available study:

- Digitech, July 2012, Project proposal for Ruramba Irrigation Schemes.

2. PROJECT DESCRIPTION / STATUS

The proposed core operations of the Ruramba irrigation schemes are to:

(a) Transform the marshlands downstream the power house into two irrigation modules and to;

(b) Introduce irrigation on suitable sections of the adjacent hillside areas.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The objective of the Ruramba irrigation schemes would be to provide additional irrigation to enhance food security.

4. RATIONALE AND CONTEXT FOR PROJECT

Agriculture remains the economic mainstay of the overwhelming majority of the Rwandan people with close to 80% of the economically active population working in the sector. Agricultural productivity has, however, been in a steady decline over the past three decades, both, in terms of productivity per area unit as well as per labour unit.

The major resulting problem is an increasing impoverishment of the rural population; the more so since the productive base for agriculture is dwindling at the same time as increases in non-agricultural employment opportunities continue to remain far below population growth.

With further worsening of the ecological situation on the hillsides and thus further lowering of area productivity it must be expected that even the limited scope of agro-based but non-agricultural income-earning opportunities will be continually reduced below current levels.

5. PREPAREDNESS FOR IMPLEMENTATION

The Ruramba irrigation schemes project is at proposal stage. Date of report unknown.

6. LOCATION

As shown figures, the proposed Ruramba Scheme is located in Ruramba Sector of Nyaruguru District as well as in Tare and Kamegeri Sectors of Nyamagabe District.

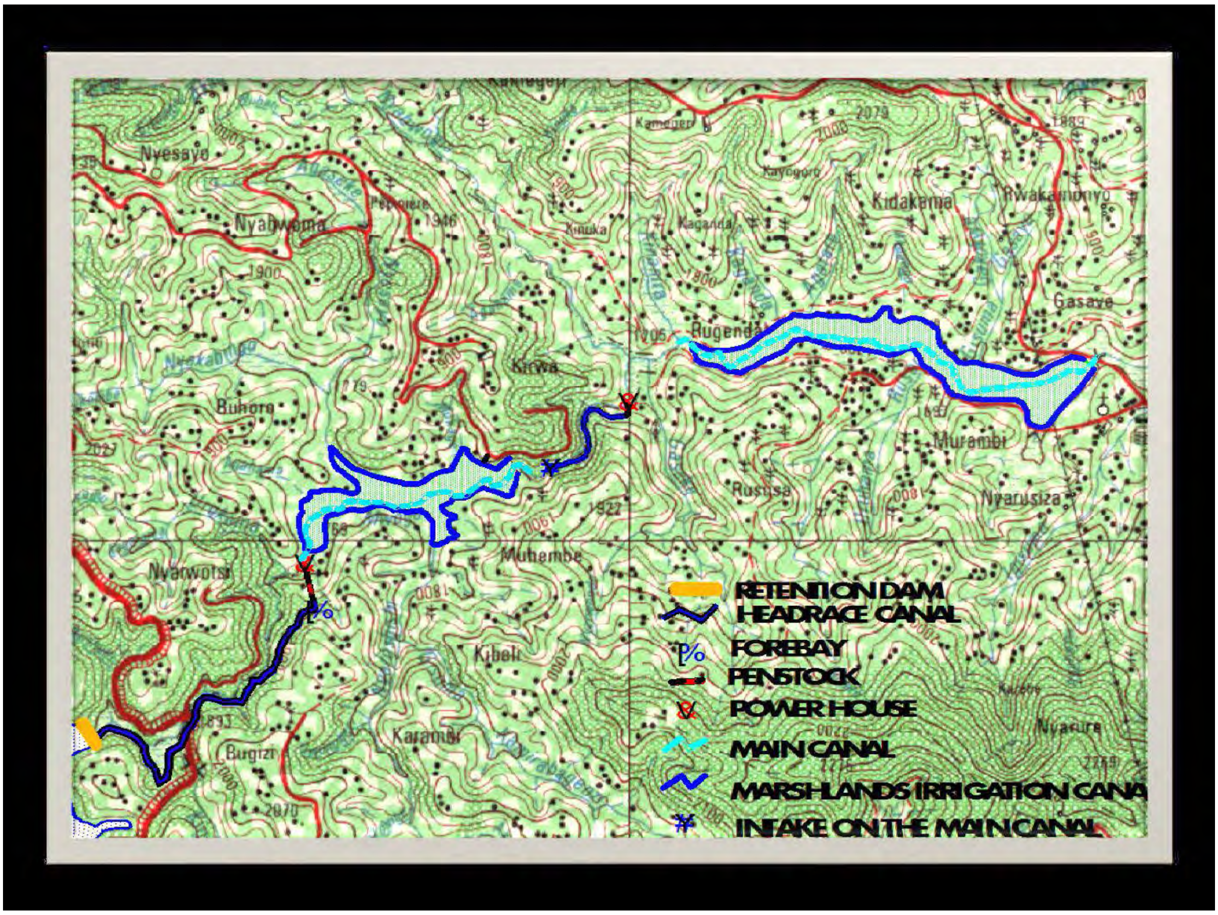

Figure 1: Ruramba Marshlands Irrigation Schemes

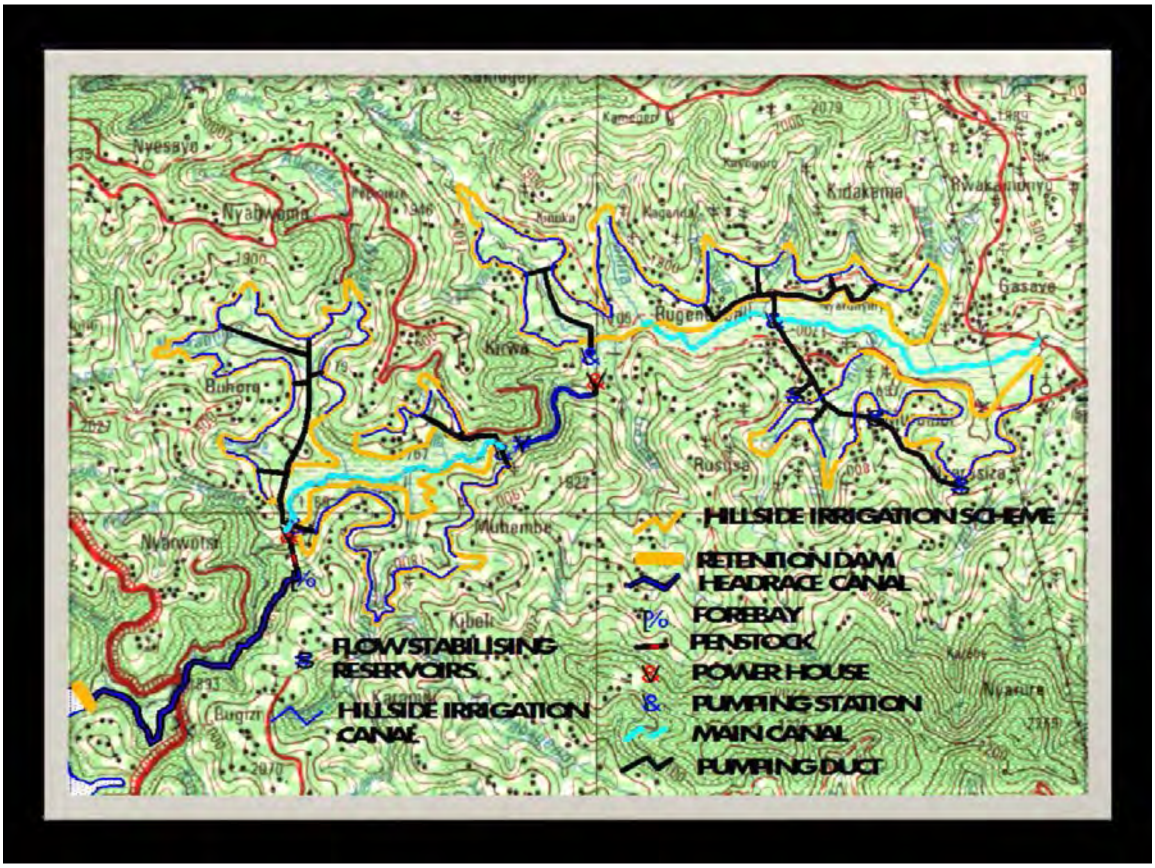

Figure 2: Ruramba Hillsides Irrigation Schemes

7. REPLICABILITY

The Ruramba irrigation scheme is linked to the Ruramba Hydropower Project.

8. BENEFIT SHARING

The Ruramba irrigation scheme will only benefit local communities.

9. TECHNICAL DESCRIPTION OF THE PROPOSED DAM

Developing the irrigation infrastructure in the marshlands for a gross area of 76,6ha will involve:

- excavation of a main canal,
- a canal connecting the two schemes,
- canal platforms,
- periphery canals as well as secondary and tertiary irrigation canals.

The estimated labour input for these activities amounts to 214.817 pers./days. This would bring the total transfer to the local population to **RWF 261.617.040** over an estimated construction period of about 18 months.

Works to be carried-out in suitable sections of the adjacent hillsides consist of:

- Terracing of an estimated 264ha of hillside areas adjacent to the developed marshlands;
- Excavation of irrigation and drainage canals;
- Stabilisation of contour lines above and between terraced areas.

The estimated labour input for these activities amounts to 982.092 pers./days. This would bring the total transfer to the local population to **RWF 1.205.592.000** over an estimated construction period of about 36 months.

10. BENEFITS

Short term benefits:

For marshlands development the estimated construction period of 18 months would mean an average employment of 600 people every month of this period. For the establishment of hillside irrigation the monthly average would amount to 1.400 people on the basis of an envisaged construction period of 36 months. It is obvious that the local economy would greatly benefit from those monetary transfers.

Long term benefits:

- The gross area of 76,6ha of the two marshlands irrigation schemes translates into a net irrigation area of 60,0ha (the remainder taken by the irrigation installations, particularly the canal system). With a general allocation limit of 0,1ha per household this would facilitate the establishment of 600 family cropping units
- For the hillsides it is assumed that land use on the identified suitable gross area of 264ha, which would translate in a net irrigation area of 250ha, can be established as follows: The dominant cash crop to be introduced would be coffee.

Marshland irrigation: Given the annual monetary returns from irrigated cropping in those areas amounting to **RWF 252.000.000**

Hillside irrigation: Given the annual monetary returns from irrigated cropping in those areas amounting to **RWF 487.200.000.**

11. IMPACTS

Not yet determined.

12. SUSTAINABILITY

13. RISKS

At this stage no risk identified.

14. DURATION AND FUNDING

For marshland irrigation development costs for both modules would amount to **RWF 651.069.000**, to be spent over a period of about 18 months.

Development costs for both hillside irrigation modules would amount to **RWF 1.506.887.000**, to be spent over a period of about 36 months.

The total budget for the PMU for its operations over 4 years would thus be in the scope of **RWF 949.204.000**, drawings of which over those four years together with the drawings for the operational funds are still to be determined.

15. ADDITIONAL INFORMATION REQUIRED

- Topographical survey of the project areas.
- Detailed design studies of the major construction measures,
- Detailed socio-economic baseline survey.
- Detailed plan of operations is to be elaborated, including timing of the different operations and coordination mechanisms.
- Project implementation organisation (Project Management Unit - PMU) has to be established.

16. RECOMMENDATIONS

The project should be assessed after the additional information is provided.

ADDITIONAL WATER RESOURCE PROJECTS

1. AQUACULTURE – IMPLEMENTATION OF FINGERPONDS - UGANDA, RWANDA, BURUNDI AND TANZANIA

The fingerpond concept is designed to exploit fringe wetlands sustainably for food production whilst conserving swamp integrity and biological diversity. The concept is a marriage of natural wetland phenomena with the historic activities of riparian peoples and more recent agro-piscicultural practices. These are summarized to highlight the main principles of fingerpond systems. Fingerponds are dug at the swamp edge in the dry season and the excavated soil is spread around their perimeters for food gardening. The ponds are stocked naturally during the seasonal floods with fish migrations, then become cut-off as the waters recede and the land between is cultivated. Manure and waste from village compounds can be used to fertilize the ponds. The fingerpond concept can be implemented in locations where increase in food security, especially in the dry season when livelihoods are most at risk, is needed.

1. SOURCES OF INFORMATION

- Information on Fingerponds was obtained from the UNESCO-IHE website (http://www.ihe.nl/Fingerponds).
- Denny, P., Kipkemboi, J., Kaggwa R. and Lamtane. H. (2006) The potential of Fingerpond systems to increase food production form wetlands in Africa. International Journal of Ecology and Environmental Science 32, 41-47 (presented at the 7th INTECOL International Conference on Wetlands in Utrecht, The Netherlands, July 2004).

2. PROJECT DESCRIPTION / STATUS

The fingerpond concept has been tested in several of the basin countries in a project sponsored by UNESCO-IHE between 2001 AND 2006. The concept was found to have potential.

Dissemination of the study results included the publication of many articles in scientific journals, as well as books and papers. A booklet with practical guidelines for the construction and management of fingerponds has been produced. A policy brief with recommendations for policy and decision makers has been submitted. There is also a 25-minute documentary film, and several presentations have been made in conferences and media.

This now requires widespread trails, with accompanying training, monitoring and evaluation.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The objective is to enhance, extend and diversify food production from wetlands, especially during the dry season.

4. RATIONALE AND CONTEXT FOR PROJECT

Riparian people of the Lake Victoria basin are vulnerable to reduced protein levels during the dry season. Moreover, over-fishing and wetland degradation have led to a decline of subsistence fisheries yields in Lake Victoria, leaving local communities deficient of proteins. Hence, there is a need to enhance appropriate fish production and agriculture.

UNESCO-IHE Institute for Water Education in Delft, The Netherlands, investigated the potential for integrating sustainable aquaculture systems into wetlands and floodplains in East Africa. The project started on 1 August 2001 and finished on 31 July 2006. It was a collaboration of six East African and European partners.

5. PREPAREDNESS FOR IMPLEMENTATION

In view of the technical potential of the technology and the promising socio-economic impact, more participatory research to refine and implement the system under field conditions is needed.

6. LOCATION

Fingerponds are excavated at the landward edge of wetlands in the dry season, and fill during the flood cycle, thereby trapping fish as the flooding recedes. During the following dry season, the ponds are enriched with manure while the trapped fish grow and can be cropped. The land in between is cultivated with seasonal crops.

7. REPLICABILITY

Thus the project can be implemented wherever there are seasonally flooded wetlands with migratory fish populations. This would be the case in all for Basin countries, and a joint implementation programme is recommended.

8. BENEFIT SHARING

Riparian communities with limited resources throughout Africa may benefit from the system. Sharing of technical and information and experience would greatly facilitate successful implementation.

9. TECHNICAL DESCRIPTION

Fingerponds are excavated at the landward edge of wetlands in the dry season, and fill during the flood cycle, thereby trapping fish as the flooding recedes. During the following dry season, the ponds are enriched with manure while the trapped fish grow and can be cropped. The land in between is cultivated with seasonal crops as indicated in **Figure 1**.

Assuming that an individual household of 7 persons owns one pond of 200 m² and applying the average yields above, the potential per capita fish supply is an additional 3.0 kg per capita per year which is equivalent to 18% of the world's per capita supply average and 38% for Africa. Under good management and effective final harvesting, a higher per capita supply can be achieved. Fingerponds potential protein supply was compared with the other farming enterprises. Apart from arrowroots, whose biomass harvest per m² was higher than the other crops, the potential protein supply from Fingerponds was about 200 kg per hectare and was higher than most of the other farming system enterprises. Cereals (predominantly maize and sorghum) constitute the main diet of many households in Kula.

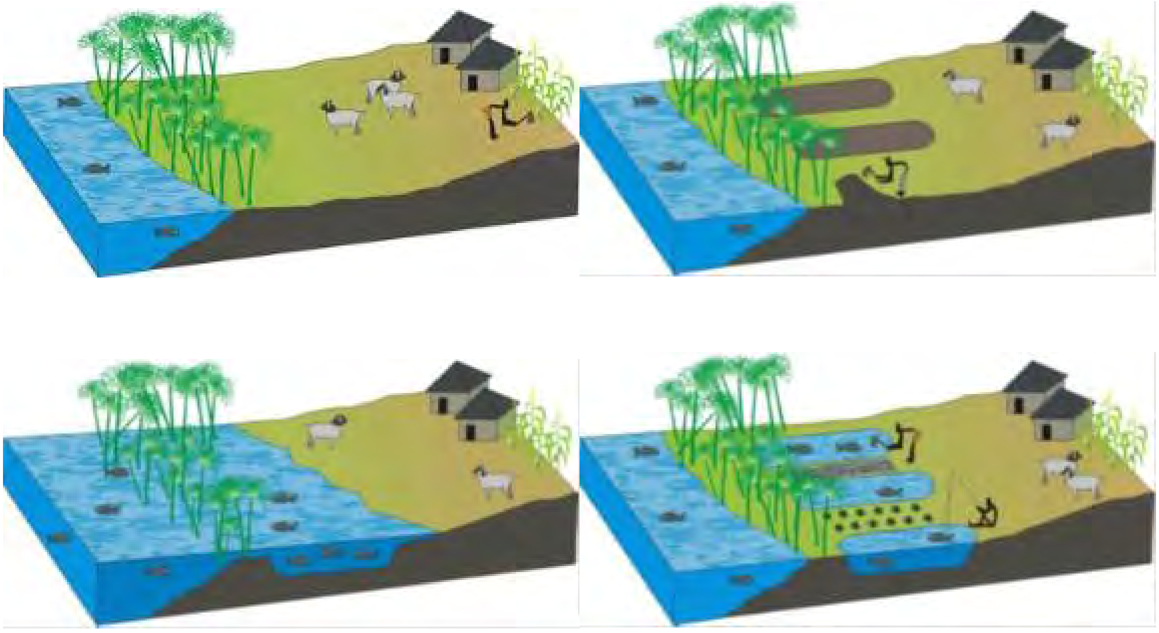

Figure 1: Preparation of Fingerponds for fish cultivation

10. BENEFITS

The main benefit of the fingerponds concept is that it makes a contribution to food production in the dry season.

There are additional benefits from fingerponds:

- The low technology relying on the natural functioning of wetlands protects the wetland from degradation, especially from their hydrological functioning.
- The methods of natural stocking of the ponds provide cost free fish and excess fish can be sold for stocking other ponds.
- Natural stocking entraps valuable, and sometimes rare, native species that can be cultured separately and used for re-stocking dwindling diversity in natural waters.
- Educational benefits in wetland wise-use principles. One of the sites in Kenya is within the bounds of, and managed by, a primary school. The fingerpond system provides and exciting a realistic demonstration of nature, how it works and how it can be a sustainable provider of produce from wetlands.

11. IMPACTS

Environmental

The environmental impact of Fingerponds in terms of habitat destruction, nutrient leaching, and disease vectors was estimated to be generally low. No enhancement of human disease vectors, such as bilharzia snails or mosquitoes, was observed. In terms of livelihoods benefits, Fingerponds in Kusa, Kenya contributed to the natural, physical, human and social assets of the community.

Socio-economic

The socioeconomic study showed that Fingerponds were comparable to vegetable production in terms of income and returns to labour. With the current technology, Fingerponds can contribute 3 kg per capita per year of protein to the diet of households owning one pond.

7. SUSTAINABILITY

Figure 2 illustrates the sustainability cycle of Fingerponds.

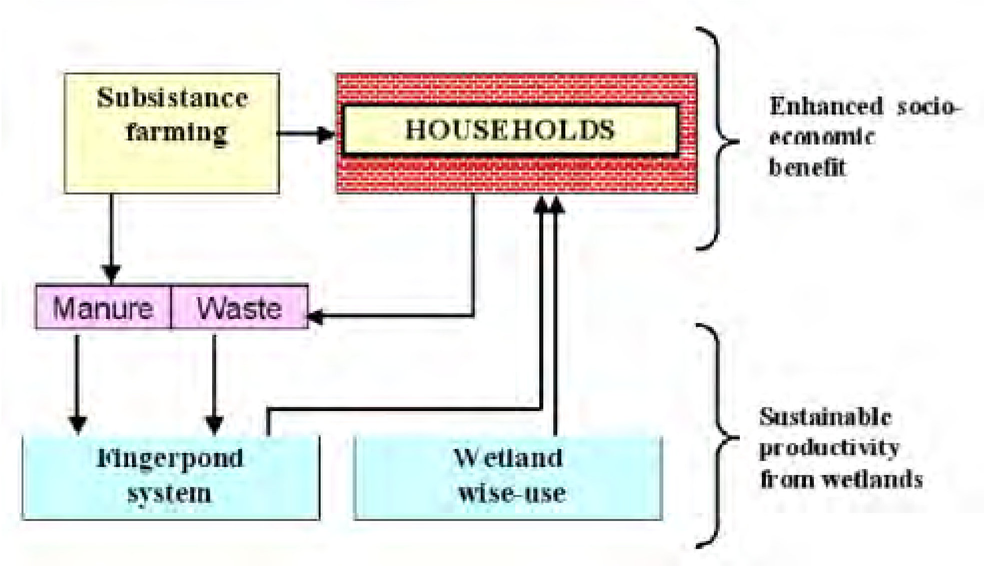

Figure 2: Schematic representation of sustainability

13. RISKS

- Both predation and theft are potential problems for farmers.
- Changes to river flow would threaten position of ponds.
- Funding risks are low relative to infrastructure projects.

14. DURATION AND FUNDING

The cost of Fingerpond construction and purchase of the seine net increased the overall fixed costs and were depreciated for 10 and 5 years respectively. Gross margin analysis of Fingerponds revealed that it is a viable enterprise and compares with arrowroot cultivation. However, high fixed costs associated with the initial investment reduced the profitability to a net income of 72.8 % less than the gross margin.

Fingerponds would be maintained by individual farmers, and would have the same longevity as farmlands provided they provided their worth and are maintained annually. This comes at the cost of individual labour.

15. ADDITIONAL INFORMATION REQUIRED

A great deal of research has already been done. However, conditions for implementation will always be regionally- and especially river-specific. Implementation will need to be under the guidance of trained extension officers.

16. RECOMMENDATIONS

Implement significant pilots.

2. KATUNA WATER SUPPLY KIOSKS PHASE 2 (EXPANSION OF EXISTING PROJECT) - UGANDA

Water kiosks are known throughout East Africa as a means of providing water to urban populations though vending machines, providing cost recovery and sustainability. A trial has been implemented in Katuna (Kabale District) in Uganda, supported by SIDA. Expansion to other project areas must now be planned and implemented.

1. SOURCES OF INFORMATION

- Interview with Mr. Bugamuhunda Turina
- Biosca Website: http://biosca-ug.net/katuna.php

2. PROJECT DESCRIPTION / STATUS

Water kiosks are known throughout East Africa as a means of providing water to urban populations though vending machines, providing cost recovery and sustainability. SIDA (the Swedish Development Agency) has funded a number of developments and have been funding the Katuna example.

A trial project is in the implementation phase in Katuna town and Kabale District. Implementing agents have been:

- BIOSCA Consultants (Kampala)
- Vidus Engineering Contractors

A feasibility study of the Katuna water supply scheme was done and this included Topographic and Baseline surveys of the project area with the help of the Kabale District Water Office Officials.
Expansion of the project to other areas must still be planned and implemented.

3. OBJECTIVES / PURPOSE OF THE DEVELOPMENT

The main project objective is to improve water distribution to people in urbanised situations but without piped supply, providing a system of selling this water to achieve self-funding and sustainability.

4. RATIONALE AND CONTEXT FOR PROJECT

This design for the Katuna Water Supply Scheme is part of the Kabale District Local Government Water Supply and Sanitation Development Programme, in conjunction with NBI's NELSAP / Kagera Transboundary Integrated Water Resources Management Project (KTIWRMP). BIOSCA Consultants Ltd. were contracted to undertake a Design and Documentation of the Katuna Gravity Flow Scheme. (http://biosca-ug.net/katuna.php)

5. PREPAREDNESS FOR IMPLEMENTATION

Phase 1 of this Project was commissioned Feb 2010.

6. LOCATION

The trial project area encompasses the town of Katuna; this includes the cells of Mayengo and Burambira. Katuna is a Ugandan border town located in Kamuganguzi Sub County, Ndorwa County, Kabale district. Katuna is located about 20 km from Kabale Town. (http://biosca-ug.net/katuna.php) . However the project offers widespread application opportunities across the Kagera Basin.

7. REPLICABILITY

Widespread applicability across the basin

8. BENEFIT SHARING

Whilst currently limited to the implementation trial in Uganda this project can, should be model prove popular and successful, be applied in towns and cities across the basin.

9. TECHNICAL DESCRIPTION

Pipes are laid to communities from a water source (this could be directly from a river or dam, from groundwater, or even from an existing municipal source). Water is preferably supplied by gravity feed. Water can be stored in holding reservoirs if necessary; it is then sold at water kiosks. These are simple vending outlets, manned by an operator. Individual users collect water in buckets.

The water supply system would target water stressed communities and institutions within the target area. Preference would be given to areas with dense populations along the pipeline and to institutions within a reasonable distance not exceeding 1km, and with no alternative sources of water. (http://biosca-ug.net/katuna.php)

For the Katuna water supply project, water is to be supplied from two 45m³ reservoirs, of which only one has been built. Water will be distributed through 16.5km of pipeline, of which 9km has been laid, to eight water kiosks. Two of these kiosks, still to be constructed, will be situated in Katuna Town. Water will also be distributed to forty public stands.


10. BENEFITS

Accessibility of clean water in urban environments

Domestic use, health

11. IMPACTS

Environmental

None

Socio-economic

Improved access to water

12. SUSTAINABILITY

Funding will pay for O&M – but not necessarily for replacement of systems or further expansion

13. RISKS

None

14. DURATION AND FUNDING

Only UGX 255 million of the UGX 497 million project has been funded. Additional funding is being mobilized.

15. ADDITIONAL INFORMATION REQUIRED

To be determined

16. RECOMMENDATIONS

This project should be implemented.

3. PROTECTING WATER RESOURCES WHILST ENHANCING LOCAL COOPERATIVE SMALL-SCALE MINING - APPLICABLE TO ALL THE BASIN STATES

This proposal is based on a project developed by Dr V. Strumberger, Senior Mineral Exploration Expert for SCBI, MINIRENA, Rwanda. It can be implemented in all the Basin States.

1. SOURCES OF INFORMATION

- Strumberger, Dr V., (undated). Enhancement of local cooperative small scale mining and water protection in the Republic of Rwanda. MINIRENA.
- LTS International, 2011. Feasibility Study for an Integrated Watershed Management Program for the Kagera River Basin. Interim Report - Annexes 6-7.
- BRL Ingénierie, 2012. NBI, NEL Multi Sector Investment Opportunity Analysis (MSIOA). Draft Situational Analysis Report. Main Report, 22 June 2012

2. PROJECT OBJECTIVES

This proposal is aimed at the introduction and use of simple but specialised equipment to improve efficiencies and reduce wastewater production in small-scale mining. The project seeks particularly to introduce equipment appropriate to artisanal mining operations for the separation and washing of mineral deposits. The project would positively impact on water resource quality in the Kagera River Basin States of Rwanda, Burundi and Uganda. There is less mining within the Kagera Basin in Tanzania but the project will be equally applicable and of value to that country.

3. RATIONALE AND CONTEXT

The Kagera River Basin States, in particular Rwanda, Burundi, and Uganda are rich in deposits of heavy minerals, particularly coltan (Nb / Ta), casseterite (Sn) and wolframite (W) but also gold, nickel, tin, vanadium, titanium and other minerals. There are hundreds of mines, some run by small private companies – but many by very small-scale artisanal mines organised at a village level. These mines are generally very inefficient, with low recovery rates and bringing very high levels of water pollution.

With regard to the management of Mineral Resources sector, the EAC Partner States have agreed in the EAC Treaty to (inter alia):

- Promote joint exploration, efficient exploitation and sustainable utilisation of shared mineral resources;
- Pursue the creation of an enabling environment for investment in the mining sector;
- Promote the establishment of databases, information exchange networks and sharing of experiences in the management and development of the mineral sector;
- Harmonise mining regulations to ensure environmentally friendly and sound mining practices;
- Adopt common policies to ensure joint fossil exploration and exploitation.

This sets the ground for the joint implementation of this project.

4. PREPAREDNESS FOR IMPLEMENTATION

The project is still at proposal level and requires trial and testing for improved recovery rates, willingness of miners to take up the technology, and unforeseen logistical problems. Equipment is commonly used in the recovery of alluvial minerals and is commercially available.

5. LOCATION

Small mines are scattered throughout the Kagera Basin States of Uganda, Rwanda and Burundi.

Trials of equipment could be run at four or five locations within each country, to test suitability for different sites and minerals.

6. REPLICABILITY

This project brings a product that is highly replicable in at least three of the four Basin countries. Tanzania has less mining potential within the Kagera Basin, but the project will bring benefit elsewhere in the country.

7. TECHNICAL DESCRIPTION

Very small-scale mining equipment is used to facilitate the extraction of heavy minerals from alluvial sediments. Water is used to separate the heavy minerals from the host rock or alluvium.

Equipment comprises:

- A separation plant. This is a trommel, or circular rotating sluice with scrubber and sorting screens (movable or portable)
- Water pump (portable)

Capacity of trommel: 1-5 tons of ore per hour.

Recovery rate: Estimated at 60%.

Artisanal miners can pan in the order of 100kg / hour at an estimated recovery rate of 10%

8. BENEFITS

- Small pumps will allow the use of settling ponds. Water can then be recycled, resulting in less wastewater and polluted run-off and sedimentation into rivers. Improvements to water quality.
- Far higher yield per ton of ore mined. Higher extraction efficiency means a far better mineral yield: wastewater pollution ratio.
- Greater profitability, with benefits to miners, local community and the national fiscus.

9. IMPACTS

Environmental

- Water from local sources (rivers and streams) is used for the separation of ore minerals. There is a major problem of both inefficiency in ore extraction, sedimentation, and water pollution as water washes back directly into streams. The introduction of improved equipment should greatly increase efficiencies.
- Less water is used and returned to streams with significant benefits to water quality.

Socio-economic

- Significant increases in profitability and hence a positive impact on poverty levels.
- Previously unprofitable sites may become profitable – increasing the number of mines, with consequent impacts.
- Income resulting to Governments will repay initial investment many times over.

10. SUSTAINABILITY

Financial

Whilst the initial project requires government support in testing the technology, setting up supply, distribution and maintenance networks, the project is expected to become entirely self-sustaining, with equipment purchased directly out of increased profits enjoyed by the mining cooperatives.

Project success is premised on the introduction of standardised equipment that can be maintained by the mining cooperatives. Replacement equipment and spares networks will have to be set up (providing business opportunities) and must be reliable.

Increased government income through taxation on minerals production

Social

No apparent issues.

Environmental

Water quality standards must be managed to legal requirements. The availability of practical and affordable technology will make this easier to implement. Improvements to water quality will enforce perpetuation.

11. RISKS

Risk in testing the introduction of this technology is minimal as the costs of equipment are low and should be shared between countries.

One possible consequence of success is that this will prove a great boost to small-scale mining, also making previously unprofitable ventures possible. An expansion of mining would lead to an expansion of pollution sources, even if levels were lower due to greater efficiencies.

.12. DURATION AND FUNDING

Implementation trials could be completed over several sites within each of the three key countries, within six months. Funding requirements are very low. The use of outside expertise is recommended in selecting the best equipment but local Minerals and Energy Departments should be able to fund trials from internal budgets. Uptake will require:

- ‘Marketing’ of the technology
- Initial training in the use of the technology until an expertise base has been built.
- Provision of the standardized selected equipment.
- Assurance of continued supplies, spares and repair services.
- Enforcement of mining legislation to discourage resource waste and water pollution.

Given the above it is expected that artisanal mining cooperatives will adopt the technology widely and that improved profits will ensure that it can be paid for even by very small-scale users.

13. ADDITIONAL INFORMATION REQUIRED

Equipment is described as comprising "a small (portable) mineral separator (trommel), and a water pump". Information is required on suppliers, costs, and sources of equipment.

14. RECOMMENDATIONS

This project should be implemented

4. MUTOBO WATER SUPPLY PROJECT – (water supply for Kigali)

Kigali has insufficient water to meet the daily needs of its inhabitants. Supply is also unreliable. This project aims to draw 100 000m^3/day from the Mutobo area, based in Musanze district in Northern Province and pipe this 100 km to Kigali. Water quality is good and gravity is largely in favour, but far closer water sources are available put the necessity of this project in doubt.

This project has already been commissioned at an estimated cost of $300 million, and will take three years to complete.

1. SOURCES OF INFORMATION

A government commissioned study conducted in 1999 indicated that more clean water could be pumped from the area.

- Article: http://focus.rw/wp/2012/06/mutobo-water-project-to-be-completed-in-three-years/
- Article: http://allafrica.com/stories/201205170143.html

2. PROJECT DESCRIPTION/STATUS

This project has been launched by the Government of Rwanda

3. PROJECT OBJECTIVES

The main objective is to increase the water supply to Kigali City and neighbouring districts

4. RATIONALE AND CONTEXT

Kigali city has about 65,000 homes and 280 public taps connected to the network. The city of Kigali has an approximate water demand of about 80,000 m^3/day.

The bulk of water supply to Kigali City comes from Kimisagara, Nzove, and Karenge among others. The current water production in the city stands at about 68,000 m^3/day which would gradually rise to 93,000m^3/day with the optimization of the Nzove water treatment plant.

5. PREPAREDNESS FOR IMPLEMENTATION

The government had earlier consulted the International Finance Corporation (IFC) as an advisor to conduct a feasibility study of the project whose findings indicated that the project was impossible to realise on the grounds that it was very expensive and required a Public Private Partnership model.

Part of IFC's study had indicated that this supply option required a 100km pipeline to be constructed.

However the GoR has commenced with this project based on need (see project rationale, above).

6. LOCATION

The project will supply clean water from the Mutobo area, based in Musanze district in Northern Province, to Kigali city and neighbouring regions like Muhanga and Bugesera districts.

7. REPLICABILITY

Attention needs to be given to the sustainability of water supply to all towns in the Kagera Basin. This is important in the face of the growing population, and the expectation that urbanization will increase. It does not appear that towns have been planned on the understanding that water can be a limiting factor. This project is a useful precursor in understanding both the needs of urban people and the cost of proving for supply.

8. BENEFIT SHARING

Urban use (water supply and sanitation) – City of Kigali

9. TECHNICAL DESCRIPTION

- According to Energy Water and Sanitation Authority, the Mutobo water treatment plant, first installed in 1988, currently processes 2,162 cubic meters of water per day but has a daily capacity of 12,500 cubic meters.
- The Mutobo Scheme will have capacity to produce 100,000 m³ of water per day.
- The water is relatively clean and will not require much treatment.
- Water will be piped to Kigali via a 100 km pipeline.
- Distribution will almost all be by gravity.
- Associated water treatment works

Nzove water supply scheme, which draws from the groundwater resource, has a capacity of 25,000 m³/day, to be increased by another at least 10,000 m³/day, also contributes to the Kigali water supply. Expansion work is expected to be completed by June.

Other water plants around Kigali include

- Kimisagara (23 000 m³/day),
- Karonge (12,000 m³/day)
- Rwamara (1,000 m³/day)
- Mburabuturo (1,000 m³/day)
- Kinyinya (1,000 m³/day)
- Byimana (800 m³/day)
- Gihogwe (500 m³/day)

Ref http://focus.rw/wp/2012/06/mutobo-water-project-to-be-completed-in-three-years/

10. BENEFITS

Additional and reliable water source for Kigali - supplies to Kigali are currently inadequate (68 000 m^3/day, with a requirement of 80 000 m^3/day at 80 litres per person per day.

11. IMPACTS *(Environmental, Social, Economic)*

A 100km pipeline may cross a large number of cultivated areas.

12. SUSTAINABILITY *(Financial, Technical, Social, Environmental)*

Urban water supply can be expected to be self-funding.

13. RISKS

N/A

14. DURATION AND FUNDING

The Government intends to spend US$300 million (approx. Rwf 190 billion) on the construction of the Mutobo water project. The project is expected to take three years to complete.

15. RECOMMENDATIONS

Other projects closer to Kigali to supply water to the city should be investigated.

Annexure D:
LTS Watershed Management Projects Study summary

LTS INTEGRATED WATERSHED[2] MANAGEMENT PROGRAMME FOR THE KAGERA RIVER BASIN

Project in progress undertaken by LTS International under Basin Grant TF095077 in conjunction with NELSAP as part of the Nile Basin Initiative (NBI)

1. SOURCES OF INFORMATION:

The key source from which this assessment is made is:

LTS International, 2012. Feasibility study for an integrated watershed management programme for the Kagera River, Project selection background document for stakeholder workshop: 25 May 2012.

Additional documentation for this study is listed below:

- LTS International, Phillips Robinson and Associates, March 2011: Feasibility Study for an Integrated Watershed Management Program for the Kagera River Basin, Inception report, Revised, NELSAP, NBI
- LTS International, November 2011: Feasibility Study for an Integrated Watershed Management Program for the Kagera River Basin, Interim Report + Annexes 1-8, Updated

2. LTS STUDY OBJECTIVES

"To prepare through feasibility type studies an **investment project for integrated watershed management of priority watersheds**"

and

"The project will contribute to addressing watershed degradation issues and optimal and sustainable integrated use of natural resources of the watersheds …" (LTS International, 2012)

3. PREPAREDNESS FOR IMPLEMENTATION

The feasibility study has been completed and presented to stakeholders. Documentation viewed included a list of selected projects and location within sub-catchments across the four basin countries but there is no plan of action, nor implementation plan. The emphasis has been on country programmes, for administrative simplicity - avoiding the need to build additional institutional levels for delivery. The trans-boundary programmes would need to be administered at the NELSAP level.

4. PROGRESS TO DATE

Technical processes have included the delineation of 22 watersheds.

Water quality issues are mapped in terms of the pollution risk to all major urban centres, along with population figures for these towns and cities.

[2] 'Watershed' is synonymous with the term 'catchment' used elsewhere in this document.

Projects have been selected and subjected to stakeholder evaluation, design and prioritisation through an iterative process with approximations and consultation in stages.

5. OVERALL DESIGN OF THE PROGRAMME

5.1 Project selection

The feasibility study recommends four country programmes and two trans-boundary wetlands programmes. Each country programme has a range of ***watershed management projects*** and up to five (additional) ***wetlands projects***.

Watershed management projects – There was agreement on four country programmes and two basin wide programmes, given 'some distinct country variations in specific issues and some clear generic similarities' (LTS, p17), with potential projects evaluated against technical and stakeholder criteria and their potential to generate down-stream and trans-boundary benefits.

Wetlands projects – Two types of projects identified (i) 'improvement of management of wetlands of high significance that cross international borders', and (ii) projects that 'focus on the acquisition of technical knowledge and information through practical intervention', although it is not clear from the report what these would be.

Criteria for selection were as follows:

(a) Watershed management criteria

Technical criteria -projects required to address

- (i) Land and vegetation degradation / soil moisture deficits
- (ii) Hydrological change – flows, sedimentation, pollution (caused by land degradation (including deforestation), and pollution
- (iii) Threats to wetlands

(b) Wetlands management criteria

Whole watersheds and not just wetlands

Wetlands criteria are not specific to projects but are all concerned with implementation approaches and alignment.

5.2 Stakeholder criteria

These were given as: Project alignment; complementarity and gaps; and addresses weak research, extension, and environmental law enforcement. Lack of knowledge on groundwater in areas of soil moisture deficits is an interesting outlier amongst stakeholder criteria (LTS, p12).

5.3 Approach

The approach was to identify intervention activities and to locate projects in hot-spot areas identified through sub-watershed characterization with ranking based on:

- Land degradation: population pressure and soil erosion risk
- Soil moisture deficits (need for additional water to enhance productivity)

Hot spot areas were classified as red zone (more severe) and yellow zone (less severe).

'Red zone' projects were to address: accelerated soil erosion, low soil fertility, deforestation, accelerated runoff, sedimentation and riverbank erosion, changing streamflow regimes, and wetland degradation.

Underlying factors that would also have to be addressed were: land tenure, participatory land use planning and zoning, value addition, marketing, credit, technology transfer, agricultural inputs.

Yellow zone projects were to address: soil water deficits through water harvesting and small-scale irrigation. Underlying weaknesses include: Poor knowledge of groundwater resources, lack of participatory planning, strategic location of livestock water supplies, marking and value adding.

It is not clear from reporting how this zonation carried through into the current project plan.

It was recognised that in the eastern part of the sub-basin water resources are not being fully realized – with a low level of irrigation development. This has implications for infrastructure development projects.

6. THE PROJECTS

6.1 Wetlands projects

The 'wetlands' projects proposed are the same for all four countries. Whilst all projects have an implementation component, for the most part this would be through the institutional and popular adoption of results of studies resulting in guidelines. There is not a strong emphasis on practical introduction of projects.

WETLANDS PROJECT	NATURE OF PROJECT
• Protection of wetland ecosystems through environmental flows and sustainable abstractions	Review (assess approaches and experience). Guidelines.
• Artificial wetlands for sustainable urban drainage	Implementation trials. Guidelines.
• Payments for wetland ecosystem services	Research and test
• Alternative livelihood for wetland communities through an ecosystem approach	Assess opportunities and social implications with 'alternative livelihoods'. Undertake trials
• Impacts on wetlands of water harvesting and development of groundwater resources	Research and guidelines

6.2 Watershed (catchment) projects

Issues or themes on which projects would be based were outlined for each country:

COUNTRY	PROJECT THEMES
Burundi	Agriculture, Fisheries/ Aquaculture, Water supply and sanitation, Tourism, Mining, Institutional development / Capacity building
Rwanda	Agriculture, Fisheries/ Aquaculture, Energy, Water Supply, Tourism, mining, Institutional Development and Capacity Building.
Tanzania	Wetlands, Forestry, Land Management and Soil Conservation, Energy, Water Supply, Fisheries/ Aquaculture
Uganda	Land Use and Management (soil conservation), Energy, Water quality, Water Resource Management, wetlands, Forestry, Fisheries

There is more variation in the watershed projects for the four countries than was found for wetlands, and projects prioritised in the different countries differ markedly in some instances, although all will carry some relevance to the entire basin. Projects are paraphrased here into key words so as to reveal the themes encompassed:

COUNTRY	PROJECTS
Burundi	Rehabilitation, soil and water conservation, irrigation, riverbank erosion control, improved farming, intensive animal husbandry, forestry, rainwater harvesting, rural infrastructure
Rwanda	Fruit production in buffer zones (wetlands protection and food security), soil and water conservation, intensive animal husbandry
Tanzania	Groundwater, soil conservation, village water supply, fisheries
Uganda	Wetland protection and rehabilitation, riverbank erosion control, soil and water conservation, forestry, payment for ecosystem services

7. COMPLEMENTARITY OF THE LTS INTEGRATED WATERSHED MANAGEMENT PROGRAMME WITH THE AURECON/WEMA BASIN DEVELOPMENT PROGRAMME

The intent of the Aurecon/WEMA Basin Development Programme (BDP) is to evaluate development activities within the Basin and particularly to single out projects for implementation. The focus is on water resource infrastructure projects and is complementary to the work currently being undertaken by LTS International, which is aimed at a completely different suite of small-scale but ideally highly replicable development activities.

The LTS process appears to have been thorough, and the emphasis on stakeholder participation and engagement in the identification of projects is very positive. It is precisely this engagement that has been visibly absent for many of the water resource infrastructure projects. The broad programme themes that come though strongly and align with the infrastructure projects proposed in this report are Wetlands Management and Watershed Management and within these:

- Wetlands protection and management
- Agriculture and livestock production (food security, coping capacity)
- Soil and Water Conservation (land degradation)
- Forestry (land degradation)
- Fisheries / aquaculture.

Village water supply and irrigation are also listed, but these (along with energy) are important focus areas for the infrastructure projects.

There are a number of features to these proposals:

(vi) **The wetlands projects** are predominately structured around assessment, evaluation, research and the development of guidelines, with some demonstration trials or projects. The intention is presumably that these studies and demonstrations will lead to the development of national programmes for implementation, and the question is whether these national programmes could not be introduced more rapidly rather than only as trials. This especially where the need is clear and there is ready experience elsewhere on which to draw (for example SIDAs work in soil and water conservation in Kenya).

(vii) **Soil and water conservation** projects predominate and rightly so. There are already national programmes to deal with the issue land degradation and it is these that should be developed and supported with great urgency.

(viii) **The watershed projects** are also at this stage a range of small projects scattered across the four countries. It is argued, correctly, by LTS that circumstances are different in each country, but these projects are unlikely to have any impact unless they can be implemented, adopted, and adapted very fast indeed. Experience also needs to be shared between countries as there are clearly important project themes missing in some countries (for example forestry in Rwanda).

(ix) **Rainwater harvesting** is given one project – yet this is typically a programme that can be implemented widely and immediately across all countries in close alignment with soil and water conservation measures and programmes to improve catchment soil water deficits and agricultural production.

(x) **Groundwater** is the biggest gap. Projects on groundwater fall right between the large infrastructure projects of the Aurecon/WEMA study and the Wetlands and Watershed projects of the LTS Feasibility Study. Although much of the Kagera Basin is well-watered, rainfall is strongly seasonal and groundwater is both a singularly important and accessible resource in supplying hundreds of thousands of scattered villages and homesteads. The importance of groundwater as a reliable source of safe and clean water is not acknowledged. Large infrastructure projects can provide surface water only to a few to small pockets of the population, and that at great expense, whilst access to groundwater can be locally and affordably implemented and has the potential to bring water within the reach of the vast majority. This will, however, require facilitation.

Annexure E:
Projects Screening Template

SCREENING PROJECTS

PROCESS AND SCORING

EXPLANATION OF SCORES BY PROJECT

CLASSIFICATION OF PROJECTS

Projects fall into different classes and cannot all be compared, one with the other, in the same way. Once screened within classes it is possible to better compare the merits of different investments. The following categories were used as shown in the Table below:

Hydropower schemes

These are schemes where the key rationale is the production of hydropower. Where dams are constructed, irrigation may be an additional activity. Hydropower schemes with dams are not included with other "larger dams" as their better cost recovery has a large impact on their scores.

Larger dams

These are all large projects with significant dam capacity or wall height. Despite the size of these dams, hydropower is not a significant option although some hydropower can be generated – at least sufficient to pump water for local domestic water supply.

Smaller dams

The World Bank classifies any dam with a wall height of <15 metres as a small dam, but for screening purposes "capacity" proves a more useful measure. Dams with a height of <15 m or with a capacity of less than 30 million m^3 were grouped together as "smaller dams".

The previous studies of most of the smaller and larger dams do not contain information about the areas that would be irrigated or the domestic water demands that would be supplied, although this information will be provided by further phases of on-going studies. Therefore for the purpose of the current study preliminary estimates of these demands were prepared as follows:

- Irrigation schemes would utilise up to 65% of the yield of the dam.
- Treated water for domestic use would be supplied to the vicinity homes close to the irrigation schemes at a rate of 50 l/capita/day. Hydropower would be generated to pump this water.
- Ecological flow releases would be about 20% of the Mean Annual Runoff corresponding to about 30% of the yield of the dam.

Other projects (Pipelines, Water quality and mining, Aquaculture, Water kiosks)

None of these projects can be strictly compared, and each should be considered on its own merits. Scoring provides a measure of individual merit.

CLASSIFICATION OF PROJECTS EVALUATED

INITIAL SELECTION OF PROJECTS

Projects were selected on the basis of their identification in previous studies, development proposals, terms of reference prepared for further investigation, or where pre-feasibility or feasibility studies have been commissioned or undertaken.

Some proposals have been "on the books" for a very long time and keep re-appearing as possibilities. These are included here and those that are clearly unsuitable projects should be relegated to a database of "evaluated but discarded projects".

Table: Projects listed within categories

Hydropower schemes	Larger dams	Smaller dams	Irrigation schemes	Other projects
Tanzania • Kakono • Kishanda Valley Uganda-Tanzania • Kikagati • Nsongyezi (85MW, 65MW and 39MW options) Rwanda-Tanzania • Rusumo Falls RoR Uganda • Maziba Gorge 1.18MW - refurbish Rwanda • Nyabarongo • Ruramba (4MW) Burundi • Ruvyironza	Tanzania • Kakanja Uganda • Kagitumba-Mazimba Rwanda • Cyanuzi-Kagogo • Muvumba • Nyabarongo Rwanda-Burundi • Kanyaru Burundi • Upper Ruvubu • Ruvyironza	Tanzania • Karazi Uganda • Bigasha • Kabuyanda Rwanda • Taba-Gakomeye Burundi • Buyongwe • Gashayura • Kavuruga • Mbarara • Munyange-Vumbi	Tanzania • Ngono Valley Rwanda-Burundi • Bugesera Rwanda • Nyanza Hillside Burundi • Buyongwe	Basin countries • Aquaculture - fingerponds • Katuna water kiosks • Mining (water resource protection) Rwanda • Mutobo pipeline

EVALUATION OF PROJECTS

All projects were evaluated on the following basis and scoring system:

Benefitting countries (1-4)

The spread of benefit across the basin in terms of benefitting countries scores 1 (only one country benefits) to 4 (all countries in the basin potentially benefit). This has a particular impact on the scores for hydropower projects, where the benefit can more easily be distributed, and the scores for some large dams located on shared rivers or close to national borders.

Preparedness for implementation (1-5)

This is a measure of how much work has been done in preparing the project for implementation. In some instances projects have only been identified as prospects, and possibly a Terms of Reference for further study may have been developed. In others a pre-feasibility or feasibility study may have been undertaken. In one or two instances construction may already have started (although information seems to be lacking), and in others pre-feasibility work is so dated that this would have to be commenced anew. Therefore these projects have been considered as being at the identification stage only.

Benefit sharing (1-5)

This is a measure of distribution of benefits. There is a measure of double counting in that if there is more than one benefitting country the benefit sharing scores the maximum of 5, but this only goes to emphasise the importance of shared benefit as a measure.

Extent of benefit / user demand / benefit to community (1-5)

Multipurpose schemes score better than single-purpose schemes as benefits are more widely distributed across sectors. However, weight is also given here to the obvious needs of communities and the necessity of the scheme.

Economic viability and cost recovery (1-5)

This criterion has been evaluated as follows:

- The project would have to be entirely supported (construction and utilisation) by government or grant funding (1)
- There likely to be some measure of self-support paying, typically, for the operation and maintenance costs of running the project (3), and
- The project would be fully self-funded, covering both investment loans and long-term operating costs (5).

Negative environmental impacts (-1 to -5)

Negative scores offset positive benefits. Environmental impacts include the impact on the environmental flow requirements of rivers, and on the loss of biodiversity. Irrigation schemes may have a negative impact on the water quality of rivers. The scores were weighted by both degree and extent of impact.

The impact on the environmental flows of rivers had not been finally assessed at the time of screening. This environmental assessment process is currently being undertaken and the scores may be modified. It is assumed, however, that a minimum of 20% of MAR would always be released to the river. Impact is therefore generally accorded, and restricted to, a value of (-2) for dams with a capacity in the same order as the MAR. Other environmental impacts include the impacts of inundation.

Negative socio-economic impacts (consequences) (-1 to -5)

These are negative scores where strong disbenefits are encountered. These scores may partially, or even entirely, offset positive benefit scores. Typically negative impacts might be the loss of land to inundation, and the inundation of homes and homesteads with people requiring relocation.

Positive socio-economic and environmental impacts are included under benefits.

Risk of fatal flaws (-1 to -5)

This is an important measure providing both a recording of possible fatal flaws (risk to the project) and a negative weight. Fatal flaws such as sedimentation of a reservoir could reduce the life of a project unless the problem can be mitigated.

Institutional capacity (O&M) (<u>not scored</u>)

This factor was not scored. It is widely recognised that institutional capacity is an issue, and that the management of remote and difficult projects is a challenge facing all countries and all projects, although more so for more remote and management intensive projects. This is an issue considered to weight all projects equally and one that must receive attention at national and basin level.

STARTER ASSUMPTIONS FOR COST ESTIMATES

The following assumptions were made for estimating the costs of schemes as there is no information in currently available reports:

- Environmental flows are assumed to be a minimum of 20% of MAR. This means that at least 20% of all flow from a catchment must be released to the river downstream of the dam, significantly affecting the utilisable yield but essential to downstream users and the health of the riverine system.
- The primary uses of water from the smaller and larger dams would be for irrigation and domestic use.
- Irrigation water would be distributed via a pipeline which would make use of the head available in the dam, although it may be possible to distribute the water via canals or via the river with diversion weirs and canals.
- Flood irrigation is assumed to be the most common form of irrigation. Few dams would provide sufficient head for sprinkler systems without additional power.
- Water for domestic use would be distributed to users in the vicinity of the irrigation scheme. Indicative estimates of water demands and of the bulk infrastructure have been made including the provision of hydropower to pump the domestic water. However it would be preferable for the local water authority to be fully responsible for the treatment and distribution of water from the dam.
- There will be a trade-off between water for irrigation schemes (marshland and plains irrigation) and water for household use.
- The availability of water for hydropower for pumping may also be a consideration if the domestic water supply area is enlarged and in this case either pumping with electricity from the grid or diesel would be required.
- Hydropower would be provided to pump domestic water and additional hydropower would only be developed on non-seasonal rivers or where more than about 200 kW of firm power would be available and could be delivered to the grid.
- The sizing of plant for viable hydro-power schemes would be optimised for about 70% of the MAR. This should ensure that for about 30% of the time the plant would operate below capacity on account of the availability of water, and for 70% of the time it would operate at higher capacity.
- The cost of infrastructure is a large variable. In general it is assumed that where hydropower is generated this would be sufficient to cover the infrastructure cost, unless the scheme is perceived to be particularly complex and inefficient.

SCREENING OF PROJECTS

The screening of the various projects is described below together with reasons for the scoring.

PROJECTS WHERE THE KEY RATIONALE IS HYDROPOWER

1. KAKONO DAM & HYDROPOWER PROJECT (Kagera River) – TANZANIA & UGANDA

Large Dam: Height: 35 m; Active storage capacity 27 million m^3; MAR: approx. 7400 million m^3/a

Purpose: Hydropower 53 MW; Irrigation 50 000ha.

A large run-of-river dam with the structure needed to provide head, not storage. This dam then serves as what is effectively a large weir for hydropower generation and diversion for irrigation.

Screening consideration	Score	Explanation
Benefitting countries	3	Located in Tanzania but power supply should also Uganda and possibly Rwanda. Burundi would probably not be supplied but would benefit indirectly in that this would free up the requirement to share power generated from planned schemes in that country.
Preparedness for Implementation	2	At best this is at pre-feasibility stage. A feasibility study was undertaken in 1976 and all later proposals have been based on this work. The feasibility study is so out-of date it can be downgraded to pre-feasibility level of knowledge.
Benefit sharing	4	Hydropower sufficient for international grid but irrigation can be expected to be for Tanzania only (and possibly for Uganda). Hydropower output limited to 53 MW.
Extent of benefit	3	User demand for power is high. The apparent call for irrigation in this area is low and a scheme would need to be developed. Possible local users have not been consulted.
Economic viability and cost recovery	3	Sale of power should cover all development and maintenance costs. Irrigation cannot be expected to pay back development costs.
Negative socio-economic impacts	-2	Inundation of homesteads - resettlement
Negative environmental impacts	-2	No major impacts, but little information available
Fatal flaws/ risk	0	
TOTAL	+11	The weakness of this project is that it has not been properly studied. Those studies that were undertaken were done 35 years ago, and there is considerable uncertainty.

2. KIKAGATI RUN OF RIVER HYDROPOWER PROJECT (Kagera River)

Diversion height 11.5m, MAR approx. 7000 million m^3

Purpose: Hydropower (16 MW)

A medium sized run-of-river diversion with the structure needed to provide head.

Screening consideration	Score	Explanation
Benefitting countries	2	Uganda and Tanzania
Preparedness for Implementation	5	Currently out on tender
Benefit sharing	4	Widespread benefit.
Extent of benefit	4	
Economic viability and cost recovery	3	
Negative socio-economic impacts	-1	Limited as on site of abandoned existing structure
Negative environmental impacts	-1	Limited as on site of abandoned existing structure
Fatal Flaws/ Risk	0	Common risk of economic viability (will the user pay?)
TOTAL	+16	

3. KISHANDA VALLEY HYDROPOWER – Kagera River Water (TANZANIA)

Weir Height: 10 m; plus Large Dam: Height 35 m; Active Storage capacity 0.5 million m^3;

MAR: approx. 7400 million m^3/a.

Purpose: Hydropower: 67 MW; Average Power: 1087 GWh/a; Irrigation (not identified).

A very complex scheme involving the diversion of water out of the Kagera River to which it is later returned.

Screening consideration	**Score**	**Explanation**
Benefitting countries	2	Power would be generated for Tanzania and Rwanda.
Preparedness for Implementation	1	Identified as a potential opportunity but has not reached pre-feasibility stage.
Benefit sharing	4	Hydropower sufficient for international distribution with Tanzania and Rwanda being the principal beneficiaries.
Extent of benefit	3	User demand for power is high across the basin. Irrigation usage and extent are very uncertain.
Economic viability and cost recovery	2	A complex and very expensive scheme with additional infrastructure undefined. Even hydropower may struggle to pay back a project of this magnitude and complexity.
Negative socio-economic impacts	-2	Unknown (-2 is a default value, but disbenefit is quite possibly higher for a project of this nature).
Negative environmental impacts	-5	Project changes the flow of the Kagera River for a part of its course, diverting water for a significant distance and returning this to the river downstream.
Fatal flaws/ risk	-3	Risk is rated significant due to complexity and uncertainty.
TOTAL	+2	A complex and very expensive scheme with large environmental impacts and uncertain benefits.

4. RUSUMO FALLS 46 MW RUN-OF-RIVER HYDROPOWER – Kagera River

Small Dam: Height 14.3 m (un-gated spillway); Storage capacity: 118 million m^3; MAR: 7400 million m^3/a

Purpose: Hydropower: 61.5 MW; Firm Energy 254 GWh/a; Secondary Energy 146 GWh/a

Screening consideration	**Score**	**Explanation**
Benefitting countries	4	Uganda, Rwanda, Tanzania, Burundi
Preparedness for Implementation	5	Scheme planning well advanced, including feasibility and public awareness, with his lower dam wall option favoured. Preliminary designs have been prepared for this option. There is public awareness.
Benefit sharing	5	Hydropower sufficient for international grid.
Extent of benefit	5	Urgent need for power earns this a high benefit score.
Economic viability and cost recovery	5	Sale of power should cover all development and maintenance costs. The power line (connecting the site to the grid) was costed by a separate study and it is understood that this is to be put in place.
Negative socio-economic impacts	0	The lower wall eliminates most of the inundation and would not flood people or homesteads.
Negative environmental impacts	-1	Inundated area relatively small.
Fatal flaws/ risk	0	
TOTAL	+23	Project scores very high due to large benefit and shared benefit, preparedness, expected cost recovery, and with almost no negative socio-economic and environmental impacts.

5. NSONGYEZI 85MW HYDROPOWER PROJECT – Kagera River

Large Dam: Height 51 m; Storage capacity 47 million m^3; Crest length 490m; MAR: 6275 million m^3/a

Purpose: Hydropower: 85 MW; Average Energy 350 GWh/a

Screening consideration	Score	Explanation
Benefitting countries	2	Located on Kagera River on the border between Tanzania and Uganda. These two countries would be the primary beneficiaries, although other countries would benefit if the grid were managed as a regional power grid.
Preparedness for implementation	2	Identified as a potential opportunity. Has not reached pre-feasibility stage.
Benefit sharing	4	Hydropower sufficient for international distribution, with Tanzania and Uganda being the principal beneficiaries.
Extent of benefit	4	User demand for power is high across the basin.
Economic viability and cost recovery	3	Sale of power should cover all development and maintenance costs. However the viability has been down-rated due to lack of information on the scheme, and consequent uncertainty.
Negative socio-economic impacts	-3	Uncertain. The larger dam option (Nsongyezi 85MW) is given a higher negative score than Nsongyezi 65MW as although uncertain the extent of the area inundated would be greater.
Negative environmental impacts	-3	Uncertain. The larger dam option (Nsongyezi 85MW) is given a higher negative score than Nsongyezi 65MW as although uncertain the extent of the area inundated would be greater.
Fatal flaws/ risk	-1	There is a risk of sedimentation as this is a relatively small dam compared with the Mean Annual Runoff of the river but with careful design and operation sediment could probably be managed by flushing.
TOTAL	+8	Project needs more detailed feasibility study. There may be an optimum size different from one of those evaluated. This larger project design does not score as well as the smaller option due to increased environmental impacts whilst the benefits (more power) are also larger but have not been scored higher.

6. NSONGYEZI 65 MW HYDROPOWER PROJECT– Kagera River

Large Dam: Height: 41m; Active Storage capacity: 18 million m³; Crest length 430m; MAR: 6275 million m^3/a; Height unknown

Purpose: Hydropower 65 MW (for the smaller of two scheme options); Average Energy 280 GWh/a

Screening consideration	**Score**	**Explanation**
Benefitting countries	2	Located o n K agera R iver on t he b order between Tanzania and U ganda. T hese t wo c ountries w ould b e t he pr imary beneficiaries, although other countries would benefit if the grid were managed as a regional power grid.
Preparedness for implementation	2	Identified as a pot ential o pportunity. H as not reached pre-feasibility stage.
Benefit sharing	4	Hydropower s ufficient f or i nternational d istribution with Tanzania and Uganda being the principal beneficiaries.
Extent of benefit	3	User demand for power is high across the basin.
Economic viability and cost recovery	3	Sale of power should cover all development and maintenance costs. However the viability has been down-rated due to lack of information about the scheme, and consequent uncertainty.
Negative socio-economic impacts	-2	Uncertain. This smaller dam option Nsongyezi 65MW is given a l ower ne gative s core t han t he hi gher dam (Nsongyezi 85MW) as al though u ncertain a s maller ar ea would be inundated.
Negative environmental impacts	-2	Uncertain. This smaller dam option Nsongyezi 65MW is given a l ower ne gative s core t han t he hi gher dam (Nsongyezi 85MW) as al though u ncertain a s maller ar ea would be inundated.
Fatal flaws/ risk	-1	There is a risk of sedimentation. But this is a relatively small dam gi ven t he s ize of t he r iver and with c areful des ign sediment could probably be managed by flushing.
TOTAL	+9	Project ne eds m ore f easibility r esearch. T here m ay be a n optimum size different from one of those evaluated.

7. NSONGYEZI 39 MW HYDROPOWER PROJECT– Kagera River

Dam wall height: 20m; Reservoir length 12 km; Active Storage capacity: unknown. Crest length approx. 430m; MAR (Kagera): 6275 million m^3/a;

Purpose: Hydropower 39 MW; Average Energy 300 GWh/a

Screening consideration	**Score**	**Explanation**
Benefitting countries	2	Located on Kagera River on the border between Tanzania and Uganda. These two countries would be the primary beneficiaries.
Preparedness for implementation	2	Feasibility study in progress.
Benefit sharing	4	Hydropower sufficient for international distribution with Tanzania and Uganda being the principal beneficiaries.
Extent of benefit	3	User demand for power is high across the basin.
Economic viability and cost recovery	4	Sale of power should cover all development and maintenance costs. This should be a fully bankable investment. See risks.
Negative socio-economic impacts	-2	Feasibility study in progress indicates relatively limited impact but some households and crops will be inundated. A Relocation Action Plan (RAP) will be required.
Negative environmental impacts	-2	The dam tails back as far as the planned upstream Kikagati HPP and 12km of river reach will be inundated. Archaeological sites will be flooded.
Fatal flaws/ risk	-1	Risks are listed by the project protagonist (Kikagati Power Company) as being willingness of the power off takers to pay, the need to take care of archaeological sites, and resource sharing between member states (Uganda and Tanzania). These are risks rather than fatal flaws and can be avoided or mitigated.
TOTAL	**+10**	It would appear that this is the best of the Nsongyezi options – particularly if Kikagati goes ahead. Complete feasibility study.

8. NYABARONGO DAM & HYDROPOWER PROJECT – Nyabarongo River (RWANDA)

Large Dam: wall height 48m; Storage capacity 363 million m^3; Crest length 228 m; MAR estimates 1762 – 2176 million m^3/a.

Purpose: Hydropower 20MW, firm energy 136 GWh/a, pumped irrigation of 2612 ha, water supply. (More power and less irrigation listed in the Chinese feasibility study of 2012).

Screening consideration	Score	Explanation
Benefitting countries	1	Rwanda
Preparedness:	3	The f easibility s tudy n eeds updat ing an d d id n ot a ddress t he supply of water t o Kigali. G eotechnical i nvestigations would need to be undertaken to confirm whether the dam site is suitable.
Benefit sharing	4	Hydropower s ufficient f or nat ional gr id. I rrigation of 261 2 hectares would be a significant local scheme. Water supply would be supplied to Kigali City – an important user.
Extent of benefit	5	Significant potential benefit to a large number of users in several sectors. There is an urgent need for more water to Kigali; there is a nat ional a nd ur gent need f or more pow er; and t here appears to be a demand for irrigation.
Economic viability and cost recovery	3	Hydropower should be able to recover full cost of its component of the project. Costs are particularly high due to relocation of homesteads and land that would be flooded. Expected sedimentation requires that the dam be designed with almost 50% extra capacity in order to ensure normal lifespan. Irrigation is unlikely to offer any level of payment for water Kigali users should be able to pay sufficient to cover O&M costs.
Negative socio-economic impacts	-5	A l arge n umber of peopl e (6000 houses) w ould be di splaced and m ore t han 15 00 h a of ex isting i rrigated l ands w ould be inundated.
Negative environmental impacts	-3	A large area would be inundated with loss of natural habitat There would be changes in the flow regime of the Nyabarango River.
Fatal flaws/risk	-1	Sedimentation is a very l arge r isk al though t he dam des ign takes t his i nto ac count b y providing ad ditional c apacity f or normal project life.
TOTAL	+7	Project not viable (scores very poorly) due to very high negative socio-economic and environmental impacts and risk.

9. RUVYIRONZA DAM AND HYDROPOWER – Ruvyironza River (BURUNDI)

Large Dam: Height 49 m, Storage Capacity 373 million m^3; Crest length 353 m; MAR 704 million m^3/a.

Purpose: Hydropower (27 MW, 140 GWh/a), but also water supply and irrigation

This is a large and expensive dam with a large catchment area. The principal objective would be to provide hydroelectric power to Burundi.

15 000 ha of irrigation below the power race - i.e. 6km downstream.

The project should not impact and may even benefit an existing s=downstream power plant.

Screening consideration	Score	Explanation
Benefitting countries	1	Burundi
Preparedness for Implementation	2	Prefeasibility
Benefit sharing	4	National level – power for the Burundi national grid.
Extent of benefit	4	Important for Burundi (need for power sources)
Economic viability and cost recovery	4	Power generated should pay for O&M but may not cover capital costs as this would be a very expensive dam.
Negative socio-economic impacts	-2	Impacts from a dam of this size likely to be significant. (8500 people affected?)
Negative environmental impacts	-2	Impacts of dam of this size on the environmental flows downstream.
Fatal Flaws/ Risk	0	
TOTAL	+11	

10. MAZIBA GORGE SMALL HYDROPOWER REFURBISHMENT PROJECT - UGANDA

Diversion height, MAR (Flow rate) unknown

Purpose: Hydropower (1.18 MW)

A small hydropower plant – upgrade and refurbishment of abandoned existing plant.

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Uganda
Preparedness for Implementation	5	Currently out on tender
Benefit sharing	3	SHPP – local benefit / national grid
Extent of benefit	3	SHPP – local benefit / national grid
Economic viability and cost recovery	3	Should cover O&M
Negative socio-economic impacts	0	On existing site. Upgraded and refurbishment should only improve current situation
Negative environmental impacts	-1	Limited as on site of existing structure. Increase in size of turbine may have minor added impact
Fatal Flaws/ Risk	-1	Scheme has previously failed
TOTAL	+13	

11. RURAMBA SMALL HYDROPOWER PLANT – RWANDA (WITH IRRIGATION)

Dam wall 35 m, Capacity 17 million m^3. MAR 18.75 million m^3/a

Purpose: Hydropower (3.42 MW)

A small hydropower plant – but with significant impoundment. Planned irrigation area 310 ha (250 ha hillside, 60 ha marshland). Impoundment area 91 ha – but used for SHPP.

The Ruramba SHPP and irrigation projects should be merged into one proposal

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Rwanda
Preparedness for Implementation	1	SHPP - Pre-feasibility Irrigation - Project proposal. Dependent on the implementation of the Ruramba SHPP
Benefit sharing	2	SHPP – local benefit / national grid Local and regional food security.
Extent of benefit	2	SHPP – local benefit / national grid. 310 ha associated irrigation. Irrigation - Benefits not researched or reported on. Benefit assumed.
Economic viability and cost recovery	2	SHPP - Major infrastructure with relatively small output. Expected that farmers will at least be able to pay tariffs that cover O&M.
Negative socio-economic impacts	0	SHPP - Lands flooded but no resettlement No relocation required but some farmland will be inundated.
Negative environmental impacts	-2	Dam capacity equivalent to MAR. Large impoundment. Significant impact on flows in the Mwogo River. Water use and environmental impact on rivers. Conversion of marshlands for cropping.
Fatal Flaws / Risk	-1	Steep-sided and degraded catchment (sedimentation) Cumulative impacts of utilization of the Mwogo River. (Nyabarongo 1, Nyanza Irrigation, Ruramba irrigation)
TOTAL	**+5**	Pay special attention to cumulative impacts on the Mwogo and Nyabarongo Rivers.

LARGER DAMS

WATER SUPPLY, IRRIGATION, SOME HYDROPOWER

1. CYANUZI-KAGOGO DAM – Kagogo River

Large dam: Height 25m; Storage capacity 39.5 million m^3; Crest length 450 m; MAR 60-64 million m^3/a

Purpose: *Irrigation, water supply.*

This dam was initially planned as a multipurpose dam for irrigation, hydropower, and possibly some water supply. Hydropower generation is however not a significant option, given the capacity of the dam and the low MAR. At the very best power could be generated to pump water for domestic / community use but there would not be sufficient to support pumping for irrigation.

It is likely that the current small dam on the site for which this much larger dam has been planned, is already effectively using most of the available MAR in the Kagogo River. The existing dam may provide a good example of how really small dams can be very effective at harvesting runoff, and far more cost effective than much larger dams.

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Rwanda
Preparedness for Implementation	1	Identified as potential site
Benefit sharing	1	Local use only
Extent of benefit	2	Uncertain at this stage. There is already an irrigation dam of 1 million m^3 capacity on this site and this would be submerged.
Economic viability and cost recovery	1	Neither irrigation nor rural domestic users could cover the cost of this dam, or even its O&M. This particularly as the cost of the existing dam would also have to written off. An additional cost would be incurred on construction as potential borrow areas would be limited by the existing reservoir basin.
Negative socio-economic impacts	-1	These do not appear significant.
Negative environmental impacts	-2	The size of the dam relative to the MAR suggests that there would be significant impact on environmental flows.
Fatal Flaws/ Risk	-3	The existence of a dam on the site, albeit much smaller, is a serious flaw in the siting of a new dam. MINAGRI use the current dam for irrigation and would prefer to keep it
TOTAL	0	The key issue is the existence of a small but functional dam on this site.

2. KAGITUMBA-MAZIMBA DAM –River Muvumba

Large dam: Height 28m ; Storage Capacity unknown; Crest Length 2300m, MAR 162.5 million m^3/a

Purpose: I rrigation, H ydropower, w ater s upply. I f u sed onl y as a hydropower dam t his w ould a llow Muvumba to serve as an irrigation dam.

Planned as a multi-purpose project with a strong emphasis on hydropower, the dam will produce enough power to pump water to supply rural users, with some small surplus.

Power generation: Initially scoped as a hydropower scheme supplying 14.1MW, and 9.45GWh/a. With a low MAR of 16 2.5 million m^3, r ecalculation (Aurecon/WEMA) i ndicates t hat t his da m c annot possibly generate significantly more than 1 MW. It has therefore been downgraded from a hydropower project, to a project where hydropower is an additional benefit.

The dam has a very long wall and could prove very expensive

Screening consideration	**Score**	**Explanation**
Benefitting countries	2	Rwanda, Uganda
Preparedness for Implementation	3	Detailed identification study (Ntale)
Benefit sharing	2	District use within each of the two countries
Extent of benefit	2	Uncertain h ow much power c ould actually be generated b ut very m uch l ess t han initially s coped. P ower i n the 1 MW range will depend on the allocation to irrigation.
Economic viability and cost recovery	3	Neither i rrigation nor r ural dom estic us ers c ould c over t he cost of this dam, or even its O&M. The dam will be expensive given i ts height (38m) and c rest l ength (2400m). E conomic viability could increase if significant hydropower is generated.
Negative socio-economic impacts	-3	A large dam with cropland and plantations inundated. Social impact increases as area below dam no longer available for irrigation if water taken down the canal race.
Negative environmental impacts	-3	The size of the dam relative to the MAR suggests that there would significant impact on environmental flows
Fatal Flaws/ Risk	-1	Cumulative impact on the Muvumba
TOTAL	+5	

3. KAKANJA DAM– Kabuyanda River

Large Dam: Height 14m; Storage capacity 72 million m^3; Crest length 520m

Purpose: Water supply, Irrigation

This da m has a v ery l arge s urface ar ea an d i s s hallow w ith an average depth of 3 metres. H igh evaporative losses can be expected.

Screening consideration	Score	Explanation
Benefitting countries	1	Tanzania
Preparedness for Implementation	1	Identified as potential site.
Benefit sharing	2	Local use only.
Extent of benefit	2	Needs of t he l ocal c ommunity ha ve no t be en adequately assessed or reported on.
Economic viability and cost recovery	2	Low likelihood of users being able to contribute., but a relatively low cost dam
Negative socio-economic impacts	-2	The large surface area would mean greater social impact (area inundated, access).
Negative environmental impacts	-2	-2 used as standard value in absence of better information.
Fatal flaws / risk	-1	Shallow reservoir with large surface area and low runoff from a relatively dry area. Evaporative losses likely to be high.
TOTAL	+3	

4. KANYARU DAM (KANYARU MULTIPURPOSE PROJECT) – Kanyaru River

Large Dam: Height 52m; Storage Capacity 334 million m^3; MAR 739 million m^3/a.

Purpose: Hydropower (4.4 MW, 42 GWh/a), irrigation (estimates between 5000ha (Aurecon) and 12 000 ha (Ntale)), and water supply

There is sufficient flow in the Kanyaru River for hydropower generation and this dam could therefore support all three purposes as intended.

Screening consideration	Score	Explanation
Benefitting countries	2	Rwanda, Burundi
Preparedness for Implementation	3	Detailed identification (Ntale)
Benefit sharing	5	Cross-border sharing of multiple benefits
Extent of benefit	3	With proper scoping the benefits could well warrant a higher score.
Economic viability and cost recovery	3	The dam appears to offer reasonable potential for hydropower generation which would probably cover O & M costs and possibly also the capital cost ($92 million). There may be opportunity for some irrigation and for domestic water supply which would not cover O and M costs.
Negative socio-economic impacts	-2	This is a big dam, inundating a significant area. Social consequences are inevitable given the densely populated landscape (estimate 8500 people)
Negative environmental impacts	-2	A dam of this size would an impact on environmental flows
Fatal Flaws/ Risk	0	
TOTAL	+12	

5. MUVUMBA DAM – Muvumba River

(NYAGATARE WATER RESOURCES DEVELOPMENT PROJECT)

Large Dam: Height 43m; Storage capacity 109 million m^3; MAR 260 million m^3/a; Crest length 1260m

Purpose: Water for domestic / community use and for irrigation and limited hydropower (3MW). Livestock forms a particularly large component of community use.

Proponents of this scheme planned that it would be a multipurpose dam also providing hydroelectric power. Although there is some uncertainty about the MAR it may be feasible to generate hydropower which could be fed into the local electricity grid if available. More limited hydropower of about 1 MW would be provided if the scheme is also used for irrigation and domestic water use.

The site of the proposed Kagitumba-Mazimba Dam is situated upstream. If this is developed only as a hydropower scheme it will not affect the Muvumba output.

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Rwanda
Preparedness for Implementation	3	Pre-feasibility (Detailed identification – Ntale 2012)
Benefit sharing	3	This is a large dam which, with good infrastructure, could serve communities at district scale
Extent of benefit	4	Hydropower and domestic water supply would be important benefits. There is a growing population in the receiving area but distribution issues could reduce the extent. Livestock watering is also important.
Economic viability and cost recovery	1	O and M costs and some of the capital cost could probably be recovered from hydropower generation however recovery would be very limited if the dam is also used for domestic water supply and irrigation and these costs would have to be subsidised by government/donor funding.
Negative socio-economic impacts	-2	This is a large dam. Scoring errs on the conservative side due to the level of uncertainty. There would be significant loss of currently farmed land. (1400 people impacted)
Negative environmental impacts	-2	With storage similar to the MAR this dam would have a significant impact on flows in the Kagitumba River particularly if hydropower is generated.
Fatal Flaws/ Risk	0	Uncertainty reduced through detailed identification study
TOTAL	+8	Project aimed at people and livestock - with the intention of taking pressure off the land – and limited hydropower.

6. UPPER RUVUBU DAM– Upper Ruvubu River

Large Dam: Height 45 m; Storage Capacity 110 million m^3; MAR 239 million m^3/a; Crest length 406 metres.

Purpose: Water supply, irrigation and hydropower (3.6 MW, 15.9 GWh/year*).*

Screening consideration	Score	Explanation
Benefitting countries	1	Burundi
Preparedness for Implementation	3	Detailed identification (Ntale 2012)
Benefit sharing	2	District level benefit
Extent of benefit	3	There is sufficient water in the Upper Ruvubu to supply a multi-purpose dam with multiple benefits for the district
Economic viability and cost recovery	2	Power generated should pay for some of the O&M cost. Irrigation and domestic water supply will need financial support.
Negative socio-economic impacts	-2	Impacts from a dam of this size
Negative environmental impacts	-2	Impacts of dam of this size on environmental flows
Fatal Flaws/ Risk	0	
TOTAL	+7	

SMALLER DAMS

Dams are classified as "smaller" dams primarily on dam capacity, rather than sticking to the World Commission on Dams classification of dams with a wall height of <15m. Some dams with lower walls have huge capacity and other taller dams are in reality quite "small". Dams with a wall height of < 15m **or** with a capacity <30 million m^3 have been considered as "smaller" dams for comparative screening.

1. BIGASHA DAM – Bigasha River

Small dam: Height 9.5 m; Storage capacity 19 million m^3; MAR 12-17 million m^3/a

Purpose: Water supply, Irrigation

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Uganda
Preparedness for Implementation	4	Feasibility study in 3rd draft. ESIA and Resettlement Policy Framework studies complete.
Benefit sharing	2	Local level use only
Extent of benefit	2	Benefits could be greater but the needs of the local community have not been assessed or reported on
Economic viability and cost recovery	1	Low likelihood of users being able to contribute
Negative socio-economic impacts	-2	Local impacts
Negative environmental impacts	-2	Local impacts
Fatal Flaws/ Risk	0	
TOTAL	+6	Implement if technical evaluation of studies is favourable.

2. BUYONGWE DAM – on a tributary of the Kanyaru, close to Rwandan border

Small dam: Height 25 m; Storage capacity 36 million m^3; Crest length 440m. MAR variously estimated at 76, 86 and 91 million m^3. 25m dam needed to manage sediment.

Purpose: Water supply, Irrigation

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Burundi
Preparedness for Implementation	3	Detailed identification (Ntale 2012)
Benefit sharing	2	Local level use only
Extent of benefit	2	Benefits could be greater but the needs of the local community have not been assessed or reported on
Economic viability and cost recovery	1	Low likelihood of users being able to contribute. Large dam required to allow for sedimentation, increasing cost.
Negative socio-economic impacts	-2	Local impacts. -2 used as standard value in absence of better information
Negative environmental impacts	-2	Local impacts. -2 used as standard value in absence of better information
Fatal Flaws/ Risk	-3	Highly eroded catchment at 1 608 t /km^2/a, or approximately 1000 m^3/km^2/a. Dam will lose 1 million m^3 capacity every four years.
TOTAL	+2	Not recommended as a dam site. Alternative diversion weir provides sufficient water for irrigable area.

3. GASHAYURA DAM – Gashayura River

Small dam: Height 19m; Storage capacity 19.5 million m^3; Crest length 532m; MAR 61.1 million m^3/a

Purpose: Water supply, irrigation (1200 ha)

This is a "large" dam in that the wall height exceeds 15 m, but of very small capacity. The dam is on a perennial river but there would not be enough head, or enough water, to provide for more than very limited hydropower. Sufficient power could probably be generated to pump water to reservoirs for domestic use, but not enough to provide electricity to users.

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Burundi
Preparedness for Implementation	3	Detailed identification (Ntale 2012)
Benefit sharing	2	Local level
Extent of benefit	3	Dam appears to be effective in offering real value to community
Economic viability and cost recovery	1	Neither irrigation nor rural domestic users could cover the cost of this dam, or even its O&M. Medium cost dam.
Negative socio-economic impacts	0	No negative impacts
Negative environmental impacts	-1	The dam will have some impact on environmental flows
Fatal Flaws/ Risk	0	
TOTAL	+8	Good for water supply; serves large number of people;

4. KABUYANDA DAM – Kabuyanda River

Small dam: Height 30 m, Crest length 350 m, Storage capacity 10 million m^3, MAR 14 million m^3

Purpose: Water supply, Irrigation (Aurecon estimate 400 ha; Ntale estimate 1300 ha but there is not enough water for 1300 ha)

Screening consideration	Score	Explanation
Benefitting countries	1	Uganda
Preparedness for Implementation	3	Detailed identification (Ntale 2012)
Benefit sharing	2	Local level use only
Extent of benefit	2	Needs of the local community have not been adequately assessed or reported on
Economic viability and cost recovery	1	Low likelihood of users being able to contribute. Low cost dam.
Negative socio-economic impacts	-1	Little indication of negative impacts but knowledge scant
Negative environmental impacts	-3	In the Rwoho Central Forest Reserve
Fatal Flaws / Risk	-1	Large urban development downstream of dam.
TOTAL	+3	

5. KARAZI DAM – on a seasonal tributary

Small Dam: Height 14m; Storage capacity 30 million m^3; Crest length 595 m; MAR approx. 27 million m^3/a

Purpose: Water supply, Irrigation

This is a seasonal river in a low rainfall area. Hydrological knowledge is very weak. Not suited to hydropower generation

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Tanzania
Preparedness for Implementation	3	Technical feasibility study
Benefit sharing	2	Local level use only
Extent of benefit	2	Needs of the local community have not been assessed or reported on
Economic viability and cost recovery	1	Low likelihood of users being able to contribute
Negative socio-economic impacts	-2	Local impacts. -2 used as standard value in absence of better information
Negative environmental impacts	-2	Local impacts. -2 used as standard value in absence of better information
Fatal Flaws / Risk	-1	Given some risk due to absence of hydrology (lack of knowledge of available water), and the reported prospect of conflict between cattle owners and irrigating crop farmers
TOTAL	+3	

6. KAVURUGA DAM – Kavuruga River

Small dam: Height 20m (Small "large" dam); Storage capacity *15 million m^3; MAR 55.6 million m^3/a; Crest length 590 metres.*

Purpose: Irrigation and water supply. Irrigable area 450 ha or less.

This dam is situated in an arid catchment with low runoff. There is no possibility of the Kavuruga River being able to support the generation of any hydropower.

Screening consideration	Score	Explanation
Benefitting countries	1	Burundi
Preparedness for Implementation	3	Detailed identification (Ntale 2012)
Benefit sharing	2	Local level use only
Extent of benefit	2	Useful in dry area
Economic viability and cost recovery	1	Limited return on investment. This dam would have to be government / donor supported.
Negative socio-economic impacts	-2	Impacts from a dam of this size
Negative environmental impacts	-2	A dam of this size would an impact on en vironmental flows – especially as runoff will be low in this dry catchment
Fatal Flaws/ Risk	-2	Impacts on existing HPP (0.85MW) 6km d/s . This also reduces the irrigable area.
TOTAL	+3	

7. MBARARA DAM – Mbarara River

Height 17m; *Crest length* 325 m Storage capacity *9.5 million* m^3*; MAR 17 million* m^3

Purpose: Water supply, Irrigation

There is no prospect of generating any hydropower from this dam in this catchment - not even sufficient power to pump water to holding tanks for household users. Water supply will therefore be limited to users downstream of the dam only.

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Burundi
Preparedness for Implementation	3	Detailed identification by Ntale (2012) but considered very poor opportunity
Benefit sharing	1	Local level use only
Extent of benefit	2	Useful in dry area
Economic viability and cost recovery	1	Limited return on investment. This dam would have to be government / donor supported.
Negative socio-economic impacts	-2	Impacts from a dam of this size
Negative environmental impacts	-2	Even a s mall dam of such as t he M barara would i mpact on environmental flows in a dry catchment area.
Fatal Flaws/ Risk	-3	Clash with Upper Ruvubu.
TOTAL	+1	

8. MUNYANGE-VUMBI DAM

Small dam: Dam wall height 14 m; Crest length 560 m; Storage capacity 6.81 million m^3; MAR 39 million m^3.

Purpose: Water supply, Irrigation (560ha)

A small dam with a small surface area. Located on the same river as Buyongwe Dam.

Screening consideration	Score	Explanation
Benefitting countries	1	Burundi
Preparedness for Implementation	1	Identified as potential site
Benefit sharing	2	Local level use only
Extent of benefit	2	Needs of the local community have not been adequately assessed or reported on
Economic viability and cost recovery	1	Low likelihood of users being able to contribute.
Negative socio-economic impacts	-3	Small dam and low surface area reduces social impact but dam floods a valley of intense cultivation
Negative environmental impacts	-2	Score of -2 used as standard value in absence of better information
Fatal Flaws / Risk	-1	Sedimentation. Small capacity on a large river
TOTAL	+2	

9. TABA-GAKOMEYE DAM

Small Dam: Height 14 m) ; Storage capacity 8.1 million m^3; Crest length 355 metres; MAR 42.9 million m^3/a

Purpose: Flood control (alternative water supply, irrigation (Aurecon 900 ha; 4 dams study 100 ha))

Dam located in an area with high rainfall / runoff

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Rwanda
Preparedness for Implementation	3	4 dams study
Benefit sharing	2	Local level use only
Extent of benefit	2	Needs of the local community have not been assessed or reported on
Economic viability and cost recovery	1	Low likelihood of users being able to contribute
Negative socio-economic impacts	-2	Local impacts. -2 used as standard value in absence of better information
Negative environmental impacts	-2	Local impacts. -2 used as standard value in absence of better information
Fatal Flaws / Risk	-3	Highly eroded catchment with high sedimentation at 1119 tonnes/km^2/a
TOTAL	2	Purpose changed to flood control. Not recommended as a dam site for water supply. Potential for irrigation as well.

IRRIGATION SCHEMES NOT INVOLVING DAM CONSTRUCTION

1. BUGESERA IRRIGATION SCHEME–

Planned irrigation area 8000 ha

Purpose: Irrigation

Screening consideration	**Score**	**Explanation**
Benefitting countries	2	Rwanda, Burundi
Preparedness for Implementation	5	Project appraisal commenced
Benefit sharing	3	Districts - within two countries
Extent of benefit	3	Irrigated lands to significant number of people
Economic viability and cost recovery	3	Expected that farmers will at least be able to pay tariffs that cover O&M.
Negative socio-economic impacts	0	
Negative environmental impacts	-3	High environmental impact because of drainage and change of character of marshlands. Pressure on resources. Impact of agrochemicals.
Fatal Flaws / Risk	0	
TOTAL	+13	

2. BUYONGWE IRRIGATION (with diversion weir as substitute for dam) – on a tributary of the Kanyaru, close to Rwandan border

Initially proposed as a small dam.

MAR variously estimated at 76, 86 and 91 million m^3.

A 25m dam would be needed to manage sediment – Sufficient water for irrigation can be provided from run of river through a diversion weir

Purpose: Water supply, Irrigation

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Burundi
Preparedness for Implementation	3	Detailed identification (Ntale 2012)
Benefit sharing	2	Local level use only
Extent of benefit	2	Irrigation
Economic viability and cost recovery	3	Low cost compared to dam construction.
Negative socio-economic impacts	0	No negative impacts
Negative environmental impacts	-2	Run of river use means significant impact on low flows of the Buyongwe River. Fertilisers will have negative impact on water quality. Impact is far lower than for dam construction.
Fatal Flaws/ Risk	0	
TOTAL	+9	Implement feasibility study aimed specifically at an irrigation scheme

3. NGONO IRRIGATION SCHEME – Kagera Mouth

Planned irrigation area 8000 ha

Purpose: Irrigation

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Tanzania
Preparedness for Implementation	2	Stage 2 activities underway
Benefit sharing	3	District – extensive area
Extent of benefit	2	Benefits not researched or reported on. Benefit assumed.
Economic viability and cost recovery	3	Expected that farmers will at least be able to pay tariffs that cover O&M.
Negative socio-economic impacts	0	Low population. Impacts unlikely.
Negative environmental impacts	-2	Fertilizers close to Lake Victoria Water use and environmental impact on rivers
Fatal Flaws / Risk	0	
TOTAL	+9	

4. NYANZA IRRIGATION SCHEME - Mwogo River (RWANDA)

Planned irrigation area 390 ha (water requirement ~ 2 million m^3/a)

Purpose: Irrigation (MINAGRI)

Screening consideration	Score	Explanation
Benefitting countries	1	Rwanda
Preparedness for Implementation	2	Feasibility study completed. (Detailed information on distribution plans – but no information available on the impoundment). Preparedness downgraded until this information becomes available.
Benefit sharing	2	Local communities. Nyanza and Kigali as markets.
Extent of benefit	2	Irrigation benefit assumed.
Economic viability and cost recovery	3	Expected that farmers will at least be able to pay tariffs that cover O&M particularly given reasonable proximity of markets.
Negative socio-economic impacts	0	Unknown but process of planning seems to have been consultative.
Negative environmental impacts	-2	Project appears to rely on dam construction and impoundment. Fertilizer leachate. Water abstraction. (Water use and environmental impact on river).
Fatal Flaws / Risk	-1	The Mwogo River is also site the Nyabarongo 1 Dam currently under construction. It is assumed that this has been taken into account. This could be a fatal flaw if not considered.
TOTAL	**+7**	Large uncertainties. Feasibility study must include inputs on the dam to be constructed, and more information required on social and environmental costs and benefits.

ADDITIONAL WATER RESOURCE PROJECTS

1. AQUACULTURE – IMPLEMENTATION OF FINGERPONDS

Source: Marshlands and wetlands - All countries

Purpose: Aquaculture (food production)

Screening consideration	**Score**	**Explanation**
Benefitting countries	4	All
Preparedness for Implementation	2	Well researched. Requires an implementation programme with technical support and funding. Would be relatively quick to implement.
Benefit sharing	2	Widespread on suitable sites across the basin, but benefits will be limited to marshlands where adopted
Extent of benefit	2	Food production for dry season protein. Benefits appear to be commensurate with effort required of farmers. Uncertainty is raised by lack of adoption of technology amongst communities although this may be due to lack of training.
Economic viability and cost recovery	3	Farmers should cover all own costs. Implementation costs will have to be carried by government intervention. A good project for donor funding.
Negative socio-economic impacts	0	Failure will be a minor cost to communities
Negative environmental impacts	-1	Impact reported relatively minor – but this could be underplayed by researchers
Fatal Flaws / Risk	-1	The concept has been well researched but will only be successful under the right conditions. It is a concern that despite all the reporting and apparent common sense of this technology it has not seen widespread adoption. There is therefore a risk that the project may not take off, but the costs of attempting this programme would be low and there would be no negative long-term after-effects.
TOTAL	+11	The implementation of this project would be low cost and results would be widespread, and should prove sustainable.

2. KATUNA WATER SUPPLY KIOSKS (EXPANSION OF EXISTING PROJECT)

Purpose: Drinking water to people without existing piped supplies, in densely populated areas

Technology intervention: Introduction of piped water and vending kiosks

Screening consideration	**Score**	**Explanation**
Benefitting countries	4	All countries would benefit from widespread implementation
Preparedness for Implementation	4	Successful implementation in Katuna and elsewhere in East Africa only requires widespread adoption. Experience and learning are still required to iron out uncertainties to do with different cultures and expectations across the different countries
Benefit sharing	3	Widespread
Extent of benefit	2	Urban users
Economic viability and cost recovery	3	Users pay for water and this side is profitable. Will need setting up.
Negative socio-economic impacts	0	
Negative environmental impacts	-1	Reduced flow in streams
Fatal Flaws / Risk	0	
TOTAL	+15	

3. PROTECTING WATER RESOURCES WHILST ENHANCING LOCAL COOPERATIVE SMALL-SCALE MINING

Purpose: Water quality management

Technology intervention: Introduction of simple but specialised equipment to improve efficiencies and reduce wastewater production in small-scale mining.

Screening consideration	**Score**	**Explanation**
Benefitting countries	3	All (although of less impact in Tanzania where there is less mining in the basin)
Preparedness for Implementation	1	Project requires an implementation programme and this is still at conceptual stage. Equipment is commercially available and in use in other countries in Africa. Implementation would be rapid. Trial implementation on several sites in several countries is recommended.
Benefit sharing	3	There are hundreds of artisanal mines in all countries. Benefits would be widespread.
Extent of benefit	4	Water quality enhancement will benefit all users in the basin and Lake Victoria
Economic viability and cost recovery	5	Higher recovery of ore would lead to far greater returns for miners. Loans could be repaid out of increased profits.
Negative socio-economic impacts	0	Water quality benefits. Higher levels of ore extraction would make individual deposits more profitable and these could be worked for longer
Negative environmental impacts	0	Positive benefits to the environment only.
Fatal Flaws / Risk	0	One possible consequence is that increased efficiency and profitability leads to an increased in mining and number of mined sites.
TOTAL	+16	

4. MUTOBO WATER SUPPLY PROJECT - 100km PIPELINE

Purpose: Water supply (Transfer of up to 100 000 m^3/day to Kigali)

This is a proposal for a 100 km pipeline from the Mutobo area in Musanze district to Kigali, with the key arguments being that the water is cleaner and will need less purification. Yet there may a number of very good sources of water closer to Kigali.

Screening consideration	**Score**	**Explanation**
Benefitting countries	1	Rwanda
Preparedness for Implementation	3	Feasibility level. The IFC has turned this study down as not being feasible
Benefit sharing	3	Kigali City (rated equivalent to district level sharing)
Extent of benefit	3	City supply is very necessary and will reach a large number of citizens
Economic viability and cost recovery	1	Urban sales of water cannot cover the cost of a 100km supply line through difficult terrain with some pumping necessary (the pipeline may be largely, but is not entirely, gravity fed.
Negative socio-economic impacts	0	
Negative environmental impacts	-1	100 m pipeline will have to be laid.
Fatal Flaws/ Risk	-5	Fatally flawed as there are far better and more economical options available. The International Finance Corporation (IFC) has turned this project down as not being feasible on the grounds of cost.
TOTAL	+5	Note that despite the score of 5 this project is viewed as fatally flawed, This score comes from the effort already put into the planning of the project (a feasibility study although this led the IFC to turn the project down), and the real benefits that enhanced water supply to Kigali would provide. Recommendation: Scope alternative sources of water for Kigali

Screening Table

		Kakono Dam Hydropower Project	The Kishanda Valley Hydropower Project	Rusumo Falls dam site 1323.5masl	Rusumo Falls dam site RoR	Nsongyezi Hydropower 85MW	Nsonghezi Hydropower 65MW	Nsonghezi Hydropower 39MW	Nyaborongo Hydropower Project	Ruvyironza dam site	Kikagati Hydropower Project	Maziba Small Hydropower Project	Ruramba Small Hydropower Project	Cyanuzi- Kagogo dam Site	Kagitumba-Mazimba dam site	Kakanja dam site	Kanyaru Multipurpose Project	Muvumba dam	Upper Ruvubu dam site	Bigasha dam site	Buyongwe dam site	Gashayura dam site	Kabuyanda dam site	Karazi dam site	Kavuruga dam site	Mbarara dam site	Munyange-Vumbe dam site	Taba-Gakomeye dam site	Bugesera irrigation scheme	Ngono Valley Irrigation Scheme	Nyanza Hillside Irrigation Scheme	Ruramba Irrigation Scheme	Aquaculture - Fingerponds project	Katuna Water Supply Project	Small Scale Mining	Mutobo Water Supply Project
Location	Tanzania	✓	✓	✓	✓	✓	✓	✓	○	○	○	○	○	○	○	✓	○	○	○	○	○	○	○	✓	○	○	○	○	○	✓	○	○	✓	✓	✓	○
	Rwanda	○	○	○	○	○	○	○	✓	○	✓	○	✓	✓	✓	○	✓	✓	○	○	○	○	○	○	○	○	○	✓	✓	○	✓	✓	✓	✓	✓	✓
	Burundi	○	○	○	○	○	○	○	○	✓	○	○	○	○	○	○	✓	○	✓	○	✓	✓	○	○	✓	✓	✓	○	✓	○	○	○	✓	✓	✓	○
	Uganda	○	○	○	○	✓	✓	✓	○	○	○	✓	○	○	✓	○	○	○	○	✓	○	○	✓	○	○	○	○	○	○	○	○	○	✓	✓	✓	○
Sectors	Water Supply (Urban, rural and industrial)	○	○	○	○	○	○	○	✓	✓	○	○	○	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	○	○	○	○	○	✓	○	✓
	Hydropower	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	○	✓	○	✓	○	✓	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
	Irrigation	✓	○	○	○	○	○	○	✓	✓	○	○	○	✓	✓	✓	✓	○	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	○	○	○	○
	Aquaculture	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	✓	○	○	○
	Mining	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	✓	○
Evaluation Criteria[1]	**Benefiting Countries**	3	2	4	4	2	2	2	1	1	2	1	1	1	2	1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	4	4	3	1
	Preparedness for Implementation (Level of feasibility)	2	1	5	5	2	2	2	3	2	5	5	1	1	3	1	3	3	3	1	3	3	3	3	3	3	1	3	5	2	2	1	2	4	1	3
	Benefit sharing	4	4	5	5	4	4	4	4	4	4	3	2	1	2	2	5	3	2	2	2	2	2	2	2	1	2	2	3	3	2	2	2	3	3	3
	Extent of Identified Benefit / User Demand	3	3	5	5	4	3	3	5	4	4	3	3	2	2	2	3	4	3	2	2	3	2	2	2	2	2	2	3	2	2	2	2	2	4	3
	Economic Viability and Cost Recovery	3	2	5	5	3	3	4	3	4	3	3	2	1	3	2	3	1	2	1	1	1	1	1	1	1	1	1	3	3	3	2	3	3	5	1
	Negative Social Impacts (Access and Inundation)	-2	-2	-4	0	-3	-2	-2	-5	-2	-1	0	-1	-1	-3	-2	-2	-2	-2	-2	-2	0	-1	-2	-2	-2	-3	-2	0	0	0	0	0	0	0	0
	Negative Environmental Impacts	-2	-5	-3	-1	-3	-2	-2	-3	-2	-1	-1	-3	-2	-3	-2	-2	-2	-2	-2	-2	-1	-3	-2	-2	-2	-2	-2	-3	-2	-2	-2	-1	-1	0	-1
	Risk or Fatal Flaws	0	-3	0	0	-1	-1	-1	-1	0	0	-1	-1	-3	-1	-1	0	0	0	0	-3	0	-1	-1	-2	-3	-1	-3	0	0	-1	-1	-1	0	0	-5
	TOTAL	**11**	**2**	**17**	**23**	**8**	**9**	**10**	**7**	**11**	**16**	**13**	**4**	**0**	**5**	**3**	**12**	**8**	**7**	**3**	**2**	**8**	**3**	**3**	**3**	**1**	**2**	**2**	**13**	**9**	**7**	**5**	**11**	**15**	**16**	**5**

See explanation of Evaluation Criteria under heading: **EVALUATION OF PROJECTS**

Annexure F:
Tables Supporting Water Demand Evaluations and Scenario Development

Table F.1: Current and projected baseline irrigation water requirements per sub-catchment

BASELINE					
	Irrigation Water Requirement (Mm^3/a)				
Sub-catchment/season	**2012**	**2017**	**2022**	**2027**	**2032**
Kagera Lakes and Wetlands	157.1	177.5	200.7	227.1	257.0
Kagera Mouth	71.8	81.2	91.8	103.8	117.5
Kagitumba	2.4	2.7	3.1	3.5	3.9
Lower Ruvubu	83.9	94.8	107.2	121.3	137.3
Mwisa	11.6	13.1	14.8	16.7	18.9
Nyabarongo Lakes and Wetlands	158.6	179.3	202.7	229.3	259.5
Nyabarongo Upper	151.0	170.7	193.0	218.3	247.1
Upper Ruvubu	81.6	92.2	104.3	117.9	133.5
Grand Total	**718.0**	**811.5**	**917.6**	**1038.0**	**1174.8**

Table F.2: Current and projected baseline livestock water requirements per sub-catchment

BASELINE					
	Irrigation Water Requirement (Mm^3/a)				
Sub-catchment/season	**2012**	**2017**	**2022**	**2027**	**2032**
Kagera Lakes and Wetlands	2.2	2.4	2.7	3.0	3.4
Kagera Mouth	1.8	2.0	2.3	2.5	2.8
Kagitumba	2.1	2.3	2.6	2.9	3.2
Lower Ruvubu	0.3	0.3	0.4	0.4	0.5
Mwisa	1.5	1.7	1.9	2.1	2.3
Nyabarongo Lakes and Wetlands	1.7	1.9	2.1	2.4	2.6
Nyabarongo Upper	2.2	2.5	2.8	3.1	3.5
Upper Ruvubu	0.3	0.3	0.3	0.4	0.4
Grand Total	**12.1**	**13.5**	**15.1**	**16.8**	**18.7**

Table F.3: Current and projected baseline domestic water requirements per sub-catchment

BASELINE					
Sub-basin	Projected Domestic Water Demand (Mm^3)				
	2012	**2017**	**2022**	**2027**	**2032**
Kagitumba					
Urban	4.16	5.81	7.96	10.75	14.33
Rural	6.58	9.48	13.12	17.65	23.26
Kagera Lakes and Wetlands					
Urban	0.64	1.27	2.21	3.54	5.40
Rural	10.28	14.76	20.34	27.25	35.77
Mwisa					
Urban	1.42	2.13	3.09	4.38	6.08
Rural	6.17	8.82	12.10	16.15	21.11
Kagera Mouth					
Urban	0.00	0.17	0.43	0.84	1.42

BASELINE					
Sub-basin	Projected Domestic Water Demand (Mm^3)				
	2012	2017	2022	2027	2032
Rural	4.05	5.83	8.05	10.81	14.21
Nyabarongo Upper					
Urban	9.30	13.00	17.81	24.01	31.94
Rural	19.17	27.28	37.28	49.53	64.46
Nyabarongo Lakes and Wetlands					
Urban	28.72	38.71	51.31	67.13	86.87
Rural	24.83	35.32	48.25	64.07	83.33
Upper Ruvubu					
Urban	3.60	5.66	8.52	12.39	17.55
Rural	22.96	32.65	44.58	59.17	76.93
Lower Ruvubu					
Urban	2.91	4.29	6.14	8.60	11.82
Rural	11.35	16.17	22.10	29.38	38.26
Total	**156.13**	**221.34**	**303.29**	**405.64**	**532.77**

Table F.4: Current and projected baseline industrial and non-domestic water requirements per sub-catchment

BASELINE					
Sub-basin	Projected Industrial and Non-Domestic Water Demand (Mm^3/a)				
	2012	2017	2022	2027	2032
Kagitumba					
Urban	1.04	1.45	1.99	2.69	3.58
Rural	0.99	1.42	1.97	2.65	3.49
Kagera Lakes and Wetlands					
Urban	0.16	0.32	0.55	0.89	1.35
Rural	1.54	2.21	3.05	4.09	5.37
Mwisa					
Urban	0.35	0.53	0.77	1.09	1.52
Rural	0.93	1.32	1.82	2.42	3.17
Kagera Mouth					
Urban	0.00	0.04	0.11	0.21	0.36
Rural	0.61	0.87	1.21	1.62	2.13
Nyabarongo Upper					
Urban	2.32	3.25	4.45	6.00	7.99
Rural	2.87	4.09	5.59	7.43	9.67
Nyabarongo Lakes and Wetlands					
Urban	7.18	9.68	12.83	16.78	21.72
Rural	3.72	5.30	7.24	9.61	12.50
Upper Ruvubu					
Urban	0.90	1.42	2.13	3.10	4.39

BASELINE					
Sub-basin	Projected Industrial and Non-Domestic Water Demand (Mm^3/a)				
	2012	2017	2022	2027	2032
Rural	3.44	4.90	6.69	8.88	11.54
Lower Ruvubu					
Urban	0.73	1.07	1.53	2.15	2.96
Rural	1.70	2.43	3.32	4.41	5.74
Total	**28.49**	**40.30**	**55.24**	**74.01**	**97.46**

Table F.5: Current and projected Gradual Improvement Scenario irrigation water requirements per sub-catchment

GRADUAL IMPROVEMENT					
	Irrigation Water Requirement (Mm^3/a)				
Sub-catchment/season	2012	2017	2022	2027	2032
Kagera Lakes and Wetlands	160.2	185.7	215.3	249.8	290.0
Kagera Mouth	73.3	84.9	98.4	114.2	132.6
Kagitumba	2.4	2.8	3.3	3.8	4.4
Lower Ruvubu	85.6	99.2	115.0	133.4	154.9
Mwisa	11.8	13.7	15.9	18.4	21.4
Nyabarongo Lakes and Wetlands	161.8	187.5	217.4	252.2	292.8
Nyabarongo Upper	154.1	178.5	207.0	240.2	278.8
Upper Ruvubu	83.2	96.4	111.8	129.7	150.6
Grand Total	**732.4**	**848.6**	**984.0**	**1141.7**	**1325.5**

Table F.6: Current and projected Gradual Improvement Scenario livestock water requirements per sub-catchment

GRADUAL IMPROVEMENT					
	Livestock Water Requirement (Mm^3/a)				
Sub-catchment/season	2012	2017	2022	2027	2032
Kagera Lakes and Wetlands	2.2	2.5	2.9	3.3	3.8
Kagera Mouth	1.8	2.1	2.4	2.8	3.2
Kagitumba	2.1	2.4	2.8	3.2	3.7
Lower Ruvubu	0.3	0.3	0.4	0.5	0.5
Mwisa	1.5	1.7	2.0	2.3	2.6
Nyabarongo Lakes and Wetlands	1.7	2.0	2.3	2.6	3.0
Nyabarongo Upper	2.2	2.6	3.0	3.4	3.9
Upper Ruvubu	0.3	0.3	0.4	0.4	0.5
Grand Total	**12.1**	**14.0**	**16.1**	**18.5**	**21.3**

Table F.7: Current and projected Gradual Improvement Scenario domestic water requirements per sub-catchment

GRADUAL IMPROVEMENT					
Sub-basin	**Projected Domestic Water Demand (Mm^3)**				
	2012	**2017**	**2022**	**2027**	**2032**
Kagitumba					
Urban	4.2	6.3	9.1	13.0	18.1
Rural	6.6	10.3	15.0	20.9	28.0
Kagera Lakes and Wetlands					
Urban	0.6	1.7	3.5	6.0	9.6
Rural	10.3	16.1	23.3	32.2	43.1
Mwisa					
Urban	1.4	2.4	3.9	6.0	8.8
Rural	6.2	9.6	13.9	19.1	25.4
Kagera Mouth					
Urban	0.0	0.3	0.9	1.8	3.0
Rural	4.0	6.4	9.2	12.8	17.1
Nyabarongo Upper					
Urban	9.3	14.2	20.9	29.8	41.6
Rural	19.2	29.7	42.7	58.5	77.7
Nyabarongo Lakes and Wetlands					
Urban	28.7	40.9	56.9	77.3	103.5
Rural	24.8	38.5	55.3	75.7	100.4
Upper Ruvubu					
Urban	3.6	6.8	11.5	18.1	27.2
Rural	23.0	35.6	51.1	69.9	92.7
Lower Ruvubu					
Urban	2.9	4.9	7.7	11.6	16.9
Rural	11.4	17.6	25.3	34.7	46.1
Total	**156**	**241**	**350**	**487**	**659**

Table F.8: Current and projected Gradual Improvement Scenario h non-domestic and industrial water requirements per sub-catchment

GRADUAL IMPROVEMENT					
Sub-basin	**Projected Industrial and Non-Domestic Water Demand (Mm^3/a)**				
	2012	**2017**	**2022**	**2027**	**2032**
Kagitumba					
Urban	1.0	1.6	2.3	3.2	4.5
Rural	1.0	1.5	2.3	3.1	4.2
Kagera Lakes and Wetlands					
Urban	0.2	0.4	0.9	1.5	2.4
Rural	1.5	2.4	3.5	4.8	6.5
Mwisa					

GRADUAL IMPROVEMENT					
Sub-basin	**Projected Industrial and Non-Domestic Water Demand (Mm^3/a)**				
	2012	**2017**	**2022**	**2027**	**2032**
Urban	0.4	0.6	1.0	1.5	2.2
Rural	0.9	1.4	2.1	2.9	3.8
Kagera Mouth					
Urban	0.0	0.1	0.2	0.4	0.8
Rural	0.6	1.0	1.4	1.9	2.6
Nyabarongo Upper					
Urban	2.3	3.5	5.2	7.5	10.4
Rural	2.9	4.5	6.4	8.8	11.7
Nyabarongo Lakes and Wetlands					
Urban	7.2	10.2	14.2	19.3	25.9
Rural	3.7	5.8	8.3	11.4	15.1
Upper Ruvubu					
Urban	0.9	1.7	2.9	4.5	6.8
Rural	3.4	5.3	7.7	10.5	13.9
Lower Ruvubu					
Urban	0.7	1.2	1.9	2.9	4.2
Rural	1.7	2.6	3.8	5.2	6.9
Total	**28.5**	**44.0**	**64.0**	**89.5**	**121.8**

Table F.9: Current and project Diversified Economy Scenario irrigation water requirements

DIVERSIFIED ECONOMY					
	Irrigation Water Requirement (Mm^3/a)				
Sub-catchment/season	**2012**	**2017**	**2022**	**2027**	**2032**
Kagera Lakes and Wetlands	166.5	202.5	246.4	300.1	365.6
Kagera Mouth	76.1	92.6	112.7	137.2	167.2
Kagitumba	2.5	3.1	3.8	4.6	5.6
Lower Ruvubu	89.0	108.2	131.7	160.3	195.3
Mwisa	12.3	14.9	18.2	22.1	26.9
Nyabarongo Lakes and Wetlands	168.1	204.5	248.8	303.0	369.2
Nyabarongo Upper	160.1	194.7	237.0	288.5	351.6
Upper Ruvubu	86.5	105.2	128.0	155.9	189.9
Grand Total	**761.2**	**925.7**	**1126.5**	**1371.7**	**1671.3**

Table F.10: Current and projected Diversified Economy Scenario livestock water requirements

DIVERSIFIED ECONOMY					
	Livestock Water Requirement (Mm^3/a)				
Sub-catchment/season	**2012**	**2017**	**2022**	**2027**	**2032**
Kagera Lakes and Wetlands	2.2	2.7	3.2	3.9	4.8
Kagera Mouth	1.8	2.2	2.7	3.3	4.0
Kagitumba	2.1	2.6	3.1	3.8	4.6
Lower Ruvubu	0.3	0.4	0.4	0.5	0.7
Mwisa	1.5	1.8	2.2	2.7	3.3
Nyabarongo Lakes and Wetlands	1.7	2.1	2.5	3.1	3.7
Nyabarongo Upper	2.2	2.7	3.3	4.0	4.9
Upper Ruvubu	0.3	0.3	0.4	0.5	0.6
Grand Total	**12.1**	**14.8**	**18.0**	**21.8**	**26.6**

Table F.11: Current and projected Diversified Economy Scenario domestic water requirements

DIVERSIFIED ECONOMY					
Sub-basin	Projected Domestic Water Demand (Mm^3)				
	2012	**2017**	**2022**	**2027**	**2032**
Kagitumba					
Urban	4.2	6.5	9.7	14.0	19.5
Rural	6.6	13.3	21.9	32.8	46.5
Kagera Lakes and Wetlands					
Urban	0.6	1.4	2.7	4.6	7.4
Rural	10.3	20.7	33.9	50.6	71.5
Mwisa					
Urban	1.4	2.4	3.8	5.7	8.3
Rural	6.2	12.3	20.2	30.0	42.2
Kagera Mouth					
Urban	0.0	0.2	0.5	1.1	1.9
Rural	4.0	8.2	13.4	20.1	28.4
Nyabarongo Upper					
Urban	9.3	14.6	21.8	31.2	43.6
Rural	19.2	38.2	62.1	92.0	128.9
Nyabarongo Lakes and Wetlands					
Urban	28.7	43.5	62.7	87.3	118.5
Rural	24.8	49.5	80.4	119.0	166.7
Upper Ruvubu					
Urban	3.6	6.4	10.4	16.1	23.9
Rural	23.0	45.7	74.3	109.9	153.9
Lower Ruvubu					
Urban	2.9	4.8	7.5	11.2	16.1
Rural	11.4	22.6	36.8	54.6	76.5
Total	**156**	**290**	**462**	**680**	**954**

Table F.12: Current and projected Diversified Economy Scenario domestic and industrial water requirements

DIVERSIFIED ECONOMY					
Sub-basin	Projected Industrial and Non-Domestic Water Demand (Mm^3/a)				
	2012	2017	2022	2027	2032
Kagitumba					
Urban	1.04	1.63	2.43	3.49	4.89
Rural	0.99	1.99	3.28	4.92	6.98
Kagera Lakes and Wetlands					
Urban	0.16	0.36	0.67	1.15	1.84
Rural	1.54	3.10	5.09	7.59	10.73
Mwisa					
Urban	0.35	0.60	0.94	1.42	2.07
Rural	0.93	1.85	3.03	4.50	6.33
Kagera Mouth					
Urban	0.00	0.05	0.13	0.27	0.48
Rural	0.61	1.22	2.01	3.01	4.26
Nyabarongo Upper					
Urban	2.32	3.66	5.44	7.80	10.89
Rural	2.87	5.73	9.32	13.80	19.34
Nyabarongo Lakes and Wetlands					
Urban	7.18	10.89	15.68	21.82	29.62
Rural	3.72	7.42	12.06	17.85	25.00
Upper Ruvubu					
Urban	0.90	1.59	2.60	4.03	5.98
Rural	3.44	6.86	11.14	16.48	23.08
Lower Ruvubu					
Urban	0.73	1.21	1.88	2.79	4.03
Rural	1.70	3.40	5.53	8.19	11.48
Total	**28.49**	**51.54**	**81.24**	**119.11**	**167.01**