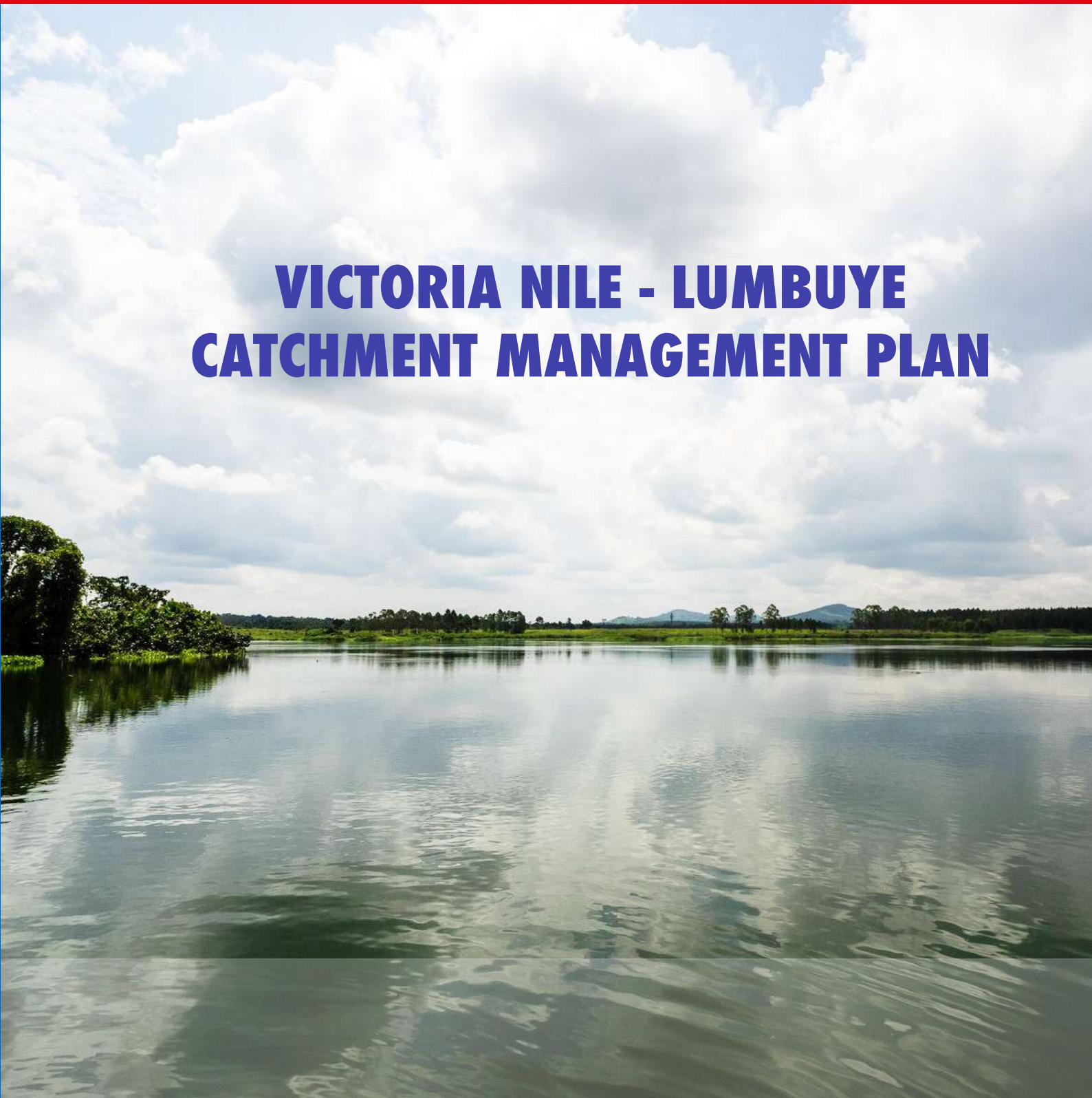


Ministry of Water and Environment
Directorate of Water Resources Management
Kyoga Water Management Zone

VICTORIA NILE - LUMBUYE CATCHMENT MANAGEMENT PLAN



FOREWORD



Hon. Sam Cheptoris

Minister of Water and Environment
The Republic of Uganda

Water resources support key sectors of the economy namely hydropower generation, agriculture, fisheries, domestic water supply, industry, navigation etc. However, efficiency and sustainability of intervention under these sectors has recently been a concern in Uganda mainly due to inadequate sectoral collaboration in planning and implementation, increasing frequency of floods and droughts, environmental degradation and pollution of water resources. This situation therefore calls for development of mechanisms for promoting integrated planning, development and management of water resources so as to create synergy among various sectors, promote efficiency in utilization of available resources, reduce water and environmental degradation and ensure more efficient utilization of water resources to meet various social and economic demands.

In 2011, my Ministry embarked on preparation of Catchment Management Plans (CMPs) as tools for ensuring equitable access to, and use of water resources, and safeguard of key natural resources for sustainable socio-economic development of the country.

A CMP provides a long-term strategy for sustainable development and utilization of water and related resource. Catchment based water resources planning and management is in line with the Integrated Water Resources Management (IWRM) paradigm, which ensures that land, water, and related resources are developed and managed in a coordinated manner without compromising sustainability of vital ecosystems. As the lead agency for implementation of Catchment based Water Resources Management (CbWRM) in Uganda, my ministry through the Directorate of Water Resources Management (DWRM) is operationalizing the CbWRM framework through the four Water Management Zones of Albert, Kyoga, Upper Nile and Victoria WMZ.

In order to develop this CMP, a number of studies were undertaken which included an assessment of the existing catchment knowledge base, the current and projected water resources situation, the catchment's social and environmental assessment, and stakeholder engagement. The CMP identifies critical issues, challenges, opportunities, and threats within the catchment which need to be addressed to ensure the socio-economic development of the people.

Guided by the key issues, challenges, threats, opportunities, key water resources planning principles and national strategies, the stakeholders developed a vision for the catchment. To achieve the vision, stakeholders came up with a number of strategic objectives, options and actions that need to be pursued in the short, medium and long term up to the year 2040.

Victoria Nile - Lumbuye CMP was developed following the Uganda Catchment Planning Guidelines of 2014 and was approved by the Victoria Nile - Lumbuye Catchment Management Committee (CMC) in October 2018.

My Ministry is therefore pleased to formally make this CMP available for use by various stakeholders. It will enormously help and guide all developers and users of water and related resources at the national and local levels. I therefore wish to call upon all the relevant government ministries and agencies at both national and local levels, the civil society, the private sector, academia and research institutions, cultural institutions, religious institutions and the local communities to utilize this plan in order to optimally plan for the development and management of water and related resources for prosperity.

In line with the provisions of Section 5 of the Water Act, Cap 152 I formally approve this Catchment Management Plan for use by various stakeholders.

For God and My Country

ACKNOWLEDGEMENT

I would like to thank the Directorate of Water Resources Management for spearheading the preparing of Catchment Management Plans in Uganda. This is a stakeholders driven process that is key in ensuring that water resources are effectively planned for and sustainably developed and managed so as to support the achievement of the country's vision 2040.

Special thanks go to all the stakeholders at the national, regional and local levels for their active participation and involvement in preparation of this plan. Special appreciation goes to the Kyoga Water Management Zone for coordinating the plan preparation process and the Victoria Nile - Lumbuye Catchment Management Organisation through the Victoria Nile - Lumbuye Catchment Management Committee for ensuring that the plan is stakeholders' driven and addresses the needs of the people in the catchment.

Finally, I wish to thank the World Bank through the Water Management and Development Project for providing the funding that enabled preparation and printing of this CMP.



A handwritten signature in blue ink, appearing to read 'Alfred Okot Okidi'.

Alfred Okot Okidi

Permanent Secretary,
Ministry of Water and Environment

EXECUTIVE SUMMARY

The Victoria Nile Catchment covers some 3,456 square kilometres (km²) of land area and 126km² of water area while the smaller Lumbuye Catchment comprises 1,478km² of land area and 42km² of water area. They are bordered on the south by a narrow strip of the Victoria Water Management Zone (WMZ), which separates the catchments from Lake Victoria. The Victoria Nile-Lumbuye catchment consists of various landscapes, water bodies, and wetlands. The land surface is generally relatively flat, with gentle undulating hills and a few isolated higher residual features with almost flat valleys. Much of the low-lying areas are drained by seasonal streams into Lake Kyoga in the north, and through tributaries to rivers like Sezibwa in the east, Lugogo on the west, South west and south, and Kafu to the northwest.

The catchment traverses a wide range of land-cover types including settled agricultural areas, bushes, swamps, wetlands of different types, and forested areas. Namukooge, Buyende, Kaliro, and the northern parts of Kayunga and Kamuli are part of the cattle corridor, with vegetation cover ranging from grasses interspersed with trees to savannah mosaics and woodlots. The vegetation cover comprises mainly combretum, acacia species, bush lands, and dry thickets. Rangelands are mainly used for grazing animals. The wetland area for Victoria Nile – Lumbuye Catchment represents, in total, around 1,215km². This total divides between the Victoria Nile Catchment, which presents almost 860km² of wetlands (24% of the total area of this catchment), including almost 120km² of permanent and 740km² of seasonal wetlands; and the Lumbuye Catchment. The Lumbuye Catchment covers a wetland area of almost 360km² (~23% of the area of the catchment), including around 40km² of permanent and almost 320km² of seasonal wetlands. The main wetland system includes the Victoria Nile, Nalwekomba, Kiko, and Nabigaga wetland systems for the Victoria Nile Catchment.

The growing population in the catchment exerts increasing pressure on water and land resources, resulting in increasing degradation of the environment. High population growth also leads to increased exploitation and destruction of ecosystem resources. Even where management plans for freshwater systems such as wetlands exist, the district environment and natural resources departments do not have the capacity, resources or tools to implement the plans and monitor human activities that negatively impact the environment. Rainfed agriculture and livestock grazing are the most widespread activities in the Victoria Nile-Lumbuye Catchment. Agriculture employs over 95% of the population. More than half of the total land area is used for cultivation since a large majority of the population is rural, and directly dependent on agriculture.

The development of this CMP followed the guidelines for Uganda's Catchment-based Water Resources Planning (MWE, 2012). The process stipulated in these guidelines provides for various steps including assessments on water resources, stakeholders, and social and environmental context among others. From these thematic assessments, major issues/challenges within the catchment, the available opportunities, potential threats and risks are identified, options for managing the identified issues also identified, and this forms the basis for strategic analysis in order to meet the catchment vision and objective. A set of agreed interventions are then mapped and an implementation plan laid out, constituting the associated timing and costs, to form the main body of a Catchment Management Plan and the Implementation Plan.

The thematic reports developed in the process of undertaking these activities included:

- The Water Resources Assessment Report, which comprises of a basic assessment of the natural catchment characteristics, natural water resources, rainfall and runoff characteristics, hydro-meteorological monitoring, water quality, water demands, and water infrastructure.
- The Social and Environmental Issues Report, which comprises of the legal and policy context, institutional arrangements, environmental baseline and socio-economic characteristics of the catchment that affect the social and environmental well-being of the catchment and highlights possible interventions to address the identified issues.
- The Water Balance Report, which gives information on the water availability for surface water and groundwater. Use of the Mike Basin model was made to determine current and future water demands and the availability of water resources for proposed development options.
- The Stakeholder Engagement Report details the stakeholder participation framework and interactions in mobilising the input of water users and affected parties in the management of water resources. Field visits, informal and formal meetings as well as the proceedings of joint stakeholder forum workshops were highlighted and their input of water resources issues captured.
- The Options for the Management and Development of Water Resources Report, which provides the process of gathering issues and developing options, assesses and shortlists them, categorises them in terms of the catchment objectives, evaluates them with the application of a scenario evaluation with Mike Basin, costing and an off-line multi-criteria screening template. The Options Report serves as the forerunner to the CMP.

The Victoria Nile-Lumbuye Catchment Management Plan summary

The vision statement for the Victoria Nile-Lumbuye Catchment is:

“To sustainably use the environmental resources for a socio-economically viable, competitive and preserved Victoria Nile -Lumbuye Catchment by 2040.”

Three strategic objectives were selected by the stakeholders and cover the different key challenges identified in the catchment namely: the environmental degradation, the low level of water resources development, the low level of human and social capital, and insufficient implementation of integrated resources management approach.

- Strategic objective 1: To restore and sustainably manage the natural resources of the catchment.
- Strategic objective 2: To develop agriculture, alternative livelihoods, and water resources for socio-economic growth.
- Strategic objective 3: To meet the institutional, technical, human requirements for integrated management of natural resources.

The activity and investment plans for the Victoria Nile-Lumbuye Catchment are presented in the tables below.

Table A: The Victoria Nile-Lumbuye Catchment Management Plan summary

Activities	Indicator unit	Targeted outputs		
		1-5 yrs	6-10 yrs	Beyond 10 yrs
1-DEVELOP WATER FOR PRODUCTION INFRASTRUCTURE				
1.1 Create fish ponds	Surface area	400m ²	-	-
	No. of farmers contacted	500	300	500
	No. radio talk-shows	5	5	5
1.2 Provide water/organise access to resources for cattle watering	No. of Sunken pits	50	50	-
	No. roof water harvesters	50	50	-
	No of rainwater tanks	50	50	-
	No. of livestock access points	10	15	-
	No. of meetings	30	50	50
1.3 Develop large infrastructure	No. of talk-shows	5	5	10
	No. of feasibility/drainage studies	8	-	-
	No. of constructed large reservoirs	-	6	3
1.4 Develop upland irrigation	No. of completed drainage projects	-	-	-
	No. of studies completed	-	1	-
	Ha. under new irrigation	309		1844
	No. of trainings	25	25	25
1.5 Organise irrigation in wetlands (formal schemes)	No. of meetings		10	
	Ha. under formalised irrigation	-	4,257	10,156
	No. of studies	4	-	-
1.6 Develop rice/aquaculture schemes	Ha under new irrigation	-	-	-
	Ha under rice/aquaculture	4	-	-
	No. demonstration farms	1	-	-
1.7 Develop rain water harvesting and individual storage solution	No. of meetings	40	40	20
	No. of sunken pits	40	10	-
	No. of roof water harvesters	40	10	-
	No. of rainwater tanks	40	10	-
2-DEVELOP THE AGRICULTURAL SECTOR AND IMPROVE PRACTICES				
2.1 Development of agro-forestry and conservation agriculture	No. of trainings	66	45	20
	No. of meetings	30	30	-
	No. of talk-shows	5	5	-
	No. of demonstration farms	-	-	-
2.2 Implement soil and water conservation measures	No. of pilot projects	1	-	-
	No. of trainings	30	20	40
	No. of studies	1	2	-
	Ha under conservation measures	-	-	-
2.3 Develop organisation and outlets for	No. of outlets	-	-	-

Activities	Indicator unit	Targeted outputs		
		1-5 yrs	6-10 yrs	Beyond 10 yrs
agricultural production				
2.4 Develop and empower farmer groups and associations	No. of farmer groups	-	-	-
2.5 Promote the use of quality inputs in agriculture	No. of talk-shows	10	10	-
	No. of demonstration sites	-	-	-
	No. of trainings	5	5	20
	No. of meetings	25	-	-
3. DEVELOP OTHER ECONOMIC ACTIVITIES				
3.1 Promote development of quality fingerlings and fish seed production	No. of fish fry centres rehabilitated	-		
	No. of hatcheries constructed	1		
3.2 Develop fish farming	No. trainings	45	30	25
	No. of meetings	45	30	25
3.3 Develop small hydropower production	No. of Feasibility studies undertaken	-	-	-
	No of HP stations constructed	-	-	-
3.4 Improve livestock husbandry (extension, breeding etc.)	No. of talk-shows	5	-	-
3.5 Provide alternative livelihoods and promote environmentally sustainable socio-economic development (tourism, bee keeping)	No. of meetings	-	25	50
4- ENVIRONMENTAL CONSERVATION AND PROTECTION				
4.1 Development of tree nurseries and tree planting activities	Ha. of trees	340	14	6
	No. of community tree nurseries	8	1	2
	No. of talk-shows	5	5	
	No. of meetings	6	9	50
4.2 Build a wetland classification according to their ecological interest and develop a wetland management and development strategy accordingly	Wetland inventory or strategy	1	-	-
	Ha under restoration	50	7,986	
	Ha of wetland demarcated	7,986	-	
	No of meetings	70	20	100
	No of talk-shows	20	5	10
4.3 Clear demarcation of wetland and forests	Km of demarcation	20	-	-
	No of meetings	30	20	50
	No of talk-shows	5	-	10
4.4 River bank protection (cultivation and sand mining)	Km of buffer zone	10	6	4
	No of meetings	45	45	60
	No of talk-shows	5	5	10
4.5 Develop a forest management and development strategy	No of studies	1	-	-
	No of restoration plans	9	-	-
	No. of plans implemented		3	2

Activities	Indicator unit	Targeted outputs		
		1-5 yrs	6-10 yrs	Beyond 10 yrs
	No of meetings	75	75	100
	No of talk-shows	5	5	10
4.6 Use of renewable energy/alternative energy sources and development strategy	No of biogas digesters	-	-	-
	No of solar panels	-	-	-
	No of meetings	150	225	-
	No of trainings	75	75	-
5 – IMPROVE WATER SUPPLY AND SANITATION				
5.1 Improve access to safe water supply	No of piped water schemes designed	5	-	-
	No of piped water schemes constructed	4	4	-
	No of piped water schemes rehabilitated	-	-	-
	No of bore holes constructed	50	15	15
	No of well springs & boreholes rehabilitated	30	15	15
	No of wells protected	25	15	15
	No of meetings	25	25	15
	No of talk-shows	5	5	10
5.2 Upgrade/improve existing waste water treatment plants and make sure effluents meet national standards	No of studies undertaken	1	-	-
	No of treatment plants upgraded.	-	1	-
5.3 Promote sanitation facilities in rural areas and small towns	No of sanitation system design studies	1	1	1
	No of sanitation systems constructed	-	3	2
	No of latrines constructed	25	15	15
	No of meetings	25	25	-
	No of talk-shows	5	-	-
5.4 Plan sanitation associated with the new piped schemes being developed in small towns and rural growth centres	No of designs for waste water treatment plants	6	4	-
	No of waste water treatment plants constructed	-	6	4
6 – CONTROL AND REDUCE POLLUTION				
6.1 Improve management of solid waste	No. of solid waste disposal studies conducted	1	2	1
	No. of catchments with proper solid waste disposal mechanisms in place	-	2	2
	No. of meetings	50	50	-
	No. of talk-show	-	3	-
6.2 Control waste water discharge and pollution from industries and artisanal activities	No. of meetings	10	-	
	No. of effluent control studies	-	8	
7 – COMMUNICATION AND CAPACITY BUILDING				
8- IMPROVEMENT OF INSTITUTIONAL CONTEXT	No. of meetings	75	75	150
9 – IMPROVEMENT OF KNOWLEDGE AND DATA COLLECTION		-	-	-

Table B: Investment plan for the Victoria Nile-Lumbuye Catchment

Activities	Cost per period		
	1-5 years	6-10 years	Beyond 10 years
1 - DEVELOP WATER FOR PRODUCTION INFRASTRUCTURE	7 085 620	71 655 851	75 112 902
1.1 Create fish ponds	298 747	49 796	77 817
1.2 Provide water / organize access to resources for cattle watering	609 109	757 277	31 847
1.3 Develop large infrastructure	3 414 470	46 753 450	16 511 300
1.4 Develop upland irrigation	1 771 422	391 522	2 142 722
1.5 Organise irrigation in wetlands (formal schemes)	736 330	23 625 600	56 271 200
1.6 Develop rice/aquaculture schemes	70 802	27 946	78 016
1.7 Develop rainwater harvesting and individual storage solution	184 740	50 260	-
2 - DEVELOP THE AGRICULTURAL SECTOR AND IMPROVE PRACTICES	345 641	323 719	410 131
2.1 Development of agro-forestry and conservation agriculture	92 809	52 104	53 662
2.2 Implement soil and water conservation measures	106 166	179 211	185 731
2.3 Develop organisation and outlets for agricultural production	39 550	39 550	71 190
2.4 Develop and empower farmer groups and associations	6 780	-	-
2.5 Promote the use of quality inputs in agriculture	100 336	52 854	99 548
3 - DEVELOP OTHER ECONOMIC ACTIVITIES	222 143	152 414	243 627
3.1 Promote development of quality fingerlings and fish seeds production	89 577	65 200	117 360
3.2 Develop fish farming	84 042	39 185	36 729
3.3 Develop small hydropower production	-	-	-
3.4 Improve livestock husbandery (exstention, breeding, etc.)	33 094	32 600	58 680
3.5 Provide alternative livelihoods and promote environmentally sustainable socio-economic development (tourism, bee keeping, etc.)	15 429	15 429	30 858
4 - ENVIRONMENTAL CONSERVATION AND PROTECTION	2 565 089	2 868 569	1 883 982
4.1 Development of tree nurseries and tree planting activities	875 844	188 944	270 779
4.2 Build a wetland classification according to their ecological interest and develop a wetland management and development strategy accordingly	333 717	1 789 028	489 045
4.3 Clear demarcation of wetlands and forests	270 869	214 143	431 197
4.4 River bank protection (cultivation and sand mining)	423 681	331 413	618 635
4.5 Develop a forest management and development strategy	433 516	117 581	74 327
4.6 Use of renewable energy / alternative energy sources and development strategy	227 461	227 461	-
5 - IMPROVE WATER SUPPLY AND SANITATION	9 765 666	5 689 212	5 105 499
5.1 Improve access to safe water supply	8 627 925	283 739	895 548
5.2 Upgrade/improve existing waste water treatment plants and make sure effluents meet national standards	55 980	500 000	-
5.3 Promote sanitation facilities in rural areas and small towns	745 881	2 028 593	2 740 651
5.4 Plan sanitation associated with the new piped schemes being developed in small towns and rural growth centers	335 880	2 876 880	1 469 300
6 - CONTROL AND REDUCE POLLUTION	618 171	1 453 064	9 886 299
6.1 Improve management of solid waste	131 128	1 033 214	9 046 599
6.2 Control waste water discharge and pollution from industries and artisanal activities	487 043	419 850	839 700
7 - COMMUNICATION AND CAPACITY BUILDING	172 355	56 600	113 200
8 - IMPROVEMENT OF INSTITUTIONAL CONTEXT (RELATED TO THE WATER SECTOR, AT CATCHMENT LEVEL)			
9 - IMPROVEMENT OF KNOWLEDGE AND DATA COLLECTION ON WATER RESOURCES			
Total per period	20 774 684	82 199 430	92 755 640
Grand Total			195 729 754

Lessons learnt

Following are important lessons learned concerning stakeholder analysis, consultation and engagement:

1. The large number and types of stakeholders in the catchments necessitates that a representative sample of stakeholders be consulted and engaged rather than attempting to contact and engage every single stakeholder in the catchments. This approach is realistic and appropriate considering the limited time, personnel and resources available.
2. Coordination between a large number of specialists in many different fields presents a special challenge for managing the inputs and outputs of a multidisciplinary team and achieving synergies between the works of the subject specialists.
3. Data required for accurate and comprehensive integrated water resources planning is usually scattered, of poor quality, has many gaps, and is difficult and time consuming to obtain and analyse. In addition, much information and data is “dynamic”, underscoring the fact that the information and data presented in reports such as this one is necessarily incomplete and imperfect. At best, a report such as this one represents a “snapshot” of what a certain group of people with certain knowledge and skills, working with limited time and resources have been able to produce at a certain point in time. Therefore, this report

should be seen as a living document that will need to be revisited periodically as the body of knowledge expands, new information becomes available, latent conflicts emerge, existing stakeholders change and new stakeholders appear on the scene.

4. While the concept and principles of IWRM and stakeholder consultation may be generally understood, how to put these concepts and principles into practice is not. Therefore, there is a need for continuous learning from best (and also bad) practices to show how effective stakeholder engagement can be realised in practice.
5. District officers, being civil servants, are subject to administrative actions such as transfers, promotions, and sick and maternity leave etc. As existing staff leave and move away, new officers from other districts in different parts of the country arrive to take their place. This fluid situation creates the need for a continuous flow of information, training, coaching, support and related activities by the WMZ office.
6. While consultants may come and go, the WMZ office has become a permanent feature of the IWRM institutional landscape in Uganda and is well positioned and staffed to build on the work with stakeholders carried out by consultants.
7. Stakeholders at the same level having common interests and facing similar issues and challenges across district boundaries in the catchments can potentially collaborate effectively if given the opportunity, organisation and resources to do so.
8. Severe resource constraints, particularly funding, hinder the effectiveness and limit the impact of stakeholder participation at all levels. Many useful initiatives and activities that were supported by time-bound projects unfortunately end when projects end and (external) funding stops. This discourages and demoralises the stakeholders that were involved in such activities.
9. District Development Plans, statistical abstracts, census reports, state of the environment reports, wetland management plans, water atlas and other useful sources of information should be collected for all districts in the catchments and WMZ. Ideally, this information should be available in hard and soft copy at a central source such as the WMZ office from the start of a consultancy assignment to avoid delays and the time taken to obtain this important information by each new consultant.
10. Care should be taken to avoid raising stakeholder's expectations for new projects in the short term during the stakeholder consultations. At the beginning, it is important to make it clear that the initial meetings and consultations are part of a longer planning process that will serve as input to the identification of a range of development options. No particular type and location of new projects can be made at the consultation stage.
11. Another important lesson is the need for the WMZ team to explain the purpose and scope of the CMP, including how it will be funded and implemented, and what the long term requirements are for implementation, operation and maintenance. Not many of the stakeholders have been involved in such an exercise before and the CMP is likely to require them to take new and unfamiliar actions.

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ABBREVIATIONS AND ACRONYMS

AIDS	Acquired Immune Deficiency Syndrome
AQUASTAT	FAO global information system on water
ASR	Alkali Silica Reaction
ATM	African Textile Mill
BEL	Bujagali Energy Limited
BMU	Beach Management Unit
BOD	Biological Oxygen Demand
CAO	Chief Administrative Officer
CAS	Country Assistance Strategy
CBD	Convention on Biological Diversity
CBO	Community-based organisation
CbWAP	Community-based Wetland Action Plan
CbWMP	Community-based Water Management Plan
CEO	Chief Executive Officer
CFR	Central Forest Reserve
CIAT	International Centre for Tropical Agriculture
CMO	Catchment Management Organisation
CMP	Catchment Management Plan
CRU	Climate Research Unit
DAP	Di-ammonium Phosphate
DCDO	District Community Development Officer
DDP	District Development Plan
DEA	Directorate of Environmental Affairs
DEAP	District Environment Action Plan
DEC	District Environment Committees
DFO	District Fisheries Officer
DFR	Department of Fisheries Resources
DLG	District Local Government
DNRO	District Natural Resources Officer
DPO	District Production Officer
DRC	Democratic Republic of Congo
DSIP	Agriculture Sector Development Strategy and Investment Plan
DWAP	District Wetland Action Plan
DWD	Directorate of Water Development
DWD	Directorate of Water Development
DWO	District Water Officer
DWRM	Directorate of Water Resources Management
EAPP	Eastern Africa Power Pool
ECF	East Cost Fever
EIA	Environmental Impact Assessment
EIS	Environmental Impact Statement
EM-DAT	International Disaster Database
EMP	Environmental Management Plan
ERA	Electricity Regulatory Authority
ESIA	Environmental and Social Impact Assessment
FAO	United Nations Food and Agriculture Organization
FIE & FOC	Farm Income Enhancement and Forestry Conservation Project
FMD	Foot and mouth disease

FS	Faecal Sludge
FSM	Faecal Sludge Management
GDP	Gross Domestic Product
GETFIT	Global Energy Transfer Feeding Tariffs
GFS	Gravity Flow Scheme
GIS	Geographical Information System
GIZ	German International Cooperation
GoU	Government of Uganda
GPCC	Global Precipitation Climatology Centre
Ha	Hectare
HPP	Hydro-Power Plant
IBA	Important Bird Area
ICCM	International Conference on Chemicals Management
IDA	International Development Association
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producers
ISFG	Integrated Support to Farmers' Groups
IUCN	International Union for the Conservation of Nature
IWRM	Integrated Water Resources Management
JICA	Japan International Cooperation Agency
Km	Kilometre
LFPR	Labour Force Participation Rate
LFR	Local Forest Reserve
LTU	Livestock Tropical Unit
MAAIF	Ministry of Agriculture Animal Industry and Fisheries
MEMD	Ministry of Energy and Mineral Development
MERECIP	Mount Elgon Regional Ecosystem Conservation Programme
MES	Ministry of Education and Sports
MGLSD	Ministry of Gender, Labour and Social Development
MLG	Ministry of Local Government
MLHUD	Ministry of Lands, Housing and Urban Development
MOH	Ministry of Health
MSIOA	Multi-Sectoral Investment Opportunity Assessment
MTI	Ministry of Tourism and Industry
MWE	Ministry of Water and Environment
NAADS	National Agricultural Advisory Services
NAPA	National Adaptation Programme of Action
NARO	National Agricultural Research Organisation
NBI	Nile Basin Initiative
NDP	National Development Plan
NELSAP	Nile Equatorial Lakes Subsidiary Action Program
NEMA	National Environment Management Authority
NEPAD	New Partnership for Africa's Development
NERICA	New Rice for Africa (rice variety)
NFA	National Forestry Authority
NGO	Non-Government Organisation
NGWDB	National Groundwater Data Base
NPV	Net Present Value
NTU	Nephelometric Turbidity Units
NWP	National Water Policy

NWRA	National Water Resources Assessment
NWSC	National Water and Sewerage Corporation
O&M	Operation and Maintenance
OP	Operational Procedure
OWC	Operation Wealth Creation
PMA	Plan for Modernisation of Agriculture
POP	Persistent Organic Pollutants
PPA	Power Purchase Agreement
RAMSAR	Convention on Wetlands of International Importance
RGC	Rural Growth Centre
RWH	Rainwater Harvesting
SAICM	Strategic Approach to International Chemicals Management
SAIL	Sugar and Allied Industries, Limited
SAPP	Southern Africa Power Pool
SCMP	Sub-catchment Management Plan
SEAP	Sub-county Environmental Action Plans
SMM	Sio-Malaba-Malakasi
SSEA	Strategic Social and Environmental Assessment
SWAP	Sub-county Wetland Action Plan
SWC	Soil and Water Conservation
SWL	Static Water Levels
SWOT	Strength, Weakness, Opportunity, Threat
TC	Town Council
TDS	Total Dissolved Solids
TSS	Total Suspended Solids
TSU	Technical Support Unit
UBOS	Uganda Bureau of Statistics
UEGCL	Uganda Electricity Generation Company Limited
UNRA	Uganda National Road Authority
UNRDS	Uganda National Rice Development Strategy
UO	Umbrella Organisation
UPE	Universal Primary Education
USAID	United States Development Agency
USD	United States Dollar
UWA	Uganda Wildlife Authority
UWASNET	Uganda Water and Sanitation Network
WAFICOS	Walimi Fish Farmers' Cooperative Society
WATSAN	Water and Sanitation
WMD	Water Management and Development
WMDP	Water Management and Development Project
WMZ	Water Management Zone
WRU	Wetland Resources Users
WSDF	Water, Sanitation and Development Facility
WSDF-E	Water, Sanitation and Development Facility East
WSP	Waste Stabilisation Ponds
WSSB	Water Supply and Sanitation Board
WSSP	Wetland Sector Strategic Plans
WUA	Water Users Association
WWF	World Wildlife Fund
WWTP	Wastewater Treatment Plant

1 INTRODUCTION

1.1 Background to Catchment Planning

The National Water Policy in Uganda is based on the Integrated Water Resource Management (IWRM) approach with implementation at the catchment level and provides an overall policy framework and defines the Government's policy objective as:

"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 and with the full participation of all stakeholders."

As part of the realisation of this objective, the National Water Policy has been based on the implementation of the objectives for water management within the IWRM framework. IWRM in a river-basin context is defined as "a process that enables the coordinated management of water, land and related resources within the limits of a basin so as to optimise and equitably share the resulting socio-economic well-being without compromising the long term health of vital ecosystems."

A key feature of the implementation of IWRM in Uganda by the Ministry of Water and Environment (MWE) through the Directorate of Water Resources Management (DWRM) was to provide for the de-concentrated management of water resources to the local catchment level with the participation of all stakeholders.

Following the recommendations of the National Water Policy, the Water Sector Reform Study (2005), the Joint Sector Review (2006) and other national and regional policies as well as steps already taken for implementation purposes, the country was delineated into four Water Management Zones (WMZs) along hydrological boundaries.

Thus, the northern parts of the country are covered by the Upper Nile Water Management Zone (UNWMZ), the western parts by the Albert Water Management Zone (AWMZ), the south by the Victoria Water Management Zone (VWMZ) and the east by the Kyoga Water Management Zone (KWMZ) as shows. Within each WMZ, there exists a number of smaller hydrological units called catchments for which tools and capacity for management of water resources have to be developed. Catchment Management Plans (CMPs) are to be developed for respective catchments in the WMZs to enable planning of water resources development and management at a catchment level.

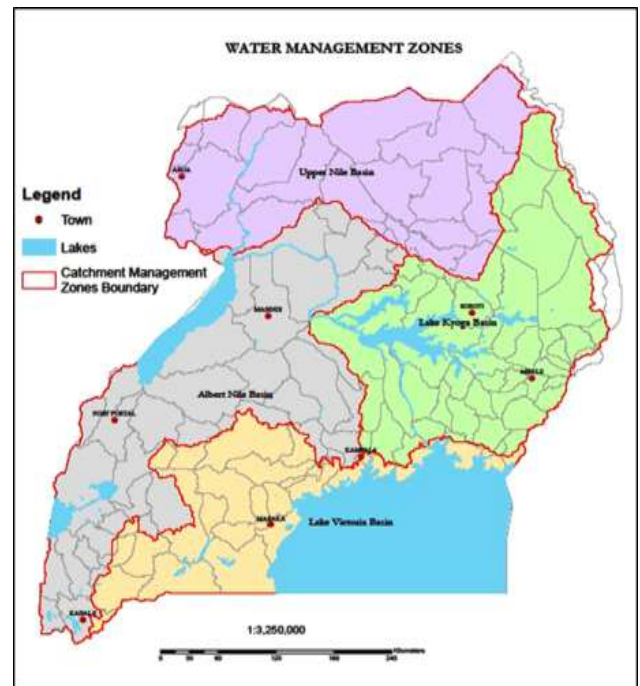


Figure 1:1: Water Management Zones

In line with this, a Catchment Management Plan for Victoria Nile – Lumbuye catchments presented in this report, has been developed to mainly identify infrastructure and water management interventions and actions for sustainable management of the catchment. The Victoria Nile – Lumbuye catchments, which are part of the Kyoga Water Management Zone, cover an area of 5,102 km² of which is 3.3% (168 km²) is water and the other is land. The preparation of this CMP is in line with the catchment management planning guidelines, (MWE, 2014).

1.1 Objectives and purpose of the CMP

The purpose of this CMP is to provide a long-term strategy for the sustainable development and utilisation of the water resources in the catchment by the stakeholders in an integrated manner.

The CMP provides the basis for understanding a complex system and prioritising key focus areas for effective management taking into consideration potential development opportunities, problems and challenges, and risks and threats. Following a participatory approach in developing the CMP, the objective is to provide information and shared motivation that will initiate interventions and/or investments, which can be implemented to realise sustainable management and development of water resources within the catchment. The CMP also purposes to:

- Consider all conditions and characteristics (physical, social, economic, environmental, political, transboundary etc.) in the catchment in an integrated manner
- Raise awareness on the understanding and importance of as well as the responsibility for water resources management and environmental conservation among all stakeholders and how this will be of benefit to the sustainable economic growth and livelihoods in the catchment as a learning process
- Clarify the interdependence of all activities in the catchment and even the effects on neighbouring catchments
- Engage the stakeholders on all levels in the integrated planning process and help them decide on the best options and scenarios for the development of their catchment as well as in the development and implementation processes
- Motivate the stakeholders and put them into the position to play an active role in preserving their water resources and the environment
- Initiate investment from within and outside the catchment.

1.2 Report structure

This report mainly has six chapters prepared to ensure logical and consistent flow of information throughout the document as highlighted here below:

- Chapter 1: Introduction. This chapter presents the background to catchment management planning in Uganda, objectives of the CMP, and general layout of the report.
- Chapter 2: Approach to Catchment Management Planning. This chapter describes the general approach to catchment management planning in Uganda, which is in line with the catchment management planning guidelines.
- Chapter 3: Legislative and Institutional Framework. The existing policy, legal, and institutional arrangements, their linkages with catchment management planning and implementation, as well as the existing gaps are presented in this chapter.
- Chapter 4: Status of the Catchment. This chapter discusses the main characteristics and features of the catchment, which ultimately leads to identification of the major social, environmental, and water resources assessment issues together with the stakeholder engagement and issues' mapping.
- Chapter 5: Vision, Objectives, and Analysis of Options. Catchment visioning and strategic analysis is presented and discussed in this chapter. The prioritisation of issues identified within the catchment, analysis of the options to manage the identified issues, as well as configuration of scenario and their evaluation.
- Chapter 6: Management and Investment Actions. This chapter presents an agreed set of interventions resulting from the options for the best ranked scenario, the implementation plan, and costing of the agreed interventions.

2 APPROACH TO CATCHMENT MANAGEMENT PLANNING

The development of this CMP followed the guidelines for Uganda's Catchment-based Water Resources Planning (MWE, 2012). The process stipulated in these guidelines provides for various steps including assessments on water resources, stakeholders and social and environmental context as indicated in Figure 2.1. From these thematic assessments, major issues/challenges within the catchment, the available opportunities, potential threats and risks are identified, options for managing the identified issues also identified, and this forms the basis for strategic analysis in order to meet the catchment vision and objective. A set of agreed interventions are then mapped and an implementation plan is laid out, comprising the associated timing and costs, to form the main body of a Catchment Management Plan (CMP) and the Implementation Plan.

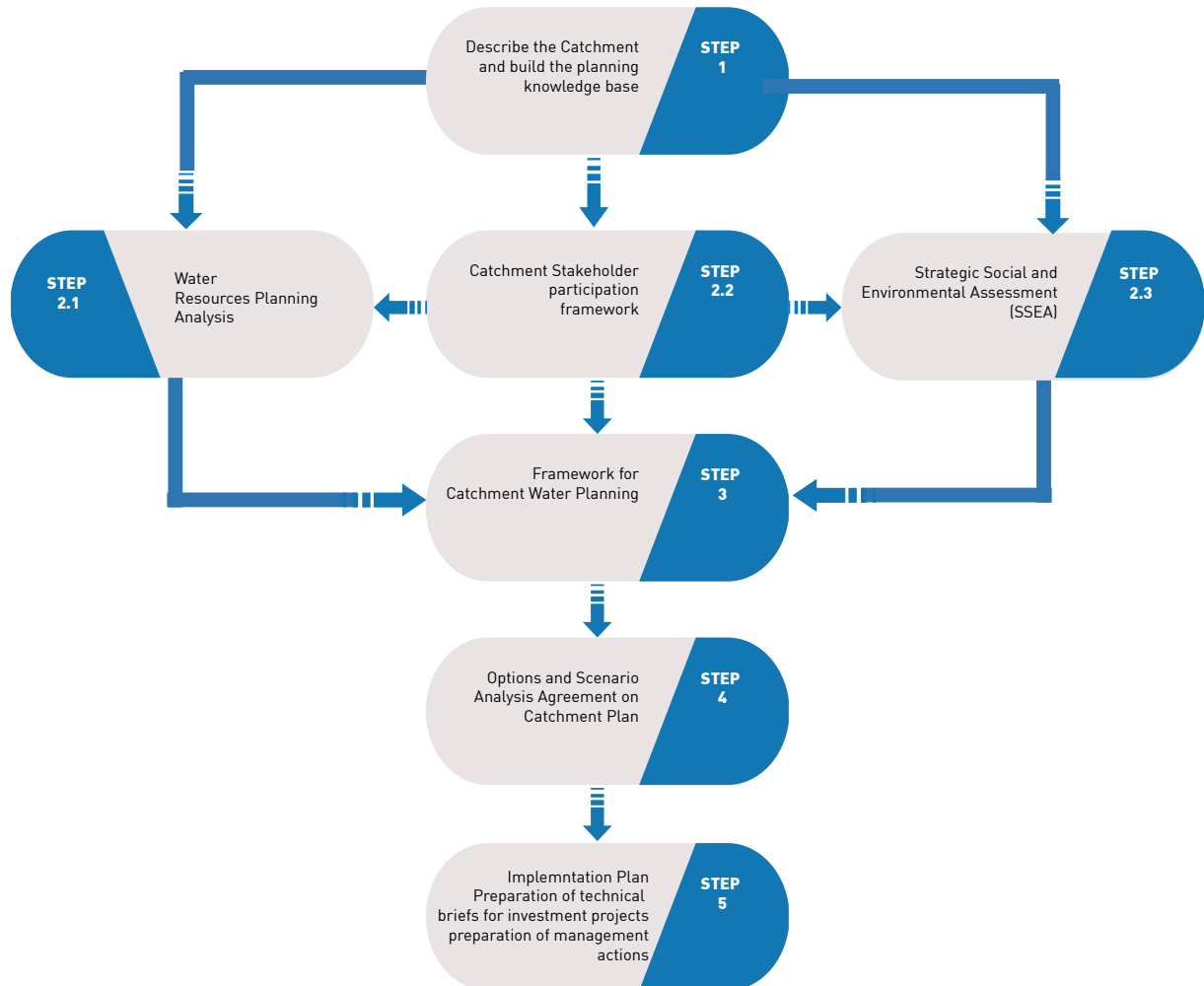


Figure 2.1: Overview of the catchment management planning process

The roadmap for the development of the CMP, therefore, sequentially included the following key activities:

- Evaluation of the existing catchment knowledge base
- Assessment of the current catchment and water resources situation
- Assessment of the catchment's social and environmental characteristics and needs
- Stakeholders engagement at various steps of the development of the CMP
- Providing a system model, analysing water availability, and future water demands
- Building consensus regarding development and management challenges and opportunities, and developing principles for catchment management and development
- Defining a vision and strategic objective
- Identifying key strategic actions to realise the vision and objectives
- Developing and analysing options and scenarios
- Providing a time-bound implementation plan (short, medium, and long term) for the options towards improved water development and management in the catchment.

All these activities and processes as stipulated in the Catchment Planning Guidelines, 2012 were adhered to and thematic reports were generated, all of which fed into this CMP. The thematic reports developed in the process of undertaking these activities included:

- The Water Resources Assessment Report, which comprises of a basic assessment of the natural catchment characteristics, natural water resources, rainfall and runoff characteristics, hydro-meteorological monitoring, water quality, water demands and water infrastructure.
- The Social and Environmental Issues Report, which comprises of the legal and policy context, institutional arrangements, environmental baseline and socio-economic characteristics of the catchment that affect the social and environmental well-being of the catchment and highlights possible interventions to address the identified issues
- The Water Balance Report, which gives information on the water availability for surface water and groundwater. Use of the Mike Basin model was made to determine current and future water demands and the availability of water resources for proposed development options.
- The Stakeholder Engagement Report, which details the stakeholder participation framework and interactions in mobilising the input of water users and affected parties in the management of water resources. Field visits, informal and formal meetings as well as the proceedings of joint stakeholder forum workshops were highlighted and their input of water resources issues captured.
- The Options for the Management and Development of Water Resources Report, which provides the process of gathering issues and developing options, assesses and shortlists them, categorises them in terms of the catchment objectives, evaluates them with the application of a scenario evaluation with Mike Basin, costing and an off-line multi-criteria screening template. The Options Report serves as the forerunner to the CMP.

All these thematic reports fed into the CMP, which consists of two main elements: first, a number of agreed investments in infrastructure and other interventions; and second, various water management interventions and actions aimed at resolving conflict, conserving and protecting the catchment and its natural resources, and ensuring equitable access to and use of water resources. The CMP further supports one of the highest priorities of the National Development Plan (NDP, 2010), which is to invest in water for production, including irrigated agriculture, water supply, livestock water supply, fisheries and aquaculture, and water for rural industry.



3 INSTITUTIONAL, LEGAL AND POLICY CONTEXT

3.1 Policy and legal context

The Africa Water Vision 2025 states its goal as “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” and the water policy reform initiative is aimed at realising this vision for water management in Uganda within the IWRM framework. Worth noting is the fact that sustainable management of water resources is not limited to physical management but also incorporates legislation, policies, economic tools, institutions, and stakeholders involved in management, regulation, and utilisation of water resources. Whilst water is essential to livelihoods, and always provides for subsistence and survival, it does not solely drive economic development. Many other factors also have to be in place if the provision of water is to have its full beneficial impact on society. A strong cooperative approach between role-players and especially governmental institutions is, therefore, essential to work together within their respective legislative and policy mandates to promote the approach to IWRM and to ensure the best economic, social and environmental development.

A synopsis of the legal context in Uganda under which IWRM is implemented and managed is provided by:

- The Constitution of the Republic of Uganda
- National Policies
- National Legislation
- Trans-boundary considerations, and
- International Conventions

3.2 The Constitution of the Republic of Uganda (1995)

The Constitution of the Republic of Uganda sets a number of national guiding principles relating to, and supporting the principles of sustainable development including having balanced and equitable development, which requires that the State adopts an integrated and coordinated planning approach. It further stipulates that the State ensures balanced development between different areas of Uganda and between the rural and urban areas with special measures employed to favour of the development of the least developed areas.

Through the constitution, the State is entrusted to protect important natural resources including land, water, wetlands, minerals, oil, and fauna and flora on behalf of the people of Uganda. The state must further endeavour to fulfil the fundamental rights of all Ugandans to social justice and economic development, with all developmental efforts directed at ensuring the maximum social and cultural well-being of the people. In terms of the Constitution, all Ugandans have a right to education, health services, clean and safe water, work, decent shelter, adequate clothing, food security, and pension and retirement benefits

The State must promote sustainable development and public awareness of the need to manage land, air, water resources, as well as use of natural resources, in a balanced and sustainable manner for the present and future generations. All possible measures must be taken to prevent or minimise damage to land, air, and water resources resulting from pollution or other causes. The Constitution entrusts the State to ensure the conservation of natural resources and promote the rational use of natural resources to safeguard and protect the biodiversity of Uganda. Through all this, the Constitution sets the scene for Integrated Water Resource Management in Uganda.

3.3 National Policies

3.3.1 National Water Policy (1999)

The 1999 National Water Policy provides an overall policy framework that defines the Government’s policy objective as managing and developing water resources of Uganda in an integrated and sustainable manner, to secure and provide water of adequate quantity and quality for all social and economic needs sustainably, with the full participation of all stakeholders (DWRM, MWE, 2012).

According to the National Water Policy and the Water Act Cap 152, the responsibilities to provide water services and to maintain facilities were devolved to local councils in districts and urban centres. The role of the Central Government’s Agencies is that of guiding and supporting as required. The Act thus emphasises the shared responsibilities in development and management of water resources among stakeholders, including the Private Sector and non-Government organisations (NGOs) to regulate human activities that can pose risks to water resources. It also provides for pollution control measures with associated penalties and fines.

The existing policy and legal framework promotes wise use of water resources from the lowest possible level, while considering roles to be played by different stakeholders at different levels. This offers an opportunity to ensure that communities can actively participate in the development and maintenance of water sources within a given catchment.

3.3.2 National Policy for the Conservation and Management of Wetland Resources (1995)

The national policy for the conservation and management of wetland resources (1995) is aimed at restricting the continued loss of wetlands and their associated resources and aims to ensure that benefits derived from wetlands are sustainably and equitably distributed to all people of Uganda. The wetlands policy calls for:

- 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 are not adversely affected
- Equitable distribution of wetland benefits; and
- The application of environmental impact assessment procedures on all activities to be carried out in a wetland to ensure that wetland development is well planned and managed.

Wetland related issues have been incorporated into the National Environmental Statute 1995. The Wetlands Policy is strengthened by a supplementary law specifically addressing wetland concerns. Wetland resources are regarded as forming an integral part of the environment and it is recognised that present attitudes and perceptions of Ugandans regarding wetlands be changed. Wetland conservation requires a coordinated and cooperative approach involving all the concerned people and organisations in the country, including the local communities. Within the context of the guiding principles, the National Wetlands Policy set five goals

- To establish the principles by which wetland resources can be optimally used over time
- To end practices, which reduce wetland productivity
- To maintain the biological diversity of natural or semi-natural wetlands
- To maintain wetland functions and values; and
- To integrate wetland concerns into the planning and decision making of other sectors.

3.3.3 Uganda National Land Policy

The Uganda National Land policy provides a framework for articulating the role of land in national development, land ownership, distribution, utilisation, alienability, management, and control of land. The Land Policy has a specific objective that seeks to ensure sustainable utilisation, protection and management of environmental, natural and cultural resources on land for national socio-economic development. It seeks to ensure that all land use practices and plans conform to principles of sound environmental management, including biodiversity, preservation, soil and water conservation, and sustainable land management. Section 6.7, item 140 of the policy promotes optimal and sustainable use and management of environment and natural resources for the present and future generations.

3.3.4 National Forestry Policy

The National Forestry policy provides for the establishment, rehabilitation and conservation of watershed protection forests. It aims at promoting the rehabilitation and conservation of forests that protect the soil and water in Uganda's key watersheds and river systems.

3.3.5 The Renewable Energy Policy for Uganda

The overall goal of the Renewable Energy policy is to increase the use of modern renewable energy, from the current 4% to 61% of the total energy consumption by the year 2017. Renewable sources of energy include solar energy, hydropower, biomass, wind, and geothermal as well as peat and wastes. For hydropower, the policy targets 1,200MW of installed capacity by 2017 for large hydropower plants and 85MW of installed capacity by 2017 for small and micro hydropower plants.

3.4 National legislation

3.4.1 Water Act Cap 152 (1997)

Uganda's Water Act Cap 152 provides for the use, protection and management of water resources and supply; and facilitates the devolution of water supply and sewerage undertakings. Its objectives are:

- i) To promote the rational management and use of the water resources of Uganda by:
 - Use of appropriate standards and techniques for the investigation, use, control, protection, management and administration of water resources
 - Coordinating all public and private activities which may influence the quality, quantity, distribution, use or management of water resources
 - Coordinating, allocating and delegating responsibilities for the investigation, use, control, protection, management or administration of water resources.
- ii) To promote the provision of a clean, safe and sufficient supply of water for domestic purpose
- iii) To ensure appropriate development and use of water resources other than for domestic use, e.g. watering of stock, irrigation and agriculture, industrial, commercial and mining uses, generation of energy, navigation,

- fishing, preservation of flora and fauna and recreation in ways which minimise damage to the environment; and
- iv) To control pollution and promote the safe storage, treatment, discharge and disposal of waste, which may pollute water or otherwise harm the environment and human health.

According to the National Water Policy (1999) and the Water Act Cap 152, the responsibilities to provide water services and to maintain facilities are devolved to local councils in districts and urban centres, with full mandates to construct, acquire or alter any water supply work. The role of the Central Government's Agencies is that of guiding and supporting as required. The Act thus emphasises the shared responsibilities in development and management of water resources among stakeholders (including the Private Sector and NGOs) to regulate human activities that can pose risks to water resources. It also provides for pollution control measures with associated penalties and fines.

Other Water Sector related policies form synergies with the Water Policy include:

- The National Gender Policy of 1999, which recognises women and children as the key stakeholders of water
- The Local Government Act of 1997, which underscores the role of Local Government in provision and management of water and sanitation, empowering the local authorities to plan and to implement development interventions according to local needs
- The 1998 Land Act, which stipulates the responsibility of the Central and Local Government in protecting environmentally sensitive areas such as natural lakes, rivers, groundwater, natural ponds, natural streams, wetlands, forest reserves, national parks and any other land reserved for ecological and tourist purposes; and
- The 1998 Water Abstraction and Wastewater Discharge Regulations for controlling water abstraction and wastewater discharge, to promote sustainable and environmentally friendly development and use of water resources. Some issues feature at the level of the policy and regulatory framework while others are crucial at catchment level. For instance, plans to develop irrigation schemes necessitate the development of a proper mechanism to protect water use rights and to settle disputes, especially between upstream and downstream water users. Issues of equity exist, whereby some users, often powerful up-stream users, put their interests first. In establishing the mechanism to handle user rights and conflict resolution, issues of active participation of all concerned stakeholders, including women, livestock keepers, and youths, should be taken into consideration.

The existing policy and legal framework promotes wise use of water resources from the lowest possible level, while considering roles to be played by different stakeholders at different levels. This offers an opportunity to ensure communities actively participate in development and maintenance of water sources.

3.4.2 National Environment Act (1995)

The National Environmental Act provides for **“sustainable management of the environment; to establish an authority as a coordinating, monitoring, and supervisory body for that purpose; and for other matters incidental to or connected with the foregoing.”**

The Act makes provision for a tiered approach to environmental planning, commencing with a National Environmental Management Plan to be prepared and reviewed every five years. Each district is required to compile a district environmental action plan every three years that compliments the National Environmental Management Plan. Both of these plans are made available to the public. At a project scale, the Act stipulates that developments of a certain nature (as determined under Section 19(7) of the Act) are required to undertake detailed Environmental Impact Assessment process in a prescribed manner.

The Act also makes provision for the monitoring of air and water quality and makes provision for the establishment and implementation of minimum standards pertaining to emissions and effluent

Section 34 of the Act deals specifically with limitations in the use of rivers and lake systems and aims to minimise the negative impacts and control activities that have the potential to be detrimental to these systems. The Act goes on to make specific provisions for the protection of river banks and lake shores in Section 35 and protection and management of wetland systems in Section 36 and 37 respectively.

Hilly and mountainous areas have also been identified as areas requiring special attention and protection by the Act. The Act makes provision for the restoration of vegetative cover in these areas. This Act coupled with the provisions made in the Prohibition of the Burning of Grass Act (1974) and the Forest Act (1947) and the Cattle

Grazing Act (1945) provides a good basis for restoration, protection and management of vegetative cover in hilly and mountainous areas.

3.5 Transboundary considerations

The trans-boundary nature of Uganda's water resources are such that there are a number of international conventions relating to management of water resources with which Uganda must comply. Currently, the key conventions/organisations to which Uganda is party are; the Protocol for Sustainable Development of Lake Victoria Basin and Nile Basin Initiative.

3.5.1 Legal Framework for the Sustainable Management of the Nile Waters:

Treaties regarding the management of the waters of the Nile basin date back to 1929 when Great Britain and Egypt signed an agreement under which no irrigation, power works or other measures were to be constructed or undertaken on the Nile, and its branches, or on lakes from which it flows in the Sudan, or in countries under British administration except with the previous agreement of the Egyptian government. The Agreement was followed by the 1959 Agreement on the Full Utilisation of the Nile Waters, which was signed between Egypt and Sudan. The 1959 Agreement allocates the waters of the Nile between the two signatory states.

3.5.2 Agreed Curve for the Lake Victoria Release:

Before the construction of the Nalubale (Owen Falls) Dam, which began in 1951, the outflows from Lake Victoria were controlled naturally by the Ripon Falls some 3km upstream of the dam site. After study of the discharge measurements, which had been made since 1923 at Namasagali, about 80km downstream of the lake outfall, an Agreed Curve was established, which described the natural relation between lake levels measured at the Jinja gauge and simultaneous measured outflows from the lake. Since 1954 (when the Nalubale Dam was completed), water flow from the lake has been constrained to mimic the natural outflows from the lake using a rating "Agreed Curve" that correlates the flow of the Nile at the source with Lake Victoria water level

3.5.3 Nile Basin Cooperative Framework Agreement

The Nile Basin countries embarked on the process of negotiating and developing a new agreement for the sustainable management and development of the shared Nile water resources in the 1990s. This process is still on-going and it is envisaged that once these negotiations are successfully concluded, the resulting agreement will supersede all the existing Nile water agreements. (NELSAP, 2012)

3.5.4 The Lake Victoria Basin Commission

The Lake Victoria Basin Commission which was established under article 33 of the "Protocol for Sustainable Development of Lake Victoria Basin" has a broad function of promoting, facilitating and coordinating activities of different actors towards sustainable development and poverty eradication of the Lake Victoria Basin. These activities include catchment management interventions among others.

3.6 International Conventions

3.6.1 Ramsar Convention (1971)

The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty that commits member countries to maintain the ecological character of Wetlands of International Importance and to plan for the "wise use", or sustainable use, of all of the wetlands in their territories. The Convention's mission is "the conservation and wise use of all wetlands through local and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world. "The wise use of wetlands is defined as "the maintenance of their ecological character, achieved through the implementation of ecosystem approaches, within the context of sustainable development." Uganda signed the Convention on the 4th July 1988. It currently has 12 Ramsar registered wetland systems, representing a combined area of 454,303ha.

3.6.2 UN Framework Convention on Climate Change (UNFCCC) and related Kyoto Protocol

Uganda ratified the UNFCCC in 1993 and is one of the Least Developed Countries (LDCs). The First National Communication to the UNFCCC was developed in 2002. A Climate Change Policy was launched in 2012, with a related prioritisation of outputs under a short (1-5 years), medium (6 to 10 years) and long-term (10-15 years) timeframes. The priorities in the National Climate Change Policy have been integrated in the Second National Development Plan (NDP II) 2015/16 – 2019/2020.

3.6.3 UN Convention on Biological Diversity

The Convention's main objective is to ensure the conservation of biological diversity and sustainable use of its components. The study process should undertake thorough investigation of the sites and come up with lists of biodiversity in the areas and available information indicate that none of the groups are threatened, rare or

vulnerable, hence no impact of the project on such groups.

3.6.4 International conventions for shared water resources

There are a number of international conventions relating to management of shared water resources with which Uganda must comply. Currently, the key conventions/organisations to which Uganda is party are; the Protocol for Sustainable Development of Lake Victoria Basin and Nile Basin Initiative referred to in section 3.5.3 above.

3.7 The institutional context

3.7.1 National Level

The Ministry of Water and Environment (MWE) plans and coordinates all water and environmental sector activities and is the ultimate authority responsible for water resources and environmental management in Uganda. The MWE has the overall responsibility for setting national policies and standards related to water and the environment, managing and regulating all water resources and determining priorities for water development and management. The MWE is divided into three directorates: Directorate of Water Resource Management (DWRM), the Directorate of Water Development (DWD), and the Directorate of Environmental Affairs (DEA).

The DWD has the responsibility for providing overall technical oversight for the planning, implementation, and supervision of the delivery of urban and rural water and sanitation services across the country including water for production. It is responsible for regulating the provision of water supply and sanitation and the provision of capacity development and other support services to Local Governments, Private Operators and other service providers. The Directorate comprises of three Departments: Rural Water Supply and Sanitation, Urban Water Supply and Sanitation, and Water for Production.

The DEA is responsible for environmental policy, regulation, coordination, inspection, supervision and monitoring of the environment and natural resources as well as the restoration of degraded ecosystems and mitigating and adapting to climate change. The DEA comprises of four departments of Environmental Support Services (DESS), Forestry Sector Support Department (FSSD), Wetlands Management (WMD), and the Department of Meteorology (DOM), recently turned into an Authority.

The MWE further works closely with the National Environment Management Authority (NEMA), which is mandated with the coordination, monitoring, regulation, and supervision of environmental management; the National Water and Sewerage Corporation (NWSC) — with the mandate to operate and provide water and sewerage services in the larger urban centers; and the National Forest Authority (NFA), whose mandate is to manage Central Forest Reserves and to supply high quality forestry-related products and services (see Error! Reference source not found.). Other national entities significantly impacted by technical water management issues are the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF); the Ministry of Tourism and Industry (MTI); and the Ministry of Energy and Mineral Development (MEMD). The Ministry of Education and Sports (MES) is responsible for the implementation of Water and Sanitation in schools, and the Ministry of Health (MOH) is responsible for sanitation via the environmental health department.

The Ministry of Local Government (MLG) oversees the implementation of Local Government Development Plans, which include water supply and programmes for the improvement of hygiene and sanitation in institutions and public places. There are a number of development partners, private sector, and NGOs that also act in the water sector providing services, advice, and facilitation. A number of NGOs active in the water sector are coordinated at the national level through the Uganda Water and Sanitation NGO Network (UWASNET), an umbrella organisation largely funded by development partners and the MWE. An outline of organisations directly or indirectly involved in water management is indicated in Figure 3.3.



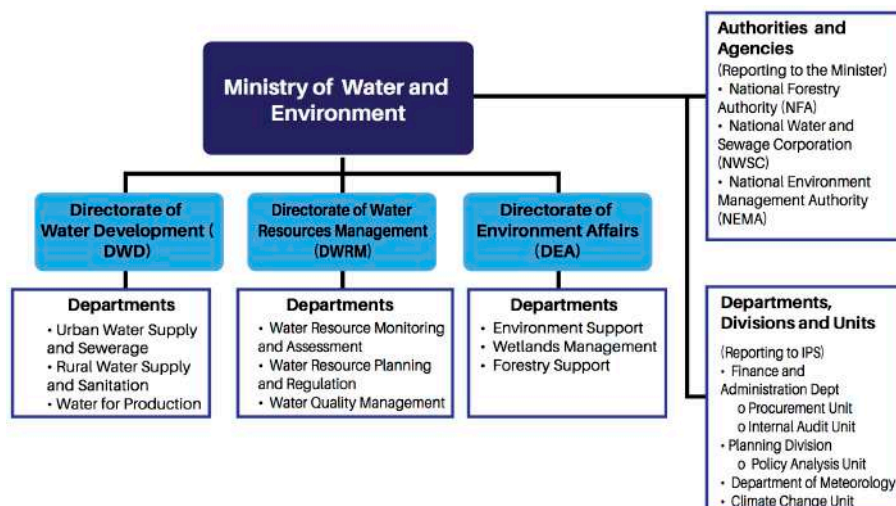


Figure 3.1: Institutional Setup at a National Level (MWE, 2009)

Coordination is a key process for Integrated Water Resources Management (IWRM), which involves multiple stakeholders from different sectors, on different scales, and with different structures and interests. At the national level, the following committees are relevant to integrated water resources management:

- The Policy Committee on Environment: chaired by the Prime Minister, at the highest level of political decision-making
- The Water Policy Committee, which is composed of directors, and enables high-level and strategic dialogue specifically in the water sector
- The IWRM Working group, which is an informal working group enabling technicians to coordinate
- The Water and Environment Sector Working Group (WESWG)
- The Inter-Ministerial Technical Committee regarding Water for Production, comprising members from the MWE, Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), Office of the Prime Minister, National Planning Authority, and Ministry of Finance. It meets on a quarterly basis to coordinate investments and works regarding water for production
- The Wetlands Advisory Group (WAG), which is a technical group dedicated to wetlands. The WAG improves coordination on wetlands issues, particularly on the issue of dry land rice
- The MWE-DWRM has created Water Net, a network for building capacities of stakeholders connected to the water sector.

The National Environment Management Authority (NEMA) is the apex body for environmental law enforcement in Uganda. However, several functions have been delegated to other institutions as lead agencies in their respective fields. NEMA is in charge of

- Review and administrative clearance of environmental evaluations, in conjunction with other lead agencies
- Delivery of permits (for instance, permits for activities within the legal buffer zones of water bodies). The responsibility of delivering permits is vested into the different lead institutions
- Monitoring compliance. The responsibility of control is distributed over 375 gazetted inspectors (2014) distributed in many Ugandan institutions (including the MWE). Only 30 of them belong to NEMA.

An Environmental Police has been formed at NEMA, comprising 25 officers. Only five regional Environmental Police officers (liaison officers) have been designated, among which one is based in Mbale (for the eastern region: his area covers 52 districts corresponding to a quarter of the country) and one in Jinja (for the south-eastern region). The liaison officers belong to the regular police but are specifically trained in environmental issues. They are under the command of the territorial police (Regional Police Commander/District Police Commander). Their functions include sensitisation, demarcation, control, issuing warnings, following up of cases, eviction, and prosecution.

Within each district, there are offices that are in charge of the environment, forestry, wetlands, agriculture, fisheries, planning among others. However, the structure varies from district to district.

3.7.2 Regional Level

As a result of the deconcentration of the management of water resources, DWRM created four Water Management Zones (WMZ) following hydrological boundaries. They operate on regional level with the objective to bring

the central services closer to the stakeholders. Their primary role is to facilitate sustainable development of the water resources for the economic and social benefit of the people in the catchment and to implement the water management measures needed to protect and conserve the catchment and its water resources, ensure sustainability, and reduce or resolve conflicts over resource use.

The DWD established the Water and Sanitation Development Facility (WSDF) as a mechanism for supporting water supply and sanitation facilities for rural growth centres and small towns, intended to promote a demand-responsive approach where Water Authorities/Town Councils or Town Boards apply for funding. The successful applicant is assisted by the WSDF to develop piped water supply systems.

Technical Support Units (TSU) established by DWD at the regional level have the mandate to support capacity building of district-based structures. This involves training, technical advice and support supervision of districts to enable them to effectively implement their roles in the rural sub-sector. The mandate also covers water for production.

Umbrella Organizations (UO) are also regional organisations constituted as associations of the local Water Supply and Sanitation Boards (WSSBs) with the principle objective of providing operation and maintenance (O&M) back-up support (training, technical, legal and organisational support, supervision of rehabilitation, and extension works as well as water quality monitoring).

The DWD has further deployed staff from its Department of Water for Production to the regions while DEA has also established offices for its Wetlands Department on regional level.

These deconcentrated units in the regions are based together for improved cooperation and integration and represent the MWE on regional level.

3.7.3 Catchment Level

During the catchment management planning process, an institutional framework has to be created, which brings the stakeholders together to present and exchange their views and thus give the process legitimacy. Hence, the WMZ establishes Catchment Management Organisations (CMOs), which builds on and utilises to the maximum practicable extent, existing structures and relationships. The CMOs consists of several bodies Figure 3.2:

- **The Catchment Stakeholder Forum (CSF)** brings together all actors on catchment management. The CSF defines key issues related to water resources in the catchment that require consideration in order to effectively protect, manage, and develop water resources. It provides input to the CMP for coordinated, integrated and sustainable development and management of water and related resources in the catchment, including their implementation status
- **The Catchment Management Committee (CMC)** is composed of representatives of all relevant stakeholder groups (government, politicians, and community based organisations, NGOs, water users, media, academic institutions, and private sector) and collaborates with the WMZ during the formulation of a Catchment Management Plan and plays a steering role during its implementation. The CMC responsibilities include: coordination of stakeholder-driven definition of key issues related to water resources, promotion of coordinated planning, and implementation as well as stakeholder-driven decision making related to integrated and sustainable development and management of water and related resources, development of plans for coordinated, integrated and sustainable development and management of water and related resources. It endorses the CMP and presents it to the Catchment Stakeholder Forum for information purposes. The CMC acts as an Executive Board for the Catchment Management Organisation.
- **The Catchment Management Secretariat (CMS)** provides support to the Catchment Management Committee in coordinating the planning and implementation of activities in the catchment as well as following up of recommended actions by the stakeholders. The CMS acts as an administrative secretariat for the Catchment Management Committee as well as the Catchment Technical Committee.
- **The Catchment Technical Committee (CTC)** forms the technical arm of the CMO and supports the CMC in their tasks. The CTC brings technical expertise and knowledge during the formulation of the Catchment Management Plan, operationalises and sometimes implements programmes and projects from the plan, and generally ensures that the different districts collaborate to implement the plan. It comprises of technical people from government, NGOs, private sector, development agencies, and other relevant organisations in the catchment.

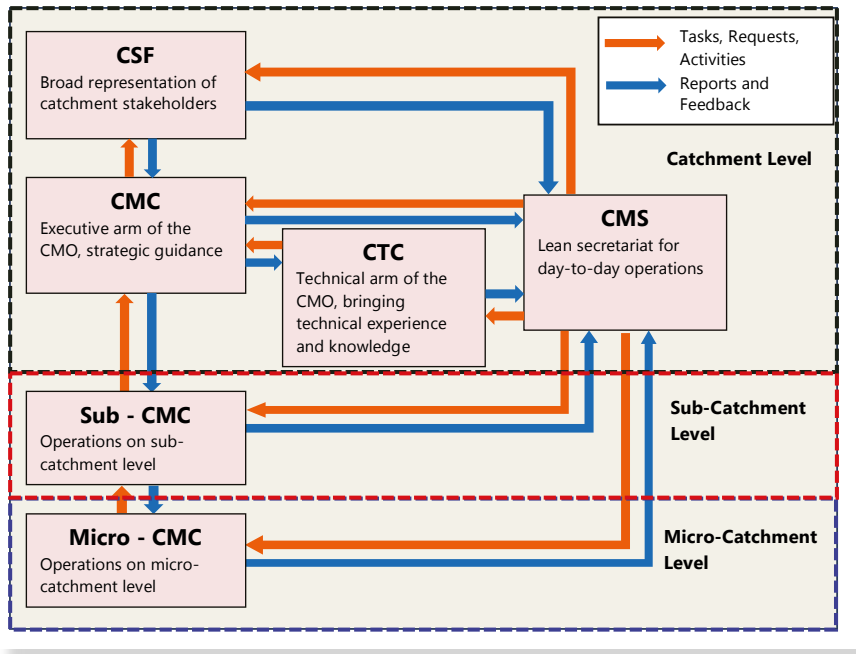


Figure 3.2: Catchment Management Organisation Structure (DWRM)

Other relevant institutions on the catchment level are:

- At the District level, the District Natural Resources Department (including the District Environment Office District Forestry Office, and District Wetlands Office), District Works or Engineering Department under which the District Water Office falls, District Production Department with the District Agricultural Office, District Veterinary Office and District Fisheries Office, District Planning Department, Department of Community Based Services, District Information Department, and District Health Department are key in the implementation of the CMP. However, the structure varies from district to district according to the natural conditions in the district
- Policies at national level are translated into Sector Development Plans, which are implemented at district level under the Decentralization Policy. Most districts have 5-year district development plans in which all sector plans are integrated. Natural Resources Management activities are mandated to be implemented by every district
- Sub-counties
- CBOs and CSOs,
- Water User Associations etc.

Additionally, there are a number of private sector and NGOs, which also act in the water sector, providing services, advice and facilitation. They work on catchment and regional level or sometimes combine the two. Many of these NGOs are coordinated at the national level through the Uganda Water and Sanitation NGO Network (UWASNET), an umbrella organisation largely funded by development partners and the MWE.



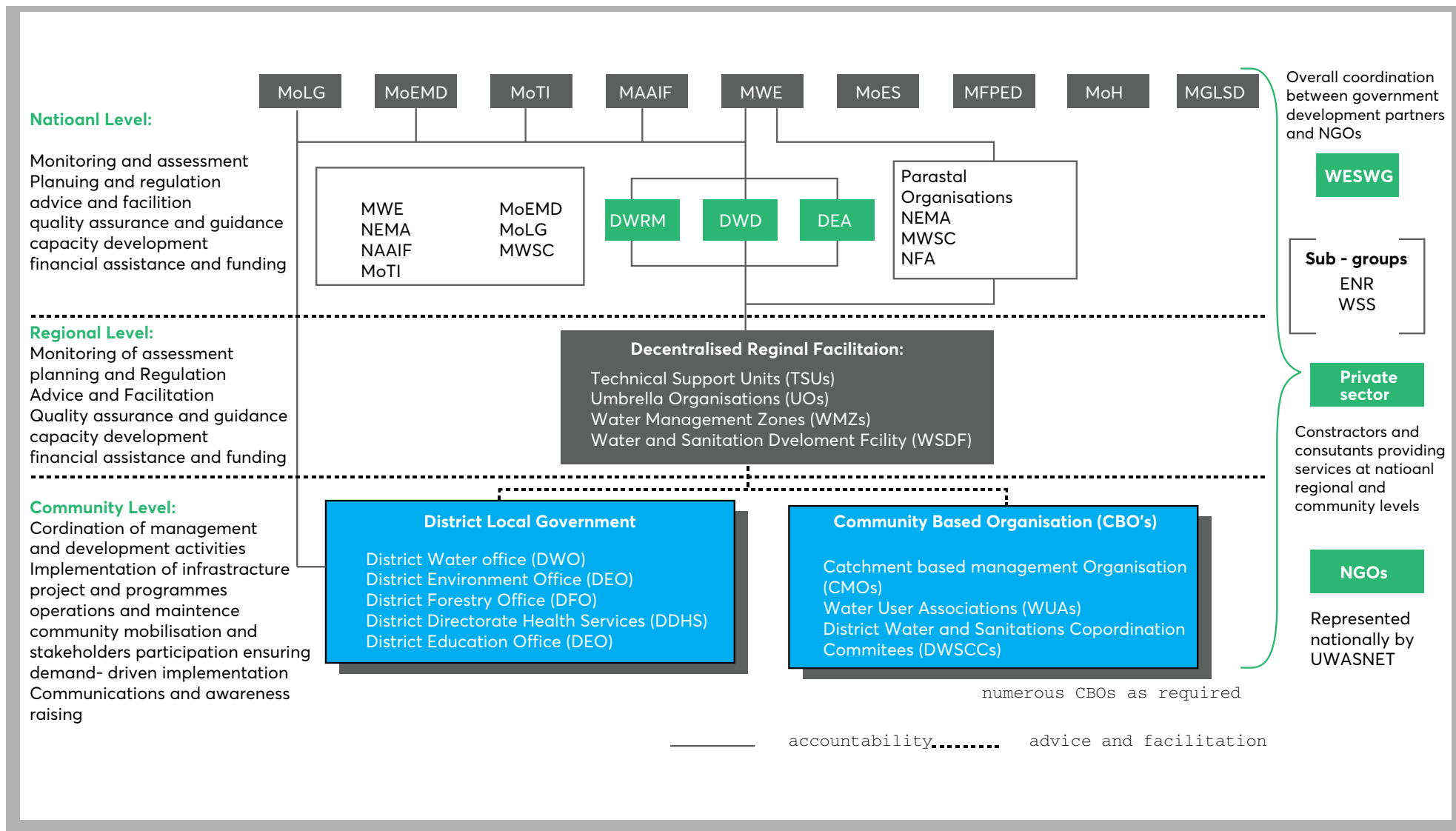


Figure 3.3: An Overview of Uganda’s Water and Environment Sector (MWE, 2009)

3.7.4 Institutional Issues

Water resources management in Uganda continues to face some institutional challenges, mainly related with technical capacity, coordination, and enforcement of rules. Table 3.1: Institutional issues and implications highlights some of these challenges.

Table 3.1: Institutional issues and implications

Issues	Background and Implications
Technical Capacity in local authorities	Limited capacity in institutions on local level with limited knowledge base. This has an impact on development and service delivery.
Coordination and cooperation between institutions	Development initiatives by respective institutions are planned independently. Lack of coordination leads to inefficient use of water resources and lack of resource protection.
New institutional framework in water management	CMOs are being established. More direct interaction on local level with institutions will create more awareness and integration. Required capacities are being transferred to the zones.
Water user participation	Formal stakeholder forums are not established yet. Some water sector committees such as water and sanitation advocacy committees need to be expanded. Water sector user groups lack capacity and information on good management practices.
Law enforcement	Limited capacity and political will to enforce legislation leads to degradation of natural resources.
Development of Catchment Management Plans	It is vital that CMPs are implemented to achieve sustainability. All parties need to reach agreement on actual accountability, actual monitoring and actual enforcement as it is here where success or failure of initiatives will be determined.



and livestock grazing are the most widespread activities in the Victoria Nile-Lumbuye Catchment. Agriculture employs over 95% of the population. More than half of the total land area is used for cultivation since a large majority of the population is rural, and directly dependent on agriculture.

4.2 Administrative Context and Population

The catchments cover wholly or partially, 9 districts of Buikwe, Buyende, Iganga, Jinja, Kaliro, Kamuli, Kayunga, Luuka, and Mayuge with a total population of about 2,326,958 habitants (source: National Population and Housing Census 2014, provisional results. UBOS). The population densities of these catchments are amongst the highest in the Kyoga Water Management Zone; population figures and annual growth rates are presented in Table 4.1. According to the National Census of Population and Housing in 2014¹, population growth rates in both catchments are generally high, far above 2% a year, with higher population growth rates in the southern parts of both catchments (Figure 4.2) along a corridor extending from Jinja through to Iganga. This high population growth is being driven in part by the increasing need for unskilled agricultural labor, in particular in areas where smallholder cultivation of sugar cane and rice are prevalent. Sugar cane outgrowers are most commonly found in areas within 40 km of sugar factories in Jinja, Kamuli, Kakira and Kaliro, primarily due to the economy of transport costs. Smallholder rice cultivation is most prevalent in areas from north of Jinja to Luuka and eastward to Mbale, in particular in and adjoining almost all wetlands. The growing population in the catchment exerts increasing pressure on water and land resources, resulting in increasing degradation of the environment. High population growth also leads to increased exploitation and destruction of ecosystem resources.

Table 4.1: Districts and population in Victoria Nile-Lumbuye Catchment

District	Catchment	Pop. 2014	Annual Growth rate 2002-2014
Buikwe	Victoria Nile-Lumbuye	205,157	2.33
Buyende	Victoria Nile-Lumbuye	243,836	4.30
Iganga	Victoria Nile-Lumbuye and Mpologoma	160,210	2.95
Jinja	Victoria Nile-Lumbuye	397,913	1.58
Kaliro	Victoria Nile-Lumbuye and Mpologoma	110,066	3.55
Kamuli	Victoria Nile-Lumbuye	490,255	2.54
Kayunga	Victoria Nile-Lumbuye	343,622	1.90
Luuka	Victoria Nile-Lumbuye	230,719	2.20
Mayuge	Victoria Nile-Lumbuye and Mpologoma	145,180	3.24
Total / average		2 326 958	2.64



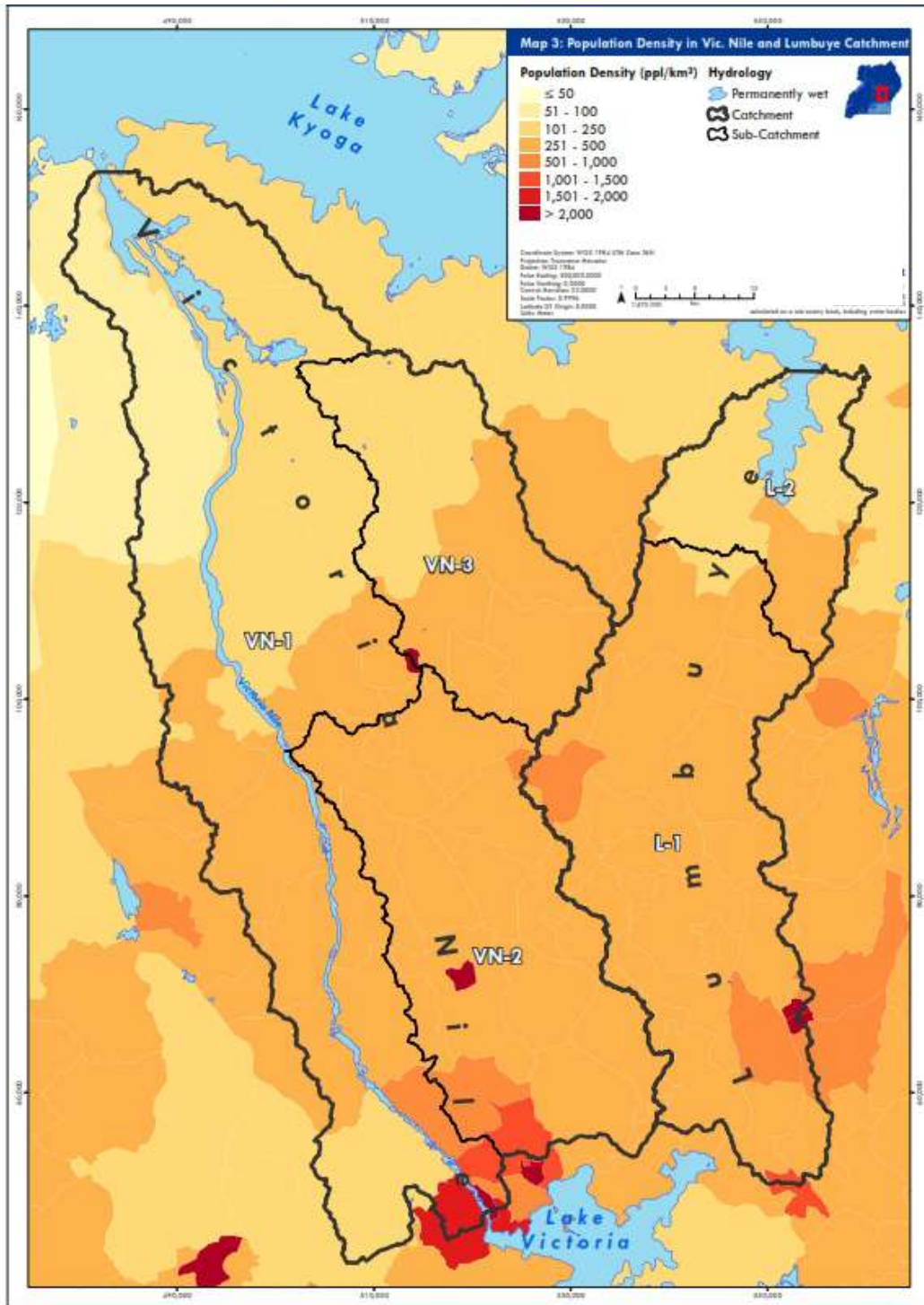


Figure 4.2: Population Density in Victoria Nile-Lumbuye Catchments

4.3 Delineation of the catchment

The catchment has been divided into smaller units (sub-catchments) presented in the following map. This delineation into sub-catchment is necessary in order to do the water resources – water demand balance analysis. An analysis at the catchment scale could hide issues and water stress situations. The delineation of the sub-catchments must at the same time:

- Be precise enough to allow capturing the situation in term of water resources-water demand balance in the different parts of the catchments
- Take into account the data available. Having too small sub-catchments would not make much sense if the estimations done on water demand cannot be made available at the same level of detail, and if available data on water resources available are too scarce. Although some assessment is done for ungauged catchments, divide the overall catchments in too many pieces does not really make sense if there is too much uncertainty on the estimations made.

Table 4.2: Delineated Sub-Catchments

Catchment	Code	Name of the sub-catchment	Description of the Sub-catchment	Remark
Lumbuye	L-1	Upper Lumbuye	Upstream part of Lumbuye, from the sources to the gauging station 82253	The upper sub-catchment will correspond to a catchment where Lumbuye functions as a river, whereas the downstream part is where river Lumbuye reach a flood plain/wetland system (Ramsar site).
Lumbuye	L-2	Lower Lumbuye	Downstream part of Lumbuye catchment, from the gauging station to the outlet	
Victoria Nile	VN-1	Nile	Nile sub-catchment, from Lake Victoria to Lake Kyoga	This sub-catchment correspond to the Nile River, from Lake Victoria to Lake Kyoga, apart from its two main tributaries. We propose not to divide this catchment into more pieces as inflow from the Kiko and Nabigaga Rivers will be negligible compared to the overall flow of the Nile, and won't have a significant impact on the overall water resource available from the Nile River.
Victoria Nile	VN-2	Kiko	Kiko sub-catchment (tributary of the Nile)	Kiko river is one of the main tributaries of the Nile between Lake Victoria and Lake Kyoga.
Victoria Nile	VN-3	Nabigaga	Nabigaga sub-catchment (tributary of the Nile)	One of the main tributaries of the Nile between Lake Victoria and Lake Kyoga



4.4 Topography

The Victoria Nile and Lumbuye catchments have rich and diverse topographic features, climatic conditions, ecosystems, and other natural resources, which include freshwater lakes, rivers, wetlands, fisheries, forests, wildlife, minerals, and soils that support different agricultural systems. Parts of Kaliro, Luuka, Kamuli, Kayunga, and Buyende districts located in the Victoria Nile-Lumbuye Catchment consist of various landscapes, water bodies

and wetlands. The land surface is generally relatively flat, with gentle undulating hills and a few isolated higher residual features with almost flat valleys. Much of the low-lying areas are drained by seasonal streams into Lake Kyoga in the north, and through tributaries to rivers like Sezibwa in the east, Lugogo on the west, south west and south, and Kafu to the northwest.

4.4.1 Geology and soils

The wetland systems are composed of the following soil classes: 1) Gleysols, and 2) Histosols. Gleysols are soils frequently developed under depression areas and low landscape positions with shallow groundwater, which therefore render it appropriate for wetland rice cultivation. Histosols are composed of soils formed in organic material, frequently under papyrus vegetation. It is desirable to protect and conserve such fragile lands because of their intrinsic value (especially their common function as sponges in regulating stream flow and in supporting wetlands containing unique species of animals) and because prospects for their sustained agricultural use. The most common form of erosion is the rill and sheet erosion, as most of the land in the catchments is heavily cultivated. Gullies are also common in the overgrazed areas in Luuka and Kaliro. Soil erosion is responsible for the sedimentation in rivers, streams and wetlands and blocking culverts leading to floods. Rill and sheet erosion are prevalent in Kigulu, Bugweri, and southern sub-counties of Luuka District.

4.4.2 Climate

The National Water Resources Assessment report using the Thornthwaite Climate Classification System categorised the catchment as dry sub-humid and with a significant water surplus during the rainy seasons and water deficits during the dry season (NWRA Report, 2013). Rainfall distribution in South-Eastern Uganda is bimodal. It allows two crops annually and adequate grazing for livestock throughout the year. There is a long rainy season from March to May and a short one from October to November. Basing on 1901-2013 period from GPCC database, the annual rainfall averages are about 1370mm in the catchments. The figure below (sources: GPCC, Climwat) gives the average rainfall and potential evapotranspiration in the Lumbuye and Victoria Nile catchments over 65 years.

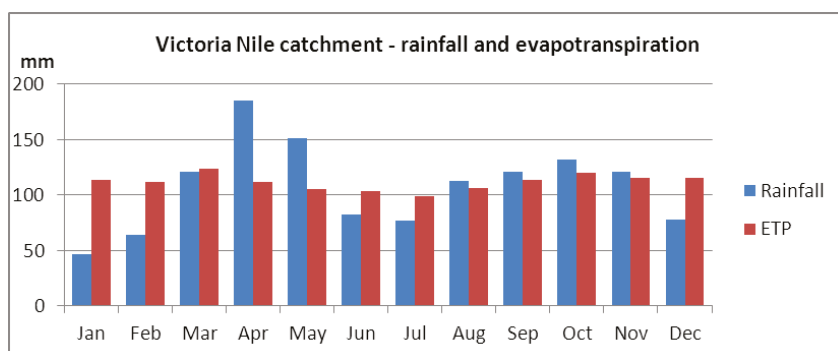


Figure 44: The average rainfall and potential evapotranspiration in the Lumbuye and Victoria Nile catchments over 65 years. Sources: GPCC, Climwat

4.4.3 Surface water

In the Victoria Nile Catchment, the Nile must be differentiated from other rivers. From a global point of view, the flows from the Victoria Nile tributaries have little impact in the overall inflow from the Nile to the Lake Kyoga. When looking at the scale of the whole Victoria Nile Catchment, water resources is plentiful and much higher than water demand. However, this resource is concentrated in the River Nile and looking at finer scale shows different conclusions.

Reference source not found. below presents the flow of the River Nile differentiated data from Mbulamuti Station (in blue) and gap filled data, using results of Multi-sector Investment Opportunity Analysis study (NELSAP, 2011).



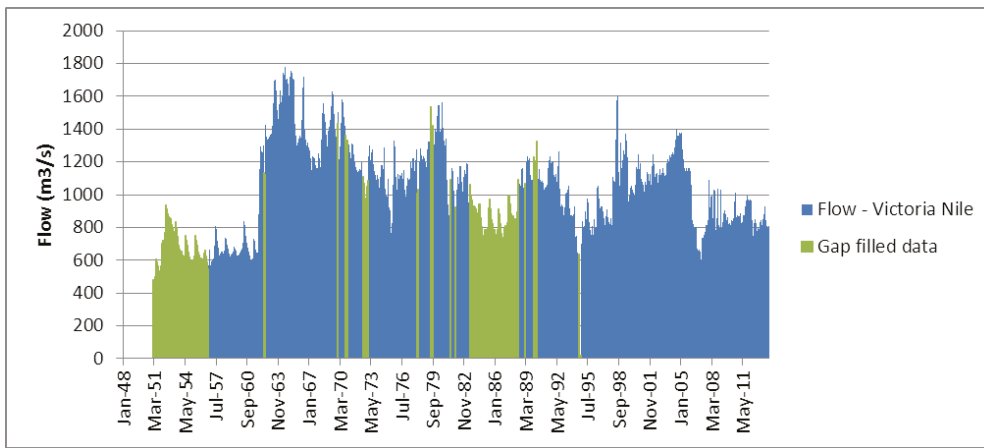


Figure 4.5: Flows of the Victoria Nile Catchment

Figure 4.6 shows the monthly flows for the three sub-catchments of the Victoria Nile Catchment (upper graph) and excluding the Nile River (lower graph). Figure 4.7 shows the monthly flows in the Lumbuye Catchment. Due to the huge reservoir constituted by Lake Victoria, flows of the Nile (VN1) remain quite stable all year round and flows during the dry season are not more than 10% lower than flows during the wet season. For the other sub-catchments (VN2, VN3 as well as L1 and L2), intra-annual variability is much higher, with clearly marked dry and wet seasons.

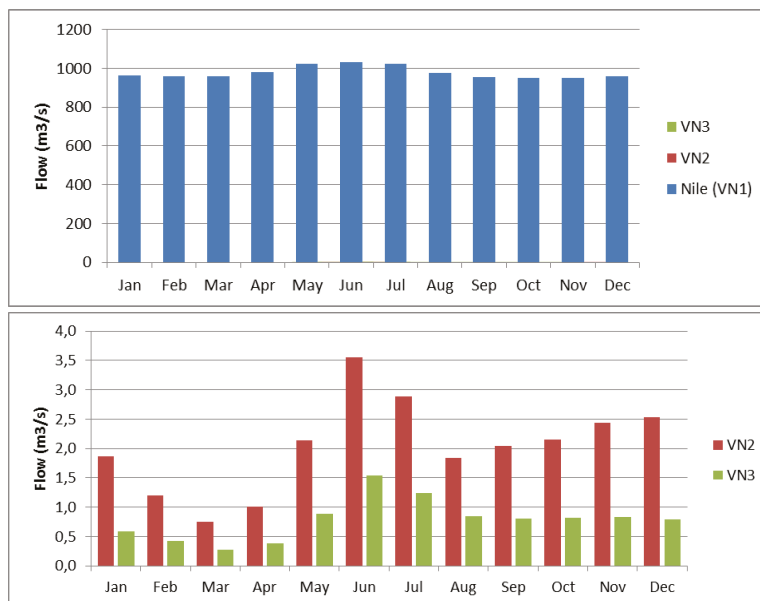


Figure 4.6: Average monthly flows in the Victoria Nile Catchment

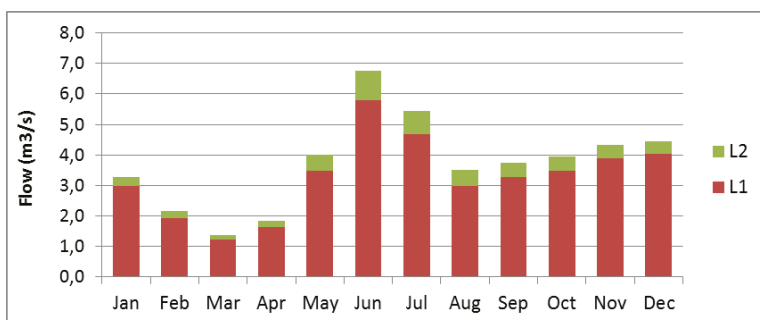


Figure 4.7: Average monthly flows in the Lumbuye Catchment

The following table presents flow characteristics at key points of the Victoria Nile and Lumbuye catchments

Table 4.3: Hydrological characteristics of sub-catchments in Victoria Nile and Lumbuye catchments

	VN1 (Nile River)	VN2	VN3	L1	L2
Area (km ²)	-	964	641	1163	373
Mean Annual runoff (in m ³ /s)	10243	2	0.8	3.32	0.5
Mean specific annual runoff (mm/year)	-	50-75	35-45	75-100	25-50
Runoff Coefficient (annual average)	-	5%	3%	7%	3%
Mean monthly flow (average, in m ³ /s)	912	0.6	0.2	1.0	0.1

4.5 Groundwater

The average borehole yields in the Victoria Nile-Lumbuye Catchment are below 4m³/hr for all geological formations, whereas Lumbuye has better yielding boreholes than Victoria Nile. This interpretation may be biased by a few outliers, as Lumbuye has a highest borehole yield of 51m³/hr and Victoria Nile of 25m³/hr. Boreholes in Victoria Nile are deeper than in the Lumbuye Catchment (61 metres below ground level, and 52 metres below ground level, respectively). Drilling depths vary from less than 15 metres to more than 125 metres. Borehole depths are, overall, between 50 metres and 75 metres. Of recent, more effort has been made to explore aquifers beyond the average maximum drilling depths of 80m. Aquifers have been encountered at depths of 120 metres to 150 metres in the Lumbuye and Victoria Nile catchments as well. Main water strikes are mostly over 40 metres in the Lumbuye Catchment, while the north-most section has slightly lesser main water strikes, at between 30 metres and 40 metres. In the Victoria Nile Catchment, main water strikes are overall lower, at less than 25 metres in the central and lower half of the catchment, whereas the northern one-third of the Victoria Nile Catchment has main water strikes below 30 metres below ground level.

The Victoria Nile Catchment has better borehole yields (around 5m³/hr) in the central part of the catchment at relatively shallow depths, with dry to low yielding boreholes with deep water strikes in the northern part of the catchment towards Lake Kyoga. Static Water Levels (SWL) are only greater than 30 metres in the northern part of the Victoria Nile. The Lumbuye Catchment does not show a distinctive pattern in terms of yield or drilling depth, while SWLs are increasing towards the north but remain below 30 meters in the northern part of the catchment. The areas near the shores of Lake Kyoga, in Kamuli and Kaliro, have saline groundwater, above the guideline value in Uganda of 1000mg/L or acceptable maximum of 1500mg/L. This affects the water quality in the Lumbuye Catchment. Iron content is over the maximum allowable concentration of 2mg/litre in the north-most corner of the Lumbuye Catchment. Similarly, in the Lumbuye Catchment, with an average pH of 6.2, groundwater is below the standards for urban treated drinking water. In areas where success-rates are known, most of the Victoria Nile Catchment is characterised by a low groundwater potential (less than 50%). In the Lumbuye Catchment, success-rates are 50-75%, but there are challenges with water quality in the northern part.

The exploitable groundwater of the aquifer systems in the catchment has been estimated in different studies. For Victoria Nile, it varies from 37.9mcm/year (JICA, 2011) to 157.7mcm/year (NWRA, 2013). For Lumbuye, it varies from 18.3 mcm/year (JICA, 2011) to 74.5mcm/year (NWRA, 2013). Based on the above reported quantities, the exploitable groundwater is adequate to sustain the long term resource development for domestic rural water supplies. Only a few areas are groundwater stressed. Urban water supply can also be served with groundwater, especially in view of the good groundwater quality and related low treatment costs. Table 4.4 gives the overview of groundwater consumed and/or discharged in the catchment

Table 4.4: Groundwater consumed and/or discharged in m³ per year in the Victoria Nile-Lumbuye Catchment

Sub-catchments	Rural groundwater abstraction							Urban groundwater abstraction	Total groundwater abstraction	
	No. of deep boreholes	Total abstraction / day (1)	No. of protected springs	Total abstr. / day (2)	No. of shallow wells	Total abstr. / day (3)	m ³ consumed and/or discharged		Total abstraction / year from production wells	Total groundwater abstraction / year - Rural and urban combined
							per day	per year		
Lumbuye	7	4,215	272	6,528	374	935	11,678	4,262,470	6,500	4,201,263
L-1	636	3,180	271	6,504	357	893	10,577	3,860,423	6,500	3,823,488
L-2	207	1,035	1	24	17	43	1,102	402,048	-	377,775
Victoria Nile	1,449	7,245	440	10,560	1,001	2,503	20,308	7,412,238	225,000	7,534,308
VN-1	666	3,330	154	3,696	324	810	7,836	2,860,140	35,000	2,869,408
VN-2	517	2,585	282	6,768	605	1,513	10,866	3,965,908	85,000	3,975,535
VN-3	266	1,330	4	96	72	180	1,606	586,190	105,000	689,365

Assumptions:

- (1) 1 hand-pump equipped deep borehole abstracts 5m³/day
- (2) 1 shallow well abstracts 2.5m³/day
- (3) 1 protected spring discharges 24m³/day

Comparing the current groundwater consumed per catchment in Table 4.4 with the total exploitable volume (based on Ugandan part), it follows that in the Lumbuye Catchment, currently, 6-23% of the exploitable groundwater volume is abstracted. Similarly, in the Victoria Nile Catchment, currently 5-20% of the total exploitable volume is abstracted (based on NWRA and JICA study, respectively).

Figure 4.8 shows the sustainable rates of groundwater utilisation per district, projected to 2030, expressed as the proportion (%) of the available resources. It shows that the demand for domestic water in rural areas and small towns can overall safely be met by groundwater where the utilisation rate is less than 15%, indicated by the various shades of green in the picture. The estimated renewable groundwater resource exceeds the projected demand for domestic water throughout the catchment, but shortages may arise in areas with a high population density (National Water Resources Assessment, 2013).





Figure 4.9: High yielding boreholes in the Victoria Nile-Lumbuye Catchment

Further development of groundwater resources for town water supplies and small irrigation systems can be successfully realised if appropriate budgets for hydrogeological and geophysical investigations and drilling programmes are used. High yielding boreholes in the catchment have been drilled based on the results of detailed hydrogeological and geophysical targeting fractured aquifers through a combination of horizontal resistivity profiling and vertical electrical soundings. Groundwater monitoring programmes should be designed and implemented simultaneously. The map below (Figure 4.8) shows the groundwater potential yields.

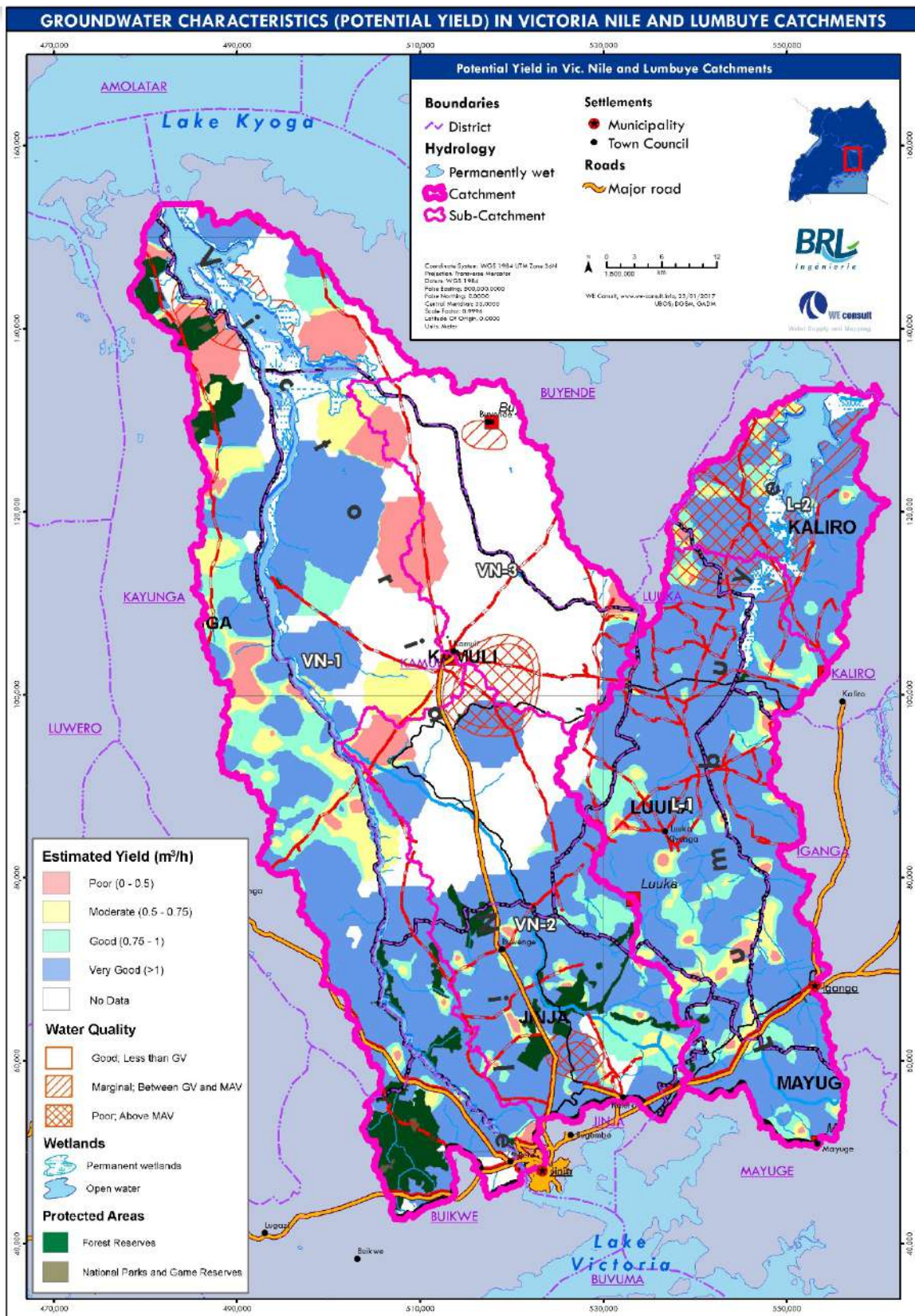


Figure 4.10: Groundwater characteristics (potential yields) in the Victoria Nile-Lumbuye Catchment

Groundwater can safely provide a substantial part of livestock drinking water needs. Table 4.5 presents livestock water demand for the main types of livestock (cattle, goat, sheep, pig and chicken), calculated based on the National Livestock Census report (UBOS, 2008).

Table 4.5: Estimates of water demand for livestock at sub-catchment level

Sub-catchment	Livestock Water demand (Mm ³ /year)
Nile (VN-1)	2.3
Kiko (VN-2)	1.3
Nabigaga (VN-3)	0.7
Upper Lumbuye (L-1)	1.7
Lower Lumbuye (L-2)	0.5

Comparing these figures with the exploitable groundwater potential, it follows that groundwater can safely provide a substantial part of the livestock drinking water needs. However, in view of the prevailing yields of boreholes in the catchment, the volumes of water required for irrigation and commercial livestock watering are too high to be economically covered by groundwater development.

The aquifers near the shores of Lake Kyoga contain water with high TDS values. In the rest of the catchment, the water is generally of good quality. The main challenge to groundwater quality in the catchment is pollution from wastewater. In view of the population growth and increasing urbanisation, a double effort should be developed:

- a) A water quality and water level monitoring plan should, therefore, be implemented for each piped groundwater scheme
- b) Sewerage planning for urban communities as soon as piped water supply is developed.

As a summary, in the Victoria Nile-Lumbuye Catchment, boreholes are the predominant source in almost all sub-catchments. Only in Kiko sub-catchment (VN-2), shallow wells are predominant. In the Lumbuye Catchment, the source density is much higher in the upper part (L-1) with 1.12 sources/km² than in the lower part (L-2) with 0.62 source/km². In the Victoria Nile Catchment, the highest source density is in Kiko sub-catchment (VN-2) with 1.53 sources/km². These densities are not alarming from a recharge point of view. If one considers a hand pump, shallow well or protected spring abstraction of approximately 5m³/day per borehole, then densities of approximately 15-20 boreholes per km² can be developed in a sustainable way based on the sustainable recharge figure as per the National Water Resources Assessment. Special attention should be paid to areas where high yielding boreholes are used for town water supplies.

4.6 Surface water quality

Based on theoretical approach, the estimation of pollution loads has been done for wastewater, urban runoff, and agriculture. Available water quality data did not permit to confirm the estimation of pollutants as the number and frequency of measures are insufficient

Table 4.6: Pollution loads on the sub catchments of the sub-catchments

Sub catchment	BOD (ton per day)	TSS (ton per day)
L-1	49	242
L-2	12	62
VN-1	68	334
VN-2	43	209
VN-3	27	139

According to the estimation of pollution on the sub catchments, the sub catchments most at risk are:

- In Victoria Nile Catchment, the sub-catchment VN-1,
- In Lumbuye Catchment, the sub-catchment L-1.

Globally, the higher pollution loads come from non-urban run-off. The Lumbuye and Victoria Nile catchments suffer mainly from pollution caused by agricultural run-off. This is coherent with land use in the catchments. This pollution is yet difficult to control and manage. The BOD loads are partly (between 15% and 18%) caused by the lack and

inadequacy of sanitation facilities, which is coherent with currently observed sanitation facilities coverage in the sub-basins. Urban run-off causes low pollution, which is coherent with land use in the catchments: built-up areas represent less than 1% of sub-basin area. It should be noted that during the dry seasons, little pollution is released from run-off and most of the pollution is due to the lack or inadequacy of sanitation facilities.

For the purposes of reducing pollution for drinking water supply, measures for improvement should be the following:

- Implementation of sanitation facilities for urban and rural population as well as industries
- As mostly water sources are surface water and the main quality problem is turbidity, adequate drinking water treatment plants should be implemented to reduce pollution and provide drinking water achieving standards of drinking water quality
- Introducing good land-use practices (education of population).

4.7 Flood and droughts

According to the Natural Water Resources Assessment Report (2013), flooding in Uganda tends to occur more often during the short rain period (October - November), which has a higher frequency of extreme rainfall. The heavy rainfalls during the short rains are often associated with El Niño events. Various human factors can aggravate extreme rainfall, such as back-water effects, blocked drainage channels, deforestation and urbanisation. Main droughts registered in the country occurred in following years: 1967, 1979, 1987, 1998, 1999, 2002, 2005, 2008, and 2011. These mainly affected the north-eastern part of the country, in Karamoja region (Emergency Event Database, Centre for Research on the Epidemiology of Disasters).

In order to support flood risk reduction activities in the Kyoga Water Management Zone, in December 2013, the German Development Cooperation (GIZ), the International Institute of Rural Reconstruction (IIRR), and the Ministry of Water and Environment through the Directorate of Water Resources Management partnered to implement the "Flood Risk Management in the Kyoga WMZ" project. The cooperation supported the development and implementation of flood risk management activities that help affected communities and local institutions improve their resilience and adaptive capacities towards extreme weather events like floods (GIZ, IIRR, 2014). In addition to this approach, the project contributed to the implementation of 14 hydrological stations with telemetry facilities to generate data on water levels and enhance community preparedness to flood risks. Sustainability of the stations is still a challenge.

4.8 Water demand and water balance

Water demand for the different uses (irrigation, livestock, water supply, and industry) has been estimated for each sub-catchment. In the Lumbuye Catchment, the total water demand is about 41mm³/year. Irrigation is by far the main water use (more than 80%). In the Victoria Nile Catchment, the total water demand is also about 41mm³/year. It should be noted that most of the irrigation requirements are for informal irrigation estimated as 4,620ha in the Victoria Nile Catchment and 11,450ha in the Lumbuye Catchment. This type of irrigation takes place in wetlands for paddy rice production. In comparison, formal irrigated area in wetlands is very low and represents only 90ha in the Lumbuye Catchment and 2,340ha in the Victoria Nile Catchment. In the Victoria Nile Catchment, irrigation represents almost more than 80% of the total water demand.



Table 4.7: Water resources and water demand per sub-catchment

Water Resources				Water demand per sub-catchment				
in Mm3	Groundwater	Surface WR of the sub-catchment	Overall surface water resources in the river at the sub-catchment outlet	Irrigation	Total water supply	Livestock	Industry	Total water demand
L1	18.3	111	111	5.14	4.26	1.69	0.07	11.16
L2		16	127	28.24	0.75	0.49	0.29	29.77
Total Lumbuye	18.3		127	33.37	5.02	2.18	0.36	40.93
VN1	37.9	32307	32307	11.1	5.08	2.25	0.13	18.61
VN2		69	69	8.8	4.15	1.27	0.10	14.36
VN3		27	27	4.4	1.72	0.72	0.05	6.90
Total Victoria Nile	37.9		32403	24.4	11.0	4.2	0.3	39.9

On an annual basis, water resources are largely sufficient to meet the demand in all the different sub-catchments. The Table 4.7 below compares the water resources and water demand in each sub-catchment on an annual basis.

However, when the intra-seasonal flow variability is taken into account, some difficulties become visible. In the Victoria Nile Catchment, deficits are limited to relatively short periods, and seem to mainly occur in March, which is a month when irrigation requirements are high and when flows still haven't gone up before the rainy season. In the Lumbuye Catchment, deficits principally occur from January to March, but are also encountered in other months, especially in the sub-catchment L2. When minimum flow requirements are taken into account, the deficits are more frequent and last longer.

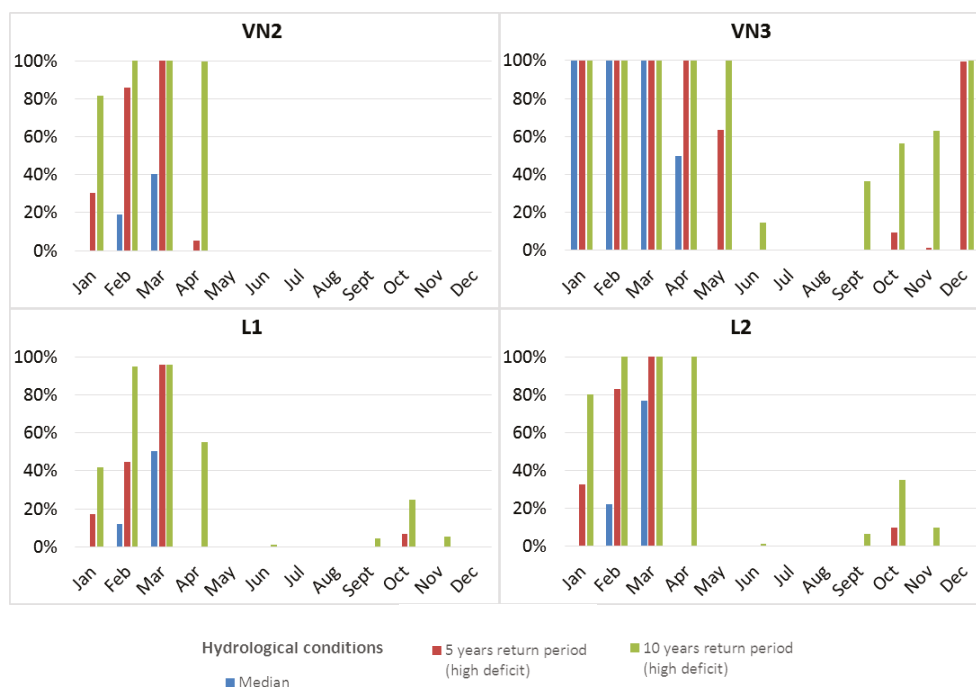


Figure 4.11: Share of the monthly water demand (in % of the total demand), which can't be satisfied by under different hydrological conditions – Victoria Nile and Lumbuye catchments, with minimum flow requirements

4.8.1 Frequency of deficits

On an annual basis, water resources of the Victoria Nile and Lumbuye catchments are generally sufficient to meet the current water demand. However, when the intra-seasonal flow variability is taken into account some difficulties to meet the demand become visible. Table 4.8 sums up the number of years² and months when the water resources are unable to meet the demand. Most of the sub-catchments experience years when water demand exceeds water resources available; however, the period of deficit is generally limited in time and deficits concentrate during a few months.

²A year is counted as "with difficulty to meet the demand" if during one month or more during this year water demand exceeds water resources.

Table 4.8: Occurrence of difficulties to meet the demand in Victoria Nile and Lumbuye catchments

Catchment or sub-catchment	No minimum flow requirement		With minimum flow requirement	
	Number of years with difficulties to meet the demand (over a total of 60 years)	Number of months with difficulties to meet the demand (over a total of 720 months)	Number of years with difficulties to meet the demand (over a total of 60 years)	Number of months with difficulties to meet the demand (over a total of 720 months)
VN1	0	0	0	0
VN2	7 (12%)	15 (2%)	127 (17%)	39 (65%)
VN3	20 (33%)	44 (6%)	303 (40%)	60 (100%)
L1	39 (65%)	60 (8%)	170 (22%)	51 (85%)
L2	60 (100%)	269 (35%)	339 (44%)	60 (100%)

4.8.2 Climate change and water resources

The impact of climate change on the surface water resources available was assessed as part of the water resources assessment. Six climate change scenarios were tested, they correspond to the running of greenhouse gases emission scenarios A1B, A2, and B1 (from the 4th IPCC assessment) combined with two different Global Circulation Models (GCM) ECHAM5 and HadCM3. The impact of climate change on the water resources was integrated in the water resources – water demand balance analysis and Figure 4.13, Figure 4.12 compare the annual water demand-water resources balance under current climate and under the most optimistic and most pessimistic of the different climate change scenarios tested.

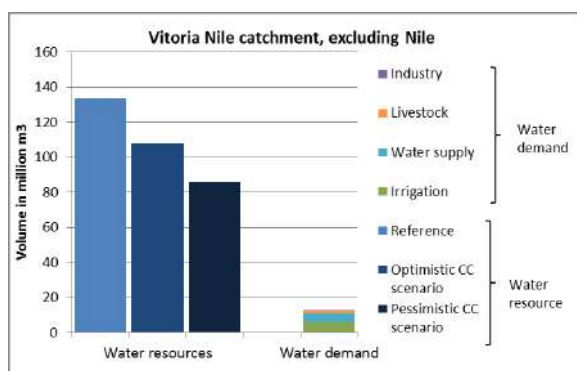


Figure 4.12: Comparison of current and future monthly rainfall for Victoria Nile

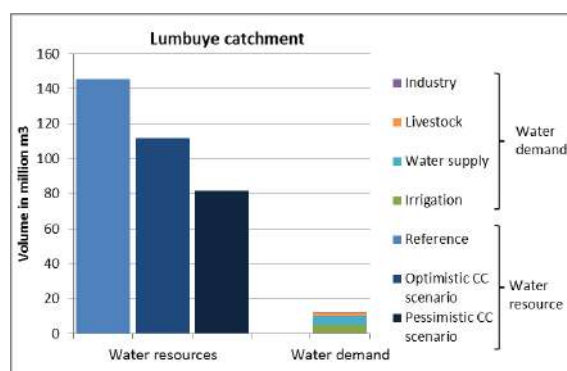


Figure 4.13: Comparison of current and future monthly rainfall for Lumbuye

Although the water resource decreases under the effect of climate change, annual resources available remains largely above annual water demand in the Victoria Nile-Lumbuye catchment. However, for the different climate change scenarios tested, a reduction of available water resources between May and November leads to an increase in the water stress and implies larger deficits to meet the demand (both in frequency and intensity). This said, it is important to keep in mind that uncertainty is important regarding: (i) future climatic conditions (only a few out of hundreds of possible scenarios have been tested) and, therefore, their impact on water resources; and (ii) the current water resources and current water resources-water demand balance, whose accuracy is limited due to the lack of hydro-meteorological data in the different sub-catchments, especially the Lumbuye Catchment and the Victoria Nile Catchment (for the tributaries of the Nile River). For some climate change scenarios and certain sub-catchments, the frequency of deficit decreases due to the fact that flows are higher under the effect of climate change than under current climate conditions during certain periods of the year, especially in February-March, which are the months when deficits are most frequently encountered.

4.9 Rainfed agriculture and livestock

Rainfed agriculture and livestock keeping are the most widespread activities in the Victoria Nile-Lumbuye Catchment. Agriculture employs over 95% of the population. More than half of the total land area is used for cultivation since a large majority of the population is rural, and directly dependent on agriculture. Most cultivation is done by smallholder farmers averaging some two hectares per farm unit. Coffee is an important cash crop in most of the districts. Damages due to the coffee wilt disease imply food crops like bananas are slowly being turned into cash crops. In addition, fruits (pineapples, watermelon, mangoes, and passion) are grown for commercial purposes especially in Kayunga District. Sugarcane occupies close to 30% of all the total land under agriculture and future estimates indicate increasing trends in the catchment. Sugarcane is the main cash crop in the districts of Jinja, Iganga, and parts of Kamuli. Kakira Sugar Works is one of the oldest and largest sugarcane plantations. It occupies 10,000ha of land and has over 7,000 out-growers in the catchment. Over 6,000 tons of sugarcanes are crushed per day producing about 150,000 tons of crystal sugar annually. Rainfed agriculture is characterised by low productivity, low land holdings, poor soil management practices and lack of incentives and means to commercialise and mechanise. For both rainfed and irrigated agriculture, various factors induce low crops yields, such as poor soil fertility, increased pests and diseases and low quality seeds.

The total number of livestock in the catchment is close to 351,770 Livestock Tropical Unit (LTU) according to the 2008 National Livestock Census. Issues identified include inadequate extension services, veterinary controls, and access to water (lack of watering points or access) in some areas. There are good prospects for developing this sector, as there is a ready market for meat and dairy products due to increasing local and export demand. Table 4.9 presents the number of livestock in each one of the districts that partially or fully contribute to the Victoria Nile-Lumbuye catchments.

Table 4.9: Number of livestock in the district partially or totally comprised in Victoria Nile-Lumbuye Catchment (based on 2006 district's boundaries)

District	Area district (km ²)	LTU cattle	LTU Sheep	LTU Goat	LTU pig	LTU Chiken	LTU total	LTU density (nb/km ²)
Iganga	1,668	87,715	760	25,487	11,074	9,045	134,080	80
Jinja	688	28,173	254	10,784	10,742	5,242	55,194	80
Kaliro	868	45,755	322	8,414	5,910	1,889	62,289	72
Kamuli	3,435	148,271	981	32,879	22,096	7,245	211,471	62
Kayunga	1,703	62,170	1,156	12,405	15,227	3,276	94,234	55
Mayuge	1,040	59,866	1,202	20,350	7,338	6,079	94,835	91
Mukono	2,945	109,074	4,621	31,006	72,738	15,517	232,956	79

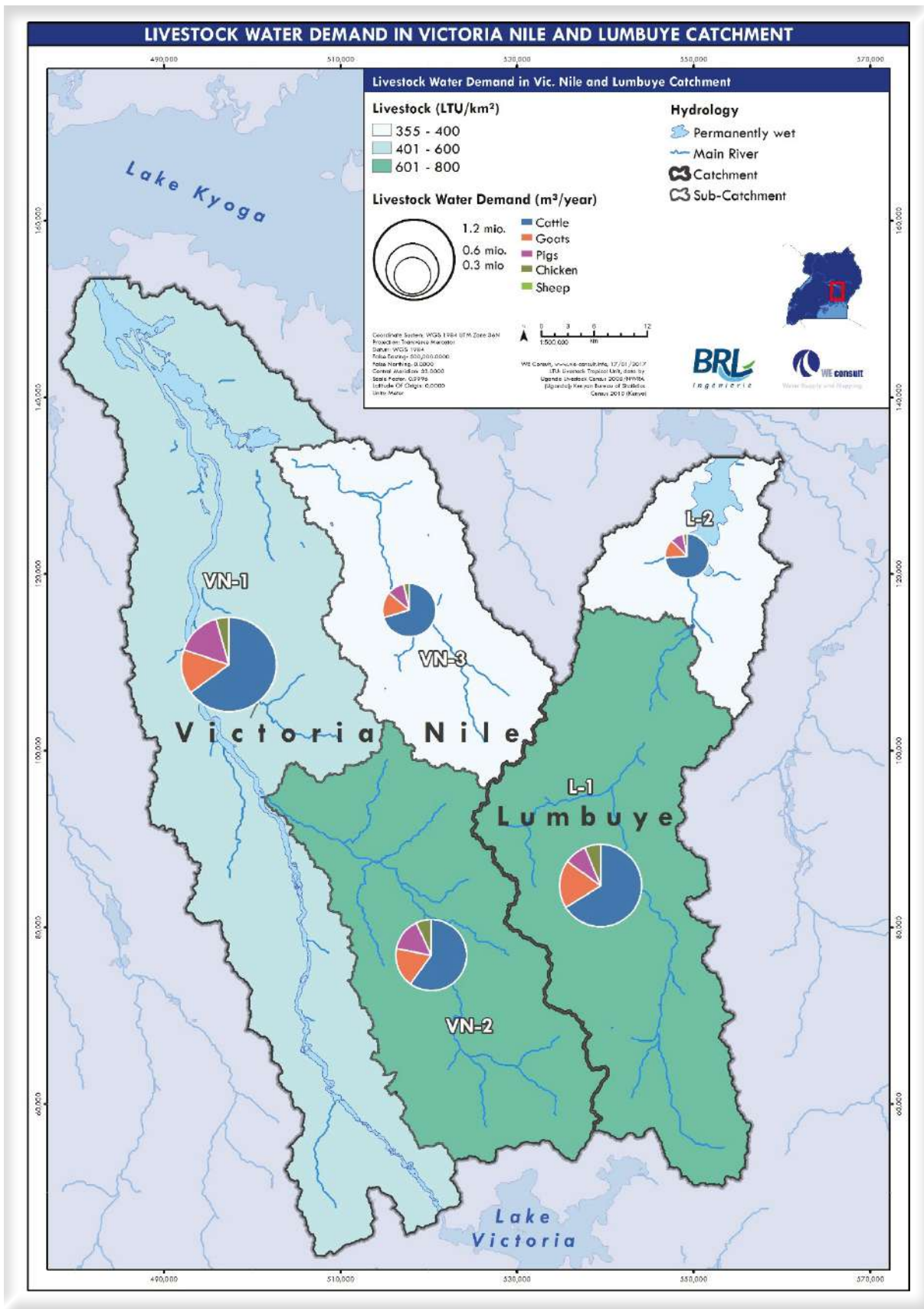


Figure 4.14: Number of livestock (in LTU) and water demand for livestock per sub-catchment in Victoria Nile-Lumbuye Catchment

4.10 Irrigation

In the Lumbuye Catchment, there is only one formal irrigation scheme partially established: Kiige Citrus Scheme. Most of the irrigation practices in the Victoria Nile-Lumbuye Catchment is informal. Rice, sugar cane, and horticulture are mostly irrigated on the fringes of wetlands. They are developed spontaneously by smallholder farmers without planning and with little or no technical assistance. Despite the absence of updated record of the extent of informally cultivated areas, informal irrigation has been estimated to 4,620ha on wetland fringes in the Victoria Nile Catchment and 11,450ha in the Lumbuye Catchment. Irrigation is needed to mitigate the impacts of unreliable rainfall. Depending on the sub-catchment, irrigation water demand varies between 0% (VN1) and 17.4% (VN3) of the available water in the Victoria Nile Catchment. For the Lumbuye Catchment, irrigation water demand varies between 5% (L1) and 28% (whole catchment) of the available water. The institutional structure and staffing levels for irrigation development are insufficient for successful development of the sub-sect .

4.11 Fisheries and fish farming

Capture fisheries is mainly exploited on the River Nile, Lake Nakuwa, Lake Kyoga, and the Lumbuye wetlands. Fish catches are apparently decreasing in the study area. The catchment is also dominated by subsistence aquaculture practices by individual farmers. The main constraints hindering capture fisheries production are degradation of water quality in lakes, rivers and wetlands, use of illegal fishing methods and invasive weeds. Regulation and law enforcement must be improved to prevent the use of prohibited gear and poaching.

4.12 Water supply and sanitation

In the Victoria Nile-Lumbuye Catchment, the overall water supply access is 70%. Improved access to safe water supply is an important factor for public-health improvement and can improve involvement of women in productive activities. Of the districts in the catchments, only Luuka (in Lumbuye) is reported to have safe water coverage above the national target of 77%. The other districts have coverage between 40% and 70%. Stagnation of water supply coverage is observed and results from population increase and from increased costs. Sanitation (latrine) coverage is close to 76%. Only Jinja Municipality has a central sewerage system. Sanitation is insufficient in the catchment. Poor sanitation impacts on the water resource, health, and on the dignity of lives. Raising awareness and the development of a sanitation culture with emphasis on rural communities must be done. Pit latrines should be within the reach of every household, although poor, high water tables, floods and fragile soils hinder progress in some parts of the catchments.

Development and maintaining existing wastewater treatment works especially in big towns such as Jinja, Luuka, and Kamuli is important. As rural growth centres expand, there will be a growing requirement for centralised sewerage treatment. Planning and implementation of improved sanitation facilities (latrines and hand washing) for public facilities and meeting places and implementation of domestic wastewater treatment options are essential.

4.13 Existing initiatives and programmes

4.13.1 Wetlands

As an impact, this pressure on wetland alters their capacity to provide various services to the local population. Wetlands should be considered as a limited resource, which needs to be managed. For this purpose, various projects and planned approaches are currently ongoing in the study area. The major one taking place in the catchment is the National Wetland Management Project in the Republic of Uganda undertaken and led by the Directorate of Environmental Affairs (DEA) and funded by the Japan International Cooperation Agency (JICA). This project, which is still on-going, has as its main objective to establish a model of conservation and wise use of wetlands in Uganda. More details regarding on-going activities and planned pilot projects are provided under the National Wetland Management Project. The overall goal of the project is "a model of conservation and wise use of wetlands is disseminated."

4.13.2 Floods

In order to support flood risk reduction activities in the Kyoga Water Management Zone, a partnership has been established in 2013 between the German Development Cooperation (GIZ), the International Institute of Rural Reconstruction (IIRR) in collaboration with the Ministry of Water and Environment through the Directorate of Water Resources Management to implement the "Flood Risk Management in the Kyoga WMZ" project. The German Development Cooperation supported the development and implementation of flood risk management activities that help affected communities and local institutions improve their resilience and adaptive capacities towards extreme weather events like floods, in the knowledge that such events may progress into disasters due to impacts of climate change (GIZ, IIRR, 2014).

In addition to this approach, the project contributed to the implementation of 14 hydrological stations with telemetry status in the Kyoga basin to generate data on water levels and in order to enhance community preparedness to

flood risks. Of the 11 out of the 14 stations visited as part the project “Detailed Assessment of Requirement for Water Resources Information System” (BRLi, 2015), only three were confi med operational.

4.13.3 Water supply schemes

Every year, about four to six Water Supply Schemes are commissioned under the WSDf-E. The table below presents the status of the water supply schemes considered currently under design or construction.

Table 4.10: Priority water piped schemes under WSDf-East

District	Village	Sub-catchment	Catchment	Description / Details	Status
Jinja	Nabitabala	VN-2	Victoria Nile	Targeted population: 6193	Design on-going
Jinja	Bugobya			Targeted population: 2500	Design on-going
Jinja	Buyengo	VN-1	Victoria Nile		Design on-going
Jinja	Kagoma, Muguluka	VN-1	Victoria Nile		Construction on-going
Jinja	Namaganga	VN-2	Victoria Nile		Designed
Jinja	Namagera-Lubani	VN-1	Victoria Nile		Procurement for construction
Kamuli	Bulopa	L-1	Lumbuye	Targeted population: 8000	Designed
Luuka	Luuka Town Council	L-1	Lumbuye	Targeted population: 12000	Construction on-going
Luuka	Ikumbya	L-1	Lumbuye	Targeted population: 3000	Design on-going

4.14 Stakeholder involvement

The purpose of stakeholder analysis is to identify and analyse key stakeholders who presently are or in the future may be involved in planning, developing, managing, and regulating or using water resources. This analysis assesses the influence of the stakeholders, i.e. the power that they have to affect the planning process and the implementation of the catchment plans. It also assesses their interest and how much they have to lose or gain from the planned implementation. The key to effectively involving stakeholders is in identifying which stakeholders should be involved at any particular stage in the process and how. If the right stakeholders are not identified and involved at the right time and in the right way, the legitimacy and effectiveness of the resulting plans in terms of participation, implementation, and the sustainability of benefits can be compromised. Identifying, understanding, consulting, engaging and organising stakeholders are conditions for the successful preparation and implementation of a CMP. For this reason, stakeholders had the opportunity to participate in all phases of the planning process and subsequently in the management and implementation of the CMPs. The following principles have been observed in the stakeholder engagement process:

- The interests, issues, needs, capacities, resources and influence of key stakeholders have been identified and taken into account in the preparation of the CMP.
 - Key stakeholders are informed, understand, appreciate and accept the need for and benefits of a participatory CMP and are willing to commit time, funds and other resources to its implementation.
 - Key stakeholders actively participate in and influence the choices made and priorities in preparing the CMP and feel a sense of ownership, responsibility and accountability in implementing the CMP.
- Engaging national, regional, catchment and local stakeholders has a number of benefits, including
- Raising awareness and fostering a greater understanding and appreciation of the importance of participatory management of water resources at catchment level
 - Facilitating greater “buy-in” and commitment by stakeholders at catchment level to plan, manage, develop, and protect water resources in the catchment
 - Identifying an organisation and processes that are accepted by water users and other key stakeholders in the catchment for conflict resolution, water regulation and enforcement, and other water management measures.

As a result of the stakeholder consultation, the inception and stakeholder consultative workshop, the influence and interests of stakeholders in regard to the elaboration and implementation of the Catchment Management Plans have been captured. Table 4.11 below summarises the findings



Table 4.11: Interest and influence of the shareholders

Level	Stakeholder/institution	Institution	Interest	Positive/Negative	Influence	Function
National	Ministry of Water and Environment (MWE)	DWRM	Water resources management, socio-economic development of the catchments.	Positive, they are always involved in water resources and environment Management and conservation	High	- Setting national policies and standards, managing and regulating water resources and determining priorities for water development and management. - Monitors and evaluates sector development programs to keep track of their performance, efficiency and effectiveness in service delivery.
		DWD	Development of water supply and sanitation and infrastructures in general.	Positive, they are involved in water supply and sanitation development.	Medium	- Technical oversight for planning implementation and supervision of delivery of urban and rural water and sanitation services
		DEA	Environment management and conservation. Environmental regulation. Sensitisation of the population.	Positive, they are always involved in water resources and environment Management and conservation	High	- Review the environmental regulatory needs (actions, new or revised regulations) based on the adopted final plan; - Issue required regulations, notices, and permits in accordance with legal and regulatory requirements - Responsible for environmental legislation and enforcement; - Issue EIA certificates for major developments
	National Environment Management Authority (NEMA)		Environmental regulation and conservation. Catchment protection, sensitisation and awareness of the population, etc.	Positive, they are always involved in Environment Management and conservation	Low	- Coordinate, monitor, regulate and supervise the state of the environment in Uganda
	National Forestry Authority (NFA)		Forest resource management and protection; Tree planting in degraded areas; Sensitisation and awareness of the population.	Positive, they are always involved in Environment Management and conservation	Low	Manage Central Forest Reserves on a sustainable basis and to supply high quality forestry-related products and services to government, local communities and the private sector
	Ministry of Agriculture, Animal, Industry and Fisheries (MAAIF)		Improve and conduct training on good farming practices, fish farming, irrigation, and alternative livelihood activities; Develop agriculture schemes in the catchments, Develop formal irrigation, Promotion and development of aquaculture and other alternative livelihoods, Develop necessary infrastructure, Sensitise farmers.	Positive, they are always involved in Environment Management and conservation	High	- Formulate, review and implement national policies, plans, strategies, regulations and standards and enforce laws, regulations and standards along the value chain of crops, livestock and fisheries; - Control and manage epidemics and disasters, and support the control of sporadic and endemic diseases, pests and vectors; - Regulate the use of agricultural chemicals, veterinary drugs, biological, planting and stocking materials as well as other inputs; - Support the development of infrastructure and use of water for agricultural production along livestock, crop and fisheries value chains; - Establish sustainable systems to collect, process, maintain and disseminate agricultural statistics and information; - Support provision of planting and stocking materials and other inputs to increase production and commercialization of agriculture for food security and household income; - Develop public infrastructure to support production, quality / safety assurance and value-addition along the livestock, crop and fisheries commodity chains; - Monitor, inspect, evaluate and harmonize activities in the agricultural sector including local governments; - Strengthen human and institutional capacity and mobilize financial and technical resources for delivery of agricultural services; - Develop and promote collaborative mechanisms nationally, regionally and internationally on issues pertaining to the sector;

Table 4.11: Continuation ...

Level	Stakeholder/institution	Institution	Interest	Positive/Negative	Influence	Function
	Ministry of Tourism and Industry (MoTI)		Development of tourism potential in both catchments and industrial activities.	Positive, there is an important potential for both tourism and industry in both catchments.	Low	<ul style="list-style-type: none"> - Formulate, Implement and Monitor Tourism, Wildlife and Cultural heritage Policies, Legislations, Plans, strategies and standards. - Ensure sustainable management of wildlife and cultural heritage conservation areas; - Ensure Tourism Product Diversification; - Promote tourism destination in Uganda; - Ensure Human resource capacity development in Tourism, Wildlife and Heritage sector; - Education and awareness creation of the sector; - Regulation and Quality Assurance of Tourism, Wildlife and Heritage programs and services.; - Tourism, Wildlife and Heritage Research, information management and dissemination
	Ministry of Local Government (MoLG)		Organise and conduct training of local government staff.	Positive	Low	<ul style="list-style-type: none"> - Responsible for capacity building in local governments and supervision of local authorities; - Establish, develop and facilitate management of decentralised local government systems; - Oversee the implementation of Local Government Development Plans that include water supply, environment and natural resources as well as public health and sanitation in institutions and public places.
Regional	Ministry of Water and Environment	Kyoga WMZ	Water resources management, socio-economic development of the catchments.	Positive, they are always involved in water resources and environment Management and conservation	High	<ul style="list-style-type: none"> - Plan, implement and oversee IWRM activities closer to stakeholders and realities on the ground, as well as improve the effectiveness of regulation and implementation of water resource development plans; - Facilitate and support DWRM's coordination of central level implementation and financial resource mobilisation; - Facilitate implementation of catchment planning projects by central departments; - Identify modalities for zonal and catchment level implantation among its public and private sector partners; - Assess water use permit applications under existing regulations;
	Water and Sanitation Development Facility (WSDF)	WSDF-East	Water supply and sanitation development, improvement of population's wellbeing. Water service provision and water resources management. Undertake implementation of projects within their area of responsibility.	Positive, they are involved in water supply and sanitation development.	Low	<ul style="list-style-type: none"> - Zonal planning and water scheme identification; - Feasibility studies and detailed designs of piped schemes; - Tendering procurement and supervision of construction contracts; - Financial management and reporting; - Capacity building
	NWSC	NWSC Mbale	Improve water supply and sanitation in the catchments. Improve effluent water quality from waste water treatment plants.	Positive, they are involved in water supply and sanitation development.	Low	<ul style="list-style-type: none"> Plan, operate and maintain water supply and sewerage services in areas entrusted to it in urban centres in Uganda. - Providing water and sewerage services; - Expanding service coverage, improving efficiency in service delivery and improving labour performance.
		NWSC Tororo				
Uganda Wildlife Authority (UWA)		Promotion of peace, protection of wildlife, sensitization of the people	Positive, they are always involved in Environment Management and conservation	Low	Ensure protection of wildlife in the protected areas	
District level	Districts	District CAO	Mobilisation and sensitisations of the community, Enforcement of rules and regulations in regards to Natural resource Management	Positive: Emphasis on proper management of natural resources	High	- Coordinate activities in the district
		District Water Office (DWO)			High	- Plan, supervise construction and monitor the operation and maintenance of water supply and sanitation facilities in the district
		District Forestry Office (DFO)			High	- Manage the status and use of the district's forests
		District Natural Resources			High	- Monitor and Manage the district's state of the environment, land management issues and the use of natural resources

Table 4.11: Continuation ...

Stakeholder/institution		Interest	Positive/Negative	Influence	Function
	Office (DNRO)				
	District Community Development Office (DCDO)			High	- Manage social issues, welfare, gender issues and vulnerable groups, households and livelihoods profile of the district
	District Planning Unit (DPU)			High	- District plans and investment profiles
Non-Government Organization (e.g. IUCN, Plan International, Red Cross, One Archer Land, KA NEGO, UWASNET, WaterAid, etc)		Supply of safe water to the community and treatment of wastewater Environmental conservation and management	Positive. Positive: They are involved in treatment of wastewater	High	
Business Community (Traders)		Utilisation of the catchment, Extension of services nearer to the people	Should be more involved in the development process, through CMCs for instance	Low	
Institutions (Schools, health units and churches)		Utilisation of the catchments, education and sensitisation of communities	Positive: The institutions emphasise conservation of the environment, At community meetings held in Kamuli District, Namasagali Sub-county, the community appreciated Busitema University for supplying them with tree seedlings and offering to plant trees in all institutions in the sub-county	Low	
Community members (Subsistence farming and rearing of animals)		Farming	Possibly negative. Some farmers practice poor farming methods such as monoculture and over-cultivation that degrades the land and the environment.	Low	

4.14.1 Lessons learnt from stakeholder consultations

Following are the important lessons learned concerning stakeholder analysis, consultation and engagement:

1. The large number and types of stakeholders in the catchments necessitates that a representative sample of stakeholders be consulted and engaged rather than attempting to contact and engage every single stakeholder in the catchments. This approach is realistic and appropriate considering the limited time, personnel and resources available
2. Coordination between a large number of specialists in many different fields presents a special challenge for managing the inputs and outputs of a multidisciplinary team and achieving synergies between the works of the subject specialists
3. Data required for accurate and comprehensive integrated water resources planning is usually scattered, of poor quality, has many gaps, and is difficult and time consuming to obtain and analyse. In addition, much information and data is "dynamic", underscoring the fact that the information and data presented in reports such as this one is necessarily incomplete and imperfect. At best, a report such as this one represents a "snapshot" of what a certain group of people with certain knowledge and skills, working with limited time and resources have been able to produce at a certain point in time. Therefore, this report should be seen as a living document that will need to be revisited periodically as the body of knowledge expands, new information becomes available, latent conflicts emerge, existing stakeholders change and new stakeholders appear on the scene
4. While the concept and principles of IWRM and stakeholder consultation may be generally understood, how to put these concepts and principles into practice is not. Therefore, there is a need for continuous learning from best (and also bad) practices to show how effective stakeholder engagement can be realised in practice
5. District officers, being civil servants, are subject to administrative actions such as transfers, promotions, sick and maternity leave, etc. As existing staff leave and move away, new officers from other districts in different parts of the country arrive to take their place. This fluid situation creates the need for a continuous flow of information, training, coaching, support and related activities by the WMZ office
6. While consultants may come and go, the WMZ office has become a permanent feature of the IWRM institutional landscape in Uganda and is well positioned and staffed to build on the work with stakeholders carried out by consultants
7. Stakeholders at the same level having common interests and facing similar issues and challenges across district boundaries in the catchments can potentially collaborate effectively if given the opportunity, organisation and resources to do so.
8. Severe resource constraints, particularly funding, hinder the effectiveness and limit the impact of stakeholder participation at all levels. Many useful initiatives and activities that were supported by time-bound projects unfortunately end when projects end and (external) funding stops. This discourages and demoralises the stakeholders that were involved in such activities
9. District Development Plans, statistical abstracts, census reports, state of the environment reports, wetland management plans, water atlas, and other useful sources of information should be collected for all districts in the catchments and WMZ. Ideally, this information should be available in hard and soft copy at a central source such as the WMZ office from the start of a consultancy assignment to avoid delays and the time taken to obtain this important information by each new consultant
10. Care should be taken to avoid raising stakeholder's expectations for new projects in the short term during the stakeholder consultations. At the beginning, it is important to make it clear that the initial meetings and consultations are part of a longer planning process that will serve as input to the identification of a range of development options. No particular type and location of new projects can be made at the consultation stage.
11. Another important lesson is the need for the WMZ team to explain the purpose and scope of the CMP, including how it will be funded and implemented, and what the long term requirements are for implementation, operation and maintenance. Not many of the stakeholders have been involved in such an exercise before and the CMP is likely to require them to take new and unfamiliar actions.

4.15 Key Issues in the Victoria Nile-Lumbuye Catchment

Based on extensive stakeholder consultations, interviews with key informants, direct observations during field visits, and relevant reports and other documentation, a number of key water resource-related issues, their causes and possible mitigation measures in the catchment were identified.

These and possible measures to address them are summarised in Table 4.12 below.

Table 4.12: Key issues in Victoria Nile-Lumbye Catchment

Risks				
Issues	Strategic implications	Possible measures	Criticality	Specific location
Floods	<ul style="list-style-type: none"> - Landslides; - Water borne diseases; - Displaced persons; - Loss of infrastructures and crops; - Death; 	<ul style="list-style-type: none"> - Develop flood warning systems; - River protection work; - Implement flood risk management activities; - Develop drainage network associated to irrigation scheme; - Implementation of flood control reservoirs. 	+2/Low	Lumbye Catchment (L1, L2)
Landslides	<ul style="list-style-type: none"> - Loss of infrastructures and crops; - Erosion and siltation of wetlands, rivers and streams 	<ul style="list-style-type: none"> - Land use planning, reforestation, land management; - Establish siltation monitoring system for future planning; - Prioritise the structure and design of comprehensive integrated reforestation, rehabilitation and Sustainable Land Management programmes for steep landscapes; - Awareness on landslide preparedness 	0	Entire catchment
Droughts	<ul style="list-style-type: none"> - Loss of crop and livestock; - Food insecurity; - Insufficient hydroelectric generation; - Water supply and health. 	<ul style="list-style-type: none"> - Promotion of rain water harvesting for domestic use and livestock watering; - Development of water resources for irrigation and the irrigation infrastructure in order to enhance crop production; - Training local community in sustainable agriculture and irrigation management; - Develop stock watering dams. 	+2/Low	<ul style="list-style-type: none"> - Cattle corridor (VN1); - Kayunga, Kamuli, Kaliro (VN1, VN2, VN3, L2)

Catchment Management

Issues	Strategic implications	Possible measures		
Soil erosion	<ul style="list-style-type: none"> - Loss of soil fertility; - Reduced soil quality; - Siltation of wetlands, rivers and streams; - Loss of biodiversity; - Water pollution 	<ul style="list-style-type: none"> - Promote and train farmers on agricultural practices that ensure stability of the soils (promote zero/minimum tillage, construction of contours, ploughing, trenches, cut-off drains, contour hedges); - Establish conservation agriculture - Training of community and demonstration on soil and water conservation techniques (construction of ditches/bands, - Land use planning; - Reforestation and tree planting activity; - Field management (contouring, buffer zones for river banks and roads.) - River bank protection; - Road drainage 	+2/Low	Upper Victoria Nile Catchment (VN1, VN2)
Deforestation and encroachment of forests (creation of crop lands and industrial areas, etc.)	<ul style="list-style-type: none"> - Soil erosion; - Sedimentation; - Decrease of soil fertility; - Loss of habitat; - Increase risk of flood events. 	<ul style="list-style-type: none"> - Sensitisation of the local communities on sustainable use and management of natural resources; - Sensitise the communities on afforestation - Restoration of degraded forests; - Demarcate rehabilitation zones; - Promote tree planting activities; - Establish and manage tree nurseries; - Increasing vegetation cover through afforestation, re-forestation and agro-forestry; - Train farmers on clean energy production through the use of energy cooking stoves; - Promote alternative sources of energy; - Development of by-laws with reward and sanctions in place; - Awareness creation on environment regulations and enforcement 	+5 / Severe	Entire catchment
subsistence farming; - Degradation of wetlands from various human activities (collect of material, etc.)	<ul style="list-style-type: none"> capacity; - Reduce fisheries possibility 	<ul style="list-style-type: none"> - Pegging of riparian zones for the rivers and streams, wetlands and swamps; - Restoration of degraded systems; - Wetland Protection through sustainable use of the wetlands; - Develop classification of wetlands and implement conservation strategies accordingly - Development of by-laws with reward and sanctions in place. - Compensate land users, if possible, o wetlands of critical importance and embark on restoration - Awareness creation on environment regulations and enforcement - Develop monitoring programme; - Prioritise monitoring activities 	+4/Important	rice growing, especially in Buzaya county and Balawoli (VN3) and Narasagali sub-counties (L1, L2), River Kiko and other
Lack of natural resources	<ul style="list-style-type: none"> - Without monitoring, there can be no 	<ul style="list-style-type: none"> - Awareness creation on environment regulations and enforcement - Develop monitoring programme; - Prioritise monitoring activities 	+4/Important	rice growing, especially in Buzaya county and Balawoli (VN3) and Narasagali sub-counties (L1, L2), River Kiko and other

Agriculture-Irrigated and Rainfed

Issues	Strategic implications	Possible measures	Criticality	Specific location
Dependence in rainfed agriculture/Reliance on rainfall	<ul style="list-style-type: none"> - Little opportunity for large scale commercial development unless rainfall reliability support; - Food insecurity depending on rainfall; - Requires systems focused on rainfed crops. 	<ul style="list-style-type: none"> - Develop irrigation schemes; - Develop water harvesting; - Adapt simple rainwater harvesting technologies like sunken pits, ditches etc.; - Implement good agricultural practices to optimise rainfall and soil moisture; - Match dams to needs 	+5/Severe	Entire catchment
<ul style="list-style-type: none"> - Low productivity of rainfed agriculture; - Poor crop variety; - Poor agricultural practices - Lack of extension services for farmers 	<ul style="list-style-type: none"> - Low yields; - Food insecurity; - Soil degradation; - Loss of soil fertility; - Limited agricultural development in both catchments 	<ul style="list-style-type: none"> - Training and skilling farmers in improved agricultural agronomic interventions or practices; - Develop tree planting, agro-forestry and fruit trees; - Increase extension services to the farmers for all crops and livestock enterprises; - Promote drought tolerant crop varieties of sorghum, cassava; - Land use planning on the farms; - Crop selection, seeds selection; - Implement rice/aquaculture scheme to develop new agricultural practices; - Create partnership with private sector; - Provide and promote the use of inputs - Create farmers organizations for better management and marketing; 	+4/Important	Entire catchment
Pests and diseases	<ul style="list-style-type: none"> - High damage to coffee plantation; - Loss of crop; - Loss of income generated; - Food crops turned into cash crops - Food insecurity 	<ul style="list-style-type: none"> - Control diseases; - Develop high technology laboratory for crop disease identification and disaster preparedness. 	+2/Low	Entire catchment
Predominance of informal irrigation on the fringes of wetland and rivers	<ul style="list-style-type: none"> - Minimum/no water control structures; - Wetland degradation and drainage; 	<ul style="list-style-type: none"> - Improve technical human resources for irrigation and drainage at the district level and below; - Create a position for irrigation engineer in district staff; - Increase farmers organisation for proper irrigation, water management and marketing of produce; - Improve planning and management of water and natural resources; - Capacity building of farmers; - Creation of Water users' associations 	3/Moderate	Entire catchment
credits	<ul style="list-style-type: none"> - Low stocking levels, - Limited uptake of new technologies; - Abandonment of fish farms; - Limited access to key equipment and tools for harvesting, grading, sampling and water quality management; - Limited start-ups by prospective fish farmers. 	as Savings and Credit Cooperative Organizations (SACCOs)		
Inadequate facilitation of technical staff at district level (DFO)	<ul style="list-style-type: none"> - Hinder development of the aquaculture sector; - Farmers not supported technically, - Absence of demonstration farms; - Lack of enforcement to avoid fishing illegalities; - Limited innovation transfer and skills among fish farmers; - Limited enforcement of fishing regulations 	<ul style="list-style-type: none"> - Establish demonstration fish farms, hatcheries and feed manufacturing infrastructure near or in their areas; - Setting up training programmes; - Establish office facilities; - Improve the capacity of fisheries technical staff 	+3/Moderate	Entire catchment
Limited fish handling facilities and access to basic social services	<ul style="list-style-type: none"> - Reduced development of the sector; - Reduced fish quality; - Increased post-harvest losses 	<ul style="list-style-type: none"> - Raise funds for the implementation of fish handlings facilities; - Develop the necessary infrastructure installation for fishing (ports, refrigerated rooms, access to electricity, etc.) 	+3/Moderate	Entire catchment

Cattle keeping/Livestock

Issues	Strategic implications	Possible measures	Criticality	Specific location
Poor livestock productivity and livestock breeds	<ul style="list-style-type: none"> - Poor growth and off-take rates - Poor livestock productivity 	<ul style="list-style-type: none"> - Integrate livestock production in rice production systems, utilisation of rice straw and chuff as livestock feeds; - Integration of livestock into crop production systems; - Construction and/or rehabilitation of access point for cattle watering 	+3/Moderate	Entire catchment
Livestock diseases	<ul style="list-style-type: none"> - Massive loss of livestock 	<ul style="list-style-type: none"> - Control of livestock diseases with support from FAO and USAID - Develop high technology laboratory for livestock disease identification and disaster preparedness. 	+3/Moderate	Entire catchment
Water supply and sanitation				
Low access to water supply	<ul style="list-style-type: none"> - Health, water for productive use (subsistence and economy); - Vulnerability to drought, food security; - Economic value of the resource. 	<ul style="list-style-type: none"> - Develop piped water systems; - Boreholes; - Rainwater harvesting; - Shallow wells and springs; - Water quality monitoring; - Guidelines and plans for rainwater harvesting (roof water tanks and large underground tanks) - Dams (large, small, etc.); - Promote water sources protection 	+5/Severe	Entire catchment
Inadequate management and development of sanitation facilities Individuals having to meet cost of mobilizing cesspool trucks from nearby big towns.	<ul style="list-style-type: none"> - Health; - Diseases; - Water pollution 	<ul style="list-style-type: none"> - Clustering of towns within a radius of 30 km so that to be served by the existing facilities under NWSC management - Plan sanitation facilities associated to the piped water system; - Construct sludge drying beds; - Support District Sanitation programme (implementation of latrines, etc.) - Construct new water treatment plants with adequate technologies; - Develop drainage system - Sensitize on water sanitation and water source protection 	+5/Severe	Entire catchment
Waste discharges to the environment (water bodies and land) from Mbale, Tororo and Iganga waste water treatment plants are below national standards In terms of coverage; the percentage of sewer connections relative to water connections ranges between 4% in Tororo and 16% in Mbale	<ul style="list-style-type: none"> - Pollution of the water resources; 	<ul style="list-style-type: none"> - Develop the construction of sewing systems; - Strengthen adherence of factories to effluent discharge standards and strengthen monitoring mechanisms. Put incentives to promote compliance to meet standards. Harmonise regulatory frameworks - Urge water treatment plant to meet national standard (upgrading of the station, implementation of new technologies); 	+3/Moderate	Entire catchment, especially newly created districts such as Luuka (L1, VN2) and Kaliro (L1, L2), urban and rural growth centres.
Discharge of untreated waste water by industries and factories	<ul style="list-style-type: none"> - Impact fisheries by reducing fish catches; - Water pollution; - Loss of aquatic habitat; - Water related diseases. 	<ul style="list-style-type: none"> - Identify and implement appropriate treatment systems to manage the various wastes emitted by factories; - Strengthen adherence of treatment plant to effluent discharge standards and strengthen monitoring mechanisms. Put incentives to promote compliance to meet standards. Harmonise regulatory frameworks - Sensitisation on industrial pollution; 	3/Moderate	Jinja (VN1, VN2), Kaliro (L1, L2)
Mining (sand & murram mining leading to soil degradation, loss of biodiversity and water pollution)	<ul style="list-style-type: none"> - Adverse impacts on flora and fauna - Water and air pollution - Soil degradation and erosion of sites and adjacent river banks - Erosion, landslides and downstream sedimentation leading to water quality degradation. 	<ul style="list-style-type: none"> - Control and regulate sand mining; - Sensitisation of mining consequences on the environment 	+1/Very low	Entire catchment

Siltation	<ul style="list-style-type: none"> - Rise of the river bed; - Increase risk of floods; - Water and wetlands pollution; - Decrease fishing activities; - Affect functionality of downstream wetlands. 	<ul style="list-style-type: none"> - Improve agricultural practices that ensure stability of the soils; - Gully Rehabilitation as a means of preventing further erosion and sediment loadings into the river 	+3/Moderate	River Victoria Nile (VN1)
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Hydroelectric power

Issues	Strategic implications	Possible measures	Criticality	Specific location
Shortage of the order of 150MW/insufficient energy alternative	<ul style="list-style-type: none"> - Fatal flaw for development: Inability to run irrigation pumps, cold chains, etc. 	<ul style="list-style-type: none"> - Undertake feasibility study for small HPPs; - Obtain license to build and operate for small HPPs; - Promote alternative source of energy (solar, gas). 	+3/Moderate	Entire catchment especially newly created districts, urban and rural growth centres

Land management

Issues	Strategic implications	Possible measures	Criticality	Specific location
Land conflicts among communities (between farmers and breeders)	<ul style="list-style-type: none"> - Inadequate share of the natural resources 	<ul style="list-style-type: none"> - Sensitising farmers on and popularising the Land Act, 1998 - Encouraging and facilitating farmers to acquire land titles - Strengthening the sub county land tribunals to help solve these conflicts 	0	Entire catchment

Institutional and management

Issues	Strategic implications	Possible measures	Criticality	Specific location
Lack of finance	<ul style="list-style-type: none"> - Inability to implement plans 	<ul style="list-style-type: none"> - Increase financial support from the government to various sector; - Fund-raising; 	+4/Important	Entire catchment
Lack of capacity	<ul style="list-style-type: none"> - Failure to implement plans 	<ul style="list-style-type: none"> - Capacity building at all levels of planning and action; - Development of guidelines 	+4/Important	Entire catchment
Enforcement of legislation	<ul style="list-style-type: none"> - Without enforcement legislations becomes meaningless - Environmental degradation 	<ul style="list-style-type: none"> - Improve technical capacity and management; - Farmers training organisation and management; - Include legislation in awareness raising; - Government support for enforcement; - Enforcement 	+4/Important	Entire catchment
Inadequate manpower and weak institutional structures to support development of irrigation	<ul style="list-style-type: none"> - Hinder development of irrigation in the catchments; - Development of informal irrigation and its consequences on the environment; 	<ul style="list-style-type: none"> - Introduce position for irrigation engineer and agronomist at district and sub-county levels; - Strengthen and expand the capacity to manage water and natural resources at the catchment/sub-catchment level - Develop and strength farmer group 	+4/Important	Entire catchment
		<ul style="list-style-type: none"> organisations/associations such as water users associations (WUA) for better management and marketing of their produce, - Train existing staff in the districts to enhance their technical capacity in planning, installation, operation, maintenance and management of irrigation, - Train farmers in operation, maintenance, and management of irrigation and also record keeping, post-harvest processing and marketing. - Set up demonstration sites at sub county and parish level where the farmers can learn. 		
Lack of knowledge and understanding of day to day livelihoods on the landscape	<ul style="list-style-type: none"> - Environmental degradation as a consequence of human behaviour that could be mitigated 	<ul style="list-style-type: none"> - Awareness raising; - Coordination of awareness raising initiatives 	+4/Important	Entire catchment
Failure to maintain infrastructure	<ul style="list-style-type: none"> - Wasted investment, failed project 	<ul style="list-style-type: none"> - Maintenance planning and budget provision must accompany all development plans; - Entrench principles of maintenance and ensure that this requirement becomes policy and thence practice 	+4/Important	Entire catchment

Alternative livelihood and income

Issues	Strategic implications	Possible measures	Criticality	Specific location
- Lack of alternative livelihood and income	- Concentration in agricultural activities with low income generated; - Hinder development in the catchment environment;	- Sensitise and promote alternative source of income; - Promote alternative livelihood (bee-keeping, fish farming, tourism etc.); - Develop infrastructures and provide means for development of other activities	+5/Severe	Entire catchment
		organisations/associations such as water users associations (WUA) for better management and marketing of their produce, - Train existing staff in the districts to enhance their technical capacity in planning, installation, operation, maintenance and management of irrigation, - Train farmers in operation, maintenance, and management of irrigation and also record keeping, post-harvest processing and marketing. - Set up demonstration sites at sub county and parish level where the farmers can learn.		
Lack of knowledge and understanding of day to day livelihoods on the landscape	- Environmental degradation as a consequence of human behaviour that could be mitigated	- Awareness raising; - Coordination of awareness raising initiatives	+4/Important	Entire catchment
Failure to maintain infrastructure	- Wasted investment, failed project	- Maintenance planning and budget provision must accompany all development plans; - Entrench principles of maintenance and ensure that this requirement becomes policy and thence practice	+4/Important	Entire catchment

Alternative livelihood and income

Issues	Strategic implications	Possible measures	Criticality	Specific location
- Lack of alternative livelihood and income	- Concentration in agricultural activities with low income generated; - Hinder development in the catchment	- Sensitise and promote alternative source of income; - Promote alternative livelihood (bee-keeping, fish farming, tourism etc.); - Develop infrastructures and provide means for development of other activities	+5/Severe	Entire catchment



5 VISION, OBJECTIVES AND ANALYSIS OF OPTIONS

5.1 Vision and Objectives

The aim of catchment visioning is to:

- Develop a sense of cohesion and common purpose in people with diverse interests in the water resource
- Direct activities related to diverse interests towards that common purpose
- Continuously improve water resources management practices and the state of the resource
- Promote a culture of co-operation and consensus-building
- Provide a chain of accountability that links the vision to management objectives and management actions, so that it is possible to track whether the actions contribute to achieving the overall vision
- Provide objectives that allow operational managers to interpret applications of water license, and formulate and recommend license conditions in a strategic manner (DWAF, 2006).

The vision statement for the Victoria Nile – Lumbuye Catchment is:

“To sustainably use the environmental resources for a socio-economically viable, competitive and preserved Victoria Nile-Lumbuye Catchment by 2040.”

Three strategic objectives were selected by the stakeholders and cover the different key challenges identified in the catchment namely: the environmental degradation, the low level of water resources development, and the low level of human and social capital and insufficient implementation of integrated resources management approach.

- Strategic objective 1: To restore and sustainably manage the natural resources of the catchment
- Strategic objective 2: To develop agriculture, alternative livelihoods and water resources for socio-economic growth
- Strategic objective 3: To meet the institutional, technical, human requirements for integrated management of natural resources.

Strategic objective 1: To restore and sustainably manage the natural resources of the catchment

This strategic objective addresses the key water-related challenge “environmental degradation. The growth of the population and increasing food demand imply a growing demand for arable land. The result is increasing agricultural encroachment on wetlands and forest reserves including even marginal areas. In addition, the absence of soil and water conservation and poor agricultural practices exacerbate degradation of the environment (erosion, sedimentation in wetlands, etc.). This also increases the risks of natural disasters such as floods and droughts

Stopping and reversing land degradation is arguably the most critical step towards realisation of the vision. Integrated catchment management practices can result in reduced loss of top soil, better soil moisture retention and increased crop yields at the farm level while better water quality, reduced silt load and an improved hydrological regime will occur downstream. The implementation of environmental protection measures (reforestation, terracing, etc.) can reduce the risk of floods and droughts and help mitigate the potential impacts of climate change

Sustainable integrated catchment management practices should include the following targets:

- a) Identification of priority areas for preservation of the catchments
- b) Implementation of improved farming practices including soil and water conservation measures (including contouring or terracing in areas of steeper slopes), improved inputs (seed, pesticides and fertilizers)
- c) Sustainable forest and wetland management programmes combining both protection and sustainable utilisation
- d) Provision for minimum flow requirement to protect and sustain water course
- e) Provide alternative livelihoods and promote environmentally sustainable socio-economic development
- f) Enforcement of existing laws and regulations
- g) Improvement of water quality.

Strategic objective 2: To develop agriculture, alternative livelihoods and water resources for socio-economic growth

This strategic objective addresses the key water related challenge “low level of water resources development”. In addition to a growing population and increased demand for food, the catchment is characterised by a high level of poverty. Most of the people live in rural areas and derive their livelihood from rain-fed agriculture. Due to lack of appropriate resources and poor practices, agricultural surpluses and derived income are low. There is poor access to credit and markets among other barrier that contribute to the never ending poverty situation. A key component of the catchment management planning vision is water resources development across all water-related sectors in order to promote socio-economic growth. This strategic objective is central to the concept of catchment

management planning, which aims at maximising development from shared water resources or a shared water resources development project.

This strategic objective includes a wide range of water resources development interventions. The development of water resources can range from something very simple to complex and expensive infrastructure. The common element is that an investment is made to develop the available water resources so that they can be used to satisfy a development need.

Typical developments that are required to bring socio-economic benefits to the population include, among others:

- a) Improve rain-fed agriculture farming practices and inputs (seeds, pesticides and fertilizers) to increase yields and marketable surplus and improve food security
- b) Develop abstraction and distribution of water (water control) for irrigation resulting in improved food security (for the region/country), irrigation efficiency and employment opportunities (in the basin or close to the basin) in agriculture and agro-processing
- c) Develop alternative livelihoods through:
 - Storage of water for the development of capture fisheries and aquaculture for improved food security (for the region/country) and employment opportunities (in or close to the basin)
 - Storage of water for the development of livestock for improved food security (for the region/country) and employment opportunities (in or close to the basin)
 - Promote alternative livelihoods such as bee-keeping, activities linked to ecotourism, etc.
- d) Improvement of the existing potable water supply resulting in improved health and efficiency
- e) Treatment of wastewater for both urban and rural communities resulting in improved human health and reduced pollution
- f) Development of hydropower for national-level socio-economic benefit but direct local benefits especially in the case of mini and micro-hydropower development and to develop alternative sources of energy
- g) Development or conservation of water resources can also support the tourism and recreation industry and create employment opportunities in or close to the basin).

Strategic objective 3: To meet the institutional, technical, human requirements for the integrated management of natural resources

This strategic objective addresses the key water-related challenge of “low level of human and social capital and insufficient implementation of the integrated water resources management approach.” Addressing this challenge is critically important if development is to be need-responsive, coordinated, and sustainable, bearing in mind that different sectors/users are relying on a common resource and in some cases common infrastructure, and in others a shared resources management system. It is also a necessary condition to achieve the other strategic objectives in an efficient way and to optimise outputs

The main issues that need to be addressed are the following:

a) Coordination: Coordination between sectors in the identification and planning process to ensure that planners in each sector are fully aware of development initiatives in other sectors and to identify opportunities for the implementation of multi-purpose projects. The lack of coordination between sectors leads to duplication of effort and waste of financial and technical resources. As soon as they are fully operational, the CMOs/CMCs in the Lake Kyoga Water Management Zone should collect information about the planned projects in each sector and be a central actor in the coordination of development plans. Regarding plan implementation, the process is rarely fully comprehensive. Participants who do not have decision-making powers generally do elaboration of the plan and initial commitment to its implementation. In addition, commitments that are not accompanied by a budget and planned actions may not be implemented. Lack of inter-district coordination is also crucial for natural resources management, as districts may be sharing common resources like wetlands or forests. Also, upstream actions may impact downstream stakeholders (flooding, erosion, pollution, etc.). This coordination is not efficient at present

b) Law enforcement: The existence and effective implementation of environmental laws and regulations is a crucial aspect to control the impact of human activities on the environment and use of resources that constitute it. Existing regulation is recognised as adequate. However, too often there is an absence of compliance with the law (encroachment on wetlands, use of illegal fishing nets, etc.) at all levels (the population, politicians, etc.). These excesses are justified by the lack of sufficient mechanisms for the implementation and effective enforcement of the relevant laws and regulations.

c) Human capital: Sensitisation and capacity-building of district technical staff, members of CMOs and users in order to improve water resources management and associated development practices in the Lake Kyoga basin. This would also contribute to narrowing the gap in capacity between decision-makers and beneficiaries and thus

promote a bottom-up approach to water resources development and management.

Sensitisation and capacity building is needed in order to:

- Increase awareness of the various stakeholders (including politicians) on water management issues, and on the necessary coordination and communication for efficient cross-sectoral planning
- Promote a bottom-up approach to water resources development and management
- Increase the capacity of water users to manage in a sustainable way the water resources (irrigation water users' associations, farming practices, fishing practices, etc.)
- Train technical staff
- To support the management and development of projects
- To provide advice to the beneficiaries of water development projects (e.g. on soil and water conservation measures, technical advice for aquaculture, etc.).

d) Technical means for action: Data acquisition and knowledge needs to be strengthened (data on climatic and hydrological parameters, on water quality, on groundwater; knowledge of existing water abstraction, on informal irrigated areas, assessment of minimum flow requirements, etc.) in order to provide information to consolidate the plans and inform the decisions of the CMOs.

5.1.1 Factors and driving forces affecting achievement of the strategic objectives

Driving forces include forces, which according to the literature/accepted theory drive changes in social, technological, environmental, economic, and political factors. This section of the report presents and assesses the driving forces that can cause changes and influence the attainment of the strategic objectives. The driving forces are divided into two categories according to the level of mastery and command one can have on each of them in the framework of the Catchment Management Plans. These are:

- The internal driving forces, with a high level of mastery and command. These forces are most likely to be influenced by actions of the CMPs. They correspond to variables and strategic levers that could be used to achieve the strategic objectives through the identification of options
- The external driving forces, with a low potential for command. These forces cannot be used directly in the achievement of the strategic objectives. These driving forces represent the framework/background within which the CMPs will be implemented. Actions in the CMPs will not be able to influence such driving forces, but they can adapt to them or mitigate their impact.

The identification of the driving forces and the SWOT analysis revealed details of the dynamics of the catchments. Aspects that are crucial for the future of the catchments are described in the sections below.

5.1.1.1 External forces affecting the future of the catchment

The analysis highlighted the following external forces that are likely to act as constraints in which the catchment management plans will be implemented. These are:

- A. High population density and population growth: It is important to acknowledge the impact of this driving force. Although it does not fall within the CMPs responsibility, slowing down the increase in population is crucial to enable sustainable management of the catchments
- B. Land tenure: Land rights vested in the citizens of Uganda (Land Act - 1998), but the ownership of wetlands belongs to the Government. The question of land titles delivered legally in wetlands prior to the Land Act is not easy to solve, as compensation mechanisms are not yet in place. In addition, some land titles in wetlands have also been obtained illegally after the Land Act was enacted
- C. Gender issues: In Uganda, women are generally unable to own or inherit land due to restrictive practices under customary land tenure or are not economically endowed to purchase land rights. While the Land Act caters for a spouse to some extent, it does not tackle the land rights of widows, divorcees, and children. Also, the representation of women in political bodies is a challenge. For the two catchments, it is desirable that women should be fairly represented in CMOs and CMCs
- D. Climate change is also one of the external driving forces, which can have an impact on the catchments. Implementing measures to adapt to and mitigate the impacts of climate change is needed. When assessing the relevance of the different actions to be included in the CMP, their contribution to climate change mitigation and reduction to climate change variability should be considered
- E. Insufficient law enforcement has been identified by the stakeholders as one of the causes of environmental issues such as wetland encroachment and forest degradation. Modification of law enforcement mechanisms and of the budget allocated to the institutions in charge of this task is outside the CMPs influence. However, some measures can be taken to adapt to this constraint:
 - Identify priorities to make sure the resources available are not wasted and concentrated on sensitive priority areas
 - Raise awareness on existing laws and regulations and the need to enforce them

- Issue ordinances and by-laws
 - Acknowledge the fact that law enforcement is unrealistic as long as some people have no other alternative but breaking the law in order to survive.
- F. Insufficient financing capacity, at all levels, is a hindrance to development as well as to the implementation of actions. There is not much that can be done at catchment level to improve the overall financial capacity of its institutions. It is important to acknowledge this factor in order to adapt the content of the plans:
- Keep in mind financial aspects and limits of budget and consider possible financing possibilities when elaborating the plan
 - Establish clear priorities between the different measures and actions to be implemented
 - Optimise coordination to avoid duplication of effort (the cross sectoral approach adopted during the CMPs and the development of an integrated water resources management approach is a step toward this optimisation)
 - Make sure that no-regret investments are selected, in particular those generating sustainable income.

5.1.1.2 Main internal forces and need for action

The analysis identified the following main internal forces that need to be considered by the plan development process:

Agricultural productivity, for both rain-fed and irrigated agriculture is a key driver for the future of the catchment. There is space for improvement and increasing productivity for the improvement of the socio-economic situation (contributing to achievement of strategic objective two). At the same time, increase of productivity is also a necessary condition to satisfy the ever-growing population and to limit encroachment on natural habitats such as forest and wetlands (contributing to the achievement of strategic objective one). There are many different ways to increase productivity, including actions such as implementation of soil and water conservation measures, training of farmers, improving the quality and availability of inputs (including seeds), and management of water for irrigated crops among others. Irrigation can also be a way to increase productivity in some cases, but is not always the limiting factor.

Inadequate and unreliable income as well as lack of alternative livelihoods are other important weaknesses in the catchment and need to be addressed. These weaknesses impact negatively on socio-economic development as well as the condition of natural resources. All the actions aiming at improving agricultural productivity will contribute to increasing incomes generated by agricultural activities. Other possible interventions include development of water for production infrastructure (for fish farming, cattle watering, and irrigation); develop alternative livelihoods; and complementary sources of income (beekeeping, ecotourism, development of agro-processing and other industries, etc).

Management of wetlands is another key area for the catchment. Their preservation has been mentioned as a necessity by many stakeholders during the consultation process and is contained in Strategic Objective 1. However, restoring and conserving all wetlands in both catchments, given the current level of encroachment and the increase in population seems unrealistic. The balance between conservation and development must be discussed, and the identification of priority areas is important to decide where efforts on restoration and conservation need to be intensified. The existing legal framework and the work undertaken under the Wetland Management and Development Project and associated action plans constitute strengths for improvement of wetland management.

Awareness and technical capacity at different levels (farmers, local government, CMOs, etc.) are also important driving forces, generally as weaknesses. Including awareness raising activities (directed toward communities and politicians), as well as developing a training programme at different levels is needed in both catchments.

5.1.2 Identified options

The SWOT (Strengths, Weaknesses, Opportunities and Threats) analysis framework was used to identify and understand the driving forces, both external and internal, that could contribute to or hinder the achievement of the strategic objectives. From the SWOT analyses, a number of options emerged to: (i) build on the identified strengths, (ii) take advantage of the identified opportunities, (iii) address the identified weaknesses, and (iv) mitigate against the identified threats in the catchment. These options also took into account the results of the previous steps, in particular the proposals made by the stakeholders, and preliminary identification of actions by the experts to address the issues identified in the catchment. The following table presents the list options taking into consideration comments and requests from the stakeholders.

Table 5.1: Options and issues addressed

Options	Details
1. Develop water for production infrastructure	1.1 Create fish ponds
	1.2 Provide water/organise access to resources for cattle watering
	1.3 Develop large infrastructure (multi-purpose dams)
	1.4 Develop upland irrigation
	1.5 Organise irrigation in wetland (formal schemes)
	1.6 Develop rice/aquaculture schemes
	1.7 Develop rain harvesting and individual storage solution
2. Develop the agricultural sector and improve practices	2.1 Development of agro-forestry and conservation agriculture
	2.2 Implement soil and water conservation measures
	2.3 Develop organisation and outlets for agricultural production
3. Develop the other economic activities	2.4 Development and empowerment of farmer groups and associations
	2.5 Promote the use of quality inputs in agriculture
	3.1 Promote development of quality fingerlings and fish feed production
	3.2 Develop fish farming
	3.3 Develop small hydropower production
4. Environmental conservation and protection	3.4 Improve livestock husbandry (extension, breeding, etc.)
	3.5 Provide alternative livelihoods and promote environmentally sustainable socio-economic development path (tourism, bee keeping, etc.)
	4.1 Development of tree nursery and tree planting activities
	4.2 Develop a wetland classification according to their ecological interest and develop a wetland management and development strategy accordingly
	4.3 Set up clear demarcation of wetlands and forests
	4.4 River bank protection (cultivation and mining)
5. Improve water supply and sanitation	4.5 Develop a forest management and development strategy
	4.6 Use of renewable energy/alternative energy sources and development strategy
	5.1 Improve access to safe water supply
	5.2 Upgrade/improve existing wastewater treatment plants and make sure effluents meet national standards
6. Control and reduce water pollution	5.3 Promote sanitation facilities in rural areas
	5.4 Plan sanitation along with new piped schemes being developed in small towns and rural growth centres
7. Communication and capacity building	6.1 Improve management of solid waste
	6.2 Control wastewater discharge and pollution from industries (sugar factories, etc.) and artisanal activities (breweries, mining, etc.)
	7.1 Awareness campaigns (subjects identified: existing laws and regulation, impact of malpractices, etc.)
	7.2 Capacity building at farm and community level (sustainable use of wetlands, good farming practices, use of quality seeds and inputs, etc.)
	7.3 Capacity building of CMOs
8. Improvement of institutional context (related to the water sector, at catchment level)	7.4 Capacity building for local government staff
	7.5 Dissemination of the plan
	8.1 Improvement of cross-sectoral planning
	8.2 Put into operation the CMOs
9. Improvement of knowledge and data collection on water resources	8.3 Support preparation of ordinances and by-laws by district local government
	8.4 Improve coordination between different institutions involved in law enforcement (technical, political, environmental police, NEMA)
	9.1 Participate and collaborate with the Kyoga WMZ for data analysis and interpretation
	9.2 Collection of information on natural resources and activities in the catchment (assess the extent of informal irrigation).

5.2 Multi-criteria evaluation of alternative plans

The Multi-Criteria Analysis (MCA) was used to select a realistic and/or preferred scenario that can best meet the ambitions of the vision and strategic objectives. The six different scenarios that were compared are described as follows:

- Two extreme scenarios: Scenario “Full development”, which corresponds to a situation where all efforts are concentrated toward socio-economic development without considering environmentally orientated options; and on the other extreme the “Maximum environmental conservation scenario”, which corresponds to a scenario where all efforts are concentrated toward improvement of environmental conditions without investment toward socio-economic development. These two scenarios are voluntarily extreme and in a way unrealistic/undesirable. The aim of studying them is to highlight the harm of neglecting one or the other of the two aspects (environment/socio-economic development)
- Four intermediate scenarios: these scenarios include the same level of development for environmental, institutional and for some of the socio-economic type of options, meant to allow a sustainable development of the catchment and which take into account the priorities expressed by the stakeholders. They differ from the levels of infrastructure and irrigation development.

A water resources analysis was undertaken in order to check the feasibility of the scenarios (and see if the resource available can meet the projected demand), and to estimate the need for storage associated to each one in the different sub-catchments (or group of sub-catchments). The content and philosophy of each one of the six scenarios is presented in Table 5.2 below.

Table 5.2: Description of the scenarios

Scenario	Development of environmental and institutional options	Development of socio economic options	
		Options not involving large storage infrastructures	Option related to large Infrastructures and irrigation development
Scenario 1: Maximum environmental conservation	Priority for the scenario.	No effort toward this type of option. Only options with an impact on environment are considered (e.g.: improvement of sanitation)	Not developed
Scenario 2	Set of options (the same for the four scenarios) based on what is considered needed to allow a sustainable development and taking into account the priorities expressed by the stakeholders.		Formalisation of irrigation in wetlands in all areas where informal irrigation is taking place.
Scenario 3			Same as scenario 2 + development of 50% of the upland irrigation potential (around 7,886 ha)
Scenario 4			Part of the wetlands already converted (10%/1,607ha) are restored. Formal irrigation is developed in the rest of encroached wetlands. Upland irrigation is developed on 1,607ha
Scenario 5			Developed up to the maximum (all seasonal wetlands are converted (formal irrigation), including the one still intact at the moment). All the area identified as irrigable in uplands is developed.
Scenario 6: Full development	No effort toward this type of option	Priority for the scenario	Developed up to the maximum (all seasonal wetlands are converted (formal irrigation), including the one still intact at the moment). All the area identified as irrigable in uplands is developed.



In collaboration with stakeholders, the list of criteria and weighing of the criteria was developed. The scenario evaluation focuses on the potential benefits or impacts of development interventions and management options in terms of social, environmental, and economic aspects. The criteria were selected for being good markers of progress toward achievement of the catchments' objectives and, hence, of the visions. Inputs from the stakeholders were taken into account to adjust the initial list proposed by the consultant.

A. Criteria to best represent progress toward the first strategic objective ("To restore and sustainably manage the natural resources of the catchment"):

1. **Watershed protection and enhancement:** The catchment is threatened by environmental issues such as deforestation, erosion, siltation of rivers and wetlands, etc. This criterion is used to assess the potential benefits or damages caused by each option in regard to catchment management and protection
2. **Improvement of water quality:** Water quality in the catchments is degraded by several sources of pollution: industries, lack of sanitation, malpractices, etc. Improvement of water quality is a criterion which must be taken into account in evaluating the scenarios in order to promote actions improving water quality and limiting the practices that contribute to water quality degradation
3. **Wetland conservation and wise use:** this criterion seeks to assess to what extent each option contributes to the implementation of measures favouring the conservation and enhancement of wetlands, which is an important issue in catchment.

B. Criteria to best represent progress toward the second strategic objective ("To develop agriculture, alternative livelihoods and water resources for socio-economic growth"):

1. **Income increase per capita:** The majority of the people in the study area are involved in agricultural production, which overall generates low yields and low incomes. In addition, almost no alternative source of income exists. The criteria "income increase per capita" aims at evaluating the potential benefit of each scenario in terms of income generated per capita and reduction of poverty
2. **Improved food production per capita:** The catchment is characterised by a significant increase in population. Most of this population lives from agriculture whose yields are relatively low, which implies low food production, and low income. By 2040, one of the challenges of the catchment will be to increase food production per capita. Without actions favouring increase in food production, the catchment will be subject to food insecurity
3. **Lowest incidence of water related diseases:** The catchment is threatened by the increased incidence of water borne diseases such as cholera, dysentery and typhoid reported in several districts in the catchment. Options, which will score high for this criterion, are the one contributing to improved access to drinking water, sanitation, reduction of water pollution, etc. This criterion reflects one major aspect of the livelihood of the population in the catchment.

C. Criteria, which contribute to the achievement of both the first and second objectives

1. **Well balanced use of water resources:** The potential effects of climate change and the development of water related activities (irrigation, aquaculture, etc.) could bring up water availability problems. Balanced use of water resources is an important factor to consider in evaluating scenarios
2. **Mitigation/adaptation to natural disasters and climate change:** with this criterion, the objective is to assess to what extent the analysed options and scenarios contribute to mitigating natural disasters (floods, droughts, landslides, etc.) and the potential effects of climate change. This includes adaptation and mitigation to the (potentially increasing) risks of droughts and floods and their consequences in terms of reduced agricultural yields and food insecurity

D. Criteria to best represent progress toward the third strategic objective ("To meet the institutional, technical, human requirements for integrated management of natural resources"):

1. **Optimises the impact of other actions:** This criterion serves to evaluate the dependence of certain options on others. As part of the future management plan, this will help to not dissociate implementation of two options, which should be implemented together. Options with high scores for this criterion will be for example the ones related to capacity building, knowledge improvement and data collection, awareness, etc.

E. Criteria to assess the feasibility and capacity to implement the options and scenarios:

1. **Feasible/affordable cost:** Limited financial capacity is one of the factors identified which limits development in the catchments. It would be counterproductive, for the final management plan, to promote too many options whose excessive cost would not allow them to be implemented. The criteria "affordable/feasible cost" evaluates the potential constraints (or absence of constraints) linked to the cost of the options. Some options whose implementation cost is very high can be developed, but in only one or a very limited number of locations.
2. **Ease of implementation:** Some actions may be considered useful but could be difficult to implement in practice, depending on acceptability by some stakeholders. For example, large dams can face difficulties due to conflict with some stakeholders in the catchment, especially when resettlement is

needed or when environmental impacts are important. There is, in addition, uncertainty of technical feasibility since many of the options have not been studied well. It is not desirable that the plan includes too many interventions with low scores on this criterion.

The process of rating the options comprised of three steps:

1. Evaluation of the impact of each option (positive or negative) on each criterion by the establishment of a rating system. This allows assigning a score indicative of the impact of the scenario in relation to each criterion
2. Normalisation: as the ranges of scores used for each criterion are not identical; they are normalised to obtain a score ranging between 0-1 for each criterion
3. Evaluation of the importance given to each criteria (weighting). This weighting allows making a distinction between the different criteria when calculating the final score for a scenario

Figure 5.1 shows how the scenarios perform against the different criteria considered. The overall scores of each scenario, taking the individual scores for all the criteria and their weighting into account are presented in Table 4.1.

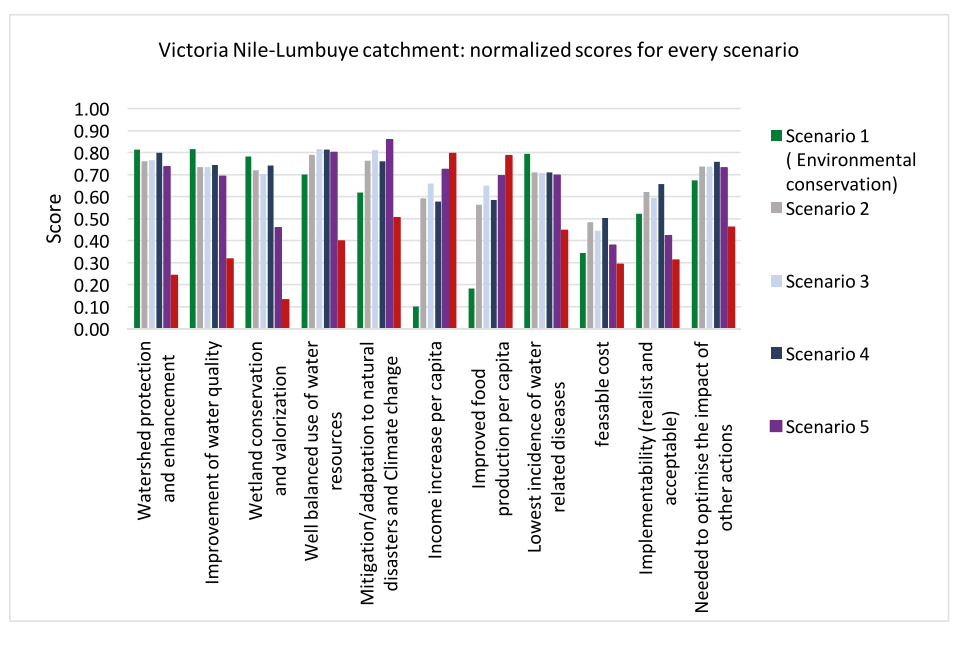


Figure 5.1: Scores of each scenario for the different criteria

Table 5.3: Scores of each scenario for the different criteria

Scenario	Overall Score
Scenario 1 Environmental conservation	0.57
Scenario 2	0.68
Scenario 3	0.69
Scenario 4	0.70
Scenario 5	0.64
Scenario 6: Full development	0.42

The results of the Multi-criteria Analysis lead to the definition of a compromise scenario associating socio-economic development and environmental conservation for each catchment. In the light of the results, the options and actions that will constitute the Catchment Management Plan are close to the ones that constitute Scenario 4. The compromise scenario includes the formalisation of irrigation in the wetlands, their restoration, and the partial development of the upland irrigation potential. On this basis, it will be possible to identify the possibilities and the opportunities to further develop the upland irrigation potential, and thus to orient the Catchment Management Plan towards Scenario 3. In the medium term (after the first 10 years of the plan), it will be necessary to re-define the ambitions regarding the restoration of wetlands, the formalisation of irrigation in wetland, and the level of development of the upland irrigation potential. This will be done taking into account the studies made and the feedback from the results obtained during the first period of the plan

The following conclusion were made from the scenario analysis: (i) formalisation of irrigation in the wetlands, (ii) development of large storage infrastructure is need to meet the future water demand especially if large irrigation schemes are to be developed, and (iii) restoration of wetlands.

5.2.1 Formalisation of irrigation in wetlands

Formalisation of irrigation in wetlands is imperative to improve the agricultural production and get a better control over wetland encroachment. It should not take place on wetlands, which have not yet been converted, to avoid encroaching on additional natural areas. Irrigation in wetlands also requires the development of a wetland strategy and management plan, complementary to other work undertaken on wetlands in the catchment. The objective of developing such a plan would be as follows: (i) to identify and map the extent of informal irrigation and other types of wetland degradation, (ii) to identify the wetlands to be preserved (because of little or no impact by human activities), (iii) to identify the wetlands to be restored (wetlands impacted by human activities but with important ecological roles and functionalities making them a priority for restoration), and (iv) to identify the wetlands where irrigation and other type of activities can be developed, applying a wise-use policy. In addition to being easily implementable in the first years of the management plan, the formalisation of irrigation and the improvement of agricultural practices present a significant potential in terms of increasing yields. The Table 5 4 below summarises the irrigation scheme projects that will be implemented in the plan.

Table 5.4: Summary of irrigation schemes

Sub Catchment	Formalisation of irrigation in wetlands (ha)	Restoration of wetlands (ha)	Development of reservoirs	Development of upland irrigation (ha)
VN1	1926	214	Reservoir not needed	0
VN2	1305	145	Implement reservoir site VN2-1	Develop the upland irrigation to 50% of the potential (1,844 ha)
VN3	927	103	Settle 11 Mm ³ of storage capacity in the Nabigaga sub-catchment (VN3)	0
L1	1404	156	Settle 10Mm ³ in the Lumbuye sub-catchment (L1, L2)	0
L2	8901	989		0

5.2.2 Development of large storage infrastructures is needed to meet the future water demand

As shown by the results of Scenarios 3 and 4, upland irrigation is worth being developed. Indeed, the scores obtained on the criteria "income increased per capita" and "improved food per capita" clearly show that these

scenarios, particularly Scenario 3, favour food production and income generation. Their scores on the criteria “feasible cost” and “Implementability” are relatively high compared to Scenarios 5 and 6 and suggest that the implementation of Scenario 4 is easier to achieve compared to Scenario 3. It generally requires storage infrastructures, which may necessitate specific studies (feasibility, impact assessment, detailed design) and are likely to be developed only in the medium or long term. To bring all the expected benefits, such developments should take place in a context where agriculture and farmers have a good level of knowledge, adequate extension services, and organisation. Irrigation adds complexity to the crop management techniques, which at the moment, based on the data available on observed yield and information collected during the previous step of the project, are not mastered by the farmers. It is, therefore, considered important to associate the development of upland irrigation with prior training of farmers (on irrigation but also on other technical aspects of crop management), development of farmers’ groups, of extension services. Development of upland irrigation, especially for large schemes, will therefore be proposed in the plan for the medium (years 6 to 10) and long (years 11 and after) terms.

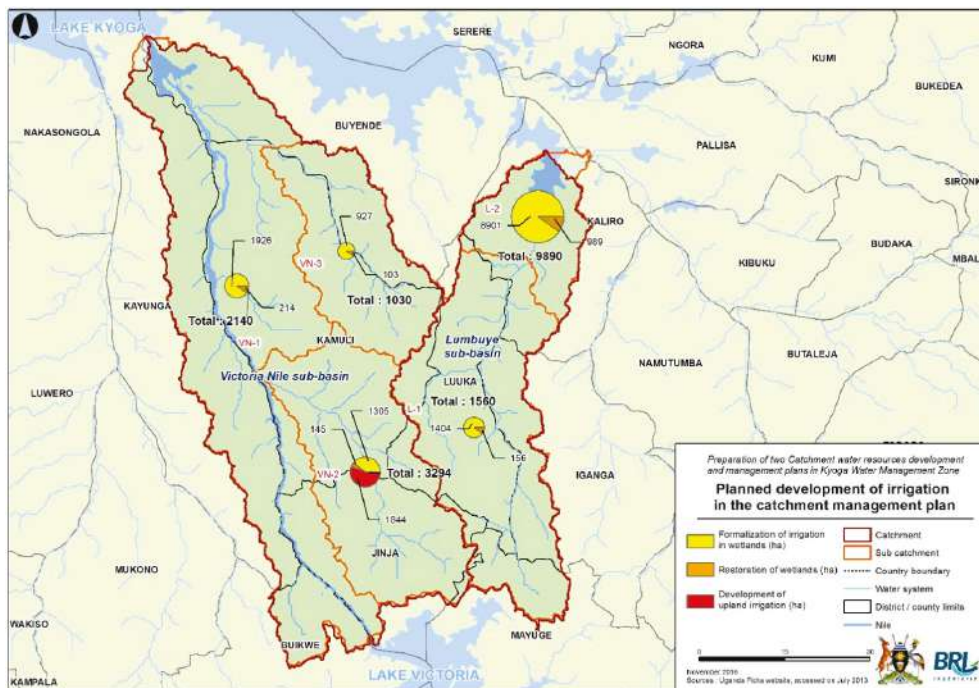


Figure 5.2: Planned development of irrigation in the CMP

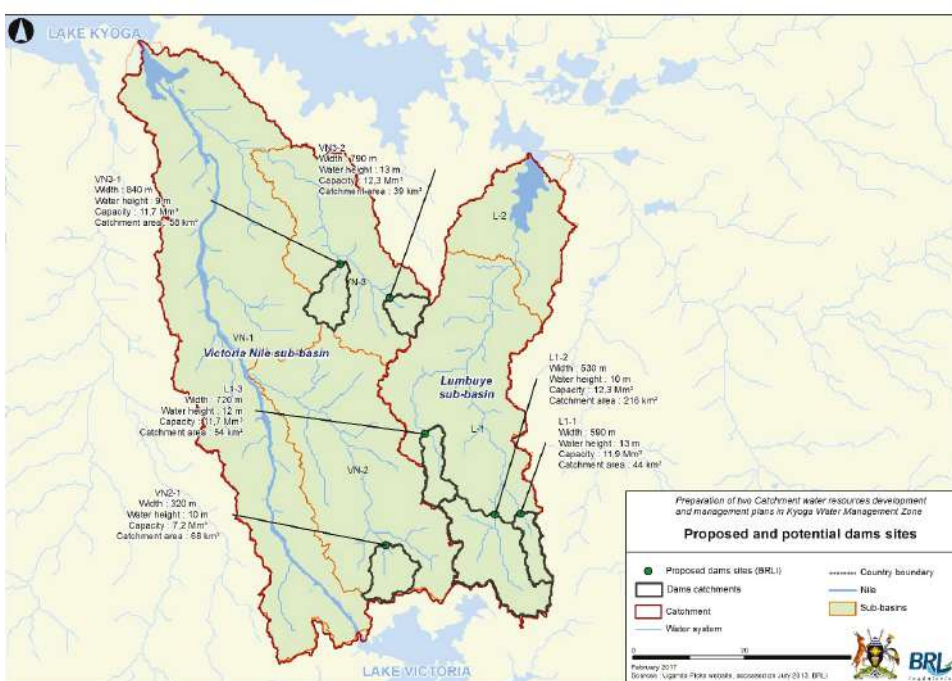


Figure 5.3: Proposed and potential dam sites

5.2.3 Restoration of wetlands

Scenario 4 includes the restoration of a part of the degraded wetlands. Compared to Scenarios 2, 3, and 5, Scenario 4 gets the highest score (0.74) for the “wetland conservation and valorisation criterion.” In addition, preservation and restoration of wetlands is one of the themes highlighted many times as important during stakeholder consultation. The rehabilitation of wetlands for their conservation is also envisaged and implemented in the first 10 years of the plan. Scenario 4 takes into account the rehabilitation of 10% of the wetlands where informal irrigation is currently in place, representing 462ha for the Victoria Nile Catchment and 1,145ha for the Lumbuye Catchment.



6 MANAGEMENT AND INVESTMENT ACTIONS

The intervention plan consists in a set of activities to be implemented in the short term: from 1-5 years, the medium term: from 6-10 years, and the long term: from 11-20 years. Activities to be included in the plan have been identified based on the expertise carried out in the previous stages of the process, especially the analysis of issues and corresponding measures, the evaluation of options and analysis of the scenarios. The implementation of the activities has been prioritised over time. The first five years of the management plan (1-5 years), the activities are implemented in the areas of the catchment where they are most needed. Then, on the medium and the long term, they are implemented in the less priority areas of the catchment. The table below presents the activity plan. The sections that follow provide more detail explanation for the activities that require additional information or where specific interventions that are in line with the plan are already underway.

Table 6.1: Activity plan for the catchment

Activities	Indicator unit	Targeted outputs		
		1-5 yrs	6-10 yrs	Beyond 10 yrs
1-DEVELOP WATER FOR PRODUCTION INFRASTRUCTURE				
1.1 Create fish ponds	Surface area	400m ²	-	-
	No. of farmers contacted	500	300	500
	No. radio talk-shows	5	5	5
1.2 Provide water/organise access to resources for cattle watering	No. of Sunken pits	50	50	-
	No. roof water harvesters	50	50	-
	No of rainwater tanks	50	50	-
	No. of livestock access points	10	15	-
	No. of meetings	30	50	50
	No. of talk-shows	5	5	10
1.3 Develop large infrastructure	No. of feasibility/drainage studies	8	-	-
	No. of constructed large reservoirs	-	6	3
	No. of completed drainage projects	-	-	-
1.4 Develop upland irrigation	No. of studies completed	-	1	-
	Ha. under new irrigation	309	-	1844
	No. of trainings	25	25	25
	No. of meetings	-	10	-
1.5 Organise irrigation in wetlands (formal schemes)	Ha. under formalised irrigation	-	4,257	10,156
	No. of studies	4	-	-
	Ha under new irrigation	-	-	-
1.6 Develop rice/aquaculture schemes	Ha under rice/aquaculture	4	-	-
	No. demonstration farms	1	-	-
	No. of meetings	40	40	20
1.7 Develop rain water harvesting and individual storage solution	No. of sunken pits	40	10	-
	No. of roof water harvesters	40	10	-
	No. of rainwater tanks	40	10	-
2-DEVELOP THE AGRICULTURAL SECTOR AND IMPROVE PRACTICES				
2.1 Development of agro-forestry and conservation agriculture	No. of trainings	66	45	20
	No. of meetings	30	30	-
	No. of talk-shows	5	5	-
	No. of demonstration farms	-	-	-
2.2 Implement soil and water conservation measures	No. of pilot projects	1	-	-
	No. of trainings	30	20	40
	No. of studies	1	2	-
	Ha under conservation measures	-	-	-
2.3 Develop organisation and outlets for agricultural production	No. of outlets	-	-	-
2.4 Develop and empower farmer groups and associations	No. of farmer groups	-	-	-
2.5 Promote the use of quality inputs in agriculture	No. of talk shows	10	10	-
	No. of demonstration sites	-	-	-
	No. of trainings	5	5	20
	No. of meetings	25	-	-
3. DEVELOP OTHER ECONOMIC ACTIVITIES				
3.1 Promote development of quality fingerlings and fish seed production	No. of fish fry centres rehabilitated	-	-	-
	No. of hatcheries constructed	1	-	-
3.2 Develop fish farming	No. trainings	45	30	25
	No. of meetings	45	30	25
3.3 Develop small hydropower production	No. of Feasibility studies undertaken	-	-	-
	No of HP stations constructed	-	-	-
3.4 Improve livestock husbandry (extension, breeding etc)	No. of talk shows	5	-	-
3.5 Provide alternative livelihoods and promote environmentally sustainable socio-economic development (tourism, bee keeping)	No. of meetings	-	25	50

Table 6.1: Activity plan for the catchment Continuation

4 ENVIRONMENTAL CONSERVATION AND PROTECTION				
4.1 Development of tree nurseries and tree planting activities	Ha. of trees	340	14	6
	No. of community tree nurseries	8	1	2
	No. of talk-shows	5	5	
	No. of meetings	6	9	50
4.2 Build a wetland classification according to their ecological interest and develop a wetland management and development strategy accordingly	Wetland inventory or strategy	1	-	-
	Ha under restoration	50	7,986	
	Ha of wetland demarcated	7,986	-	
	No of meetings	70	20	100
4.3 Clear demarcation of wetland and forests	No of talk-shows	20	5	10
	Km of demarcation	20	-	-
	No of meetings	30	20	50
4.4 River bank protection (cultivation and sand mining)	No of talk-shows	5	-	10
	Km of buffer zone	10	6	4
	No of meetings	45	45	60
4.5 Develop a forest management and development strategy	No of talk-shows	5	5	10
	No of studies	1	-	-
	No of restoration plans	9	-	-
	No. of plans implemented		3	2
4.6 Use of renewable energy/alternative energy sources and development strategy	No of meetings	75	75	100
	No of talk-shows	5	5	10
	No of biogas digesters	-	-	-
	No of solar panels	-	-	-
5 – IMPROVE WATER SUPPLY AND SANITATION	No of meetings	150	225	-
	No of trainings	75	75	-
5.1 Improve access to safe water supply	No of piped water schemes designed	5	-	-
	No of piped water schemes constructed	4	4	-
	No of piped water schemes rehabilitated	-	-	-
	No of bore holes constructed	50	15	15
	No of well springs & boreholes rehabilitated	30	15	15
	No of wells protected	25	15	15
	No of meetings	25	25	15
5.2 Upgrade/improve existing waste water treatment plants and make sure effluents meet national standards	No of talk-shows	5	5	10
	No of studies undertaken	1	-	-
5.3 Promote sanitation facilities in rural areas and small towns	No of treatment plants upgraded.	-	1	-
	No of sanitation system design studies	1	1	1
	No of sanitation systems constructed	-	3	2
	No of latrines constructed	25	15	15
	No of meetings	25	25	-
5.4 Plan sanitation associated with the new piped schemes being developed in small towns and rural growth centres	No of talk-shows	5	-	-
	No of design for waste water treatment plants	6	4	-
	No of waste water treatment plants constructed	-	6	4
CONTROL AND REDUCE POLLUTION				
6.1 Improve management of solid waste	No. of solid waste disposal studies conducted	1	2	1
	No. of catchments with proper solid waste disposal mechanisms in place	-	2	2
	No. of meetings	50	50	-
	No. of talk-show	-	3	-
6.2 Control waste water discharge and pollution from industries and artisanal activities	No. of meetings	10	-	-
	No. of effluent control studies	-	8	-
7 – COMMUNICATION AND CAPACITY BUILDING				
8- IMPROVEMENT OF INSTITUTIONAL CONTEXT	No. of meetings	75	75	150
9 – IMPROVEMENT OF KNOWLEDGE AND DATA COLLECTION		-	-	-



6.1 Develop Water for Production Infrastructure

6.1.1 Creation of fish ponds

Creation and promotion of fishponds will ultimately develop the aquaculture sector and support development of alternative livelihoods. Aquaculture development will increase fish stocks in the Victoria Nile-Lumbuye Catchment and reduce fish depletion in rivers and lakes. The Victoria Nile-Lumbuye Catchment is dominated by subsistence aquaculture practiced by individual farmers. The Table 6.2 indicates the potential (number of fish ponds compared to the number of ponds stocked) for the development of fish farming based on information available at district level for the Victoria Nile-Lumbuye Catchment.

Table 6.2: Key aquaculture indicators in districts in the Victoria Nile-Lumbuye Catchment (source: consultations with DFO and/or DLG statistical abstracts)

District	Number of ponds	Number of ponds stocked	Number of ponds unstocked/abandoned	Average surface (m)
Kamuli	204	0	0	200
Luuka	71	-	-	832
Kaliro	102	11	91	-
Jinja	130	32	98	560

Accordingly, the following activities should be implemented in the short-term period:

- Make a complete inventory of all existing ponds (stocked, unstocked, abandoned, etc.) to identify the existing potential and make the abandoned ponds available for new fish farmers
- Register all private aquaculture practitioners. This can protect farmers from malicious practitioners who exploit them by providing them with sub-standard advisory services
- Promote fish farming as an alternative livelihood and source of income among the population
- Promote the creation of fish farmers groups. The creation of such groups is a mean to strengthen the fish farming sector by pooling capital, which will allow the purchase of new means of production. It is also a means to enhance production and sales it
- Training fish farmers on good farming practices such as water quality management, sampling, grading, record keeping and feeding, stocking and make their own feed
- Establish demonstration farms: this measure is seen as a mean to promote and train farmers on good farming practices
- Identify new sites for the construction of ponds and carry out the construction.

6.1.2 Construction and rehabilitation of livestock watering points

In the short-term, the following measures to improve water access for cattle watering should be implemented:

- Promote and implement simple rainwater harvesting technologies like sunken pits, ditches, roof water harvesting and rainwater tanks
- Development of roof water harvesting such as corrugated, plastic and ferro-cement tanks is a useful solution to storing water for domestic purposes. Rainwater tanks can also be useful to capture local runoff and can provide water for subsistence food gardening
- Organise access to watering points and formulate policy guidelines that provide for establishment of livestock corridors to access watering points in wetlands
- Integration of livestock into crop production systems such as rice production systems. For example, residues from crop harvests like maize stover, rice straw and chaff can be used as feed for livestock. This will improve agricultural water productivity since the amount of water depleted in the production of crop residues will be almost negligible and already accounted for in the crop water requirement to produce food.

6.1.3 Develop large infrastructure

The need for infrastructure is highly dependent on the projects to be implemented in the catchment. Priority should be given to the parts of the catchment where water stress is most encountered in the current situation, and/or where it is anticipated to increase due to the expected increase of water demand. The table presents the storage capacity required per sub-catchment and the characteristics of the identified potential sites

Table 6.3: Required storage capacity and identified potential sites in the Victoria Nile-Lumbuye Catchment.

Sub catchment	Storage capacity required (Mm ³)	10% required volume (Mm ³) (small dead volume)	Storage capacity considered (Mm ³)	Identified reservoir sites	Water height (m)	Volume (Mm ³)	Reservoir's surface (km ²)
VN2 (Kiko)	6	0.6	6.6	VN2-1	10	7.17	2.082
VN3 (Nabigaga)	11	1.1	12.1	VN3-1	10	15.43	4
				VN3-2	13	12.32	2.665
Lumbuye	10	1	11	L1-1	13	11.89	2.488
				L1-2	10	12.28	3.446
				L1-3	12	11.74	2.355

For the Kiko sub-catchment (VN2), the development of a 6Mm³ reservoir to cater for the deficit that occurs in four years over a period of five years and the development of 1,844ha of upland irrigation. In other sub-catchments, development of the required storage capacity will cater for the deficit that occurs every four years over a period of five years. However, the development of upland irrigation is not suggested.

The Catchment Management Plan takes into account the realisation of the feasibility studies in the short term (1-5 years). Depending on the results, the construction of the reservoir would be planned under the medium to long term. For sub-catchments where several potential reservoir sites have been identified, the Catchment Management Plan takes into account the construction of the required storage capacity in each sub-catchment. The results of the feasibility study should help in determining the most adequate reservoir to develop.

Implementation of reservoirs or multipurpose dams projects should be accompanied with measures aimed at helping the implementation and optimising the benefits of the new infrastructure. This will include

- Activities to protect the catchment and limit erosion (and then siltation in the reservoirs) upstream the sites. For example, implementation of soil and water conservation measures and good farming practices, tree planting, development of alternative livelihoods in order to provide new sources of income to people relying on activities leading to erosion and deforestation among others
- Activities to improve the organisation and management of agricultural production (in the case of reservoir associated to irrigation development) in order to make sure the farmers can optimise the benefits of the new access to water. This will include training, organisation and development of outlets for agricultural production, development of farmer groups and association, use of quality inputs, among others.

At the end of the first 10 years, it will be necessary to revise the Catchment Management Plan. The objective will be to review the ambitions of the plan regarding the development of the upland irrigation potential. This will principally depend on the results of the feasibility studies of the identified reservoirs. Ambitions regarding formalisation of irrigation in wetlands and their protection will also be revised.

Flood is a critical issue in the catchment. To improve flood management, a flood risk prevention plan will be developed after assessing areas that may be flooded to provide technical, legal and human remedies to address them. Such a study is recommended for the short term in the Lumbuye Catchment. In addition, the catchment plan will consider the construction of drainage systems for flood control. Drainage systems contribute to the drainage of rainwater. Within the framework of the management plan, feasibility and design studies for the installation of drainage systems are taken into account in the short term. Two hotspots have been identified in this framework as follows in the table below.

Table 6.4: Identified hotspots for the design and implementation of a drainage system

District	Sub-county	Parish	Village	Latitude	Longitude	Sub-catchment
Kaliro	Budomero	Budomero	Nabwende	1.083	33.460	L2
Mayuge	Mayuge	Ikulwe	Dwaliro A, B & C	0.457	33.488	L2

6.1.4 Development of upland irrigation

Agriculture in Victoria Nile-Lumbuye Catchment is mainly rainfed with low yields. Development of upland irrigation is a way to increase agricultural production in the catchment. Increasing production is most likely to increase the marketable part and thus improve the incomes generated and reduce the risk of food insecurity. In addition, the development of upland irrigation is also seen as a way to reduce informal irrigation in wetlands. To be effective, development of upland irrigation must be associated with:

- Training farmers on good farming practices, operation, maintenance and management of irrigation and also record keeping, post-harvest processing, and marketing. This must be done jointly with the establishment of demonstration farms
- Organising farmers into groups and encouraging them to join other social groups to help them gain access to credit and other benefits

Upland irrigation potential has been identified at district level and is based on the district boundaries established in 2006. Potential irrigation area has been estimated per sub-basin based on the share (in percent) of each district in each sub-basin. The ratios obtained were then used to estimate the potential share of irrigation for the sub-basin. The results are presented in the Table 6.5 below:

Table 6.5: Irrigation potential estimated per sub-basin

Sub-catchment	Upland Irrigation (ha)
VN-1	3,929
VN-2	3,688
VN-3	1,795
L-1	4,051
L-2	2,308

6.1.5 Organise irrigation in wetlands

Cultivation of rice in wetlands is the traditional informal irrigation. Most of it is located on the fringes of wetlands and small holders developed it spontaneously without planning and with little or no technical assistance. In the Victoria Nile-Lumbuye Catchment, informal irrigation has been estimated to be 16,070ha as follows: 4,620ha in the Victoria Nile Catchment and 11,450ha in the Lumbuye Catchment. Conversion of informal irrigated areas into formal irrigation schemes is seen as a way to limit the uncontrolled encroachment of wetlands and to improve the water control and, therefore, the efficiency of irrigation. Assuming that farmers practicing irrigation in an area targeted by a project will all access the new formal irrigation facilities and will not relocate their activity in other informally irrigated areas, such conversion will imply a reduction of the water demand by improving the irrigation efficiency.

Table 6.6 below indicates areas of informal irrigation for which formalisation is considered in the management plan. This represents 90% of the total informal irrigated area. The CMP plans the wetland's restoration of the remaining 10%. For the areas indicated in the table below, the CMP plans a detailed design and mobilisation of funds for implementation of irrigation schemes in the short term. Areas targeted for formalisation of irrigation will be adjusted according to this study. Formalisation of irrigation through is planned in the medium to long term.

Table 6.6: Areas of informal irrigation targeted for formalisation.

Sub-catchment	Informal irrigated area to be formalized in the CMP (ha)
Nile (VN1)	1,926
Kiko (VN2)	1,305
Nabigaga (VN3)	927
Lumbuye	10,255

Three hotspots have been identified for implementation of formal irrigation schemes and are presented in Table 6.7. Among them, two sites present an important potential for implementation of formalised irrigation. As the area involved is relatively large and shall be developed on the wetlands, the development of irrigated agriculture will

be detrimental to the protection of wetlands. The implementation of these irrigated areas should be based on a more comprehensive study taking into account the state of degradation of wetlands and the relative importance given to the development of irrigated agriculture and wetland protection.

Table 6.7: Location of existing irrigated areas and of the potential for irrigation in the Victoria Nile-Lumbuye Catchment. (Source: National Water Resources Assessment, 2013 & IIRR Survey 31/08/2016 - 02/09/2016).

District	Village	Latitude	Longitude	Sub-basin	Description/details
Luuka		0.839	33.358	L2	Source: IIRR Survey 31/08/2016 - 02/09/2016
Iganga	Lumbuye	0.84	33.37	L1/L2	Source: NWRA Actual (ha)= 0 Potential (ha) = 7686 Crop= Rice, maize Type= Dams and checks
Kaliro	Nyanza	1.06	33.44	L2	Source: NWRA Actual (ha)= 0 Potential (ha) = 300 Crop= N/A Type= N/A

6.1.6 Development of rice/aquaculture

Development of schemes combining rice production with will contribute to: (i) formalise irrigation in wetlands; (ii) associate two different sources of income and therefore increase the generated income; and (iii) increase the production of different marketable surplus. In order to optimise the development of rice/aquaculture scheme among the population, the following measures must also be implemented:

- Establishment of demonstration farms
- Training adequate local government staff in rice/aquaculture production for them to support farmers' initiatives
- The organisation of producers into groups to facilitate access to credits for the development of their activities and the promotion of marketable products
- Identification and organisation of markets for the sale of marketable surpluses

6.2 Develop the Agriculture Sector and improve practices

6.2.1 Development of agro-forestry and conservation agriculture

Promoting good agricultural practices among farmers' communities is a way to:

- Increase agricultural yields and, therefore, reduce food insecurity and generate additional income
- Reduce soil degradation and loss of fertility, thus reduce enrichment of aquatic systems with sediment, nutrients and other pollutants among others.

Measures to improve agricultural practices are varied and include: promotion among farmers and training on agro-forestry and smart agricultural practices, training of local government staff to make them able to support the farmers, creation of a demonstration sites. In addition, the organisation of farmers into groups should be promoted.

6.2.2 Develop soil and water conservation measures

Implementation of soil and water conservation practices is a way to reduce erosion, siltation of streams and wetlands and soil fertility among others. Conservation measures include, among others: (i) setup of hedgerows, to reduce erosion on the hills; (ii) rehabilitation of gullies; (iii) construction of terraces in farms; and (iv) promotion of Napier grass planting. The implementation of such measures and the training of farmers will be prioritised in the Nile and Kiko sub-catchments (VN1 & VN2). One hotspot (see Table 6.8 below) has been identified by IIRR. In the short term, the definition of a pilot projects is considered. This project aims at enhancing conservation of soil and water by associating complementary activities such as: reforestation, training of farmers on soil conservation measures and reforestation, demarcation of forest. The project would take place in the Nile sub-catchment (VN1) and include the identified hotspot in the table below. The plan proposes the implementation of activities related

to various options including reforestation, clear demarcation of forests, and implementation of soil and water conservation measures among others. These are:

- Baseline survey and boundary marking with community stakeholders - Sisal plants, aloe plants as boundaries
- Reforestation programme: Replanting/infilling the degraded forest area with appropriate seedlings, 10ha
- Reforestation programme: Facilitating households to plant at least 10ha tree seedlings (timber and fuelwood) for domestic use
- Reforestation programme: Facilitating one school to plant at least 2ha tree seedlings
- Manage/rehabilitate five gullies in the ecosystem
- Facilitate construction of terraces in 20 farms/200 meters.

The command areas of the reservoir sites identified in the catchment also constitute a priority area for implementation of soil and water conservation measures. Implementation of soil and water conservation measures will contribute to reduce siltation in streams where the reservoirs will be implemented. In the medium and long term, new sites should be identified.

Table 6.8: Hotspot identified by IIRR where soil and water conservation measures must be implemented

District	Sub-county	Parish	Village	Latitude	Longitude	Sub-catchment
Kamuli	Namasagali	Kisekye	Kabanyolo	1.016 5	32.962	VN1

6.2.3 Develop organisations and outlets for agricultural production

The creation of an organisation and outlets for marketable surplus is a means to ensure that the sale of surplus increases the income of producers and enable them to develop. The measures identified to achieve this are

- Developing relations between producers and the private sector (food processing companies for example). It is assumed that private companies will provide ready market for surplus production and thus income for producers. This allows the creation of potential benefits and enables the development of producer
- Establish producer organisations that ensure collection of generated surplus, transportation to sales places (urban centres, etc.), sale and profit sharing. This also implies the development of structures for the sale of products (cooperatives, markets, etc.).

6.2.4 Promote the use of quality inputs in agriculture

Agriculture in the Victoria Nile-Lumbuye Catchment is essentially rainfed with low yields. Use of poor quality inputs is a major constraint to agricultural production. Most of the crop varieties are of low productivity. Farmers use their own saved seeds, which have lost genetic viability over time. They consequently get poor yields on harvest. The National Agricultural Research Organisation (NARO) runs a research institute in Buginyanya with a mandate of conducting and delivering research products for improved crop in the Southeast agro-ecological zone where the two catchments are found. The following activities shall be implemented to promote the use of quality inputs in agriculture:

- Promote participatory planning, developing and dissemination of the research products among district leaderships, NARO, and other stakeholders in the catchments to ensure meaningful and sustainable agricultural development. Development of on farm demonstration should be considered
- Promote selection and investment in best crop varieties among farmers
- Organise and facilitate the provision of high yielding crop varieties
- Promote the use of fertilizers to boost production and train farmers in selection and use of pesticides with low fish and bird toxicity and safe use of pesticides



One hotspot has been identified to implement the use of improved seeds and fertilizers in the table below.

Table 6 9: Identified hotspots for the implementation of quality inputs and the use of fertilizers

District	Sub-county	Parish	Village	Latitude	Longitude	Sub-catchment
Luuka	Bukoma	Kamirantumbu		0.839	33.358	L1

6.3 Other Economic Activities

6.3.1 Promotion development of quality fingerlings and fish feed production

Currently, the main source of commercial feeds is Ugachick, located in Kampala that is distant from most of the areas in the catchments. The expensive feeds, coupled with low returns, has led to limited pond area under aquaculture, and abandonment of ponds observed in most of these areas. In addition, limited access to quality seeds for stocking ponds is also a problem to aquaculture. Farmers obtain seeds from the wild or are supplied by malicious stakeholders with seeds of poor quality with slow growth rates leading to undesirable sizes of fish at the end of the culture period leading to losses. Activities for promotion and procurement of quality fingerlings and fish feeds include

- Rehabilitation and put into operation the regional fish fry centres such as the one in Mbale District so that farmers can get increased access to fish seed from areas near their establishments. This can reduce costs for fry, transport and loss of fish seed due to stress suffered during transi
- Promote and organise production of fish seeds among fish farmers
- Encouraging or facilitating the private sector with soft loans or subsidies to set up hatcheries and feed making factories
- Development of hatcheries.

Such activities are already planned in the District Development Plans for financial years 2015-2020 of Tororo and Manafwa districts (Tororo District Development Plan 2015-2020, Manafwa District Development Plan 2015-2020).

6.3.2 Develop fish farming

The existing and future plans for fisheries development in the districts in the catchments all aim to increase capture fisheries production, especially in districts such as Kamuli and Kayunga, which have water bodies with considerable capture fisheries. Implementation of cage fish farming is seen as a way to reduce fish depletion, which has been identified as a major issue in the catchment. Creation and promotion of fish farms will ultimately develop the aquaculture sector and support development of alternative livelihoods. Fish farming development will increase fish stocks in the Victoria Nile-Lumbuye Catchment and reduce fish depletion in rivers and lakes. In the framework of the Catchment Management Plan, the following activities shall be implemented:

- Register all private aquaculture practitioners. This can protect farmers from malicious practitioners who exploit them by providing them with sub-standard advisory services
- Train fish farmers on good farming practices such as water quality management, sampling, grading, record keeping and feeding, stocking and make their own feed
- Sensitise fish farmers on proper fishing methods, impact on water quality.

6.3.3 Promotion of livestock husbandry

Livestock in the catchment is characterised by low yields. This can be explained by indigenous breeds with low milk production levels, poor growth, and off-take rates. In addition, livestock diseases such as East Cost Fever (ECF), Foot and Mouth Disease (FMD), New Castle, and Swine Fever were the most reported challenge limiting livestock productivity. High prevalence of livestock diseases consequently leads to massive loss of livestock in the catchments. To improve livestock husbandry, participatory planning should be promoted between the district leadership, NARO, and other stakeholders in order to develop and disseminate the research products in the catchments and to ensure meaningful and sustainable agricultural development. Livestock extension services should also be increased to improve breeder's practices and better selection of livestock breeds.

Finally, integration of livestock into crop production systems should be envisaged. Residues from crop harvests like maize stover, rice straw and chuff can be used as feeds for livestock. This will improve agricultural water productivity since the amount of water depleted in production of crop residues will be almost negligible and already accounted for in crop water requirement to produce food. By integrating livestock, livestock products such as milk, live animals can be sold to earn households income thus relieving poverty. In addition, livestock manure

can be used as a source of fertilizers thus reducing the burden of using artificial inorganic fertilizers and reducing the costs of production and pollution of wetlands downstream. For this purpose, identification and establishment of a pilot project to implement these measures and disseminate this approach among farmers and breeders is important.

6.3.4 Provide alternative livelihoods and promote environmentally sustainable socio-economic development paths

Promotion and development of alternative livelihoods is a way to:

- Generate alternative sources of income
- Reduce part of the population involved in agricultural activities
- Reduce the existing pressure on natural resources.

The possibilities of creating alternative livelihood are many and varied. Among them, plant and tree nurseries, creation of private woodlots, cultivation of high-value vegetables, beekeeping, fish processing, zero grazing/feedlots, citrus fruit growing, training in vocational and technical skills for youth and women. Many of these activities are not location-specific and can be promoted throughout the catchment. For example, some areas are more suitable for citrus cultivation and an agronomist should identify these areas. Among alternative livelihoods, the development of tourism can be closely linked with the protection and enhancement of wetlands. They are ubiquitous on all the catchment, especially on the downstream part of the Lumbuye Catchment. They are landmarks for bird-watching. The Victoria Nile-Lumbuye Catchment is also characterised by the Nile River that gives many possibilities (scenery and white water sports) all along its course from Jinja to Lake Kyoga: Kalagala Falls, Itanda Falls, Izaniri Falls. Development of alternative livelihood can also be considered through development of integrated/combined activities: fish farming, horticulture, tourism, bee keeping, and rice growing among others.

6.4 Environmental conservation and protection

6.4.1 Development of tree nurseries and tree planting activities

Tree planting is a need generalised in the catchment. It is a way to reduce soil erosion, and siltation of rivers and wetlands. Related activities include planting trees with a rapid growth. This type of measure can help to quickly recover forest cover and reduce erosion and watershed degradation. Alternatively, when watershed degradation is not critical, it is possible to reforest with indigenous trees. The implementation of such measures and the training of farmers must be carried out as a priority (0-5 years) in the Nile and Kiko sub-catchments (VN1 and VN2). For the other part of the catchment, tree planting is included in the medium to long term plans. A total of eight hotspots have been identified in the catchment where tree planting is required and listed in the Table 6.10 below.

Table 6.10: hotspots identified by IIRR for tree planting activities

District	Sub-county	Parish	Village	Latitude	Longitude	Sub-catchment
Jinja	Mafubira	Kaitabwala		0.463	33.181	VN1
Kayunga	Kangulumira	Kangulumira	Kangulumira	0.582	33.030	VN1
Iganga	Bulamagi	Bulamagi	Bwanalira	0.624	33.441	L1
Iganga	Bulamagi	Bwanalira	Bwanalira	0.627	33.441	L1
Luuka	Waibuga	Kakumbi	Kisimba	0.690	33.368	L1
Luuka	Bukooma	Kamirantumbu		0.839	33.358	L1
Mayuge	Buwaya	Buwaya		0.523	33.480	L1
Kaliro	Budomero	Budomero	Nabwende	1.083	33.460	L2

These reforestation activities should also be accompanied by the development of tree nurseries to supply the catchment with the seeds for the reforestation. Promotion of tree planting activities among the public (schools, farmers, communities, etc.) must also be implemented. Activities related to tree planting are also planned under the following planning documents: (i) Kamuli District Development Plan (2015-2020); and (ii) Kaliro District Development Plan (2015-2020).

6.4.2 Setup and demarcation of wetlands and forests

Implementation of demarcation of wetlands and forests must accompany wetland and forest management and

development strategy. The main objectives of demarcating wetlands and forests are to:

- Clearly define the status of each wetland and forest (local and national) as well as its state of degradation (Heavily degraded, etc.)
- Establish a clear physical delimitation observable by the public
- With the presence of this boundary, to indicate peoples' rights (access, etc.) and prohibitions (timber, fire, etc.) and the consequences of not respecting the rules and regulations

Regarding wetland demarcation, the following hotspot in Table 6.11 has been identified

Table 6.11: hotspots identified by IIRR where demarcation of forest or wetland is required

District	Sub-county	Parish	Village	Latitude	Longitude	Sub-catchment
Luuka	Bukanga	Kiloba		0.686	33.372	L1

6.4.3 River Bank protection

River bank and lakeshore degradation is mainly due to agricultural practices and sand mining activities, resulting in erosion and siltation of rivers and wetlands. The various measures identified for river bank protection are as follows:

- Create and maintain a buffer zone to protect lakeshores and riverbanks from cultivation. This action aims to define a perimeter beyond which any agricultural practice and other activities should be prohibited
- For more efficiency, this action can be accompanied by a re-vegetation of the river banks and lakeshores. The root development of vegetation will maintain the edges of rivers and thus limit their erosion and siltation
- Promote riverbank and lakeshore stabilisation through re-vegetation with grass and tree planting activities. Organisation of campaigns is important to raise awareness among communities and sensitise them on the impacts of degrading river banks and lakeshores
- Develop by-laws to define buffer zone to protect riverbanks and lakeshores.

These activities must be implemented as a priority along the river Victoria Nile (VN1). Four hotspots related to this objective were identified by the IIRR survey in the catchment. The Kaliro and Kamuli District Development Plans for 2015-2020 also include such measures.

Table 6.12: Identified hotspots by IIRR where protection of river banks or lakeshores is required

ID	District	Sub-county	Parish	Village	Latitude	Longitude	Sub-catchment
92	Kamuli	Namasagali	Kisekye	Kabanyolo	1.016	32.962	VN1
93	Buyende	Nkondo	Kigingi	Bunangwe	0.952	33.125	VN3
94	Kaliro	Border of luuka and kaliro	Bulongo		0.924	33.408	L1
95	Mayuge	Imaniro	Namokya		0.520	33.435	L1

6.5 Improve water supply and sanitation

6.5.1 Improve access to safe water supply

In the Victoria Nile-Lumbuye Catchment, the overall water supply access is 70%. Of the major urban areas, only Jinja is served by a surface water resource from Lake Victoria. The rural areas and small urban centres are mainly served by groundwater resources (to over 90%), especially boreholes, shallow wells, and springs. Improved water supply can be achieved by:

- Development and construction or rehabilitation of piped water schemes
- Rehabilitation or construction of wells springs and boreholes to improve access to safe water supply.
- Sensitisation of population on practices to improve access to a safe water resource and enhancement of these practices among the catchment.

Construction and rehabilitation of boreholes, shallow wells and springs is the fastest and cheapest way to increase access to water resource. In the catchment, this should be a priority in Nabigaga sub-catchment (VN3) sub-catchment where access to water is the lowest. The Lower Lumbuye (L2) sub-catchment should be prioritised in the

medium term with the other sub-catchments. The District Development Plans for Kamuli, Luuka, and Kaliro districts envisage the construction and rehabilitation of boreholes and wellsprings. One hotspot has been identified for rehabilitation of boreholes.

Table 6.13: Identified hotspot for the rehabilitation of borehole

District	Sub-county	Parish	Village	Latitude	Longitude	Sub-catchment
Mayuge	Buwaya	Buwaya		0.523	33.480	L1

6.5.2 Upgrade/improve existing waste water treatment plants

Within the Lumbuye-Victoria Nile catchments, Jinja Municipality has a central sewerage system, with 2,853 active sewer connections as of June 2014. The Jinja waste water treatment facility comprises of two treatment plants of WSP at Kirinya (in the Victoria Nile Catchment) and Kimaka (at the limit of Victoria Nile Catchment). The wastewater discharges to the environment (water bodies and land) from this town are below national standards, and this might have a cumulative overall pollution impact on the water resources within the catchment. To solve this problem, two main measures can be implemented. These are:

- Upgrading the treatment plants. This implies, for each plant, the introduction of new functional facilities, equipping stations with new technologies for water treatment and increasing their processing capacity linked to the growing population. In addition, the operators should receive training so that the operations of the station is assured
- Strengthen adherence of treatment plant to effluent discharge standards and strengthen monitoring mechanisms. Put incentives to promote compliance to meet standards. Harmonise regulatory frameworks.

6.5.3 Promote sanitation facilities in rural areas and small towns

In the Victoria Nile-Lumbuye Catchment, the sanitation (considering latrine) coverage is close to 76%. Only Jinja municipality has a central sewerage system, with 2,853 active sewer connections as of June 2014. Otherwise, dry on-site sanitation systems are the pre-dominant system within the catchment. Some of the latrines in the rural growth centres and institutions can be considered lined and the sludge is probably transported to the nearest WSP. As the haulage distance can be prohibitive, especially for the urban and rural poor, other disposal mechanisms are practiced. Therefore, it can be implied that, water resources within the catchments are likely to be polluted due to the poor disposal of sludge. More challenges regarding lack of sanitation facilities include:

- Absence of Faecal Sludge (FS) treatment/disposal/re-use facilities in most towns
- Lack of cesspool/pit-emptying trucks in most small towns
- High emptying charges due to low demand and individuals having to meet cost of mobilising emptying trucks from nearby big towns
- Illicit dumping of collected FS in swamps, quarries, gardens and water bodies with extreme negative environmental and public health consequences
- Inadequate legal regulations and law enforcement on proper faecal sludge management.

Improving sanitation systems in rural areas and small urban centres will improve the living conditions of the inhabitants but also help in limiting the degradation of the environment including pollution of water resources. Several measures can be implemented to achieve this.

The National Faecal Sludge Assessment (FSM) report for Small Towns in Uganda (2013) recommended clustering of towns within a radius of 30km. Those clustered are to be served by the existing facilities under NWSC management, if the treatment plant is not currently overloaded. Clustering FS treatment facilities would reduce haulage and make FSM a more viable venture to the private players. This includes Jinja town in the Victoria Nile-Lumbuye Catchment. Under clustering, the towns or RGCs with a piped water supply and institutions within a radius of 30-35km would still use the WSP already available in Jinja Municipality under the management of NWSC.

Construction of public latrines is an affordable way to improve access to sanitation. The establishment of public latrines must be given priority in small towns and rural growth centres with the lowest rate of access to improved sanitation. For this reason, construction of public latrines should be envisaged in the Nile and the Kiko sub-catchments (VN1, VN2) and the Upper Lumbuye sub-catchment (L1) followed by the Nabigaga sub-catchment (VN3) and Lower Lumbuye (L2). However, for the implementation of this measure to be fully effective, the following challenges must be addressed:

- Identify and create specific areas for waste disposal and treatment
- Adequately equip small towns and rural growth centres with cesspool / pit emptying trucks

- Promote the use of pit emptying trucks and reduce the cost of emptying charges
- Improve and enforce legal regulations and law enforcement on proper faecal sludge management to avoid illicit dumping and thus environmental degradation.

This requires the implementation of a study to identify needs, sources of funds and implement adequate sanitation facilities for every town within the catchment. In addition to implementing adequate sanitation facilities, sensitisation of the population on good hygiene practices must be envisaged. Such measures are envisaged in the Kamuli, the Kaliro, and the Luuka district development plans for financial years 2015-2020

6.5.4 Improve management of solid waste

Another source of pollution in the catchment, which deserves attention, is the pollution generated by solid waste. Solid wastes of various types (domestic waste, plastic bags, etc.) are generally thrown into the environment. Depending on the nature of the solid waste, it will take weeks to several years to be degraded by the environment and may generate various impacts: loss of biodiversity, pollution of water resources, and general degradation of the environment, among others. Several measures can be implemented to reduce such pollution.

The main measure to improve solid waste management consists in implementing mechanisms for solid waste collection, disposal, and management. This can be done through the procurement and use of garbage skips, self-loading garbage truck, and designated dumpsite. Such a measure must be implemented in all towns and rural growth centres in the catchment. The implementation of such a measure is an important task that involves the implementation of a long-term programme. Two specific locations were identified and are presented in the following table Table 6.14. It is necessary to set up an awareness campaign in the long term and target all age brackets (children, young people and adults). This will promote better practices among the population regarding the impact of solid waste on the environment

Table 6.14: Identified hotspots for the implementation of solid waste disposal and management

District	Sub-county	Parish	Village	Latitude	Longitude	Sub catchment
Iganga	Central division	Boundary of Walugogo and Buliigo	Walugogo estate	0.605	33.470	L1
Iganga	Bulamagi	Bwanalila	Bwanalira	0.627	33.441	L1

6.6 Cross-cutting and/or permanent activities

Implementation of the identified measures in the Catchment Management Plan must be accompanied by sensitisation and awareness campaigns among the population. According to the issues addressed, these campaigns aim to inform, to create awareness, to introduce new concepts and to imply change in every day practices. Sensitisation campaigns can have different forms to reach a maximum number of the population. These include poster campaigns, radio talk shows, and organising meetings among others. The implementation of these campaigns is essential to the implementation of the management plan. Sensitisation of the greatest number on the protection of wetlands, forests, the existence of alternative sources of income, good agricultural practices, etc. is essential for



the integration and implementation of these practices in the basin. The different sensitisation campaigns identified are listed in the Table 6.15

Table 6.15: Identified sensitisation campaigns identified for the optimisation of the Catchment Management Plan

Capacity building	Objectives
1. Develop water for production infrastructures	
Rain water harvesting	Sensitise communities on the interest of rainwater harvesting systems (corrugated, plastic and ferro-cement tanks) as a way to supplement domestic water supplies and reducing dependence on polluted and distant water sources. Sensitisation can also be done on surface water harvesting with installation of sub-surface masonry rainwater tanks for supplementary irrigation
2. Develop the agricultural sector and improve practices	
Good farming methods	Sensitise farmers and communities on the impact of poor farming methods on soil fertility, erosion, etc. and introduce better farming practices.
The Land Act, 1998	Sensitising farmers on and popularising the Land Act, 1998 to improve land management among farmers and communities and minimise conflict among farming communities.
Flood awareness	Raise awareness about the risk of flooding. The existing causes (siltation of wetlands, poor soil management, etc.) and advise on possible measures to limit the risk of flooding or protect themselves.
Landslide preparedness	Awareness on landslide risks and possible consequences. Raise awareness of the possible causes (deforestation, poor farming practices, etc.) and inform on possible measures.
Soil and water conservation practices	Sensitise farmers and the general population on the need to implement measures for the conservation of water and soil. Raise awareness about the risks: erosion, landslides, siltation, floods, etc. Learn about the different existing conservation measures.
Pesticides with low fish and bird toxicity and to promote safe use of pesticides.	Sensitise farmers on the interest of pesticides for agriculture, the potential benefits and the possible negative impacts. Educate farmers on the proper use thereof.
3. Develop the other economic activities	
Existing alternative source of income	Raise awareness about the existence of alternative sources of income (tourism, beekeeping, etc.), especially the young population. This will open up the agricultural sector.
4. Environmental conservation and protection	
Sustainable use and management of water and natural resources	Sensitise farmers and communities on water resources protection and other natural resources. This includes pollution of water resources, degradation of wetlands (bushfire, etc.) and the forest. Raise awareness about the impacts of human activities (bushfire in wetlands, deforestation, etc.) and offer alternative practices.
Reforestation/tree planting/ Benefits of the trees and forests	Sensitise on the impacts of deforestation and promote and train farmers and communities on tree planting.
Importance of wetlands/ Sustainable utilisation of the wetland	Raise awareness of the importance of protecting wetlands, the impact of human activities on wetlands, and the importance of wetlands for flood mitigation. Raising awareness on the sustainable use of wetlands
Boundaries (forest, wetlands, etc.)	Raise awareness of the role and significance of forest and wetland delineation and associated regulations.
Buffer zone for river bank and lakeshore protection through tree planting	Sensitise communities on the consequences of agriculture and mining on the river banks and lakeshores (erosion, siltation, etc.). Promote the establishment of buffer zones and the re-vegetation of the edges of rivers and lakes.
Benefits of using energy saving technologies and clean energy	Sensitise communities on the impact of deforestation and on the use of energy saving technologies (cooking stoves, use of solar panel, etc.).
5. Improve water supply and sanitation	
Water source protection by fencing, tree and grass planting around the wells and sources and prohibiting polluting practices	Sensitise communities on practices likely to pollute water resources, the need to separate resources according to uses (watering livestock or source of drinking water). Promote implementation of water source protection by fencing, tree and grass planting, etc.
Hygiene promotion through sanitation and hygiene promotion activities.	Promote good hygiene practices among the population.
6. Control and reduce water pollution	
Solid waste disposal	Sensitise the population to the impact of solid waste on the environment and potentially on health. Promotes the use of garbage bag and good practices (dumps, etc.).
Sensitisation on the chemicals used by miners that mercury which is used to purify the gold adversely affects the quality of water, soil and human health	Sensitise minors and the public on the health impact of mercury use. Sensitise also on the environmental impact of mercury and mining activities in general.
8. Improvement of institutional context (related to water sector, at catchment level)	
Environmental laws, environment regulations and their enforcement	Warn and educate communities about the existence of laws for the protection of the environment, the importance of these laws and the importance of respecting them for the restoration of the basin.

6.7 Investment plan

Table 6.16 presents the investment plan for the project. The basis for the estimation of the costs is provided in the annex I below.

Table 6.16: Synthesis of costs for the implementation of the plan

Activities	Cost per period		
	1-5 years	6-10 years	Beyond 10 years
1 - DEVELOP WATER FOR PRODUCTION INFRASTRUCTURE	7 085 620	71 655 851	75 112 902
1.1 Create fish ponds	298 747	49 796	77 817
1.2 Provide water / organize access to resources for cattle watering	609 109	757 277	31 847
1.3 Develop large infrastructure	3 414 470	46 753 450	16 511 300
1.4 Develop upland irrigation	1 771 422	391 522	2 142 722
1.5 Organise irrigation in wetlands (formal schemes)	736 330	23 625 600	56 271 200
1.6 Develop rice/aquaculture schemes	70 802	27 946	78 016
1.7 Develop rainwater harvesting and individual storage solution	184 740	50 260	-
2 - DEVELOP THE AGRICULTURAL SECTOR AND IMPROVE PRACTICES	345 641	323 719	410 131
2.1 Development of agro-forestry and conservation agriculture	92 809	52 104	53 662
2.2 Implement soil and water conservation measures	106 166	179 211	185 731
2.3 Develop organisation and outlets for agricultural production	39 550	39 550	71 190
2.4 Develop and empower farmer groups and associations	6 780	-	-
2.5 Promote the use of quality inputs in agriculture	100 336	52 854	99 548
3 - DEVELOP OTHER ECONOMIC ACTIVITIES	222 143	152 414	243 627
3.1 Promote development of quality fingerlings and fish seeds production	89 577	65 200	117 360
3.2 Develop fish farming	84 042	39 185	36 729
3.3 Develop small hydropower production	-	-	-
3.4 Improve livestock husbandery (exstention, breeding, etc.)	33 094	32 600	58 680
3.5 Provide alternative livelihoods and promote environmentally sustainable socio-economic development (tourism, bee keeping, etc.)	15 429	15 429	30 858
4 - ENVIRONMENTAL CONSERVATION AND PROTECTION	2 565 089	2 868 569	1 883 982
4.1 Development of tree nurseries and tree planting activities	875 844	188 944	270 779
4.2 Build a wetland classification according to their ecological interest and develop a wetland management and development strategy accordingly	333 717	1 789 028	489 045
4.3 Clear demarcation of wetlands and forests	270 869	214 143	431 197
4.4 River bank protection (cultivation and sand mining)	423 681	331 413	618 635
4.5 Develop a forest management and development strategy	433 516	117 581	74 327
4.6 Use of renewable energy / alternative energy sources and development strategy	227 461	227 461	-
5 - IMPROVE WATER SUPPLY AND SANITATION	9 765 666	5 689 212	5 105 499
5.1 Improve access to safe water supply	8 627 925	283 739	895 548
5.2 Upgrade/improve existing waste water treatment plants and make sure effluents meet national standards	55 980	500 000	-
5.3 Promote sanitation facilities in rural areas and small towns	745 881	2 028 593	2 740 651
5.4 Plan sanitation associated with the new piped schemes being developed in small towns and rural growth centers	335 880	2 876 880	1 469 300
6 - CONTROL AND REDUCE POLLUTION	618 171	1 453 064	9 886 299
6.1 Improve management of solid waste	131 128	1 033 214	9 046 599
6.2 Control waste water discharge and pollution from industries and artisanal activities	487 043	419 850	839 700
7 - COMMUNICATION AND CAPACITY BUILDING	172 355	56 600	113 200
8 - IMPROVEMENT OF INSTITUTIONAL CONTEXT (RELATED TO THE WATER SECTOR, AT CATCHMENT LEVEL)			
9 - IMPROVEMENT OF KNOWLEDGE AND DATA COLLECTION ON WATER RESOURCES			
Total per period	20 774 684	82 199 430	92 755 640
Grand Total			195 729 754



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Annex I

Unit costs used in the calculations in the investment plan

The sources listed below were used to define the unit costs and Consultant’s experience was used wherever there were no appropriate sources within the country. Provisional costs for the civil works have been proposed by the consultant based on its expertise.

Table 8.1: Unit cost used for the investment plan

Time	Monthly Cost (USD)
Employee	2,260
Consultant	12,995
Transportation costs	Monthly Cost (USD)
4*4	1,000
Construction of Water for Production infrastructure and drainage system	Unitcost(USD/m)
Valley Tanks	9.8
Valley Dams	3.8
Sand Dams	14.7
Sub-surface Dams	4
Fish pond for aquaculture	9.8
Concrete dams	0.6
Organisation of meetings and trainings	Unit cost (USD)
Conduct public awareness raising and deliver extension messages (per campaign)	291
Training of 1 farmer	20
Training of government officers or CMOs	40
Training one operator	24
Organize radio talk show (per radio talkshow)	99
Fisheries	Unit cost (USD)
Consolidation of existing plants (purchasing 5 sign nets, and 200 m PVC pipes to ensure sustainable activity)	1,710
Rehabilitation of one pond	600
Rehabilitation of the regional fish fry centre	150,000
Development of one hatchery	17,857
Development of rice-aquaculture scheme (per ha)	7,143
Livestock	Unit cost (USD)
Access point for cattle watering (per access point)	536
Pilot project implying integration of livestock (per farm)	5,000
Rainwater harvesting technology	Unit cost (USD)
Sunken pit	300
Roof water harvesting	3,571
Rainwater tanks, including VAT, installation & overheads (per m3)	340
Agriculture and irrigation	Unit cost (USD)
Demonstration farm (per ha)	7,143
Development of large irrigation schemes (per ha)	5,500
Development of small irrigation scheme (<100ha) (per ha)	5,975
Environment	Unit cost (USD)
Baseline survey and boundary making with 1 community stakeholder	9,734
Reforestation programme: replanting/infilling 1 ha degraded forest area with appropriate seedlings	2,047
Manage/rehabilitate 1 gully in the ecosystem	354
Facilitate construction of terraces in 1 farm	239
Implement a tree nursery (per ha)	1,733
Wetland restoration and management (per ha)	1,161
1km of demarcation of protected area	510
Construct 1km of gabions	17,857
1km of river pegging	250
Plant riparian vegetation (per ha)	867
Procure 50,000 seedlings	0.10
Forest restoration and management project (per ha)	700
Support the construction of bio-gas digester (per digester)	357
Construction of 1 firewood efficient stoves, train and equip artisans to construct/maintain firewood efficient stoves	495
Water supply and sanitation	Unit cost (USD)
Construction of 1 well spring (including protection)	1,671
Construction of 1 Borehole	6,339
Rehabilitation of 1 well spring (including protection)	517
Rehabilitation of 1 borehole	517
Water sources protection (1 source)	769
Construction of public latrine (1 public latrine)	3,982
Construction of piped water system (per habitant)	177
Lumpsum estimation per water treatment plant	500,000
Sanitation (per habitant)	100
Put in place 1 central faecal sludge treatment site for public institutions	53,571
Put in place 1 cesspool	26,786
Procure 1 cesspool emptiers	53,571
Construct 1 sewage systems	53,571
Establish and protect 1 lagoons	53,571
Solid waste management	Unit cost (USD)
Lumpsum estimation for one solid waste treatment site	53,571
Procure 1 dump truck	125,000
Hydropower	Unit cost (USD)
Micro-hydropower per kW	4,200

ANNEX III

ID	Category	Options	Sub-options	Identified activities	District	Sub county	Parish	Village	Latitude	Longitude	Sub-catchment
5	1. Develop water for production infrastructures	1.3 Develop large infrastructure (multipurpose dams)	Implementation of multipurpose dams	Construction of Dams to provide water and help in fish farming as an alternative livelihood option	Kaliro	Budomero	Budomero	Nabwende	1.083	33.460	L2
6	1. Develop water for production infrastructures	1.3 Develop large infrastructure (multipurpose dams)	Implementation of drainage system	Digging of drainage channels to control floods	Kaliro	Budomero	Budomero	Nabwende	1.083	33.460	L2
7	1. Develop water for production infrastructures	1.3 Develop large infrastructure (multipurpose dams)	Implementation of drainage system	Digging of drainage channels to control floods	Mayuge	Mayuge	Ikulwe	Dwaliro a,b & c	0.457	33.489	L2
8	1. Develop water for production infrastructures	1.3 Develop large infrastructure (multipurpose dams)	Implementation of multipurpose dams	If the dam in namadope is worked on, it could supply water to this whole area to reduce water scarcity in this area.	Luuka	Bukanga	Kiloba		0.686	33.372	L1
22	1. Develop water for production infrastructures	1.5 Organise irrigation in wetlands (formal schemes)	Implement formalized irrigation in wetlands	Scheme can be formed in order to prevent degradation of this swamp and improve yields	Luuka	Bukooma	Kamirantumbu		0.840	33.358	L2
23	1. Develop water for production infrastructures	1.7 Develop rainwater harvesting and individual storage solution	Develop rain water harvesting infrastructure	Provision of water harvesting tanks to increase the supply of water	Kaliro	Budomero	Budomero	Nabwende	1.083	33.460	L2
30	2. Develop the agricultural sector and improve practices	2.2 Implement soil and water conservation measures (terracing, bunding, ...)	Implement soil and water conservation measures	Soil and water conservation technologies such as digging of retention ditches to control soil erosion	Kamuli	Namasagali	Kisekye	Kabanyolo	1.017	32.963	VN1
36	2. Develop the agricultural sector and improve practices	2.4 Development and empowerment of farmer groups and associations	Create and empower environmental committees	Form environmental committees to conserve the environment	Kamuli	Namasagali	Kisekye	Kabanyolo	1.017	32.963	VN1
40	2. Develop the agricultural sector and improve practices	2.5 Promote the use of quality inputs in agriculture	Facilitate the provision and promote the use of quality seeds	Use of improved seeds	Luuka	Bukooma	Kamirantumbu		0.840	33.358	L1
67	4. Environmental conservation and protection	4.1 Development of tree nurseries and tree planting activities	Reforestation/tree planting	Reforestation/Tree planting	Jinja	Mafubira	Kaitabwala		0.464	33.181	VN1
68	4. Environmental conservation and protection	4.1 Development of tree nurseries and tree planting activities	Reforestation/tree planting	Reforestation/Tree planting	Kayunga	Kangulumira	Kangulumira	Kangulumira	0.582	33.031	VN1
69	4. Environmental conservation and protection	4.1 Development of tree nurseries and tree planting activities	Reforestation/tree planting	Reforestation/Tree planting	Iganga	Bulamagi	Bulamagi	Bwanalira	0.625	33.441	L1
70	4. Environmental conservation and protection	4.1 Development of tree nurseries and tree planting activities	Reforestation/tree planting	Reforestation/Tree planting	Iganga	Bulamagi	Bwanalira	Bwanalira	0.628	33.442	L1
72	4. Environmental conservation and protection	4.1 Development of tree nurseries and tree planting activities	Reforestation/tree planting	Reforestation/Tree planting	Luuka	Waibuga	Kakumbi	Kisimba	0.690	33.369	L1
73	4. Environmental conservation and protection	4.1 Development of tree nurseries and tree planting activities	Reforestation/tree planting	Reforestation/Tree planting	Luuka	Bukooma	Kamirantumbu		0.840	33.358	L1
74	4. Environmental conservation and protection	4.1 Development of tree nurseries and tree planting activities	Reforestation/tree planting	Reforestation/Tree planting	Mayuge	Buwaya	Buwaya		0.523	33.481	L1
75	4. Environmental conservation and protection	4.1 Development of tree nurseries and tree planting activities	Reforestation/tree planting	Reforestation/Tree planting	Kaliro	Budomero	Budomero	Nabwende	1.083	33.460	L2

ID	Category	Options	Sub options	Identified activities	District	Sub-county	Parish	Village	Latitude	Longitude	Sub-catchment
77	4. Environmental conservation and protection	4.1 Development of tree nurseries and tree planting activities	Create and equip tree nurseries to increase available tree seedlings and develop alternative livelihoods	Supply tree seedlings for the community to plant	Kamuli	Namasagali	Kisekye	Kabanyolo	1.017	32.963	VN1
81	4. Environmental conservation and protection	4.2 Build a wetland classification according to their ecological interest and develop a wetland management and development strategy accordingly	Compensate land users, if possible, on wetlands of critical importance and embark on restoration	Compensation for the evicted communities	Iganga	Central division	Boundary of Walugogo and Buliigo	Walugogo estate	0.605	33.470	L1
85	4. Environmental conservation and protection	4.3 Clear demarcation of wetlands and forests	Set up a clear demarcation of wetlands and organize access according to their situation (degraded or not)	Demarcation of the wetland.	Luuka	Bukanga	Kiloba		0.686	33.372	L1
92	4. Environmental conservation and protection	4.4 River bank protection (cultivation and sand mining)	Promote river banks and lakeshore stabilisation through re-vegetation with grass and tree planting activities	Planting of grass and trees to stabilise the soil along the river banks	Kamuli	Namasagali	Kisekye	Kabanyolo	1.017	32.963	VN1
93	4. Environmental conservation and protection	4.4 River bank protection (cultivation and sand mining)	Promote river banks and lakeshore stabilisation through re-vegetation with grass and tree planting activities	Buffering of shore by planting tree to prevent siltation	Buyende	Nkondo	Kigingi	Bunangwe	0.952	33.126	VN3
94	4. Environmental conservation and protection	4.4 River bank protection (cultivation and sand mining)	Create and uphold a buffer zone to project lake and river's banks from cultivation	River bank demarcation	Kaliro	Border of luuka and kaliro	Bulongo		0.925	33.409	L1
95	4. Environmental conservation and protection	4.4 River bank protection (cultivation and sand mining)	Promote river banks and lakeshore stabilisation through re-vegetation with grass and tree planting activities	River bank restoration	Mayuge	Imaniri	Namokya		0.521	33.435	L1
97	5. Improve water supply and sanitation	5.1 Improve access to safe water supply	Construct water piped schemes	Providing piped water	Kamuli	Namasagali	Kisekye	Kabanyolo	1.017	32.963	VN1
99	5. Improve water supply and sanitation	5.1 Improve access to safe water supply	Rehabilitate well springs and boreholes to improve access to safe water supply	Borehole rehabilitation	Mayuge	Buwaya	Buwaya		0.523	33.481	L1
113	5. Improve water supply and sanitation	5.1 Improve access to safe water supply	Promote and enhance practices to improve access to a safe water resource water	Cleaning the water sources	Iganga	Central division	Boundary of Walugogo and Buliigo	Walugogo estate	0.605	33.470	L1
128	6. Control and reduce pollution	6.1. Improve management of solid wastes	Organise and develop infrastructures and mechanisms for solid waste disposal and management	Put in place mechanisms for solid waste disposal and management	Iganga	Central division	Boundary of Walugogo and Buliigo	Walugogo estate	0.605	33.470	L1
129	6. Control and reduce pollution	6.1. Improve management of solid wastes	Organise and develop infrastructures and mechanisms for solid waste disposal and management	Put in place mechanisms for solid waste disposal and management	Iganga	Bulamagi	Bwanalifa	Bwanalira	0.628	33.442	L1
131	6. Control and reduce pollution	6.2 Control waste-water discharge and pollution from industries (sugar factories, tanneries, etc.) and artisanal activities (slaughterhouses, waragi breweries, etc.)	Strengthen adherence of factories to effluent discharge standards and strengthen monitoring mechanisms. Put incentives to promote compliance to meet standards. Harmonise regulatory frameworks	Put in place a proper mechanism for treatment of waragi residue for its disposal	Jinja	Mafubira	Kaitabwala		0.464	33.181	VN1
132	6. Control and reduce pollution	6.2 Control waste-water discharge and pollution from industries (sugar factories, tanneries, etc.) and artisanal activities (slaughterhouses, waragi breweries, etc.)	Strengthen adherence of factories to effluent discharge standards and strengthen monitoring mechanisms. Put incentives to promote compliance to meet standards. Harmonise regulatory frameworks	Regular monitoring to ensure compliance to relevant environment management actions by the distillers	Jinja	Mafubira	Kaitabwala		0.464	33.181	VN1

ID	Category	Options	options	Identified activities	District	Sub-county	Parish	Village	Latitude	Longitude	Sub-catchment
133	6. Control and reduce pollution	6.2 Control waste-water discharge and pollution from industries (sugar factories, tanneries, etc.) and artisanal activities (slaughterhouses, waragi breweries, etc.)	Strengthen adherence of factories to effluent discharge standards and strengthen monitoring mechanisms. Put incentives to promote compliance to meet standards. Harmonize regulatory frameworks	Regular monitoring to ensure compliance to relevant environment management actions by the distillers	Jinja	Mafubira	Mwanda	Makeke	0.460	33.201	VN1
146	6. Control and reduce pollution	6.2 Control waste-water discharge and pollution from industries (sugar factories, tanneries, etc.) and artisanal activities (slaughterhouses, waragi breweries, etc.)	Strengthen adherence of factories to effluent discharge standards and strengthen monitoring mechanisms. Put incentives to promote compliance to meet standards. Harmonize regulatory frameworks	Regulation and laws be strengthened in Tembo milling still on pollution control	Iganga	Bulamagi	Bulamagi	Bwanalira	0.625	33.441	L1
147	6. Control and reduce pollution	6.2 Control waste-water discharge and pollution from industries (sugar factories, tanneries, etc.) and artisanal activities (slaughterhouses, waragi breweries, etc.)	Strengthen adherence of factories to effluent discharge standards and strengthen monitoring mechanisms. Put incentives to promote compliance to meet standards. Harmonise regulatory frameworks	Monitoring and evaluation of projects and industries should be done	Iganga	Bulamagi	Bulamagi	Bwanalira	0.625	33.441	L1
149	7 Communication and capacity building	7.1 Raising awareness campaigns (different subjects identified: existing laws and regulation, impact of malpractices, etc.)	Law	Law enforcers be sensitised too, because instead of enforcing the law they are the ones who are protecting the culprits at extremes they even have armed escorts in uniform	Kayunga	Kangulumira	Kangulumira	Kangulumira	0.582	33.031	VN1
150	7 Communication and capacity building	7.1 Raising awareness campaigns (different subjects identified: existing laws and regulation, impact of malpractices, etc.)	Sensitisation of people on environment management and conservation, and sustainable use of natural resources	Sensitisation of people on environment conservation options such as efficient energy use	Kamuli	Namasagali	Kisekye	Kabanyolo	1.017	32.963	VN1
151	7 Communication and capacity building	7.1 Raising awareness campaigns (different subjects identified: existing laws and regulation, impact of malpractices, etc.)	Sensitisation of community members on other sources of income	Sensitisation of community members on other sources of income	Kayunga	Busaana	Lusenke	Lusenke	0.752	33.001	VN1
181	7 Communication and capacity building	7.1 Raising awareness campaigns (different subjects identified: existing laws and regulation, impact of malpractices, etc.)	Sensitise the population about boundaries (forest, wetlands, etc.) and buffer zone (river banks).	Dialogue between the government and the local people as they know where the boundaries are meant to pass for the wetland	Iganga	Central division	Boundary of Walugogo and Buligo	Walugogo estate	0.605	33.470	L1
182	7 Communication and capacity building	7.1 Raising awareness campaigns (different subjects identified: existing laws and regulation, impact of malpractices, etc.)	Sensitisation on wetlands conservation and wise use of wetland	Sensitisation on wetlands	Kaliro	Border of luuka and kaliro	Bulongo		0.925	33.409	L1
183	7 Communication and capacity building	7.1 Raising awareness campaigns (different subjects identified: existing laws and regulation, impact of malpractices, etc.)	Sensitisation on the importance and benefits of the trees and tree planting activities	sensitisation of the people on the benefits of the trees	Iganga	Bulamagi	Bwanalira	Bwanalira	0.628	33.442	L1
184	7 Communication and capacity building	7.1 Raising awareness campaigns (different subjects identified: existing laws and regulation, impact of malpractices, etc.)	Sensitisation of people on environment management and conservation, and sustainable use of natural resources	Sensitisation of people on environmental management and conservation	Luuka	Waibuga	Kakumbi	Kisimba	0.690	33.369	L1

ID	Category	Options	Sub-options	Identified activities	District			Village	Latitude	Longitude	Sub-catchment
185	7 Communication and capacity building	7.2 Capacity building at farmers and community level (sustainable use of wetlands, good farming practices, use of quality seeds and inputs, etc.)	Education of population on the environment conservation	Education of population on the environment conservation	Kayunga	Kangulumira	Kangulumira	Kangulumira	0.582	33.031	VN1
186	7 Communication and capacity building	7.2 Capacity building at farmers and community level (sustainable use of wetlands, good farming practices, use of quality seeds and inputs, etc.)	Extension workers are provided to educate people on good farming methods	Extension workers are provided to educate people on good farming methods	Kayunga	Kangulumira	Kangulumira	Kangulumira	0.582	33.031	VN1
187	7 Communication and capacity building	7.2 Capacity building at farmers and community level (sustainable use of wetlands, good farming practices, use of quality seeds and inputs, etc.)	Promote change agents in the communities who will be the trainers of others in regards to environment conservation and management	Promote change agents in the communities who will be the trainers of others in regards to environment conservation and management	Kamuli	Namasagali	Kisekye	Kabanyolo	1.017	32.963	VN1
221	7 Communication and capacity building	7.2 Capacity building at farmers and community level (sustainable use of wetlands, good farming practices, use of quality seeds and inputs, etc.)	Train farmers on proper farming methods	Training to improve farming methods	Kaliro	Border of luuka and kaliro	Bulongo		0.925	33.409	L1
224	8. Improvement of institutional context (related to water sector, at catchment level)	8.3 Support the preparation of ordinances and by-laws by district local governments	Preparation of ordinances and by-laws by district local governments	Come with policies and regulations and guidelines governing the mining and implement	Kayunga	Busaana	Lusenke	Lusenke	0.752	33.001	VN1
230	8. Improvement of institutional context (related to water sector, at catchment level)	8.3 Support the preparation of ordinances and by-laws by district local governments	Implement the policy and laws to enforce integrity of wetland area	Bye-laws regarding environmental conservation strengthened and implemented	Kamuli	Namasagali	Kisekye	Kabanyolo	1.017	32.963	VN1
231	8. Improvement of institutional context (related to water sector, at catchment level)	8.3 Support the preparation of ordinances and by-laws by district local governments	Preparation of ordinances and by-laws by district local governments	The laws governing the proper disposal of the wastes be implemented	Kayunga	Kangulumira	Kangulumira	Kangulumira	0.582	33.031	VN1
232	8. Improvement of institutional context (related to water sector, at catchment level)	8.4 Improve coordination between different institutions involved in law enforcement (technical, political, environmental police, NEMA)	Strengthen enforcement mechanisms	Strengthening the implementation of policies and regulation regarding the wetland and forest	Kamuli	Namasagali	Kisekye	Kabanyolo	1.017	32.963	VN1
237	8. Improvement of institutional context (related to water sector, at catchment level)	8.4 Improve coordination between different institutions involved in law enforcement (technical, political, environmental police, NEMA)	Strengthen enforcement mechanisms	Strengthening implementation of the laws regarding the wetland	Luuka	Waibuga	Kakumbi	Kisimba	0.690	33.369	L1

